AiT Advanced Instrument Technology

Operating & Service Manual

CMT-SR2000N
Sheet Resistance / Resistivity Measurement System

Contents

Please check below 5 items in the package.

1. Main Body ---------- 1 set
2. Power Cable ---------- 1 e/a
3. Communication Cable ---------- 1 e/a
4. OP Software (CD- Rom) ---------- 1 e/a
5. Operation & Service Manual ---------- 1 e/a

DECLARATION OF CONFORMITY

Manufacturer's Name : AIT Co., LTD.

Manufacturer's Address : 103-407 Digital Empire 2, 486 Sindong, Yeongtong, Suwon, Gyeonggi, 16681 Korea.

Declares that the product.

Product Name : Sheet Resistance / Resistivity Measurement System.

Model Number : CMT-SR2000N

Product Option : All

Supplementary Information:

The product was tested & calibrated in a typical configuration with AIT

Test System.

Chapter 1. Specifications

1. Overview

CMT-SR2000N is a full automatic system to measure sheet resistance and Resistivity for max. 200mm wafer or 140x140mm square sample, etc.

This system can be operated by itself, furthermore, perfect remote control is available by using a PC and exclusive software, and it provides a various data analysis functions.

2. Feature

- Ø X-Y-Z axis full automatic system.
- Ø Automatic & Manual measurement range selection.
- Ø Up to 200mm wafer or 140x140mm square sample capability.
- Ø Perfect remote control by exclusive operating software.
- Ø Data analysis functions - 2D, 3D map, Data map, etc.
- Ø ASTM, SEMI measurement mode.

3. Component

The system consists of following components.

- Ø 4-point probe head unit.
- Ø Automatic contact unit.(Z-axis)
- Ø Rotation sample stage (X axis) & Straight-line motion arm (Y axis).
- Ø 200mm stage.
- Ø Membrane keyboard panel.
- Ø LCD display window.
- Ø Remote control communication port. (USB port)
- Ø Vacuum input port (one-touch fitting connector).
- Ø Operating Software.
- Ø Standard accessories
  - Power connection cable.
  - Remote control communication cable. (USB cable)
  - Operating & Service manual.

4. Specifications

Ø Sheet resistance measurement.

- Measuring method : Contacted by four point probe
- Measuring range : 1 mohm/sq ~ 2 Mohm/sq

Ø Resistivity measurement.

- Measuring method : Contacted by four point probe (Input thickness)
- Measuring range : 10.0 μohm · cm ~ 200.0 kohm · cm

Ø Current Source.

- Range : 5nA to 160mA

Ø Measurement Accuracy.

- ±0.5% (Precision Resistor)

Ø Measurement Repeatability. (2 σ)

- ±0.15% (Precision Resistor)

Ø Measurement time : Approx. 2 ± 1 sec/point

Ø Four point probe (JANDEL ENG.)

- Pin spacing : 25 ~ 50 mils by 5mil increments
  Tolerance ± 0.01 mm
- Pin Load : 10 ~ 250 gram/pin
- Pin radius : 12.5~500 microns (polished above 25 μ)
- Needles : Solid tungsten carbide φ 0.40 mm

Ref)
- A type : 40 micron, 100g, 1mm
- B type : 100 micron, 100g, 1mm
- C type : 200 micron, 100g, 1mm
- D type : 500 micron, 100g, 1mm
- E type : 40 micron, 200g, 1.59mm

5. Specimen

Ø Maximum 200mm Wafer or 140x140 square sample.

6. Outside dimensions

Ø 254mm(W) x 562mm(D) x 250mm(H)

Note) The outside dimensions take to change by maker in case of need.

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7. Operating software

- Ø General Personal computer.
- Ø Operating system : Microsoft Windows XP SP3 / 7 Ver.
- Ø Communication method : USB (Virtual Serial port communication)
- Ø Measurement Data management
  - Data save & load, export & import
  - NFS transfer via LAN

- Ø Various Measurement Mode
  - Recipe measurement : Recipe Point designation by user.
  - Standard measurement : ASTM & SEMI Mode.
  - Pattern measurement : 49, 81, 121, 225point, etc.
  - Step measurement : Point interval designation by user.
  - Manual measurement : Random measurement with coordinate values.

- Ø Data Analysis functions : 2D, 3D map, Data map, Statistics, etc.
- Ø User management : User register, selectable security levels of user, Login, etc.

8. Operating environment

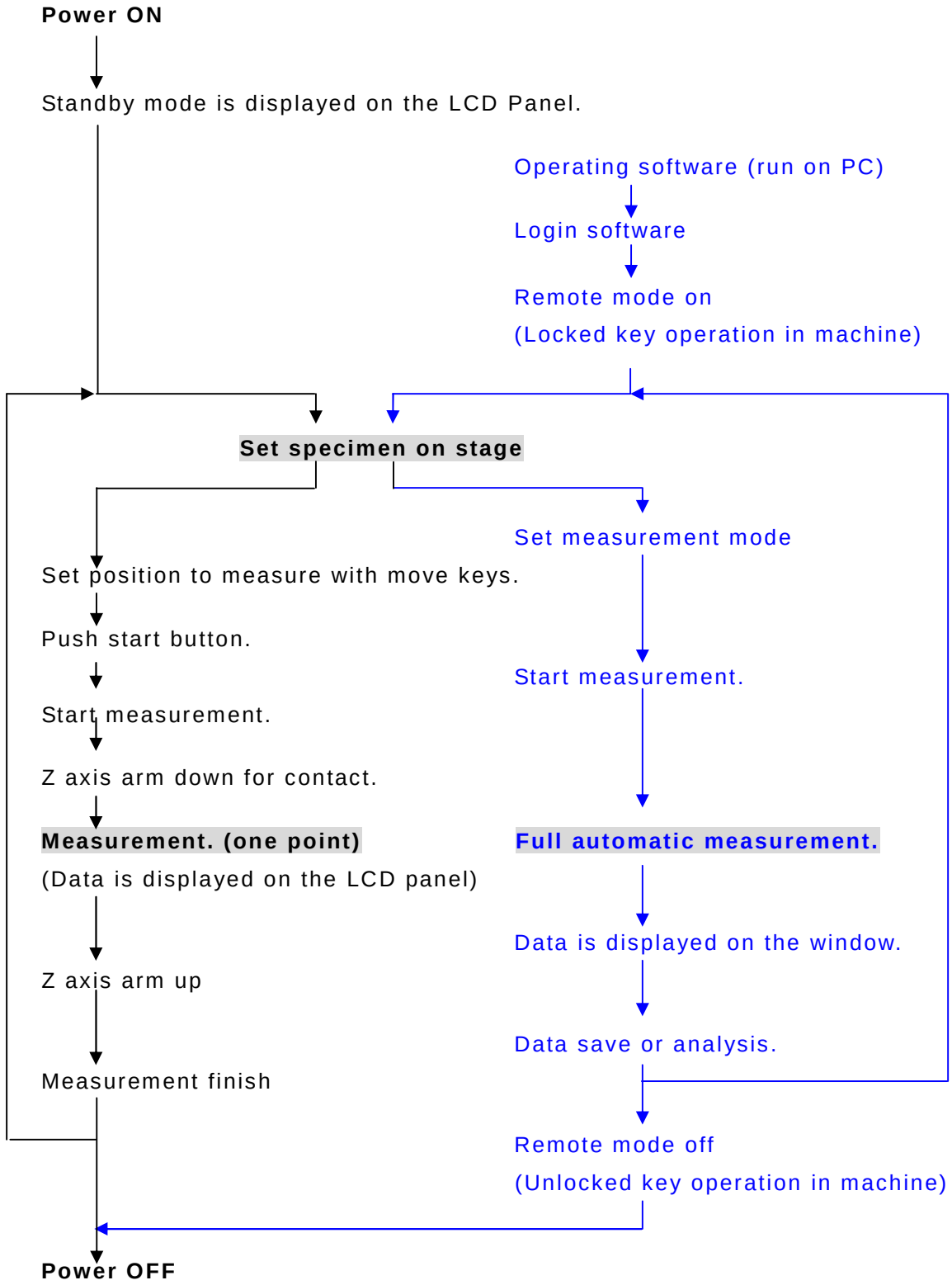
- Ø Temperature range : 23℃ ±1℃
- Ø Relative humidity : 30% ~ 70%
- Ø Avoid placing the system near a source of RFI, vibration and sources of gas.
- Ø Avoid large changes in temperature.

9. Utility requirements

- Ø Power requirements (1 Line)
  - Line voltage : AC 220V or 110V ± 10%
  - Electric power : 100 W, 500 mA
  - Line frequency : 50/60 Hz

- Ø Vacuum requirements (1 Line)
  - Vacuum : about 200mmHg
  - Connection method : Urethane tube ϕ 4 mm (outside diameter)

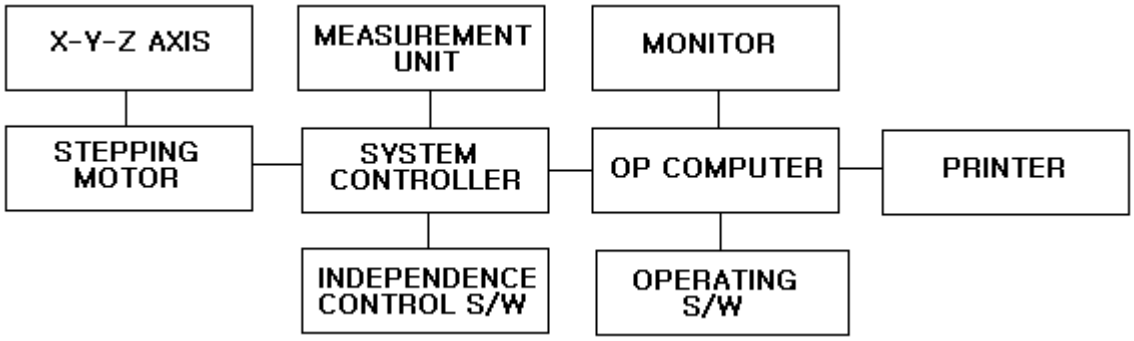
10. Measurement Flowchart



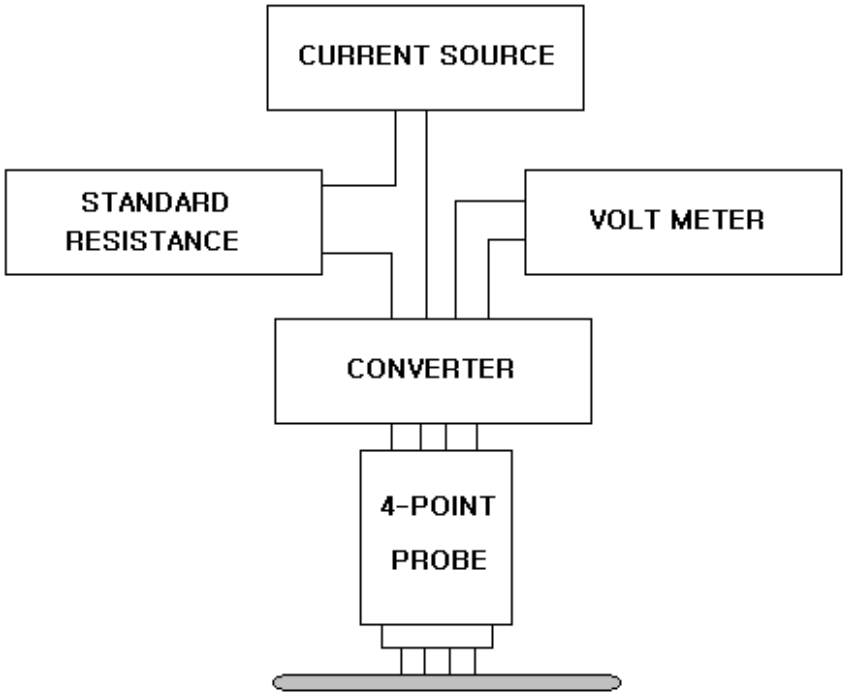
Note)

- Black color is flow for stand alone operation.
- Blue color is flow for remote controls by software.

11. System Layout



12. Measurement Layout



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Chapter 2. Installation

1. Installation & Operation Environment

- Ø Temperature range : 23°C ± 1°C
- Ø Relative humidity : 30 ~ 70%
- Ø Avoid placing the system near a source of RFI, vibration and sources of gas.
- Ø Avoid large changes in temperature.

2. Hardware Installation

Ø Perform the following procedure to install this system.

a. Place this system (CMT-SR2000N) on a flat site without any vibration.

b. Connect the power cable to AC power source (110V or 220V).

c. Install CMT-SR2000NH software and Virtual Com port driver from CD.
(Ref. 3. Software Install)

d. Connect the communication cable between the system and USB port in PC.

e. Connect the tube of vacuum line to vacuum port in this system's rear panel.

f. Hardware install is completed through above steps.

3. Software Installation

Ø Perform the following procedure to install this system's software.

a. Operate the OS [Microsoft Windows XP SP3 / 7 Ver.] of PC.

b. Insert the Installation disk into CD-ROM.

c. Install Virtual Com port Driver from CD to use USB port of PC for communication.

Note) The installed Virtual Com port by Virtual Com port driver will be displayed on 'Port (Com & LPT)' in 'Device Manager' of Windows.

d. Run CMT-SR2000NH setup file from CD and follow the instruction to set up the software.

e. After finish the installation of CMT-SR2000NW Operation Software, a group of CMT-SR2000NH8x is generated in the program group and an icon of CMT-SR2000NH8x is also generated.

f. To run the software, click Start – Program – CMT-SR2000NH8x – SR2000nh8x.exe.

