



ISP CO., LTD
www.ispXRF.com

Manual Copper Plating Thickness Gauge (iTG-B10)



CopperGauge

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1. Precautions

Thank you for choosing iTG-B10.


If you do not follow the instructions herein when using the device, the device may become damaged or a safety accident may occur. Before you use the device, make sure you thoroughly read and understand this user guide to ensure proper use of the device.

ISP Co., Ltd. is not responsible for any damage or loss caused due to failure to follow instructions here when using the device. Make sure you follow this user guide when using the device.

1.1 Precautions for safe use

	Caution
	<ol style="list-style-type: none"> 1. DO NOT arbitrarily remove the device cover or disassemble the device for any reason. ISP Co., Ltd. is not responsible for any damage or loss resulting from such removal or disassembly. 2. If disassembly is inevitable due to an impact or other reason, please contact the technical service representative for assistance. 3. If liquid has been spilled on the device, cut off the power and contact the technical service technician for assistance. If there is a possibility that liquid has entered the device, DO NOT operate the device. 4. Make sure the device is installed at a stable location on a flat surface. Make sure the probe is stored in the probe holder. 5. Please note that ISP Co., Ltd. is not responsible for any problem caused by controlling the device using software that is not provided by ISP Co., Ltd.

1.2 Safety instructions for user

	Caution
	<ol style="list-style-type: none"> 1. This device is very precise; make sure you use a 220 V power supply. If you use a different power supply, the device may become damaged. 2. DO NOT touch the power unit with wet hands. 3. If the power cable is damaged, replace it with a power cable that is not damaged. 4. DO NOT use an extension cable or distributor for power supply; connect the device directly to a 220 V power source.

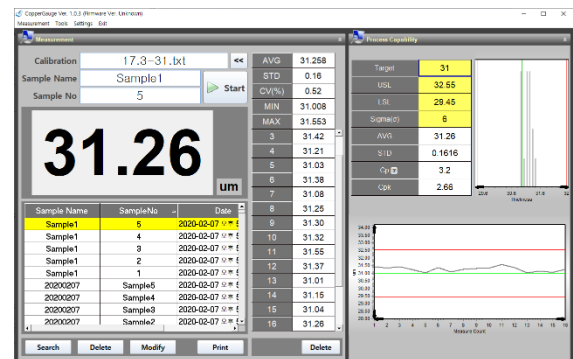
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2. Product Overview

2.1 Configuration of product

This system consists of the following units:

1. Main unit
2. Measurement software (CopperGauge and Excel Add-in)



2.2 Product specifications

Item	Details
Measurement type	Electrical resistance type using 4-pin probe
Measurable sample	Copper layer on PCB
Measurement range	Range 1: 0.1–10 μm
	Range 2: 10–120 μm
Degree of accuracy	Within $\pm 1\text{--}3\%$ based on the standard sample
Measurement time	1 sec/point
Compatible computer type	Laptop computer
Max. sample quantity that can be measured	Unlimited
Storage capacity	Unlimited
Result data	Measurement results can be printed in PDF or Excel format / Excel-linked program is supported
Lifespan of probe	It can repeat measurement a maximum of 500,000 times

3. Functions of iTG-B10

3.1 Names of hardware components

3.1.1 Side of device



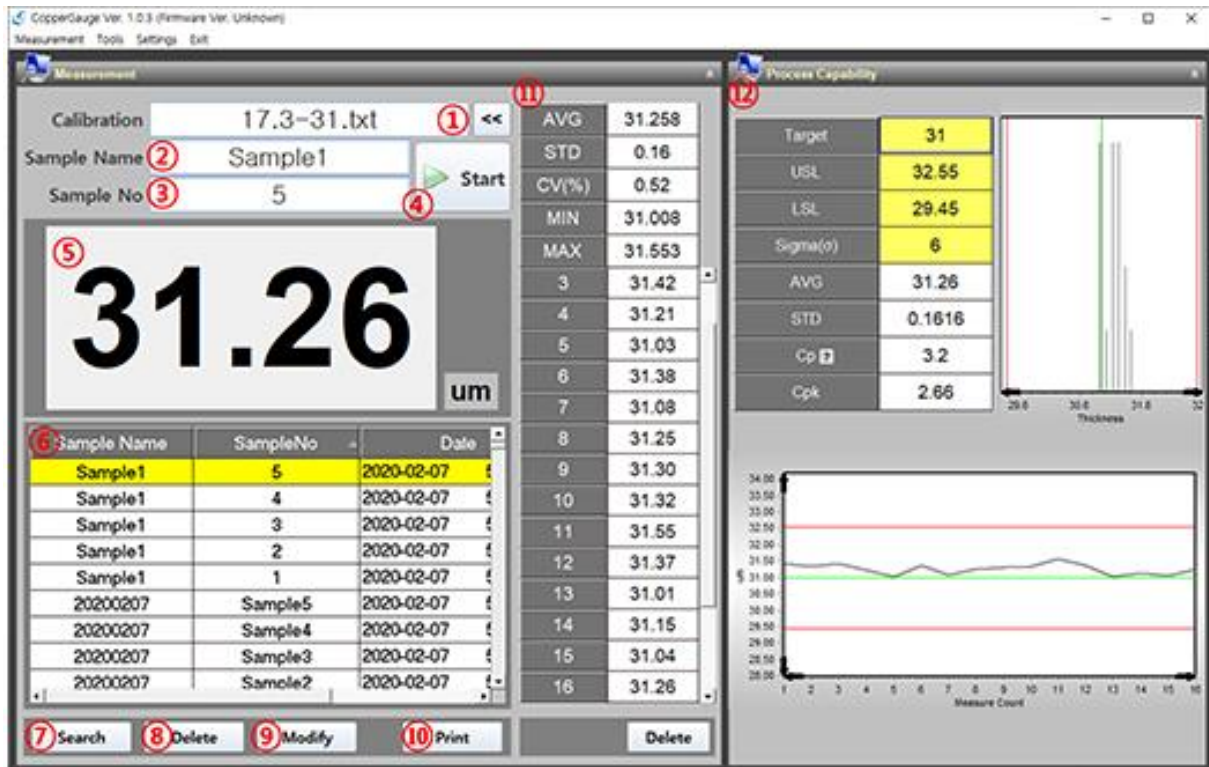
No.	Name
①	Start button
②	Volume button
③	USB port for RS232 cable

