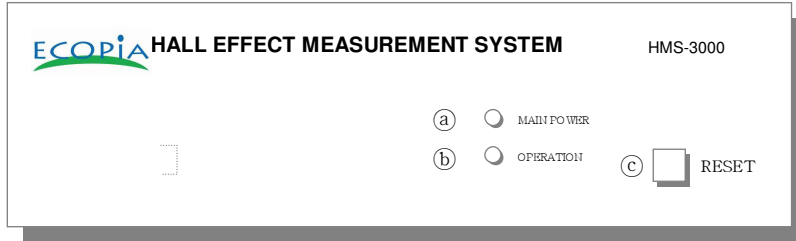




1. Before starting: Naming of each part

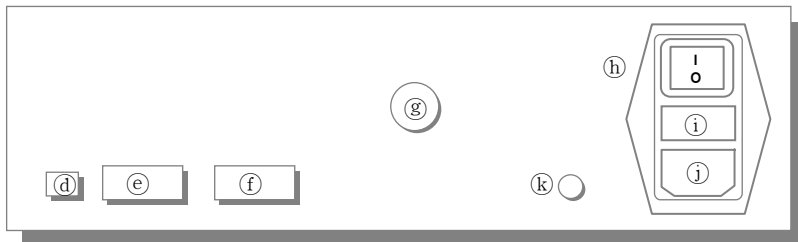
■ Main Body

Front



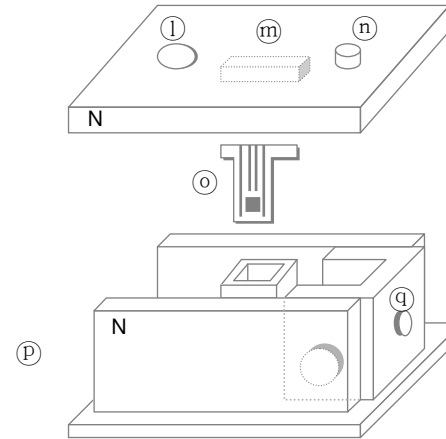
- (a) Main power LED
- (b) Operation LED
- (c) Reset button

Back



- (d) USB / RS232 Select S/W.
- (e) RS232 Port
- (f) USB Port
- (g) Sample connect
- (h) Power S/W.
- (i) Fuse
- (j) Power cord
- (k) Earth

■ Magnet set



- (l) Liquid Nitrogen Inlet
- (m) Sample Board Connector
- (n) Main Body Connector
- (o) Sample Board
- (p) MagnetSet Case
- (q) Permanent Magnet



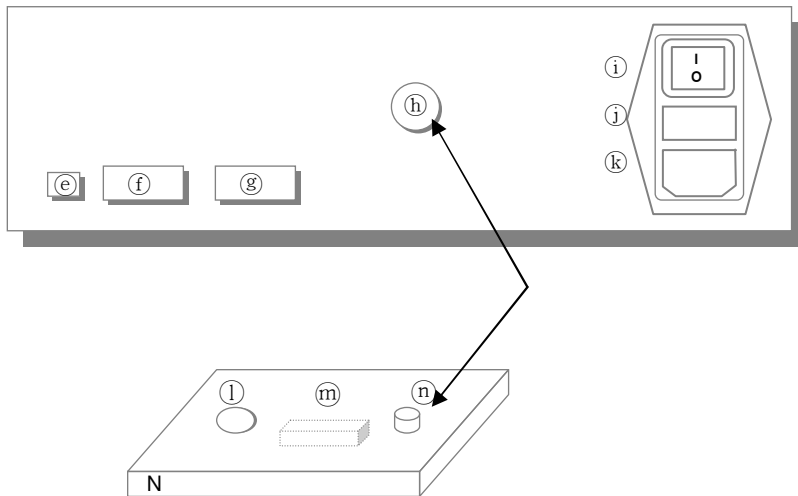
2. Measuring a Device

■ Connect the ⓐAC Power Connector cable to Main Body

Power supply : AC 100 - 240V / 50 - 60Hz 2A



■ Connect the sample connection cable between the ⓑ sample connect (5pin connector in rear of Main Body) and ⓓ Main body connector located on top of the white Magnet Set cover.

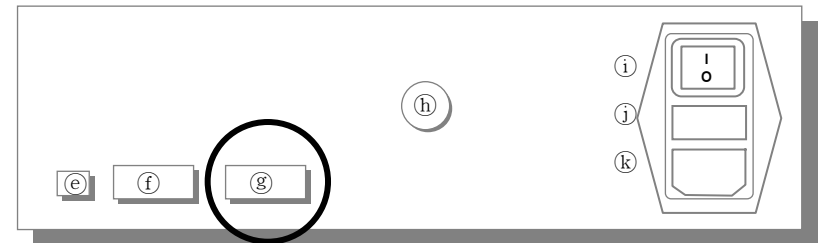


■ Connect the Main body to PC

Connect ⓑRS232 Port of Main body to Serial port of PC using 9pin serial cable supplied. (ⓐ USB / RS232 : Select Port switch RS232 in this case)



Or connect ⓐUSB Port of Main body to PC USB Port using USB Cable supplied. (ⓐ USB / RS232: Select the switch USB in this case)



■ Install the CD ROM software program that is supplied with the system onto a MS Windows based PC.