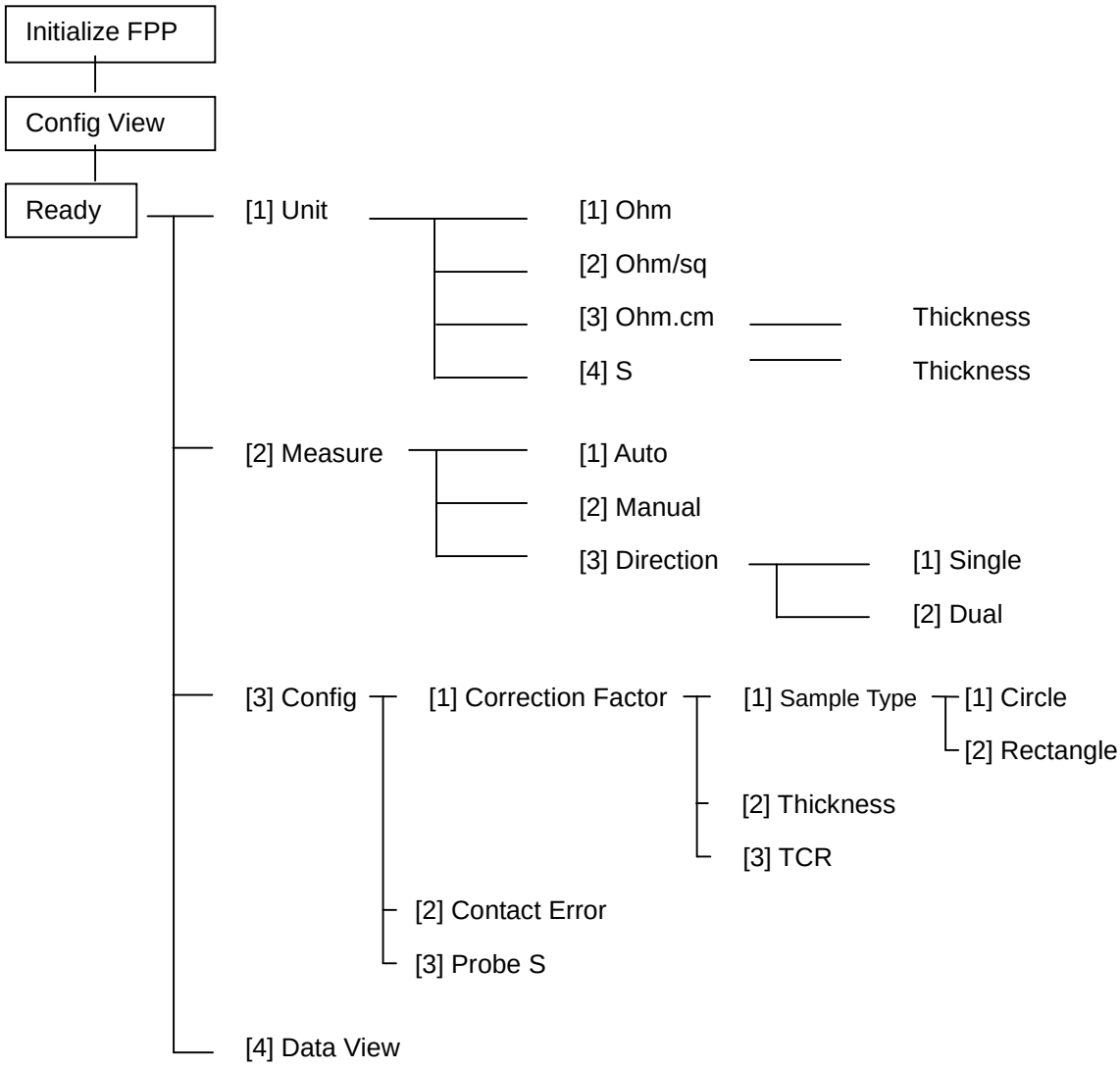
g. For the first time, log in by Setup Engineer ID and Password, and then new user can be registered.

- Setup Engineer ID : "**aitco**"
- Setup Engineer Password : "**00000000**"

Setup Engineer has the same authority as System Engineer of User Levels.
Setup Engineer's Password can be changed and the detail is in 2.3 of chapter 4.

Chapter 3. Hardware manual

1. Hardware Operating Structure



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2. keyboard Introduction

a. Key 1 has its inherent own number 1 inputting function and additionally serves to move Z-axis arm downward. If Z-axis arm is down some little, X-/Y-axis are unmovable and the measurement is unavailable.

b. Key 2 has its inherent own number 2 inputting function and additionally serves to move Y-axis arm toward home position only during being pushed.

c. Key 3 has its inherent own number 3 inputting function and additionally serves to move Z-axis upward.

d. Key 4 has its inherent own number 4 inputting function and additionally serves to rotate the sample stage (X-axis) in the right direction only during being pushed.

e. Key 5 has its inherent own number 5 inputting function and additionally serves to move Y-axis arm and the sample stage(X-axis) toward home position with being one time pushed.

f. Key 6 has its inherent own number 6 inputting function and additionally serves to rotate the sample stage (X-axis) in the left direction only during being pushed..

g. Key 7 has inherent own number 7 inputting function and additionally serves to lower the current source at Manual range mode. Whenever pushed one time, the current downs by one step.

h. Key 8 has its inherent own number 8 inputting function and additionally serves to move Y-axis arm forward only during being pushed.

i. Key 9 has its inherent own number 9 inputting function and additionally serves to heighten the current source at Manual range mode. Whenever pushed one time, the current up by one step.

j. Key 0 and • has its inherent own number 0 and • (decimal point) inputting function.

k. “Esc” key is used to return to the previous mode and cancel the inputted number.

l. “Mode” key is used to utilize menu in which a variety of environment can be specified. Please refer to “Clause 4 Defining Method of Configuration”.

m. “Vacuum” key serves to stick a sample on the sample stage, in order to avoid any movement of the sample.

n. “Enter” key serves to apply the inputted number to the configuration. On the contrary, if you do not want to apply the inputted number, press “Esc” key to remain the previous inputted number.

o. “Measure” key performs the measurement.

3. Brief Measuring Method

Push the Power Switch (in this system's rear panel) to "I" position. When the electric power turns "ON", LCD displays Fig. 1 and this system performs the initialization.
After initializing, LCD displays all kinds of the defined values during some seconds, as shown in Fig. 2. Then, LCD displays a message indicating that measurement is ready, as shown in Fig. 3.

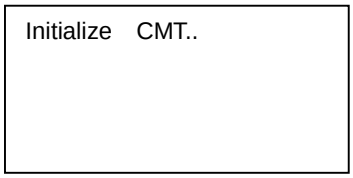

Fig. 1

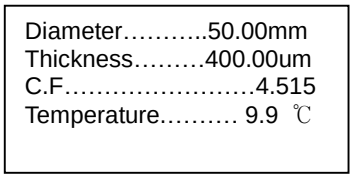

Fig. 2

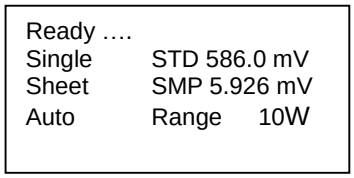

Fig. 3

Place a wafer on the center of the stage, fix the wafer to the stage (by using Vacuum key), then let probe head to touch the surface of the wafer (by using Measure key). If so, LCD displays a message as shown in Fig. 4. When completing the measurement, LCD displays the measured data as shown in Fig. 5.

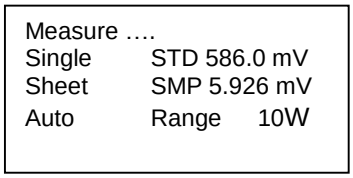

Fig. 4

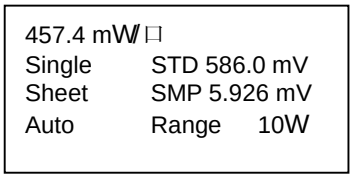

Fig. 5

To measure other sites, you can use ▲ ▼ ◀ ▶ key. If you move a measuring position anywhere, using ▲ ▼ ◀ ▶ key and press Measure key, this system starts measuring a wafer.

<< Contents of Measured Data >>

a."457.4 mW/sq" : Measured data for Sheet Resistance.

b."STD 586.0 mV" : Voltage applied to inner Standard Resist.

c."SMP 5.926 mV" : Voltage applied to Wafer.

d."Sheet" : Measurement unit.

e."Single" : Measurement method.

f. "Auto" : Current range mode.

g. "Range 10W" : Current range used when measuring
(Range is selected among 10W, 100W, 1KW, 10KW, 100KW, 1MW, 10MW, 100MW. When Auto mode, the range is automatically selected. When Manual mode, the range can be selected by user.)

Note) The manual range selection function is not supported on operating software. Operating Software can support Auto range only.

h. "Range not found" : Error message in case correct current range is not found on Auto range mode.

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4. Defining Method of Configuration

Pressing Mode key displays the Menu as shown in Fig 6.

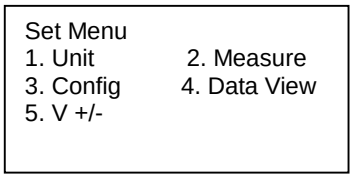

Fig. 6

[1] Unit

Unit Mode in Fig.6 can change a measuring unit into a desired unit and consists of 4 modes as shown in Fig. 7. To select a desired unit, press the corresponding number.

In case of [3]ohm.cm and [4]S, Thickness menu is displayed as shown in Fig. 8. You can enter the film thickness of sample into the menu. "Unit : [㎛]" means the setting unit is ㎛. "Def. : 400.0" means the default value is 400 ㎛. "[400.00]" means a currently entered value.

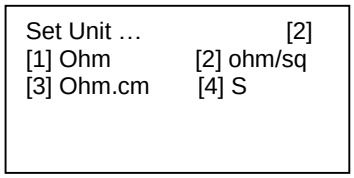

Fig. 7

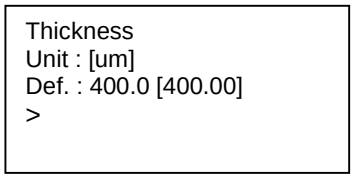

Fig. 8

[2] Measure

Measure has 3 modes (See Fig. 9).

- Auto : Automatically selects an appropriate current value.
  (Displaying "Auto" at the lower left-hand corner of LCD)

- Manual : Allows user to select an appropriate current value.
  To change a current value, use key 7 and 9.
  (Displaying "Manual" at the lower left-hand corner of LCD)

- Direction : This mode selects Measurement method. It has Single and Dual as Fig. 10. User can select one of the both mode.

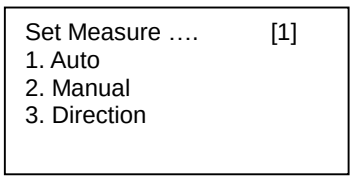

Fig. 9

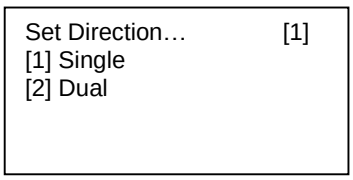

Fig. 10

[3] Config

Consists of 3 modes (See Fig. 11).

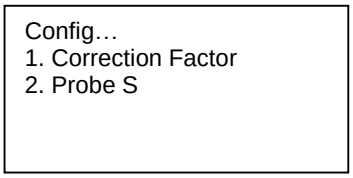

Fig. 11

1) Correction Factor : User inputs Sample type, Thickness, TCR(Temperature Coefficient) as Fig.12 to set correction factor. The Correction Factor is generated by inputted values automatically. Generated Correction Factor is applied to measuring.

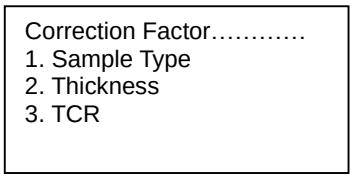

Fig. 12

a. Sample Type : User selects shape of sample as Fig. 13 and diameter or size of the sample.

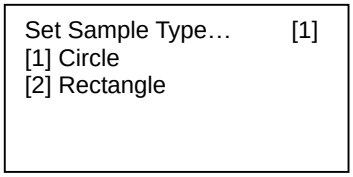

Fig. 13

- Circle : In case of Circle, user inputs a diameter of sample as Fig. 14.

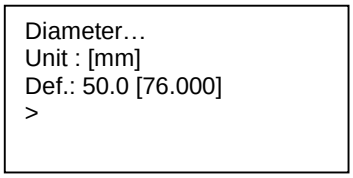

Fig. 14

- Rectangle : In case of Rectangle, user inputs a size of sample as Fig. 15, 16, 17.

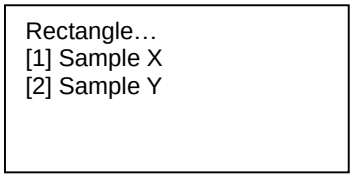

Fig. 15

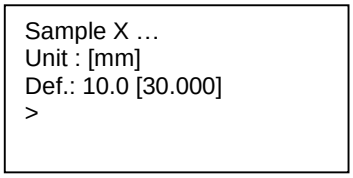

Fig. 16

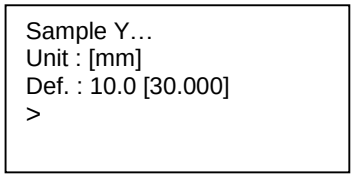

Fig. 17

b. Thickness: User inputs the thickness of film on sample. (See Fig. 8)

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c. TCR : User inputs Temperature Coefficient of sample. The default is 0.

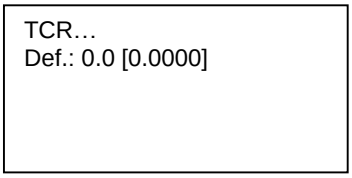

Fig. 18

2) Probe S : This is a function to input space of probe tip. The default is 1.0mm. (See Fig. 20)

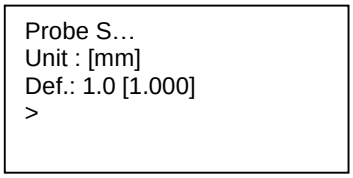

Fig. 20

[4] Data View

Measured data can be saved to inner memory automatically. It displays the saved data with temperature. The maximum is 28 data.

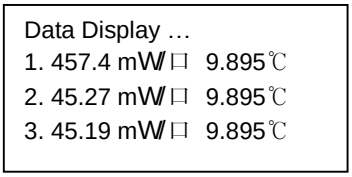

Fig. 21

[5] Motor Set (Enter+Esc).

This is a function to set acceleration and velocity of three axis(X-Y-Z). The current setting values are best that tested by manufacturer. Please don't modify the current setting value by yourself.

Note) In case user modify the setting value by themselves, if the machine has some problem, manufacturer is not responsible for that.

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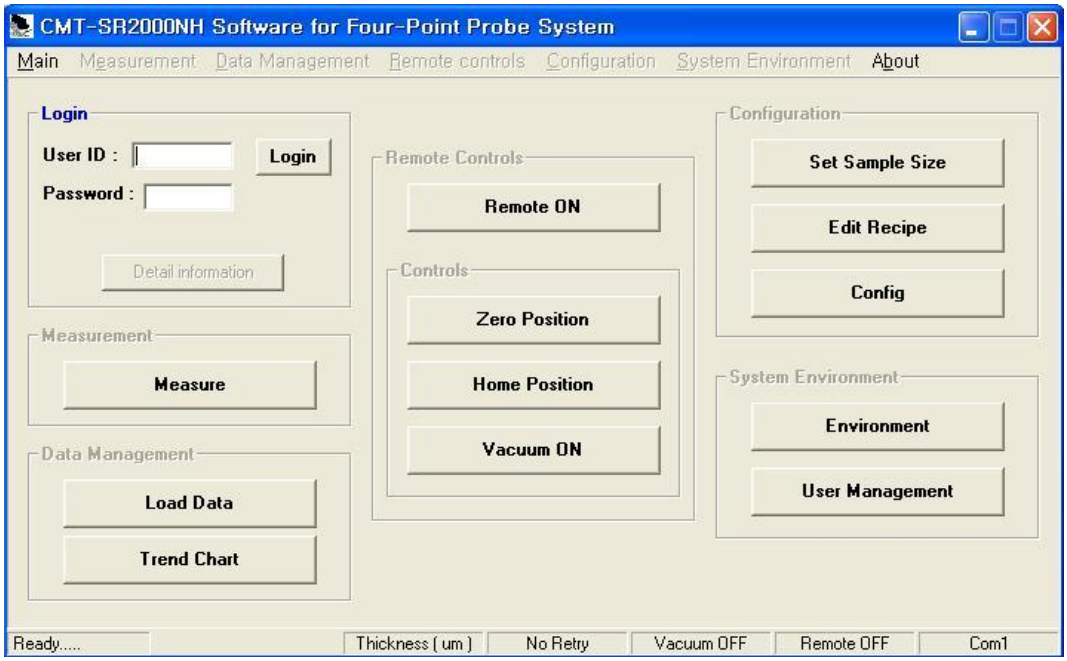
Chapter 4. Software manual

1. Main window



1.1 Title Bar

Shows the name (CMT-SR2000NH) of current operating software, and contains Window Control buttons - Min button, Close button.