3.1.2 Rear of device



No.	Name
①	220 V power port
②	Probe port
③	USB port
④	HDMI port
⑤	LAN port

3.2 CopperGauge UI

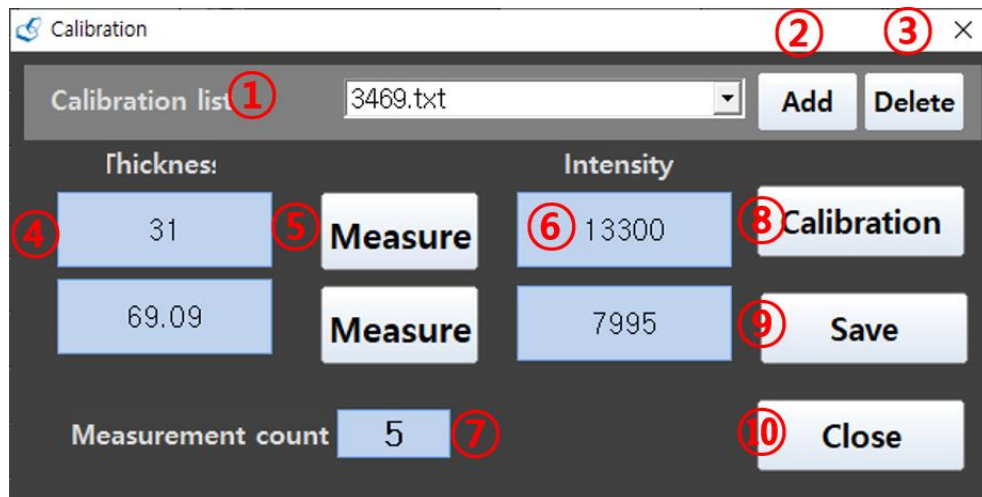


3.2.1 Main UI

No.	Name
①	Import calibration data
②	Name of target sample for measurement (test name)
③	Number assigned to target sample for measurement (test number)
④	Start/Stop button
⑤	View calibration result data
⑥	List of measurement result data by test number
⑦	Search for a list of measurement result data
⑧	Delete the selected test name
⑨	Edit the selected test name or test number
⑩	Print the data and statistics corresponding to the selected test name in Excel or PDF format
⑪	View measurement result data values and statistics

⑫	View the trend of data using a graph and the specifications of the sample
---	---

3.2.2 Calibration UI



No.	Name
①	Calibration list currently included in the Calibration folder
②	Create a new calibration file
③	Delete the selected calibration file
④	Enter the thickness of the target standard samples for measurement
⑤	Perform measurement of the standard sample
⑥	Intensity value of the standard sample
⑦	Specify how many times the standard sample will be measured
⑧	Create calibration data based on the intensity value of the measured standard sample
⑨	Save the data to a calibration file and select the data
⑩	Close the Calibration window

3.3 Functions of CopperGauge

3.3.1 Starting measurement

Launch the CopperGauge software, select the Calibration data, enter the test name and test number, and then click the **[Start]** button.