Setting up the programming should be finished before measurement (Refer to set up the programming)

■ Measuring at 77K

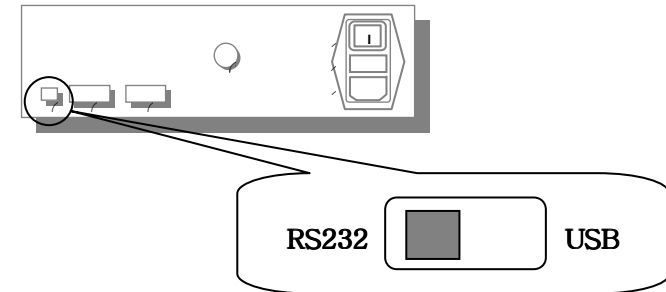
Have some liquid nitrogen available if you are planning on measuring at 77K.



3. Setting up the Program

■ In case of connecting with RS232C cable

1. Select Switch to RS232 in the rear of the Main body.



Confirm the com port driver.

2. Confirm if there is not-using COM1~6 Port in PC and confirm the Port available.

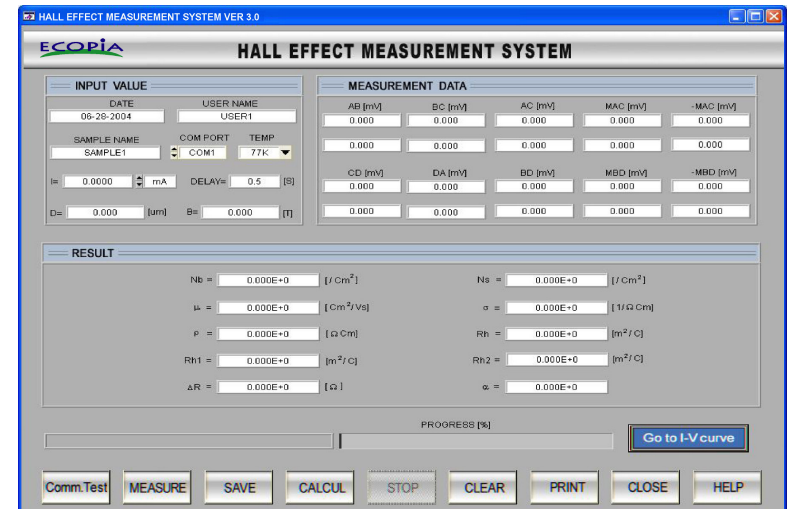
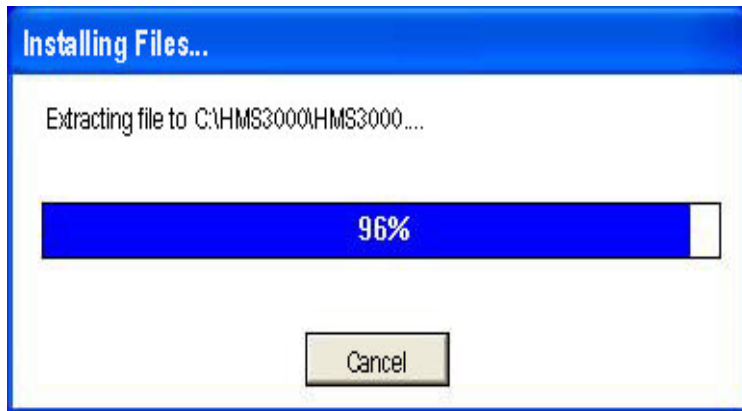
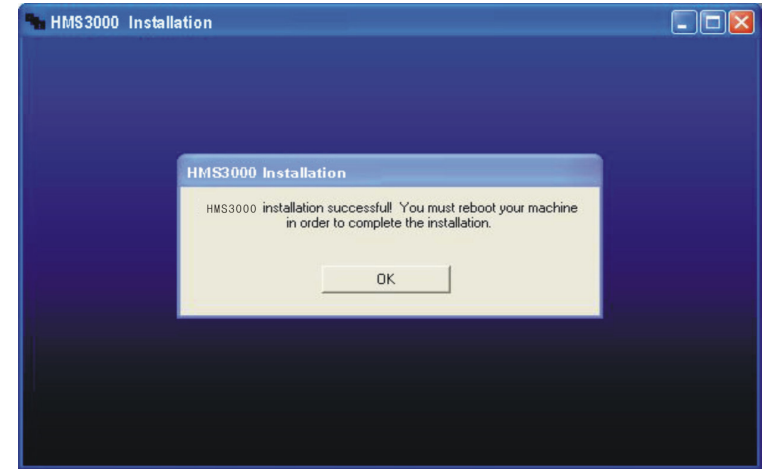
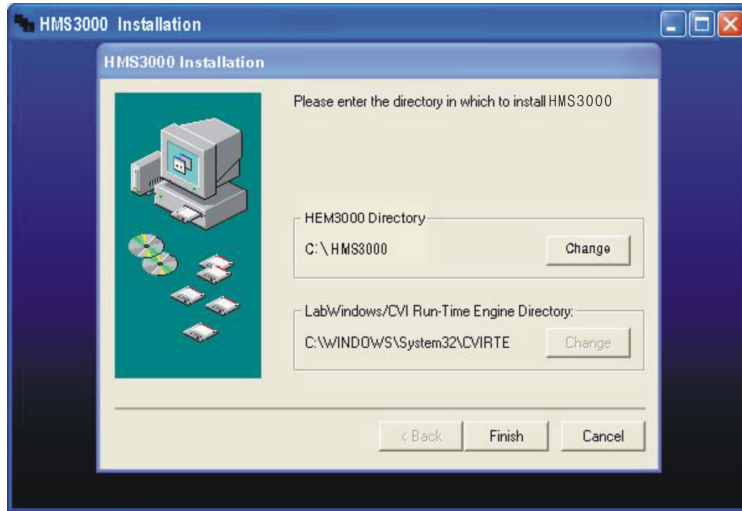
※ In case the setting up program is not operated due to user's PC environment, OS error, ask service center of the PC manufacturer.