1.2 Menu Bar

Each menu is activated/non-activated depending on Excess Authority of user's level. The function of each menu is same to below Function Buttons.

1.3 Function Buttons

1.3.1 Login (System Eng., Config. Eng., Operator)

1) User ID : Inputting User's ID.
2) Password: Inputting User's Password.
3) Login button : Click after inputting ID & Password.

1.3.2 Measurement (System Eng., Config. Eng., Operator)

It is a mode for measuring samples.

1.3.3 Data Management (System Eng., Config. Eng., Operator)

1) Load Data : Searching and analyzing the saved Measurement data.
2) Trend chart : Searching and analyzing the saved Trend data.

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1.3.4 Remote Controls (System Eng., Config. Eng., Operator)

1) Remote ON : On/Off communication connection to controlling the instrument.
   Under 'Remote On' mode, sub menus in 'Controls' section is available.

2) Controls
   ① Zero Position : X & Y robots move onto the center of stage.
   ② Home Position : Moving parts(X, Y, Z axis) are initialized.
   ③ Vacuum ON : ON/OFF vacuum Function.

1.3.5 Configuration (System Eng., Config. Eng.)

1) Set Sample Size : Set sample size for measuring.
2) Edit Recipe : Creating & editing Recipe.
3) Config : Setting configurations related with measurement.

1.3.6 System Environment (System Eng.)

1) Environment : Setting environment factors related with operation.
2) User Management : Managing users.

1.3.7 Status Bar

Status Bar shows present condition and setting like Unit, Auto Retry, Error control, etc.

2. Main menu

2.1 Login

Login with registered User ID and Password, then see user's information including the level. According to the level, some functions are limited.

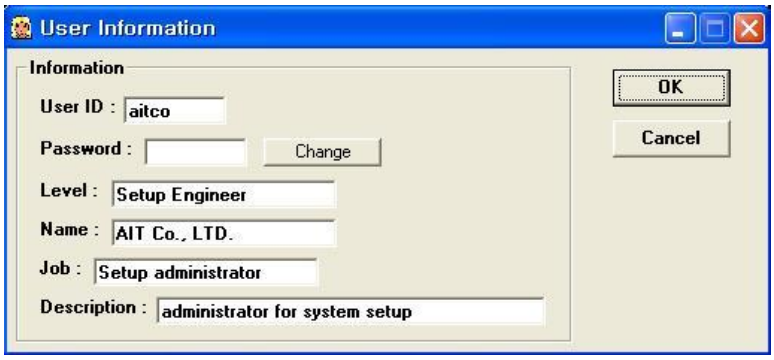
1) User ID : ID of login user.
2) Level : level of login user.
3) Name : name of login user.

2.2 Login/Logout

Performing login or logout function.

2.3 Detail information

Detailed information of user is displayed as shown in below. And user can change the password which was set by System Engineer beforehand.

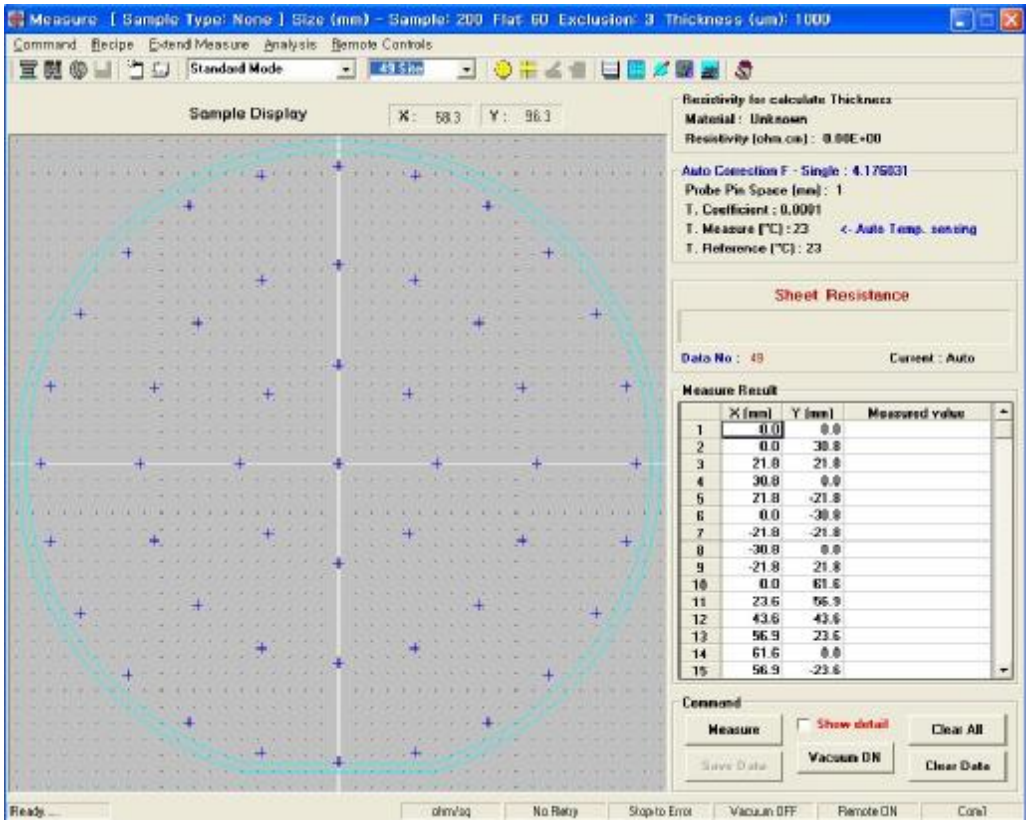


2.4 Exit

User should logout, and then can exit the CMT-SR2000NH software.

3. Measurement menu

Select Measurement method and proceed.



Note) It is displayed a rectangular shape in case of software for rectangular sample.

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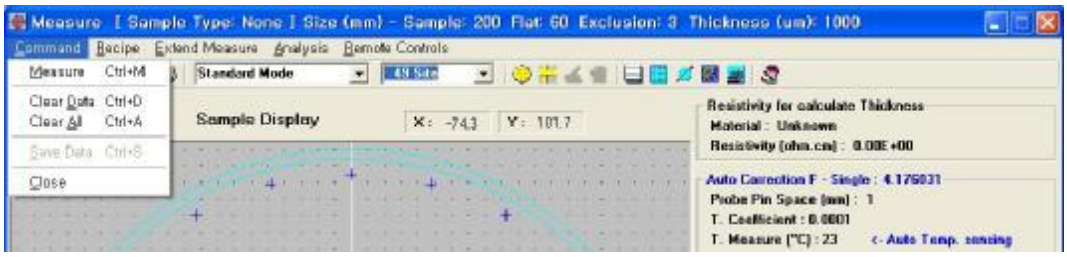
3.1 Command menu



3.1.1 Measure (Ctrl+M)

Performing measurement by selected measurement method. (Recipe mode, Extend measure mode)

3.1.2 Clear Data(Ctrl+D)

Deleting all measured data only from 'Result Sheet' after measurement.

3.1.3 Clear All (Ctrl+A)

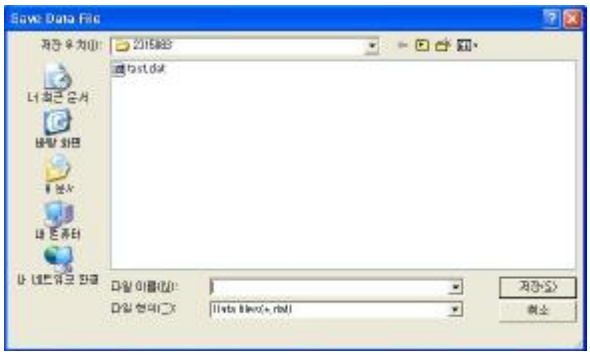
Deleting all measured data and site after measurement.

3.1.4 Save Data (Ctrl+S)

Saving the measured data after measurement. According to selection in 'Data Save Option', saving method is distinguished as follows.

u As Data Save Option is 'Default'

After finishing the measurement, user can save the measured values. User selects a folder and input filename to save.



1) Save

The default folder is a 'data' in program folder. User can select other to save.

① The name of selected folder will be recorded to Lot ID item inside saved data file.

② In case user selects 'Auto create save folder with LotID generated date format' function in 'Save folder Option at default location' item of 'Envrionment' menu(See 6.1.3 Save folder Option at default location), the measured data will be saved in folder named by selected date format(ex. YYYYMMDD) automatically. The folder name will be recorded to Lot ID item inside saved data file.

③ If the folder named by selected date format is already existed, the folder will be selected. If not, it will create new folder.

2) Cancel

Cancel to save.

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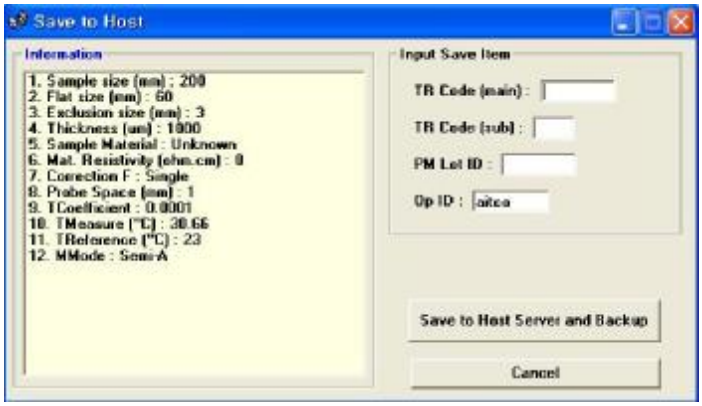
u As Data Save Option is Host server or Host server and Backup

Inputting 'Input Save Item' and applying Save, a folder "year month\machine code\" will be created automatically in Host folder path. Then, save the data as a defined file name in the created folder.



Note) In case of selection this option, measured data are saved in Host server only. It is not saved in data folder of software.

1) Save to Host server and Backup
The data file which named as below filename format will be saved to folder defined in Host Sever.

Ex) If TR Code(main) is "1111111" and TR Code(sub) is "222", Filename will be "1111111-222.xls"

2) Cancel
Cancel the save.

3.1.5 Close

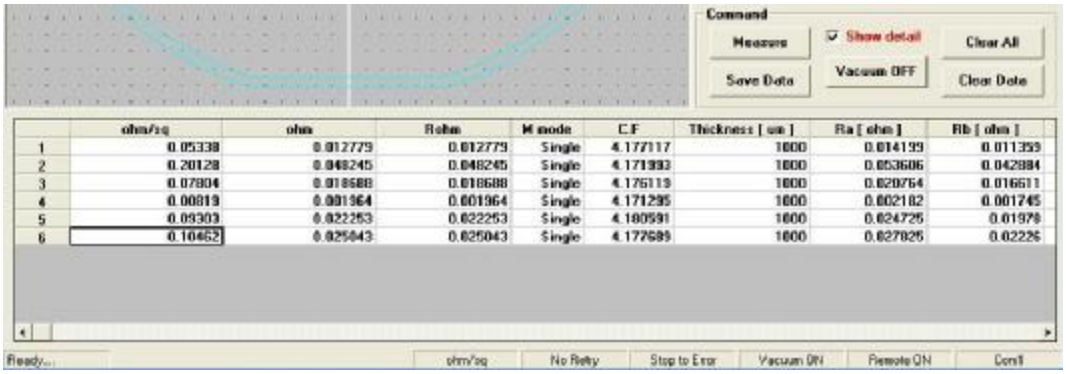
Closing the measurement window. Only, if the measuring point and the measuring value on the window of 'Sample Display' exist, you cannot terminate the software. Its termination is possible in case all measuring points and their values are cleared by using 'Clear All' Button.

3.1.6 Vacuum ON.

ON/OFF vacuum Function. It's same with "Vacuum ON/OFF of Controls Menu in 3.5.2.

3.1.7 Show detail.

This function will display a details of measured values like current and voltage, C.F, temperature, etc. as below.



The column 1 in displayed items is a measurement value with current selected unit. The column 2 is a measurement value with second unit.

① ohm/sq (column 1) : column 1 is a value with current selected unit.

② Ohm (column 2) : column 2 is a value with second unit.

ex)	Selected unit (column 1)	Second unit (column 2)
	ohm	ohm/sq
	ohm/sq	ohm
	ohm.cm	ohm/sq
	Thickness[um]	ohm/sq
	Thickness[A]	ohm/sq

③ Rohm : Resistance value transferred from machine.

④ M mode : Measure method (Single or Dual method)

⑤ C.F : Correction Factor.

⑥ Thickness [um] : film thickness of sample.

⑦ Ra [ohm] : Resistance value under forward current or Ra value of Dual method.

⑧ Rb [ohm] : Resistance value under reverse current or Rb value of Dual method.

⑨ Ia [mA] : Forward current value or Ia value of Dual method.

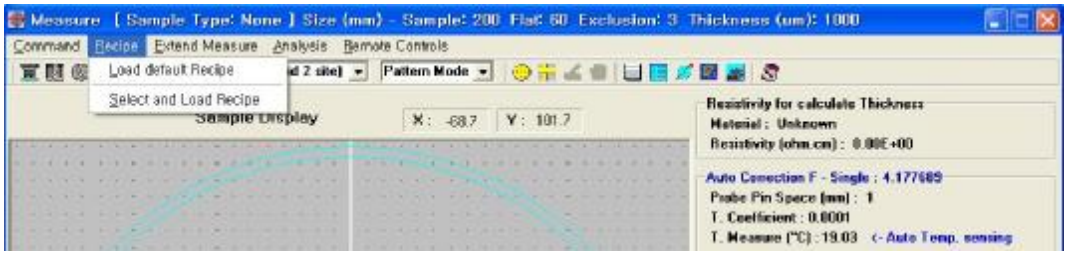
⑩ Ib [mA] : Reverse current value or Ib value of Dual method.