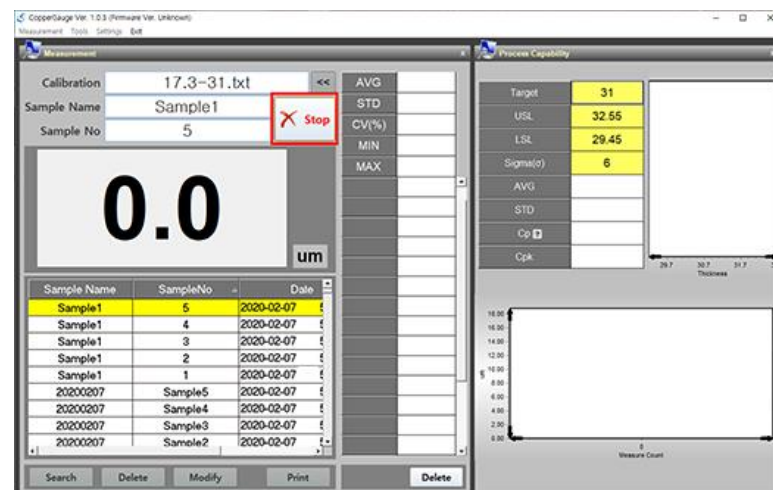


If the Start button is clicked, the **Search**, **Delete**, **Edit**, and **Print** buttons become deactivated; you can only delete a line using the “Delete one line” button or change the **Standard** value.

Now you can use the probe to measure the sample.

3.3.2 Stopping measurement

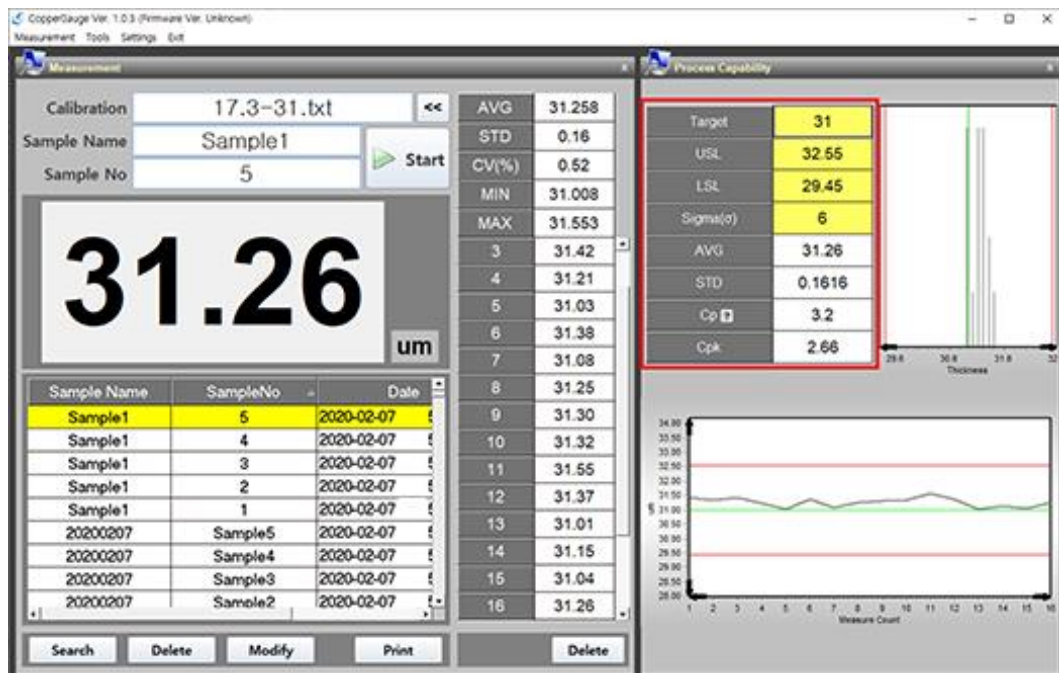
To stop measurement, click the **[Stop]** button, as shown in the photo below.



If the **Stop** button is clicked, it is not possible to save measurement result data under the current test name; you can only delete a line using the “Delete one line” button or change the **Standard** value.