3. Start setting up the program of Hall Effect Measurement System

① Insert CD supplied into CD-ROM.

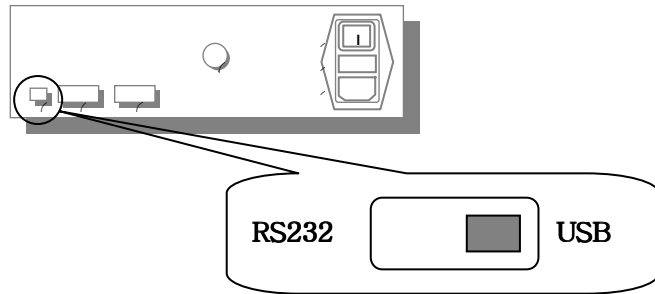
And it executes program setup wizard automatically.

If it does not be executed automatically, pls execute "Setup.exe" in CD-ROM driver.

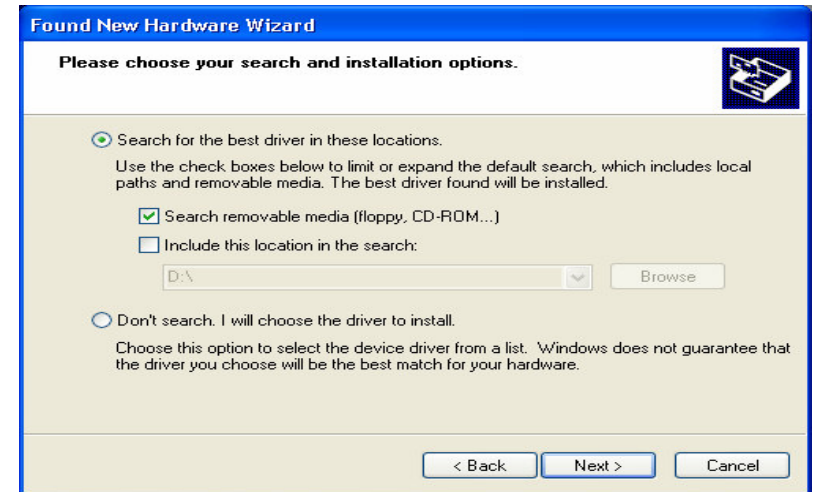


■ In case of connecting with USB cable.