⑪ Va [V] : Voltage of sample under forward current or Va value of Dual method.

⑫ Vb [V] : Voltage of sample under reverse current or Vb value of Dual method.

⑬ T [“C] : Temperature of around sample.

3.2 Recipe menu



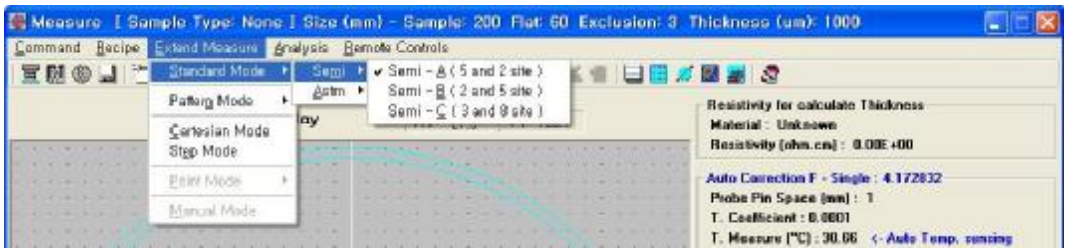
3.2.1 Load default Recipe

Loading the default Recipe defined in ‘Select and Load Recipe’ function or ‘Recipe File of Recipe Measure mode’ in ‘Config’ menu.(See 5.3 Config)

3.2.2 Select and Load Recipe

Selecting and Loading the saved Recipe file.
Recipe files can be created or edited by ‘Edit Recipe’ function. ‘Edit Recipe’ function is supposed to be limited depending on the User level. The extension of Recipe file is “.rcp”.

3.3 Extend Measure menu



3.3.1 Standard Mode

Provided standard mode like Semi, Astm. (9, 13, 25point are available in rectangular S/W)

1) Semi

It is a simple measuring method. It takes sample (wafer) size into account and specifies measuring points by a regular pattern.

① Semi – A (5 and 2 Site)

It specifies 6 sites for measurement. 2- and 5-site are repeated twice on the center of sample, 1-/ 3-/ 4-/ 6-site are specified at half-radius of sample by 45° in the left and right direction relative to the vertical diameter.

② Semi – B (2 and 5 Site)

2- and 5-site are same with Semi-A, and 1-/ 3-/ 4-/ 6-site are specified at the inside position of 6mm from exclusion zone, by 45° in the left and right direction relative to the vertical diameter.

③ Semi – C (3 and 8 Site)

It specifies 10 sites for measurement. 3- and 8-site are repeated twice on the center of sample, 2-/ 4-/ 7-/ 9-site are specified at half-radius of sample by 45° in the left and right direction relative to the vertical diameter. And, 1-/ 5-/ 6-/ 10-site are specified at the inside position of 6mm from exclusion zone, by 45° in the left and right direction relative to the vertical diameter.

2) ASTM

It is similar to Semi pattern in the measuring method but some different in the angles

① ASTM – A (6 Site)

Small Area Cross Pattern – Six measurements are made two at the center of the wafer and four at the half radius (R/2) point.

② ASTM – B (6 Site)

Large Area Cross Pattern – Six measurements are made two at the center of the wafer and four 6.0 mm (0.24 inches) from the wafer edge.

③ ASTM – C (10 Site)

Small Area and Large Area Cross Patterns – Ten measurements are made : two at the center of the wafer. Four at the half radius (R/2) and four 6.0 mm (0.24 inches) from the wafer edge.

④ ASTM-D (Interval 2mm)

Single-Diameter, High-Resolution Pattern – Measurements are made at the center of the wafer and at as many additional sites as possible along a diameter at intervals of 2 mm between the center and each edge with the exclusion of the outer 3mm of the sample at each end of the diameter.

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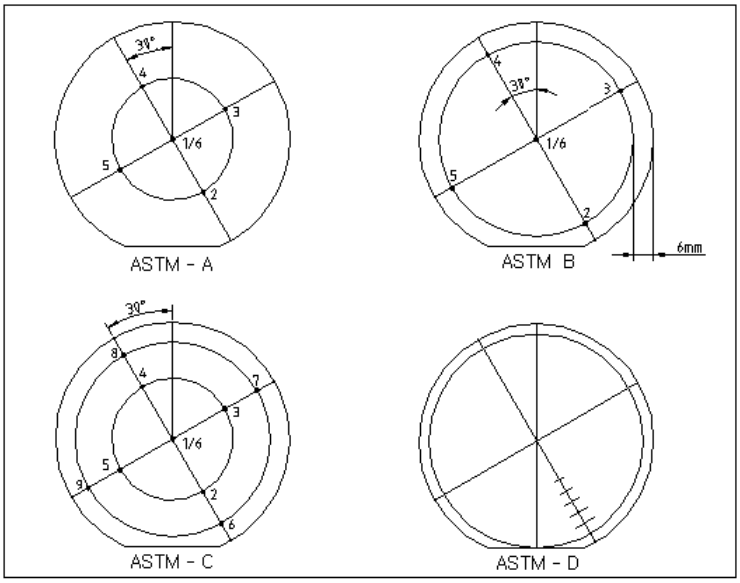
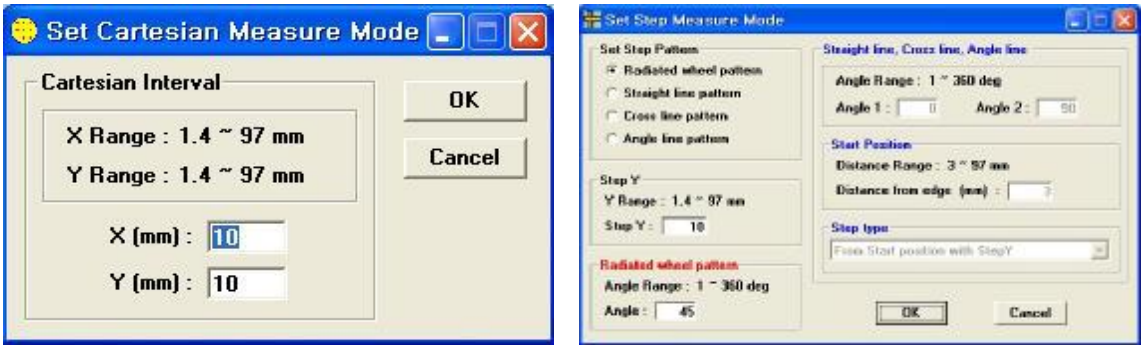


ASTM Measurement Point

3.3.2 Pattern Mode (not available in rectangular S/W)

It specifies measuring points as many as the number of sites, in a regular angle and a distance with regard to sample size. It can measure the whole body of sample closely and regularly.

3.3.3 Cartesian Mode and Step Mode



1) Cartesian Mode : It sets measurement points with inputted X&Y interval from center position of sample.

2) Step Mode : It sets measurement points with inputted angle and Y step, Start Position, Step pattern by selected “Set Step Pattern” .

3.3.4 Point Mode

1) Set Point

‘Set Point’ is a measuring point setting method to enable the necessary measuring points to be continuously set, identifying the value of X, Y axis on Sample pattern of Measurement window. The measuring point set by this function is the same as the position on the actual sample. User can set various kinds of measuring points using this function properly.

① After placing mouse pointer at an auxiliary position on Measurement window, you click the left button of mouse to set the measuring point.

② To delete a point, set block, click the “Delete Point” in Pop-up menu by click left button of a mouse on the list.

③ To delete all points, click ‘Clear All’ button.

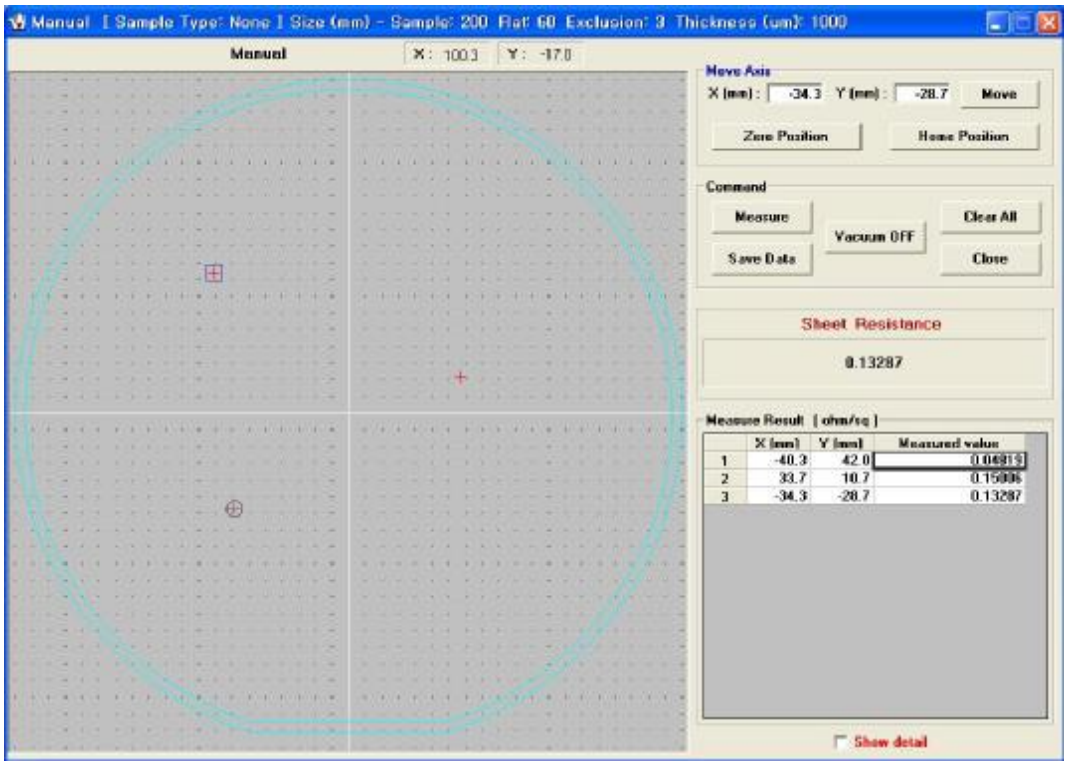
④ As shift button on the left side of keyboard is pressed and mouse is moved to investigate into the more exact position on Measurement window, the indication of Cross Line in the form of + appears in a larger size.

2) Cancel Point Set

It releases ‘Set Point’ function. If the measuring points are set, it is not possible to release this function. Its release is possible after all measuring points are deleted by ‘Clear All’ function.

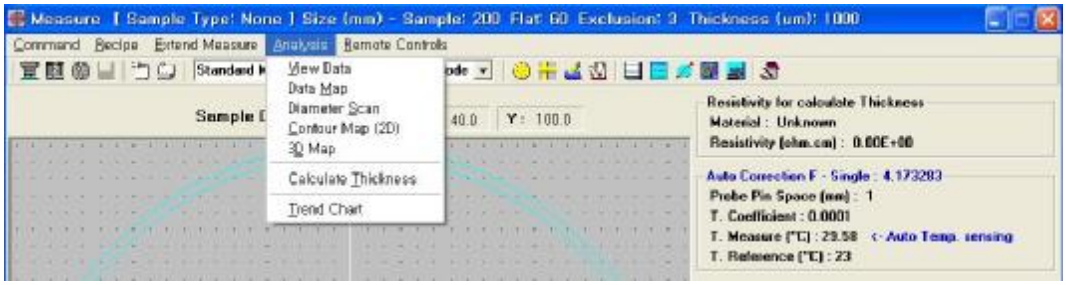
3.3.5 Manual Mode

User can select a point and measure. To select a point, click the left button of a mouse or input X, Y coordinates in Move Axis. To move the device to the point, click ‘Move’ button. And then click ‘Measure’ button. The round mark indicates the present position of the device and square mark indicates the point which was selected in ‘Measure Result’ list.



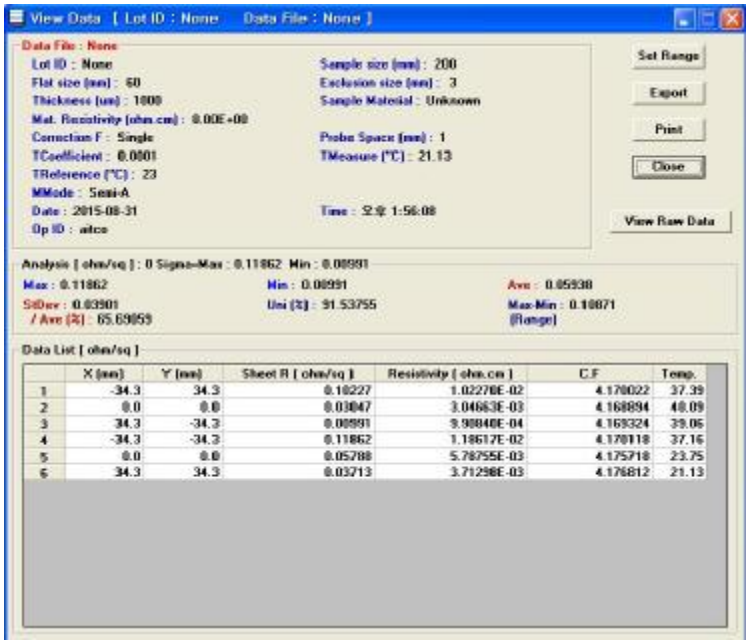
3.4 Analysis menu

This software offers a variety of data analysis functions.



3.4.1 View Data

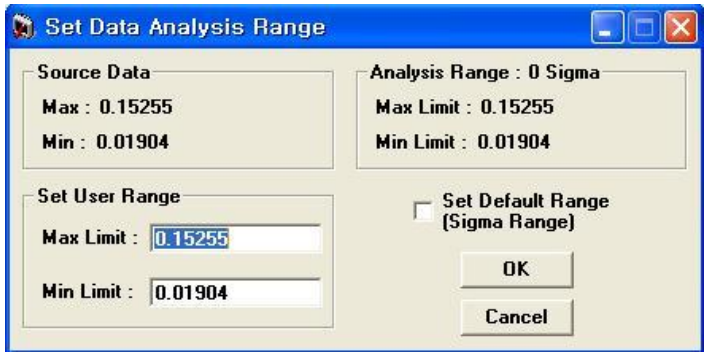
View Data shows information of measured sample and statistics like Min, Max, AVE, StDev, Uni, Max-Min. And X, Y coordinates and measured values of each measured point are displayed in the 'Data List'



1) Set Range

The Range is defined with selected Sort Sigma in 'Config' and it shows in 'Analysis' item. Outranged values are green color in 'Data List' and Error values are red color. User can set the range with this function in case of need.