3.3.3 Changing the standard graph

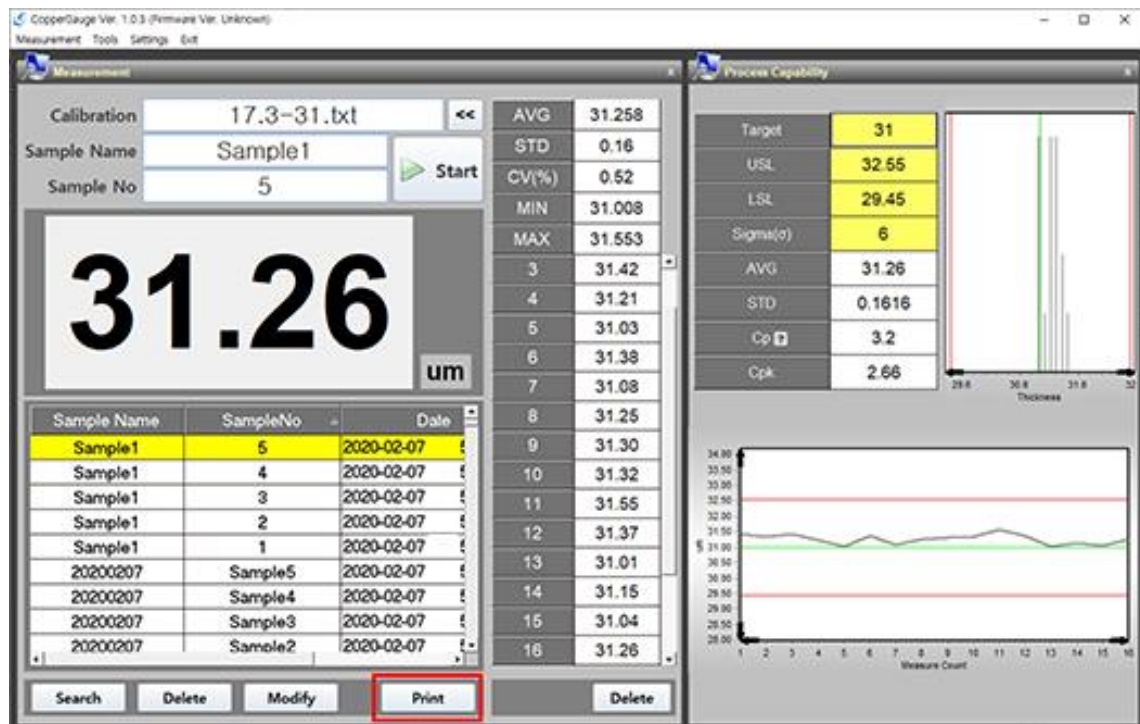
By changing the **Standard** value, shown in the red box in the photo below, you can change the maximum and minimum sample ranges displayed in the graph.



If you change the standard value, the upper and lower standard limits are automatically calculated using the range value in the [Cpk] section of the config.ini file which is saved in the folder where the software is installed. The range value is set to 5%, but it can be changed to narrow or widen the range. The upper or lower standard limit, shown in the red box above, can also be manually entered, as required.

3.3.4 Report function

CopperGauge supports the report function. To use the report function, click the **[Print]** button shown in the figure below.



If you click the **[Print]** button, the following screen appears.

Print
Export PDF
Export Excel
Close

Test Report

Sample name Sample1

Date 2020-02-07 오후 5:21:39

Company

Address

Sample No 1

Tel.

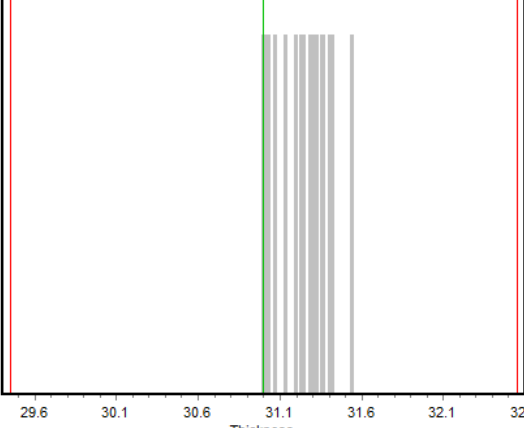
Measurement Data Unit

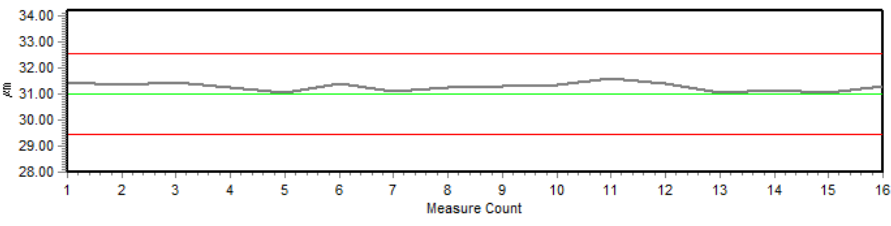
Average	31.3
Deviation	0.2
CV(%)	0.5
MIN	31
MAX	31.6

1	31.4			
2	31.3			
3	31.4			
4	31.2			
5	31.0			
6	31.4			
7	31.1			
8	31.2			
9	31.3			
10	31.3			
11	31.6			
12	31.4			
13	31.0			
14	31.1			
15	31.0			
16	31.3			

Process Capacity

Target	31
USL	32.55
LSL	29.45
Sigma	6
Average	31.26
Deviation	0.1616
Cp	3.2
Cpk	2.66