1. Select Switch to USB in the rear of the Main body.



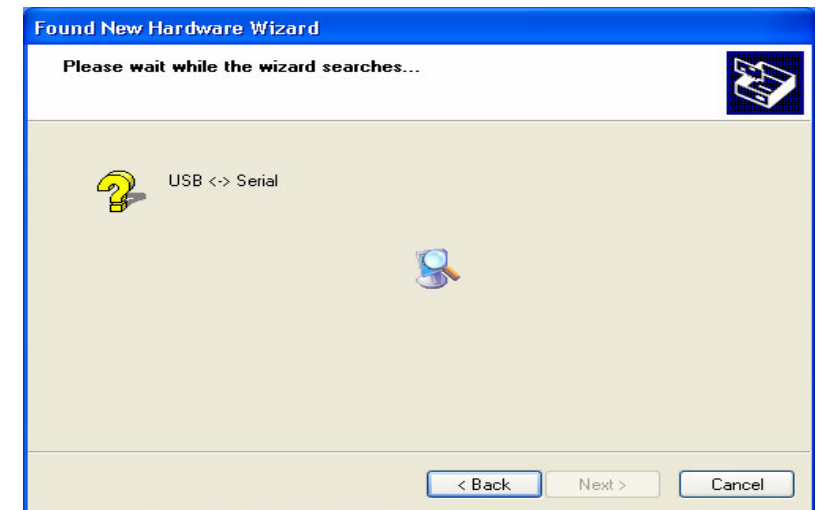
2. Connect the USB cable between Main body and PC and turn on the power of Mainbody. The “New hardware set up” screen will pop up. Set it up to the position of CD driver supplied.



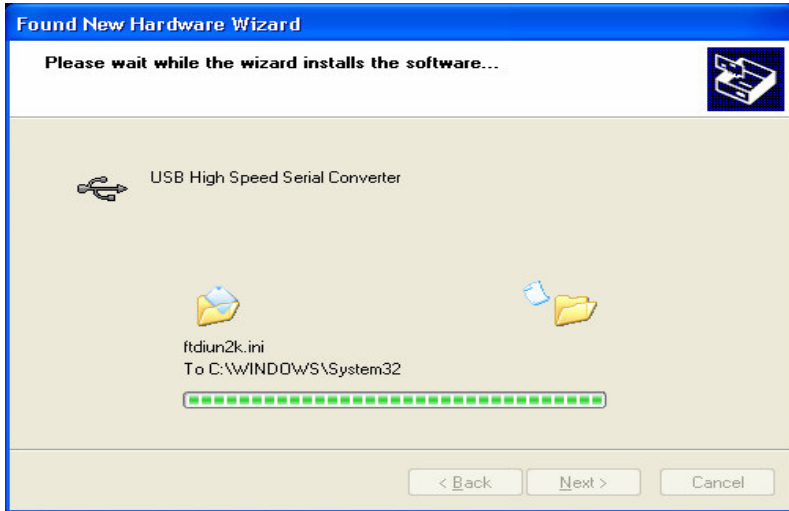
Check it as picture and click the “Next” button.



Check it as picture and click the “Next” button.



It is searching USB <-> Serial.



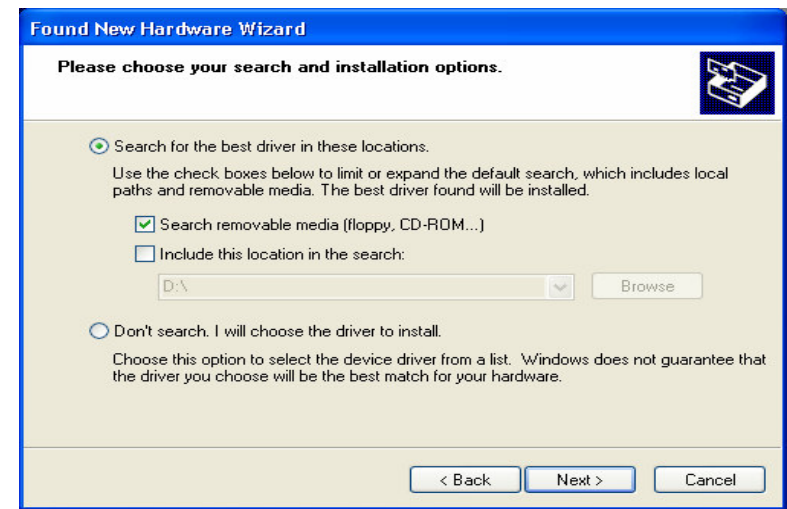
It is setting up the file to set up on window.



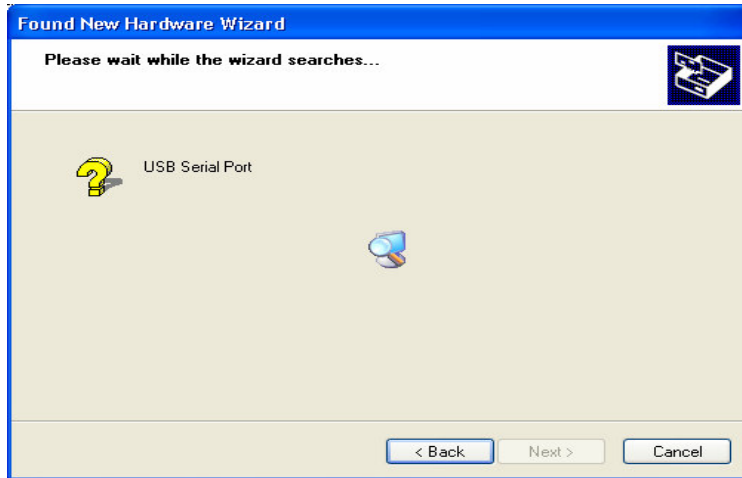
Click the "Finish" button and first setting up is finished.