Note) This function is included in Data Map, Diameter Scan, Contour Map, 3D Map and the usage is the same.



① Source Data

Indicated Maximum and Minimum of measured values.

② Analysis Range

Basically indicated Max and Min calculated by Sort Sigma in 'Config' menu. If user sets, the values are indicated.

③ Set User Range

User can set the range.

2) Export

Data can be saved as Excel or Text file.

3) Print

Print View data.

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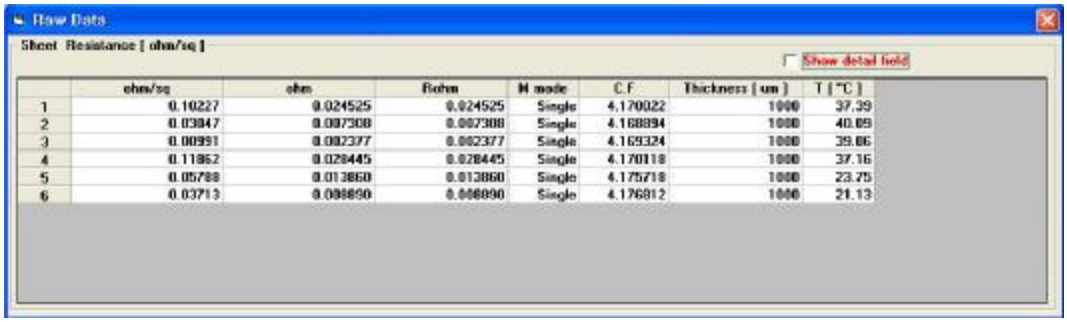
4) Close
Close View data

5) View Raw Data

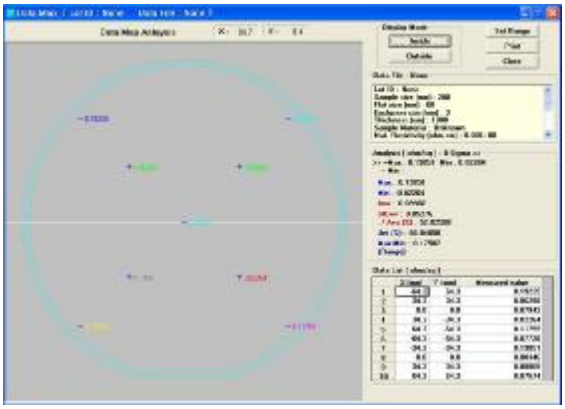


	ohm/sq	ohm	Rohm	M mode	C.F	Thickness [um]	T [°C]
1	0.10227	0.024525	0.024525	Single	4.170022	1000	37.39
2	0.03847	0.007308	0.007308	Single	4.168894	1000	40.09
3	0.00991	0.002377	0.002377	Single	4.169324	1000	39.86
4	0.11862	0.028445	0.028445	Single	4.170118	1000	37.16
5	0.05788	0.013860	0.013860	Single	4.175718	1000	23.75
6	0.03713	0.008890	0.008890	Single	4.176812	1000	21.13

This function will display a details of measured values like current and voltage, C.F, temperature, etc. as below. (See 3.1.7 Show detail)

3.4.2 Data Map

It indicates the positions of measured points within sample pattern, and the information of sample, the statistics, the measured positions and the measured values for the sample.
To see the measured value for any point, you can position Mouse pointer on the point and click left button of mouse. It offers additional functions like 'Inside Map' or 'Outside Map'.



Inside Map

Outside Map

1) Inside
All of the measured values are indicated inside the sample pattern.

Note) If measuring points are too many, values could be overlapped and sorting will be difficult.

2) Outside
All of the measured values are indicated outside the sample pattern. It is easy to identify the measured values without overlap.

Note) If the number of measuring points is more than the limit to display, some of them will not be displayed.

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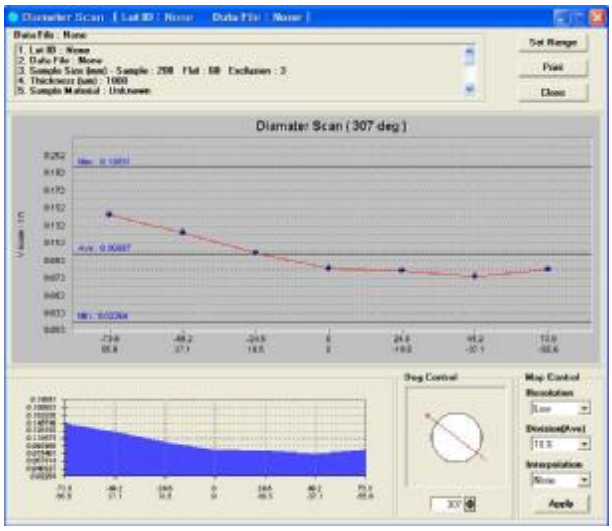
3.4.3 Diameter Scan

By referring to measured values of each points and interpolate values according to Diameter line between horizontal degree (0 ˚ ~ 360 ˚) of sample, the interpolated values are displayed with line graph. User can set the degree(min interval 1 ˚).



1) Deg Control
User can change the degree by clicking degree button or dragging with mouse left button on the degree line. Also user can input the degree directly.

2) Map Control

① Resolution : Selecting Map's Interpolation resolution.

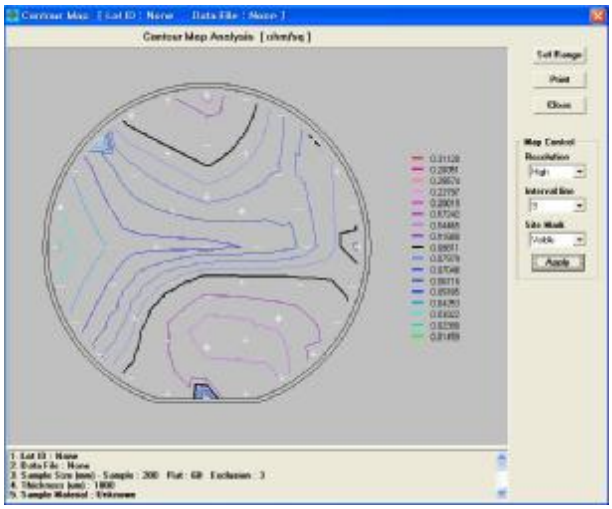
② Division(Ave) : Selecting Y axis' Division of graph.

③ Interpolation : Selecting kind of line graph.

Note) Main graph is printed only and line-area graph is not printed.

3.4.4 Contour Map

It indicates the measuring value of each point in a contour map. Referring measured values of each point, the whole area of the sample is interpolated. By the number of interval lines which were arranged on the basis of the mean value, contour line is displayed. Measured values in each contour level divide the range between max and min as many as the number of arranged interval in 'Config' menu. It also displays whether higher of lower than Ave. Contour map can be printed out.



1) Set Range : Refer to 'Set Range' in 3.4.1 View Data.

2) Map Control

① Resolution : Selecting the Interpolation resolution of the map.

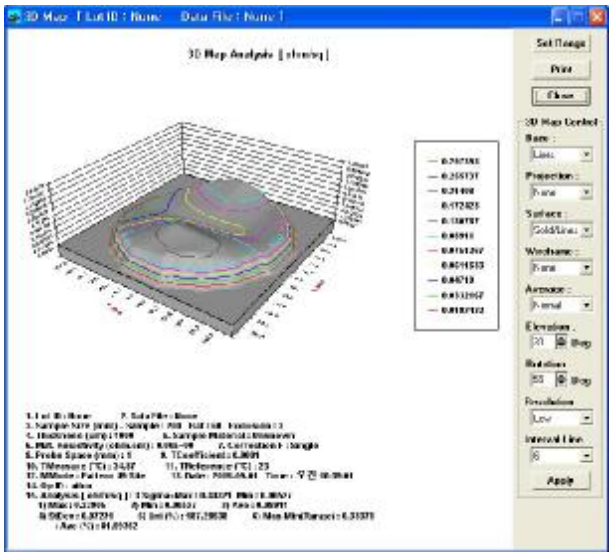
② Interval Line : Set the interval of Contour level.(refer to 5.3)

③ Site Mark
If values are higher than Ave., "+" is displayed and lower, "-". Over ranged values indicate "+" and "o" together and errors indicate "+" and "x" together.

Note) When measuring points are uniformly distributed, the reliability of the Contour map get higher. If measuring points are less than 10, it is not much reliable. If it is less than 2, Contour amp is not displayed because measuring points is not enough to make map.

3.4.5 3D Map

3D Map represents Contour Map in a three dimension to improve the visual effect. The comparison and interpolation method and interval line are the same as Contour Map. Also it is able to design map by using the element of 3D Map Control item. The horizontal and vertical angles are adjusted using the element of Elevation and Rotation item. User can analyze Map at various angles. 3D Map can be printed out.



1) Set Range : Refer to 'Set Range' in 3.4.1 View Data.

2) Map Control : Controlling visual factors of the map.

Note) Printing will be slow because of a lot of graphic data.

3.4.6 Calculate Thickness

This function is able to calculate a Thickness for each point by using the Sheet Resistance values of each measuring points. This function can be used when user already get Resistivity for material of sample. The important point is that the calculated thickness data is not actual thickness but it is a calculated thickness by using formula relate with theory of Sheet Resistance and Resistivity, Thickness. Therefore, the calculated thickness by this function may be unreliable value in compare with actual thickness.

Note) The manufacturer does not warranty this calculated thickness since the thickness is only calculated values by software.

1) Selection : Selecting or inputting the kind of material for sample.

2) Resistivity
In case of selecting any material in the list, Resistivity value of the selected material is inputted automatically. Also it is able to input resistivity of sample directly.

3) Thickness Unit : Selecting unit of thickness.

4) Calculate Thickness : By each inputted conditions, calculate thickness, then display the calculated thickness as below.

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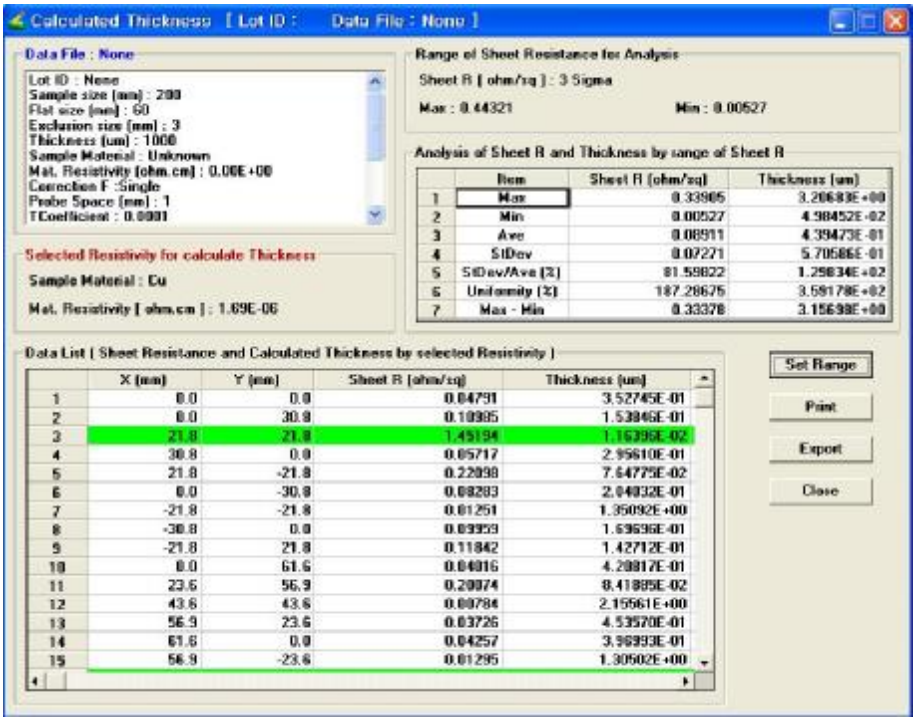


5) Set Range : Refer to ‘Set Range’ in 3.4.1 View Data.

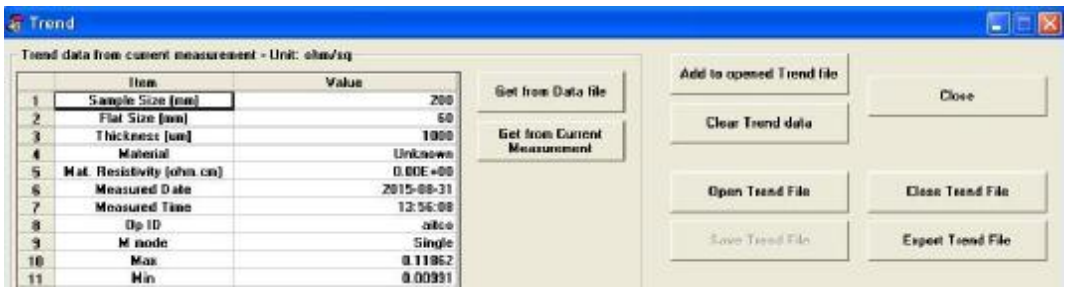
3.4.7 Trend Chart

Trend Chart is able to save a Trend data(Average, Max, Min etc.) with file format. It create new file or add to saved file. This function is useful to analysis the resistance variation of sample according to the time elapse. For example, if the same sample is measured once a day and Trend data(Average, Max, Min etc.) of the measured values per each times are saved in Trend Chart file, the resistance variation of sample can be analyzed even after the elapse of some time.

In case the measured values are existed in ‘Measurement’ of window, user can get the Trend data from current measurement by ‘Get from Current Measurement’ function.

This includes all of functions in ‘4.2 Trend Chart’ and additionally has ‘Get from Current Measurement’.

Note) Please refer ‘4.2 Trend Chart’ about details of each function excluding ‘Get from Current Measurement’.



1) Get from Current Measurement : Get Trend data from current measurement in case measured data are existed in ‘Measurement’ window.

Note) ’4.2 Trend Chart’ does not support this function.

Ref) Formula of Standard Deviation and Uniformity

StDev = Standard Deviation

Data : x_1, x_2, x_3 ---x_n.

Average : m

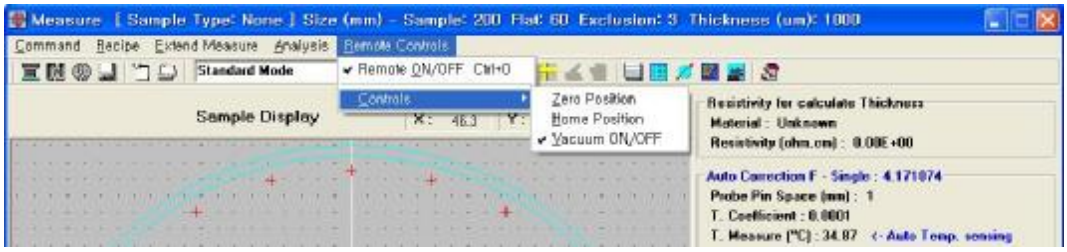
Standard Deviation (1) = $$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n} x_i^2 - m^2$$

Standard Deviation / Ave (%) = (Standard Deviation (1) / Average) x 100

Uni = Uniformity (Min = Minimum data, Max = Maximum data)

Uniformity = (Max - Min / 2 Average)100

3.5 Remote Controls menu



3.5.1 Remote ON/OFF (Ctrl + O)

This is a function to remote control the system (CMT-SR2000N) by software. This makes a communication connection between system and Operating PC. ON/OFF status of Remote Mode is indicated on Remote Mode Indicator of Status Bar in the lower side of Main window.