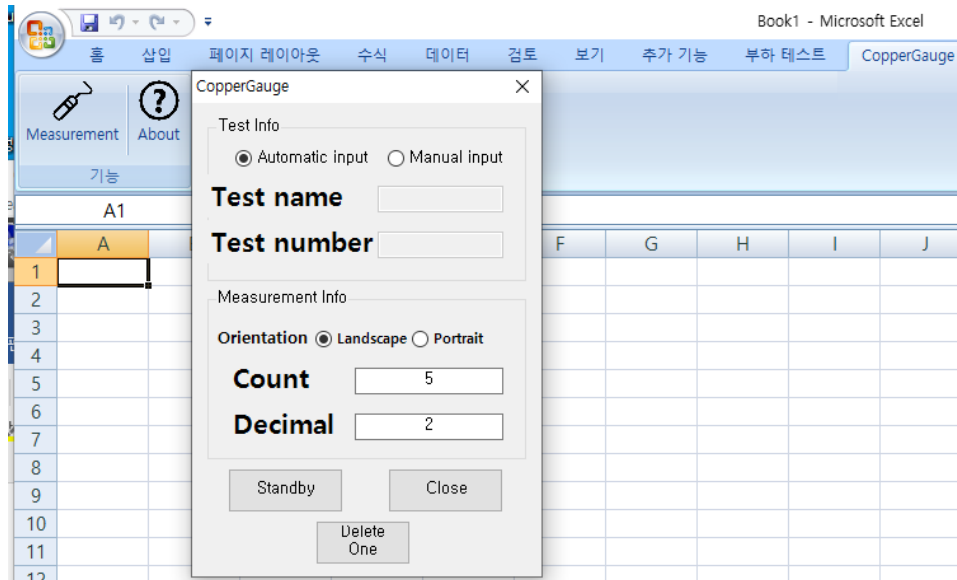


The screen shows information corresponding to the test name, including the data, specifications, and graph; a maximum of 60 data items are shown. From this screen, you can export data as a report in PDF or Excel format.

3.3.5 Realtime data transmission

Transmit measurement result data in real time as an Excel file to another computer. To use this function, first make sure you install Excel Add-In, developed by ISP Co., Ltd., on the computer. To install Excel Add-In, refer to [4.3 Installing Excel Add-In].

After installing Excel Add-In, click the **[Measure]** button in the **[CopperGauge]** tab to open the following window.



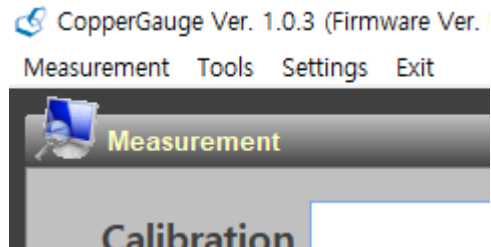
The **[Test Info]** item has two options: **[Automatic input]** and **[Manual input]**. If you select **[Automatic input]** and click the **[Standby for measurement]** button, the values in the **[Test name]** and **[Test number]** fields are sent to the ISP system. Then the test name and test number are automatically entered, and measurement begins. If **[Manual input]** is selected, the user should manually enter values in the **[Test name]** and **[Test number]** fields. As soon as the **[Standby for measurement]** button is clicked, the values entered in the two fields are sent to the ISP system and measurement begins.

Under **[Measurement Info]**, set the orientation in which the data will be displayed. For example, if "Landscape" is selected, a specified number of measurement result data values are displayed horizontally along each row. The "Decimal" item is used to set the number of decimal places for displaying measurement result data. The maximum number of decimal places is "5."

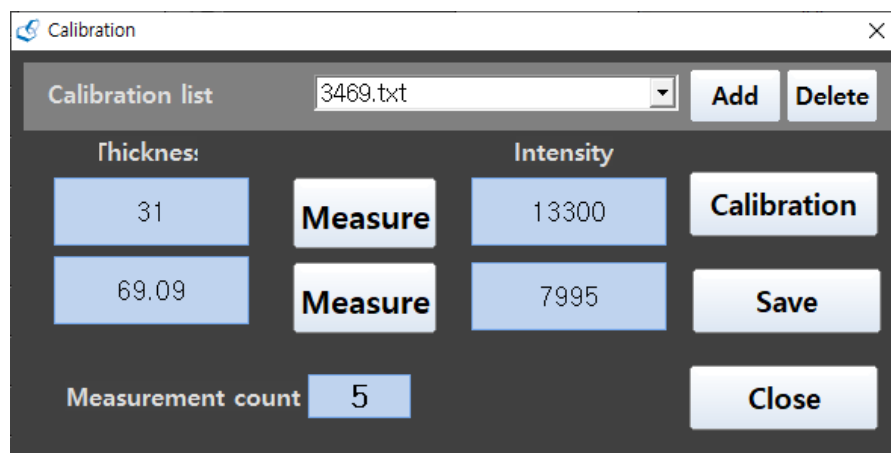
If you click the **[Standby for measurement]** button, the system switches to standby state. As soon as measurement begins, the measurements appear in the Excel worksheet. If you click the **[Delete one]** button, the previous measurement is deleted. Measurements can also be deleted by pressing the **[Space]** key.