Check it as picture and click the "Next" button.



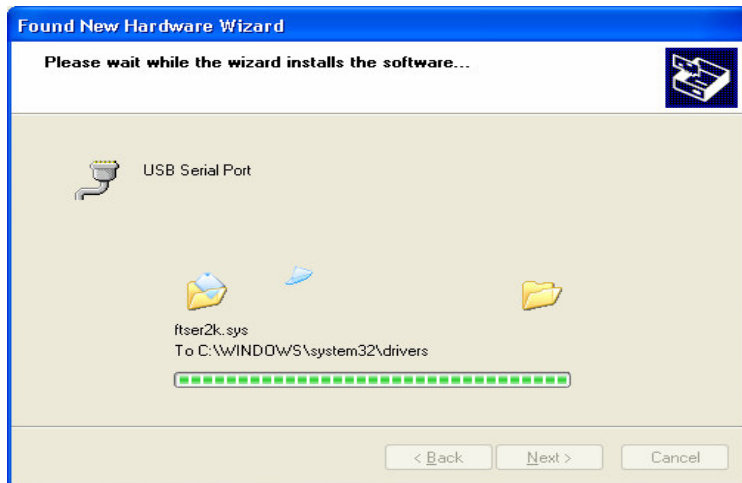
Check it as picture and click the "Next" button.



It is searching required file.

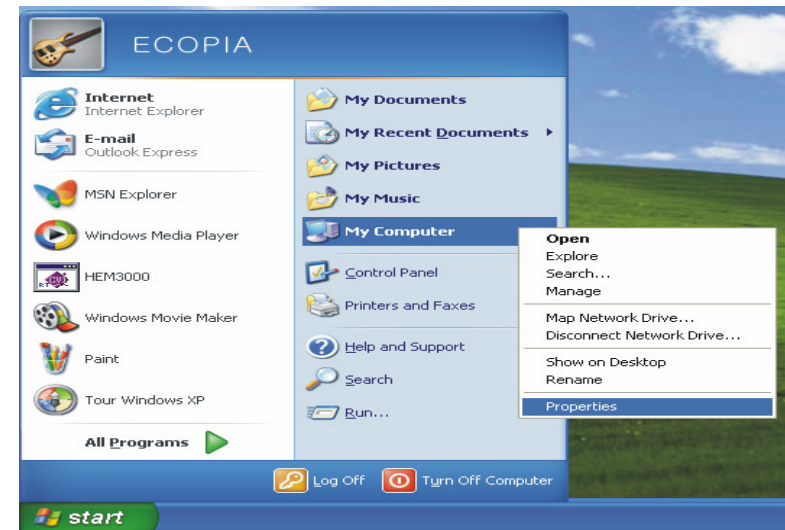


Click the "Finish" button and the setting up is finished.

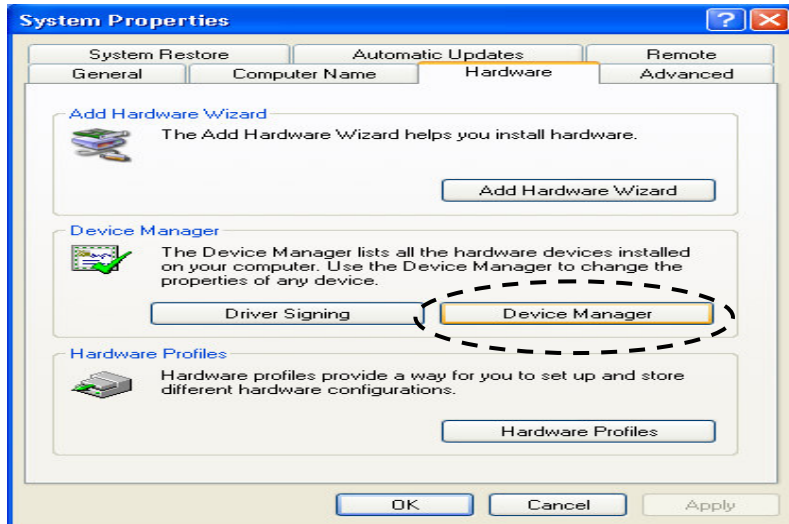


It is setting up the file to set up on window.