3.5.2 Controls

1) Zero Position

To send the moving parts (X, Y, Z axis) of CMT-SR2000N to the Zero position, click 'Zero Position'.

Note) This function is available only when Remote On.

2) Home Position

To send the moving parts (X, Y, Z axis) of CMT-SR2000N to the Home position, click 'Home Position'.

Note) This function is available only when Remote On.

3) Vacuum Mode

This can be used to hold the sample on the stage. The present vacuum status is indicated in the status bar as ON or OFF.

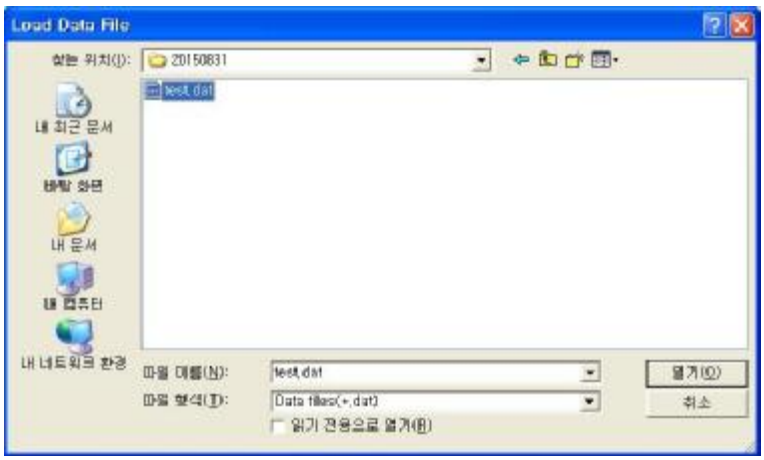
Note1) This can be used when vacuum is connected and set as Remote On.

Note2) To do remote control the vacuum by using the Operating software, vacuum must be released in the system prior to Remote On. During system is in Remote On mode, it is not possible to use the vacuum switch in the device.

4. Data Management menu

4.1 Load Data

To load saved data file, move to folder and select data file. Click ‘Open’.



1) Open

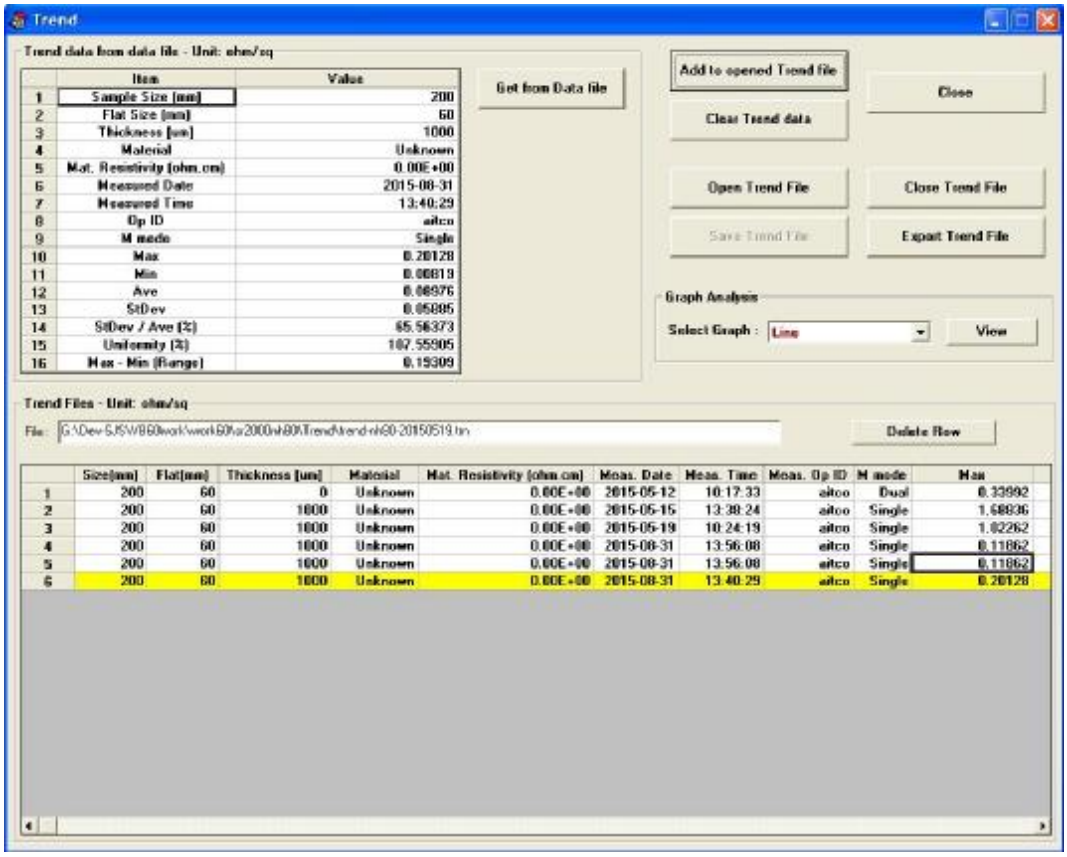
Open select data file in file list.

2) Cancel

Cancel load.

4.2 Trend Chart

This is same function with ‘3.4.7 Trend Chart’. This has same functions with ‘3.4.7 Trend Chart’ excluding ‘Get from Current Measurement’.



1) Get from Data file.
Get Trend data from saved data file.

2) Get from Current Measurement.
Get Trend data from current measurement in case measured data are existed in 'Measurement' window.

Note) This is available on '3.4.7 Trend Chart'.

3) Add to new Trend file / Add to opened Trend file

- **u** Add to new Trend file :
  Create new Trend file and add Trend data to the new one.

- **u** Add to opened Trend file.
  Add Trend data to opened Trend file.

Note 1) The extension of Trend files is '.trn'.

Note 2) The added Trend data will be displayed with yellow color on list. The added Trend data will be sorted with date and time automatically.

4) Clear Trend data : Clear current Trend data.

5) Close : Close Trend Chart.

6) Open Trend File : Open saved trend file.

7) Save Trend File : Save Trend file.

8) Close Trend File : Close Trend file.

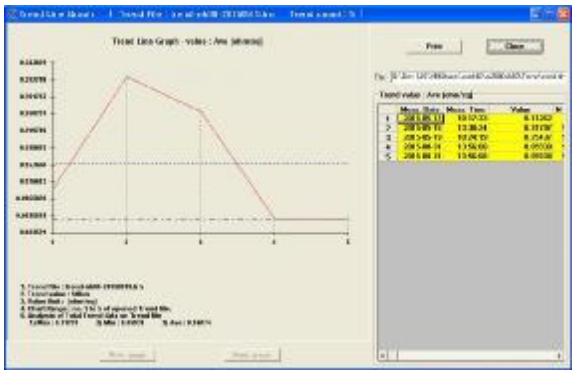
9) Export Trend File : Export current Trend file to Excel or Text format.

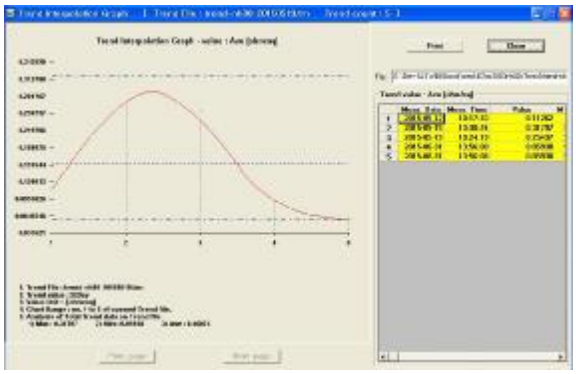
10) View.
This is a function to show a graph with Trend data (Max and Min, Ave). The Ave value is default to display graph. If one of Max and Min, Ave is selected with block, it will display the selected value on graph. It's able to select one of graphs (Line, Interpolation, Bar)

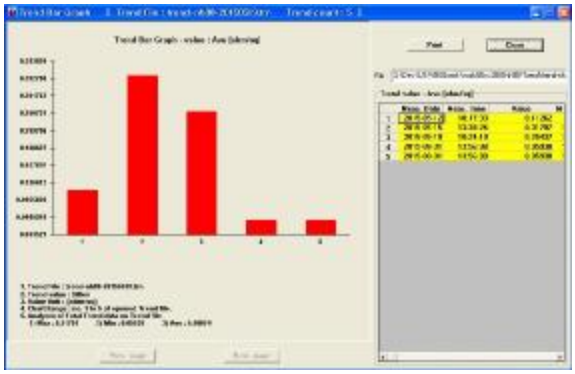
① Line Graph.
This is to display the selected item on Line Graph.

② Interpolation Graph
This is to display the selected item on Interpolation Line Graph.

③ Bar Graph
This is to display to the selected item on Bar Graph.







Note) The data on Graph are described with yellow color on list.

11) Delete Row : Delete data which selected with block on list.

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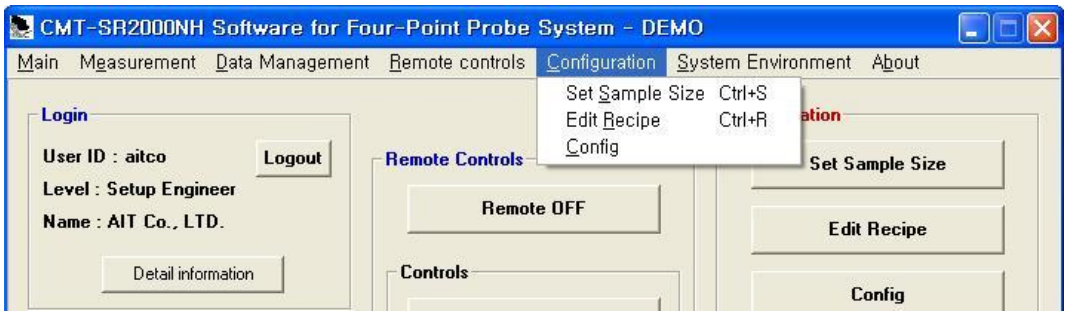
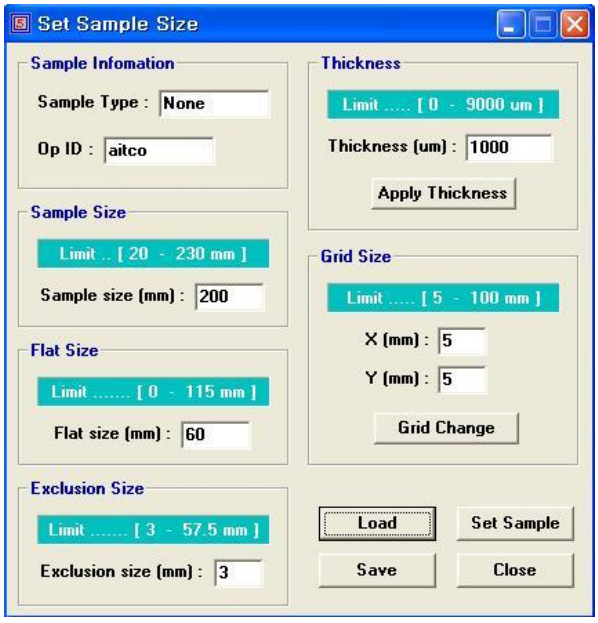
5. Configuration menu



5.1 Set Sample size (able to set the size of a sample in a rectangular S/W)

When user enters each of items and clicks 'Set Sample' button, the shape of test sample is changed according to the entered (specified) values. User can change grid in the 'Sample Display' field that is displayed a sample shape in the 'Measurement' window. Also, User can change a Thickness of sample and apply it by 'Apply Thickness' button. When you click 'Cancel' button, all of the entered (specified) values are cancelled.



1) Sample Information
Sample Type is defined by user. Unless the Sample Type is not loaded by using 'Load' function, "None" displayed, and Op ID will be the ID of login user. If the sample is loaded by 'Load' function, the loaded 'Sample Type' and 'Op ID' will be displayed.

2) Sample Size
Input Sample Size (Diameter).

3) Flat Size (not available in rectangular S/W)
Input Flat Size. (The maximum limit of the Flat size depends on Sample size.) The Flat size is length of Flat zone.

4) Exclusion Size
Input Exclusion Size. (The maximum limit of the Exclusion size depends on Sample size.)

5) Thickness
Input the thickness of the sample. (The limit is 0 ~ 9000um.)

Note) In case Thickness value is specified in 0.0 and the unit is specified in ohm.cm (Resistivity), all of the measured values is indicated in 0.00000.

6) Grid Size
Input grid size (The limit is 5 ~ 100mm).

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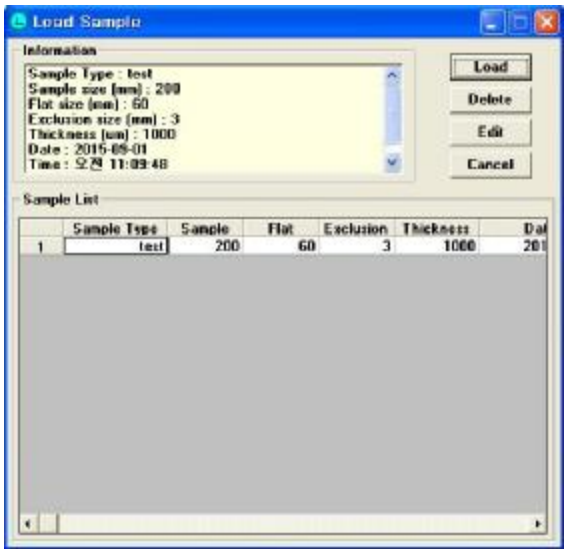
5.1.1 Load

When measuring various kinds of Samples, user selects Sample Type stored to set the size of sample and the related information. Sample Type and the related information currently stored are indicated in ‘Sample List’ item.

1) Load

After selecting record with block function, clicks the ‘Load’ button or double clicks of mouse. The size of the selected Sample Type will be displayed on the ‘Set Sample Size’ window.



2) Delete

It is possible to delete Sample Type stored, by using ‘Delete’ button. To delete any records in ‘Sample List’, user selects the records with block function and then clicks the ‘Delete’ button.