3.3.6 Calibration

To perform calibration, first have ready the standard sample. Next, at the top left of the CopperGauge software screen, click the **[Measurement]** menu and click **[Calibration]** one after another.

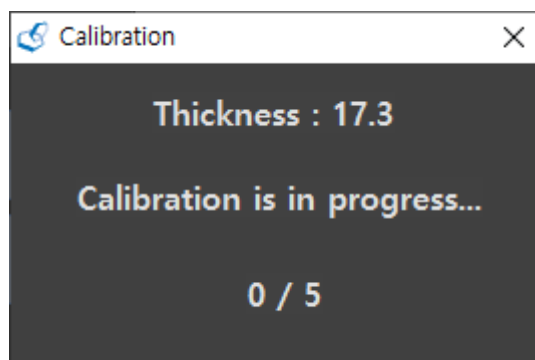


If you click **[Calibration]**, the Calibration window appears, as shown in the photo below.



If the calibration list is empty, you can create a calibration data item by clicking the **[Add]** button. To delete a created calibration data item, click the **[Delete]** button.

Fill in the "Thickness" field with the thickness of the standard sample, and click the **[Measure]** button. A message appears saying **[Calibration is in progress...]**, as shown below, and the probe measures the standard sample the number of times specified in the "Measurement count" field shown in the photo above.

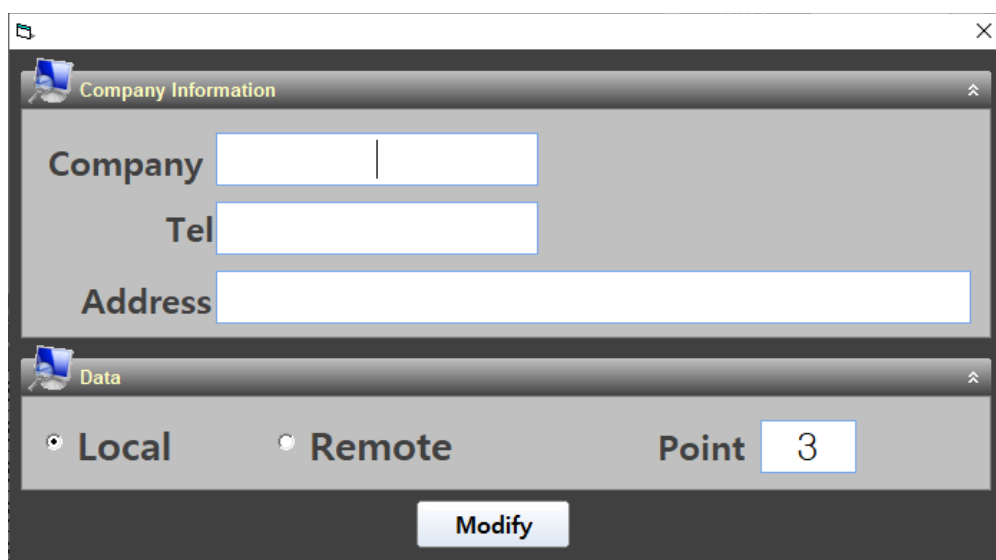


After measurement is completed, the window is closed and an average of the intensity values is calculated and automatically recorded in the text file. After measurement of two standard samples

is completed, click the **[Calibration]** button and **[Save]** button one after another to save the calibration data.

3.3.7 Settings

Use the **[Settings]** window to enter your company information. The information entered in this window is used when the Report function is performed. Under **[Data]**, if you select **[Local]**, measurement result data is only displayed on the ISP system. If you select **[Remote]**, the data is displayed in Excel format. If **[Remote]** is selected, the **[3.3.5 Realtime data transmission]** function is activated.



The screenshot shows a software window titled "Settings" with a close button (X) in the top right corner. The window is divided into two main sections: "Company Information" and "Data".

Company Information section:

- Company**: A text input field with a vertical cursor.
- Tel**: A text input field.
- Address**: A text input field.

Data section:

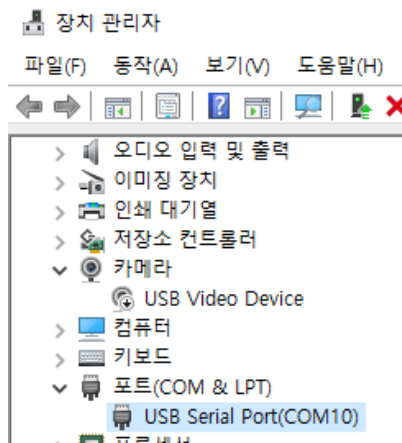
- Local**: A radio button that is currently selected.
- Remote**: A radio button.
- Point**: A text input field containing the number "3".

At the bottom of the window is a **Modify** button.