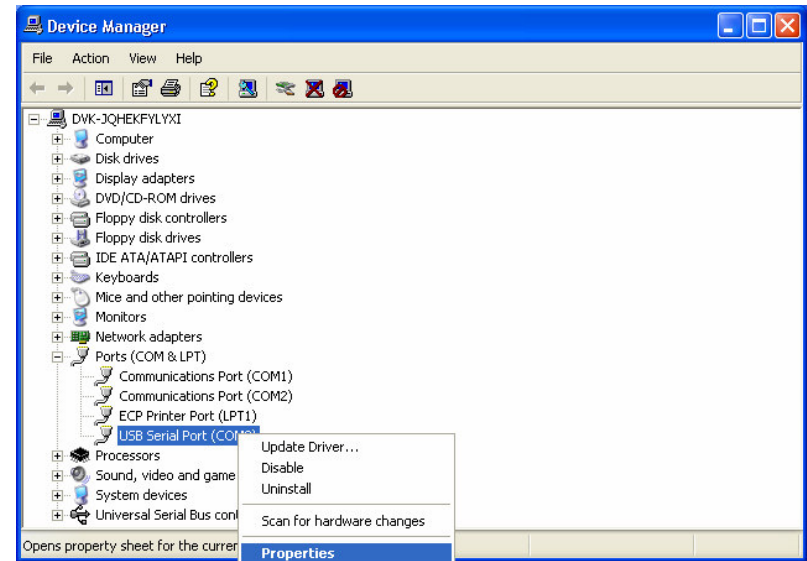
< The following process is about checking setted up USB Serial Port >



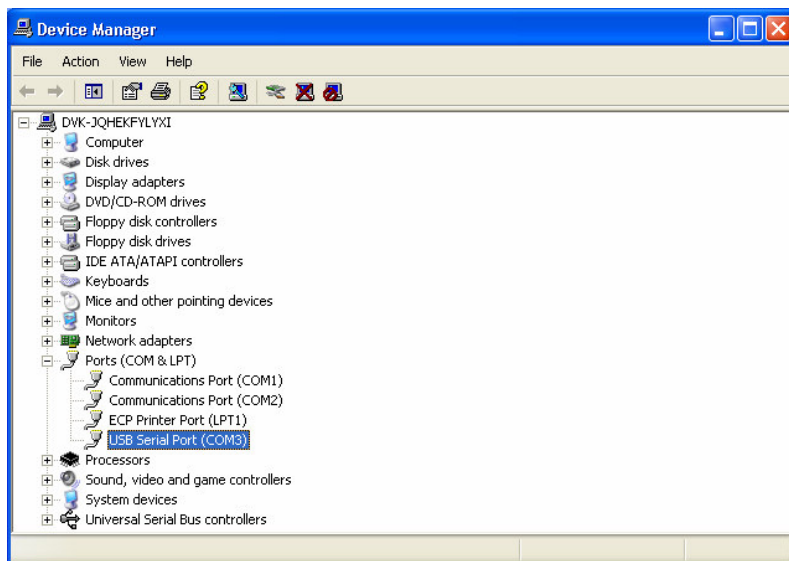
Click the "Properties" on "My Computer" as picture.



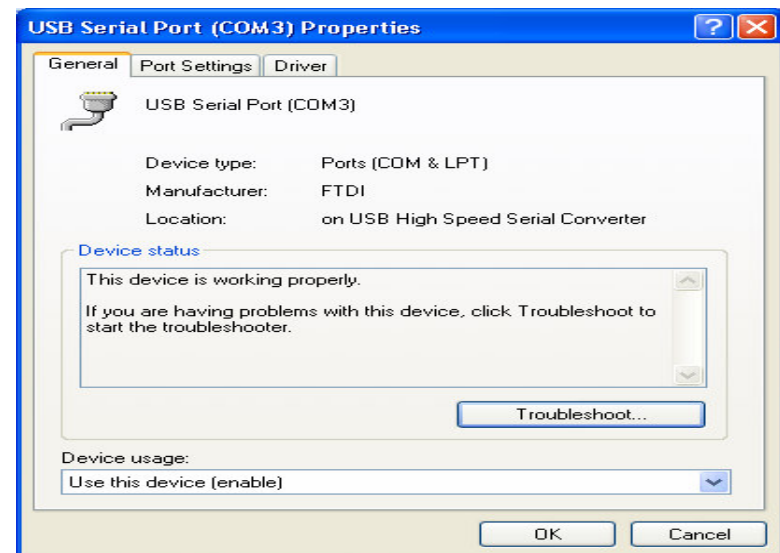
Click the “Device Manager” on Hardware tap as picture.