3) Edit

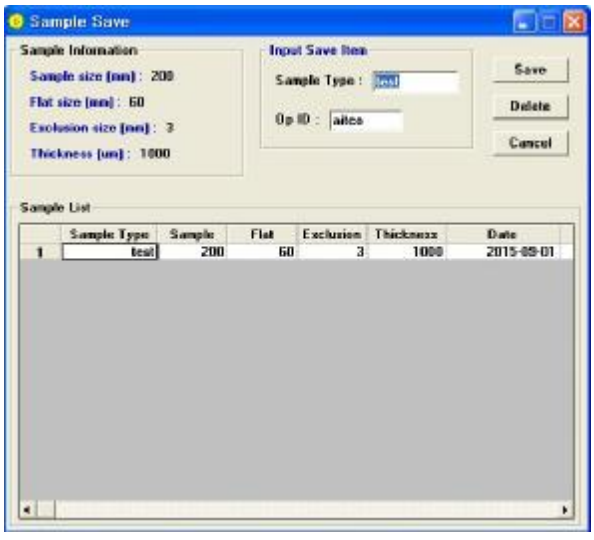
It is possible to edit Sample Type stored by using ‘Edit’ button. To edit any records, user selects a record with block function and then clicks ‘Edit’ button. Then, the selected record is indicated in the Edit item. After edit the fields, user clicks ‘OK’ button to finish the edition. Thereafter, the ‘Cancel’ button is clicked to return.

4) Cancel

Cancel and Close the Load sample.

5.1.2 Save

It is possible to store the size of Sample and its related information.



1) Save

After inputting Sample Type and Op ID, user clicks ‘Save’ button to store the sample information indicated in ‘Sample Information’ item.

2) Delete

To delete any record in ‘Sample List’, User selects records with block function and then clicks ‘Delete’ button.

3) Cancel

Cancel and Close the Sample Save.

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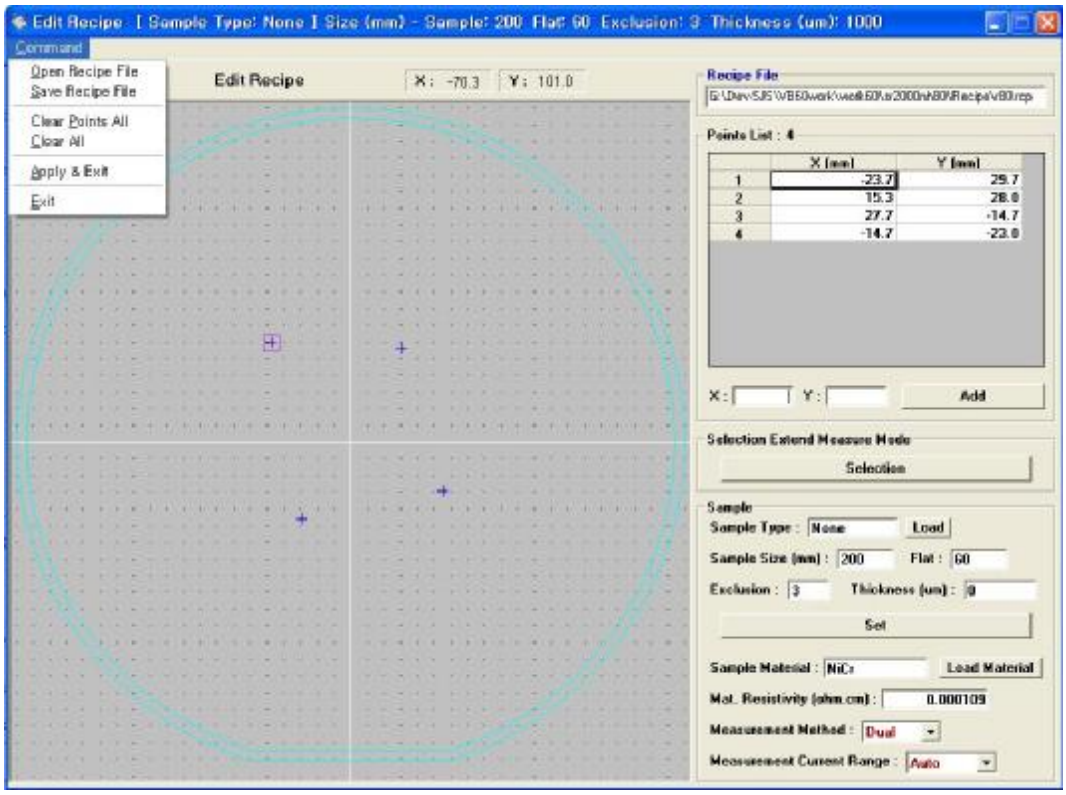
5.2 Edit Recipe



5.2.1 Command menu

1) Open Recipe File
Opening a recipe file saved. The location of opened file is displayed on 'Recipe File' item.

2) Save Recipe File
Saving the measurement points and Sample size, information to recipe file.

3) Clear Points All
Clear all points except sample size.

4) Clear All
Clear all points and sample size. Then, default sample size will be displayed.

5) Apply & Exit
Applying the current setting and exiting. The recipe file will be applied by 'Load Recipe' function at 'Measurement' menu.

6) Exit
Exit without applying.

5.2.2 Edit Recipe Method

1) Sample setting
Loading the saved Sample Type or setting the sample by user's inputting. After setting the sample size and clicking 'Set' button, sample setting is completed.

2) Points setting by Mouse

Place the mouse pointer on the 'Edit Recipe' field, and click left button of mouse pressing the left shift button of keyboard, then a point will be created on the clicked place. And the point will be added on the new row of 'Points List' item.

3) Points setting with 'Add' button and Pop-up menu in Points List

a. Add: If user inputs a value in X, Y fields and clicks 'Add' button, the point of the inputted value will be add in Point list.
b. Insert Row: In the 'Points List' item, popup menu(Insert Row, Edit Row, Delete Row) is available by right click of mouse. It's possible to insert new point with 'Insert Row'.
c. Edit Row: It's possible to edit selected point with 'Edit Row'.
d. Delete Row: It's possible to delete selected points with 'Delete Row' after set block points in Point list.

4) Points setting by Extend Measure Mode.

Clicking 'Selection' button in 'Selection Extend Measure Mode' item, points can be set by selecting one of 'Standard Mode', 'Cartesian Mode' and 'Step Mode'. No. (2) and (3) functions can be available at same time.

5.3 Config

After inputting each of items and clicking 'OK' button, the setting values are applied.

1) Display Unit

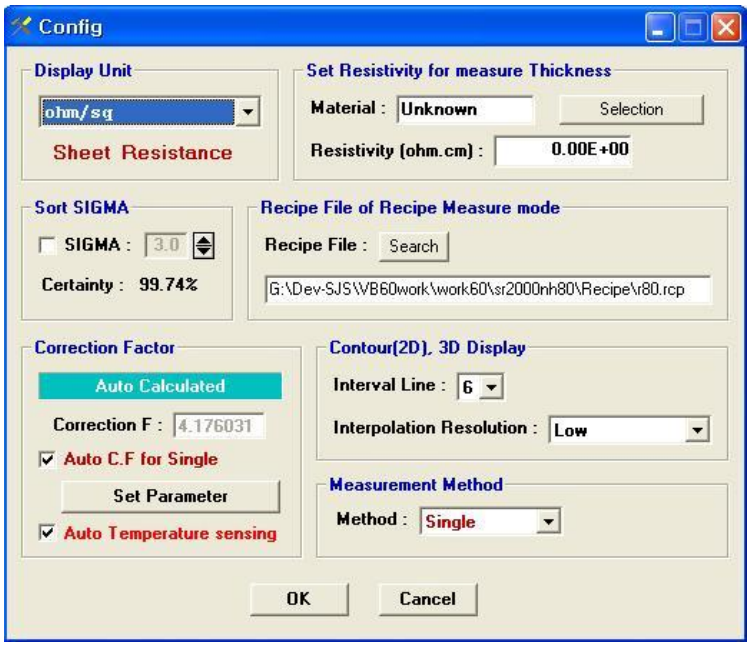
Selecting one of measuring units ohm, ohm/sq., ohm.cm.

2) Sorting Sigma

When analyzing data with 'Analysis' menu, the reliable range of measured values is set with the selected Sorting SIGMA and also the statistics like Max, Min, Ave, StDev, Uni in analysis functions is calculated on the basis of selected Sorting SIGMA.

3) Correction Factor

When measuring sheet resistance, user can enter a necessary correction factor. Correction factor is 0.1 to 100.0 and the default value is 4.532.



About details of correction factor, refer to 'Chapter 6 Theory of 4-point probe system' in this manual.

① Auto C. F for Single.

In case of check 'Auto C.F for Single', the Correction Factor under Single Measurement Method is calculated with setting sample size, thickness and temperature automatically.

Note) This is for only Single Measurement Method. In case Measurement Method is Dual, the Correction Factor is calculated with ratio of measured resistance (Ra and Rb) for measuring automatically.

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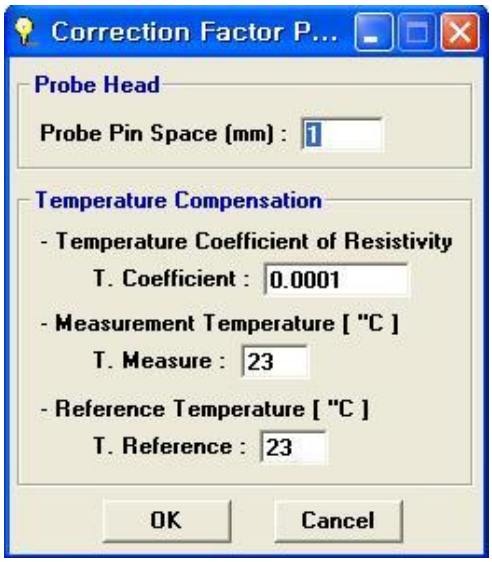
② Set Para

Setting each variables required to auto calculate correction factor.



a. Probe Pin Space
Input the space of pin (mm).

b. Temperature Coefficient of Resistivity
The temperature coefficient of sample is directly entered by the user. If user does not input the temperature coefficient or it is '0', the factor for temperature compensation will be just '1' and it won't be included to Correction Factor.

c. Measure Temperature
Input ambient temperature in the room or round the device.

Note) In case of check 'Auto Temperature sensing', the temperature to calculate C.F will be applied by sensing automatically.

d. Reference Temperature
In this item, the reference temperature is directly entered by the user. Generally, this value is 23ºC

③ Auto Temperature sensing
In case machine has a temperature sensor, if this is checked, the temperature to calculate C.F will be applied by sensing of temperature automatically.

4) Set Resistivity for measure Thickness
For measure thickness of sample, user can input resistivity and material for sample or select. In case user select 'Thickness' unit in 'Display Unit' item, it is displayed thickness values in measurement and analysis functions by calculating with selected resistivity in this item.

① Material : user can input comment or sign for material of sample.

② Resistivity(ohm.cm)
User can input a resistivity for material of sample. The resistivity value must be input with 'Ohm.cm' unit.

③ Selection
When click this button, it display a saved resistivity list. User can modify the list with a below functions. User can select any item in list by left button of mouse double click.

a. Apply Resistivity : this function apply a selected resistivity to software.
b. Add / Save : this function add a inputted item to list and save it.
c. Delete : this function delete a item selected by block in list.

5) Recipe File of Recipe Measure mode
In case to use 'Load Recipe' of Measurement mode, Recipe File can be set as a default in order that user (User level : Operator) can measure the sample easily.

6) Contour(2D), 3D Display

① Interval Line :
This is an item to enter the equal division of Contour Level being used in Contour Map and 3D Map.

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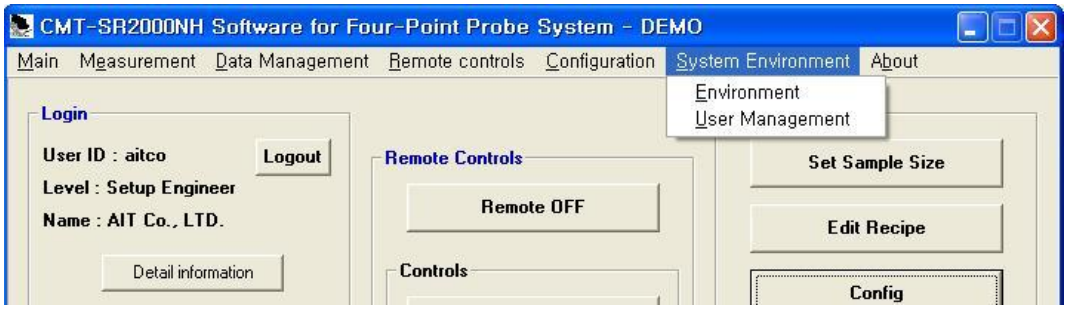
② Interpolation Resolution
Set default resolution of the interpolation for Contour and 3D map.

7) Measurement Method
This function is to select Single or Dual Measurement Method.

Note) Please refer to Four Point Measurement Theory for details of Measurement Method.

6. System Environment menu



6.1 Environment

6.1.1 Measurement Option

1) Error Process
Managing the process when a measurement error is occurred

① Skip Error Points
If a measurement error would occur at any point, it displays "ERROR" and skips over the error point to keep measuring.

② Stop at Error Point
If measurement error would occur at any point, it stops the measurement without move next point, displays "ERROR" and waits for user's response.

2) Complete Message
It is able to display general message or Analysis (View Data, Data Map, Diameter Scan, Contour Map, 3D Map) functions directly when the measurement is finished.

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6.1.2 Data Save Option

According to the option, deciding the save method that is saved by default data file format into local Data folder and DB, or by other file format (Excel, Text) into a folder of Host sever.

1) Auto Save after Measure (Host Server)

① Check
Before measurement, user can input the information about the file which will be saved, then after measurement, the measured data file is automatically saved. It is related with Save Location options.

② No Check
After measurement, the measured data file is saved by user.

2) Save Location
① Default :
The measured data file is saved as a default data file format in local data folder. The auto-saving function is not available. Default data file is saved as '.dat' under local Data folder.

② Host Server :
The measured data is saved as Excel file format and transferred to defined folder in 'Host Folder Path' field.

③ Host Server and Backup :
Saving as above 'Host Server' process and also the measured data file is saved in the Backup folder.

3) Host folder Path
In case the option of Save Location is 'Host Server' or 'Host server & Backup', the data file is saved to defined folder in this field. User can select a folder by using 'Search' function.

6.1.3 Save folder Option at default location

In case of check 'Auto create save folder with LotID generated date format', a sub folder named by selected date format(ex. YYYMMDD) in default 'data' folder is created when data is saved. The measured data will be saved in the folder. The folder name will be recorded to Lot ID item inside saved data file.