4. Software Installation

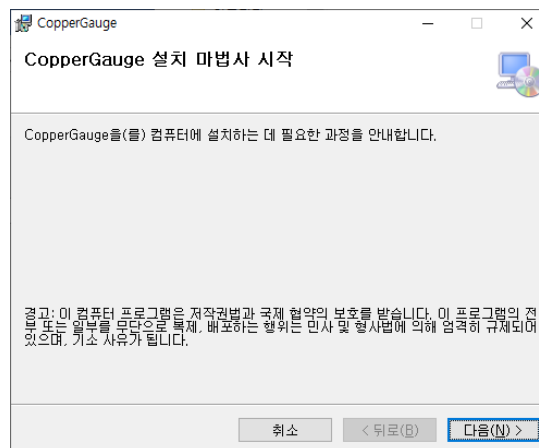
4.1 Installing the driver

Connect the RS232 to the computer on which Excel Add-in will be installed. The driver is automatically installed. If the driver is not automatically installed, open the folder compatible with your computer's operating system from the **[Driver]** folder on the supplied USB storage device and install the driver. After installation is completed, go to **[Device Manager]** and make sure **[USB Serial Port]** is found under **[Port (COM & LPT)]**, as shown in the photo below.



4.2 Installing CopperGauge

On the supplied USB storage device, run the **[CopperGauge_Installer.msi]** file in the **[CopperGauge]** folder. If you run the installation program, the following screen appears.

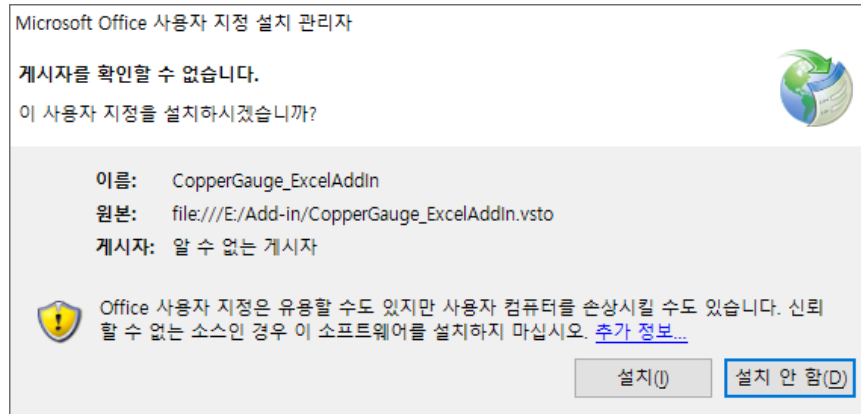


Click the **[Next]** button to install the software, and click the software icon on the **[desktop]** to run CopperGauge.

The CopperGauge software automatically runs when the computer is rebooted.

4.3 Installing Excel Add-In


On the supplied USB storage device, run the [setup.exe] file in the [Add-in] folder. If you run the installation program, the following screen appears. Click the [Install] button.



During installation of Excel Add-in, several programs required to run the software may also be installed together.

5. Maintenance and Safety Management

5.1 Precautions

	<p style="text-align: center;">Caution</p> <ol style="list-style-type: none"> 1. Make sure you turn off the device prior to maintenance of the device. 2. Exercise caution to ensure that no liquid enters the device. 3. Make sure the device is NOT laid on its side, front, back or top.
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5.2 Troubleshooting

5.2.1 General problems that may occur

Trouble	How to resolve
Software has frozen	<ul style="list-style-type: none"> • If the gauge software freezes, press the Ctrl+Alt+Del keys to force shut down the CopperGauge software and restart it. • If the Excel Add-in software freezes, click the [Close] button in CopperGauge to close the software. • If the same trouble persists, close the Excel window and try again.
Data cannot be measured	<ul style="list-style-type: none"> • If data cannot be measured, check that the [Start] button has been clicked from CopperGauge on the system. • Check that the probe is connected to the system properly.
Software cannot be started	<ul style="list-style-type: none"> • Reinstall the software.
The computer has suddenly frozen	<ul style="list-style-type: none"> • On the right side of the device, press and hold the [Power] button for at least 5 seconds to force shut down the computer.
Deviation of data is serious	<ul style="list-style-type: none"> • If deviation of data is serious, check to make sure that no electronic device or vibration is found around the device. Electronic devices or vibration may cause noise, which increases deviation. • Check that the pins are uniformly arranged.
Data is incorrect	<ul style="list-style-type: none"> • Environmental factors (e.g., temperature, humidity) may affect the probe and system. If data is found to be incorrect, perform calibration again.