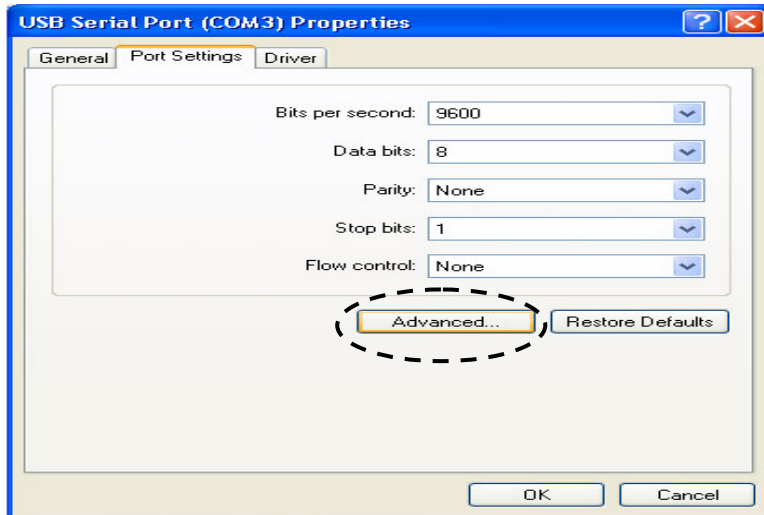
Click the “Properties” button as picture.



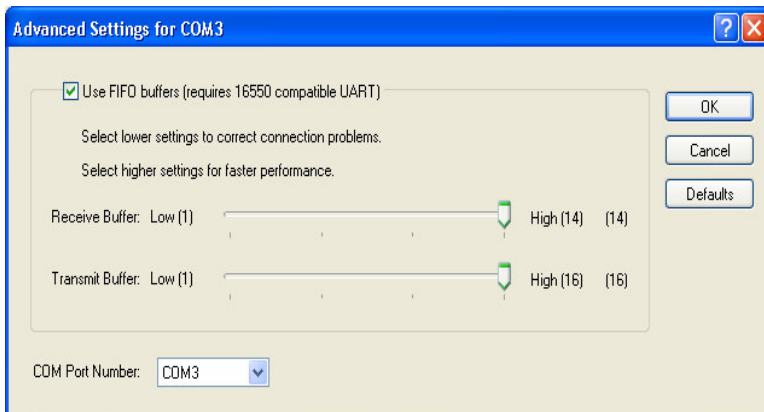
Click the “Ports(COM&LPT)” and click the “USB Serial Port”



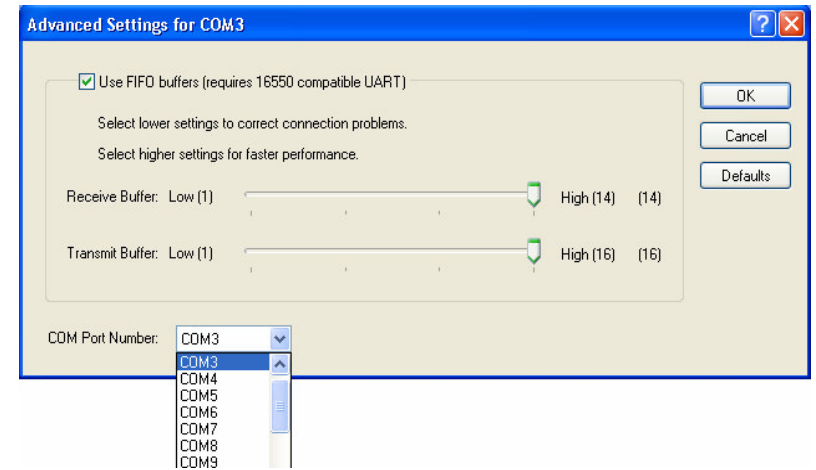
Click the “Port Settings” tap.



Click the "Advanced" button.

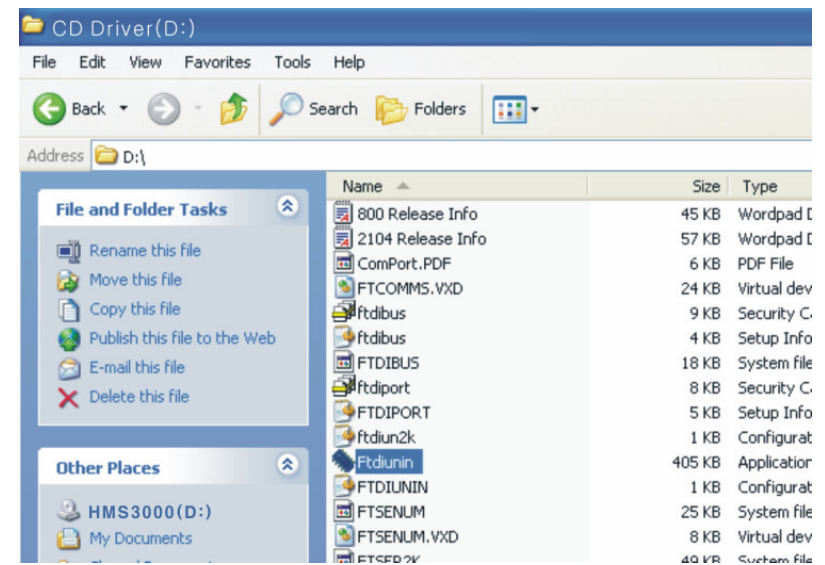


In above "COM Port Number", select "COM1" or "COM2"