Ex) If date is Sep. 01, 2015 and selected date format is 'YYYYMMDD', the sub folder of '20150901' is created in 'data' folder

6.1.4 Current Source

It is able to select the current source Range, the Direction of current flowing and Typical Applications.

1) Range : Current range is Auto only.

2) Direction : Selecting current flowing direction. It's only 'both'

3) Typical Application : Selecting sample type (CMT-SR2000N restricted for wafer only).

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6.1.5 Auto Retry Measure

When the measuring point has measurement error, the point can be moved little bit to retry measurement according to the 'Direction' option (Setting direction from error point) and 'Step' option (Setting distance from error point). If the error occurs again on the moved point, the moved point can be moved again in several times according to the 'Retry Count' option (Setting retry times). If the error still occurs on the moved points up to 4 times, the error control process will be decided according to option defined in 6.1.1 Error Process option.

1) Auto Retry Measure
   ① Check: Applying Auto Retry Measure function.
   ② No Check : Not applying Auto Retry Measure function.

2) Direction
   ① X axis : Moving the point to direction of X axis.
   Ex) + 3 + 1 + 0 + 2 + 4

   ② Y axis : Moving the point to direction of Y axis.
   Ex)
   + 3
   + 1
   + 0
   + 2
   + 4

   ③ X, Y axis - A : Moving the point to both direction of X and Y axis.

   ④ X, Y axis - B : Moving the point to both direction of X and Y axis .

   + 3
   + 1 + 0 + 2
   + 4
   Ex) X.Y axis-A

   +1 +3
   + 0
   +4 +2
   Ex) X. Y axis-B

3) Step : Inputting the distance. (unit : mm, range : 1~10mm)

4) Retry Count : Setting the retry times. (1~4 times)

Note) When the measurement is completed with the retry times, stop retry.

6.1.6 Rs-232 Port

It selects a communication port (RS-232C) of PC for the remote control of CMT-SR2000N. The default value is Com1.

Note) In case of using USB port of PC, the 'Virtual Com port' driver should be installed on PC. The 'Virtual Com port' driver is included in offered CD. After finish the installation of 'Virtual Com port' driver on PC, it's able to check the port number from 'Port (Com & LPT) in 'Device Manage' of Windows.

6.1.7 Machine Code

Input Machine code. When the data file is saved in Host folder path of 'Data Save Option' (6.1.2.), a folder is created using Machine code (less then 8 digits of character) under Host folder.

Ex) If Machine code is aaaa, Host folder path is "C:\sr2000nw\host" and Measurement date is 2003/01/06, then the folder of "C:\sr2000nw\host\aaaa\20030106\" will be created and the data will be saved there.

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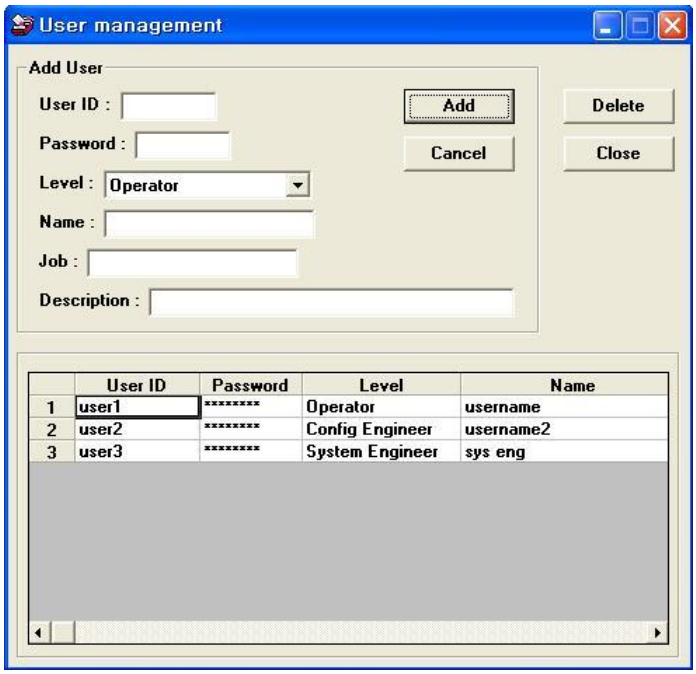
6.2 User Management

Adding or deleting User ID who will use Operating software.

6.2.1 User Add



1) User ID : User's ID (8digits of character)

2) Password : User's Password

3) Level : There is limitation to use the program according to the level, so that important values or setting can be remained. Level is divided into 3 group and refer to the below.

u Explanation of Level

① Operator :
Execute measurement, saving, and analysis functions. And it is limited for the functions related with Configuration and System Environment functions.

② Config Engineer :
It is able to use all functions except the functions related with System Environment.

③ System Engineer : It is able to use all functions.

4) Name : User's name.

5) Job : User's job.

6) Description : Remarks.

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Chapter 5. Service Manual

A. Calibration

1. By a Physical Change

The physical change of probe head, depending on the wear of probe head, offers the requirement for calibration which can be found out by measuring a standard wafer sample. For this purpose, it is recommended that you use Resistance Standard 3" Wafer of VLSI Incorporation Ltd. When this system has a measuring error of more than 1%, please contact the seller or AIT Co., Ltd. to calibrate this system. A much worn probe should be replaced or repaired as damaging this system.

The life of Jandel Probe Head remains to 100,000 measurements (or 2 years). For an accurate and repeatable measurement, a probe head beyond the lifetime should be replaced or repaired.

2. By a Circuitry Change

For this purpose, it is recommended that you use Resistance Standard 3" Wafer of VLSI Incorporation Ltd. When this system has a measuring error with VLSI standard wafer, it means that any change happened in the circuitry of this system. In this case, please contact the seller or AIT Co., Ltd. to calibrate this system because the calibration of circuitry requires special test equipment.

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B. Theory of 4-point probe & C.F.

1. Purpose

To determine the Resistivity of a substrate or a thin film by using the four point probe, current source. This SOP also determines the conductivity using the four-point probe.

2. General Instructions and Precautions

The probe tips are a very critical part of the four-point probe and great care should be taken when using the equipment. Two different materials are used for the probe tips. Tungsten Carbide is a crystalline material, which is very hard and somewhat brittle. If the wafer is moved horizontally while the probe arm is down, the Tungsten Carbide tips tend to break off in little pieces. The second material, osmium, is also a hard material but does not chip. When mishandled, the entire tip can be broken. Osmium tips cost more than Tungsten Carbide and is the kind used in the four-point probe system.

3. Resistivity Theory

The four-point probe is preferable over a two-point probe because the contact and spreading resistance associated with the two-point probe can't be measured. This means that the true sheet resistance can't be accurately separated from the measured resistance. The four point probe consists of two current carrying probes (1 and 4), and two voltage measuring probes (2 and 3) (refer to schematic). Since very little contact and spreading resistance is associated with the voltage probes, one can obtain a fairly accurate calculation of the sheet resistance, which is then used to calculate the Resistivity. The Resistivity (p) of a semi-infinite wafer with equal probe spacing (s) is given by:

p=2*pi*s*V/I

Since wafers are not semi-infinite in extent, the right hand side of this equation must multiply a combination of correction factors. By following the procedure below, the need for many of these factors is eliminated. The correction factors still needed, and the final forms of the formulas for sheet resistance and Resistivity are given below in the procedure section.

4. Resistance correction factor

Sheet Resistance ***(RS) = p/t= (V/I) X C.F.1 X C.F.2 X C.F.3***

Where p is the Resistivity is the thickness of the sample, and C.F.1 is the sheet resistance correction factor, which depends on the wafer diameter (d) and the probe tip spacing (s). For the UofL setup, s is equal to 62.5 mils. If the ratio of d/s is greater than 40, the sheet resistance correction factor levels off at 4.5324. If the ratio is less than 40, use the table below [3] to determine the appropriate correction factor. In the rectangle columns, the number refers to the length to width ratio, with the length being the longer of the two sides. The rectangle 4 column refers to a ratio greater than or equal to 4. Rectangular samples should be tested with the length parallel to the probe tips and the width should be taken as d when determining the correction factor. s is the spacing between the probe tips (62.5 mils for UofL setup and C.F.2 is the Resistivity correction factor. C.F.2 is given in the table below. For the case when t is much less than s (less than 4/10 of s), C.F.2 is simply equal to unity. [1] Note: the above equation and the table are only valid for junctions diffused on one side of the sample. A chemical source will diffuse both sides, which means the back side must be removed to use these factors, or different factors must be used. C.F.3 is Temperature Correction Factor.

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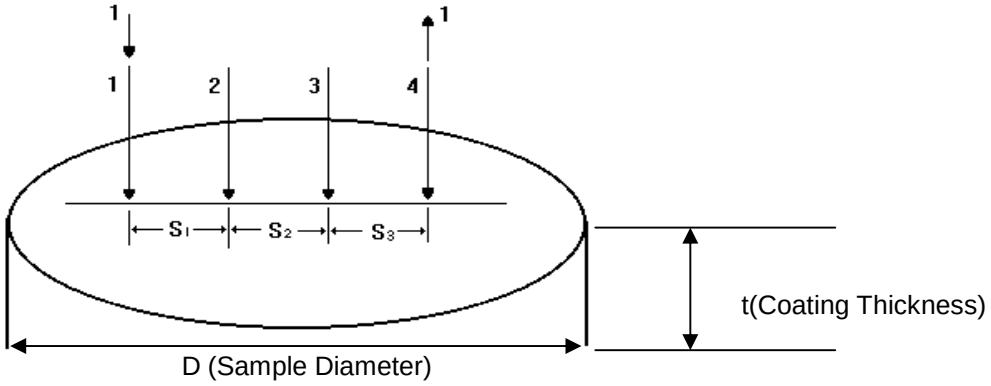
Ø Four Point Probe Schematic



Ø Sample Size Correction Factor (C.F.1)

C.F.1(d/s)	Circle	Square	Rectangle L/W=2	Rectangle L/W=3	Rectangle L/W=4
1.0				0.9988	0.9994
1.25				1.2467	1.2248
1.5			1.4788	1.4893	1.4893
1.75			1.7196	1.7238	1.7238
2.0			1.9475	1.9475	1.9475
2.5			2.3532	2.3541	2.3541
3.0	2.2662	2.4575	2.7000	2.7005	2.7005
4.0	2.9289	3.1127	3.2246	3.2248	3.2248
5.0	3.3625	3.5098	3.5749	3.5750	3.5750
7.5	3.9273	4.0095	4.0361	4.0362	4.0362
10.0	4.1716	4.2209	4.2357	4.2357	4.2357
15.0	4.3646	4.3882	4.3947	4.3947	4.3947
20.0	4.4364	4.4516	4.4553	4.4553	4.4553
32.0	4.4791	4.4878	4.4899	4.4899	4.4899
40.0	4.5076	4.5120	4.5129	4.5129	4.5129
infinity	4.5324	4.5324	4.5325	4.5325	4.5324

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Sample Thickness Correction Factor (C.F.2)

C.F.2(t/s)	F (t/s)
< 0.4	1.000
0.400	0.9995
0.500	0.9974
0.555	0.9948
0.625	0.9896
0.714	0.9798
0.833	0.9600
1.000	0.9214
1.111	0.8907
1.250	0.8490
1.429	0.7938
1.667	0.7225
2.000	0.6336

Temperature Correction Factor Table (C.F.3)

Note) approximate values for Silicon.

Ohm.cm / Temp (°C)	1~5 ohm.cm		5~25 ohm.cm		25~120 ohm.cm		120~Infinity ohm.cm	
	N type	P type	N type	P type	N type	P type	N type	P type
10	1.1001	1.1014	1.1053	1.1079	1.1079	1.1118	1.1079	1.1144
12	1.0847	1.0858	1.0891	1.0913	1.0913	1.0946	1.0913	1.0968
14	1.0693	1.0702	1.0729	1.0747	1.0747	1.0774	1.0747	1.0792
16	1.0539	1.0546	1.0567	1.0581	1.0581	1.0602	1.0581	1.0616
18	1.0385	1.0390	1.0405	1.0415	1.0415	1.0430	1.0415	1.0440
20	1.0231	1.0234	1.0243	1.0249	1.0249	1.0258	1.0249	1.0264
22	1.0077	1.0078	1.0081	1.0083	1.0083	1.0086	1.0083	1.0088
23	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**
24	0.9923	0.9922	0.9919	0.9917	0.9917	0.9914	0.9917	0.9912
26	0.9769	0.9766	0.9757	0.9751	0.9751	0.9742	0.9751	0.9736
28	0.9615	0.9610	0.9595	0.9585	0.9585	0.9570	0.9585	0.9560
30	0.9461	0.9454	0.9433	0.9419	0.9419	0.9398	0.9419	0.9384

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C. Center position Calibration Method

1. After the hardware is ready to start the operation, press [Enter + ESC key] on its membrane. The following message appears on LCD screen.

   Motor set.
   1] X-axis
   2] Y-axis
   3] Z-axis

2. Press 2-key to select y-axis. The following message appears.

   Set y-axis
   1] Accelerate Block
   2] Speed
   3] Home Pos.

3. Press 3-key to select Home Pos. and then, the following message appears and Y-axis moves to the center of the sample stage (platform).

   Y-pos set
   1] Manual
   2] Auto

4. Press 2-key and then, the following message appears.

   Manual Moving
   Using 1, 2, 3 and 8 key
   Enter: FINISH

   <Key Description>
   Key 1 : move Z-axis down
   Key 3 : move Z-axis up
   Key 2 : move Y-axis backward
   Key 8 : move Y-axis forward

   You position the probe tip at the center (vacuum hall) of the stage by using above 4 keys. With moving Z-axis down, you can move the probe tip close to the center (vacuum hall) of the stage in order to confirm if the probe tip is exactly positioned at the center.

   Note 1) Each key is functional just during pressing.

   Note 2) Even when Z-axis come down a little by using 1-key, Y-axis moving key of 2-/ 8-key is subject to be mal-functional to prevent the probe tip from a contact damage.

5. If the probe head is positioned at the center, press [Enter] key and confirm the following message.

   Search Complete!
   Y-Pos : 10096
   1 : Set
   2 : Cancel

6. Press 1-key for setting and then, press [ESC] key to complete all specification.

Finally, you lift Z-axis to the top using 3-key and then press 5-key. If so, the probe head moves to its home position.

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D. Service

1. Service

Period of Warranty : 1 year

Please check the following items before asking for service.

- Remove the white protector cap from probe head?
- Use a correct power source?
- Check the state of fuse?
- Correctly enter a correction factor of a mode?
- Check if a test sample is suitable to a current probe head? (Refer to “Probe selection guide” in Next page)
- When you find out something wrong except above check-points, please contact the seller or AIT Co., Ltd.

2. Symbol

~ : Alternating current

: : Protective conductor terminal : Caution

| : On (Supply) 0 : Off (Supply)

3. Safety

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

E. Probe Head Selection Guide