5.3 Contact information

Headquarters	Road name-based address	ISP Co., Ltd., F1, 109, Wonmanseong-ro, Deokjin-gu, Jeonju City, Jeollabuk-do, South Korea
	Lot number-based address	ISP Co., Ltd., F1, 835-12, Palbok-dong 2, Deokjin-gu, Jeonju City, Jeollabuk-do, South Korea
Telephone		+82-63-263-8444
Fax		+82-63-263-8445

6. Appendix

6.1 Plating

“Plating” refers to the application of a different thin material over the surface of an object to make it more useful than the quality of its original material. In general, it refers to the act of applying different metal over the surface of a metal product. The metals used as plating material include the alloy as well as pure metals. These metals are used to plate not only metal materials but also plastic materials. Available plating types include electroplating, chemical plating, hot-dip plating, vacuum plating, and ion plating.

Plating plays a role of improving the functions and value of a product by adding qualities appropriate for the characteristics required by the product. Merits of plating include improvement of exterior, improvement of durability, and improvement of functionality.

The improvement of exterior has been one of the most important purposes ever since plating was first introduced; the exterior of a product can be plated with a beautiful film and kept as is semi-permanently. For purposes of exterior improvement, precious metal plating using gold, silver, or rhodium, is used to plate finished products. This plating involves use of another type of plating.

For purposes of durability improvement, zinc plating or cadmium is used to prevent corrosion of materials. In particular, zinc plating features a chemically excellent and durable thin film that is widely used to plate iron materials.

The improvement of functionality involves wear resistance, electrical conductivity, electromagnetic property, optical property, and thermal property.

[Wear resistance]

The industrial chrome plating, one of the surface hardening methods, improves wear resistance. The chrome features excellent durability under natural environment conditions because it is easily oxidized in the air to form a thin inert film. It is mechanically strong and has a low frictional coefficient. The electroless plating can plate intricate-pattern components with a consistent-thickness film (usually less than $\pm 5\%$). The nickel-phosphorus alloy plating has a degree of hardness close to the chrome plating. There is also a composite plating co-deposited with SiC Wc.

[Electrical conductivity]

Types of plating that can improve electrical conductivity are used when making circuits for electronic circuit boards. The types of plating used when making circuits include the electroless plating and through-hole plating. The through-hole plating, which passes through both sides of a circuit board to send an electric current, simplifies and densifies an intricate-pattern electronic circuit board. The ports on most electronic components are plated with nickel, gold, silver, or tin soldering. IC frame connectors are plated with a variety of precious metal.

[Electromagnetic property]

Tapes and disks, which are magnetic recording media, are plated using sputtering or electroless plating with Ni-Co, Ni-Co-P, or Ni-Fe. The underplate films of aluminum magnetic disks (hard

disks) are plated using non-magnetic Ni-P alloy plating for purposes of improvement of mechanical hardness and precision.

[Optical property]

Gold, Silver, and aluminum are metals that have high reflexivity. Mirrors and condensing lamps are plated using silver plating or aluminum vacuum evaporation films. For purposes of safety, mirrors with a highly pure aluminum sheet plated using nickel-chrome plating are also available in the market now.

[Thermal property]

Several types of plating are used to plate solar heating collectors. Black chrome plating is one of the optimum methods to make durable radiant heat absorbers. A stainless steel frying pan with a copper-plated bottom is advantageous because the copper film, with excellent thermal conductivity, distributes temperature uniformly over the stainless steel surface that has poor thermal conduction.

The unit used to show the thickness of plating is micron. When 1 mm is divided into 1,000 equal parts, each of the parts is called "1 μ " (1 micron). The surface area of a plated object is expressed in dm^2 . 1 dm^2 is as follows: $10 \text{ cm} \times 10 \text{ cm} = 100 \text{ cm}^2$. The surface area of a plated object can be calculated as follows:

$$\text{Plating surface area (dm}^2\text{)} = \text{weight of material (kg)} \div \text{thickness of material (mm)} \div \text{specific gravity of material} \times 2 \times 100$$

6.2 Plating steps

The steps of plating are as follows:

**Pickling → rinsing → plating → rinsing → chromate (post-processing) → rinsing
→ dewatering and drying**

[Pickling]

This pre-plating processing improves adhesion to the exterior by removing the oxidized layer formed on the metal surface of the material and exposing the new metal surface. This step uses acid to chemically remove oxidized films or hydroxides created on the metal surface after the material has gone through thermal treatment or has been left unused for a prolonged period of time.

[Chromate (post-processing)]

This usually refers to zinc plating or aluminum-type chrome treatment. This treatment increases the durability of material by several times by immersing the material in a solution containing hexavalent chrome to form a film.

6.3 Principle of electrical resistance-type measurement

Using the “Electrical resistance method” principle, it is possible to easily and quickly measure thickness of the copper on a PCB or film. In the probe which consists of four pins, the two pins on both ends generate and deliver DC current to above the contacted copper. The other two inner pins generate a potential difference due to the electric current flow. The potential difference is converted to a thickness, which is shown to the user. The measurement principle is illustrated in the figure below.