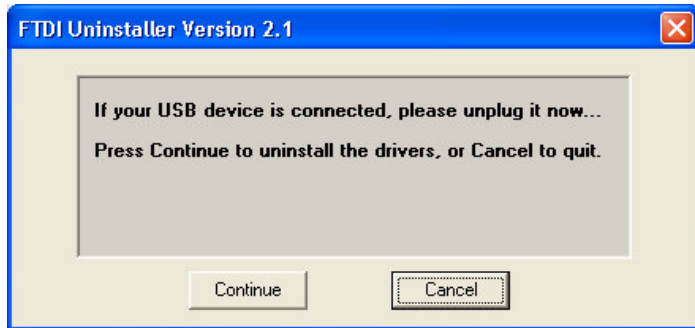


Select and click "OK".

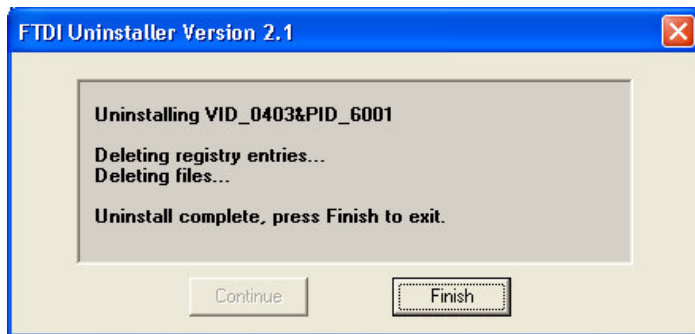
< The followings are for deleting USB driver >



Click the "Ftdiunin" as picture.



Click the "Continue" button.



Click the "Finish" button and USB driver deleting is finished.



4. Program Instruction



4 - 1. Hall Effect Measurement System Program

* The first screen shot *



- 1) Click "START MEASUREMENT" to move to measurement page.
- 2) "EXIT" – Finishing the measurement.

■ INPUT VALUE PART

DATE : Date is shown in a month-day-year order.

USER NAME : Input user name.

SAMPLE NAME : Input sample name.

COM PORT : Select the Com port of PC.

TEMP : Temperature condition selection.

I : If you apply input current over range (0 ~ 20mA), “Over range” warning message appears in text window.

DELAY : The time that takes from applying input current to measurement.(Not important). “0.1” second will be recommended.

D : Sample thickness input window.

B : Magnet flux density input window.

The electrical properties of the sample(carrier concentration, mobility, and etc) is calculated based on raw data(hall voltage) using a numerical formula.

MEASUREMENT DATA PART

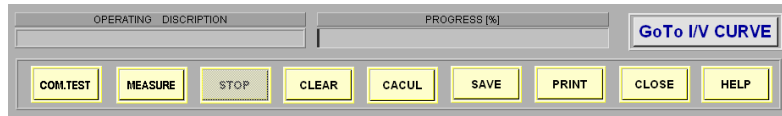
MEASUREMENT DATA				
AB [mV]	BC [mV]	AC [mV]	MAC [mV]	-MAC [mV]
-22.409	-5.569	-16.856	-16.975	-16.752
22.353	5.486	16.792	16.898	16.678
CD [mV]	DA [mV]	BD [mV]	MBD [mV]	-MBD [mV]
-22.412	-5.571	-16.857	-16.752	-16.973
22.348	5.483	16.792	16.675	16.898

Hall voltage is measured as user apply “INPUT VALUE”.

RESULT PART

RESULT	
Nb = -2.873E+20 [1/Cm ³]	Ns = -2.873E+15 [1/Cm ²]
μ = 3.989E+1 [Cm ² /Vs]	σ = 1.836E+3 [1/ΩCm]
ρ = 5.447E-4 [ΩCm]	Rh = -2.173E-2 [m ² /C]
Rh1 = -2.167E-2 [m ² /C]	Rh2 = -2.178E-2 [m ² /C]
ΔR = 1.108E-1 [Ω]	α = 2.470E-1

■ Order button part



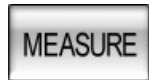
Open the help window.



: Diversion to I-V Curve window



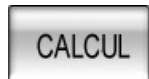
Confirm if system is connected and the communication is available.



Start measurement after entering up input values.



Save measured data and results value.



Changing raw data(hall voltage) makes other results value change as calculated formula.



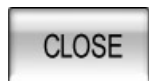
Toggle between STOP operating when measuring, and CONTINUE measuring when stopped.



Clear measurement data and results value.



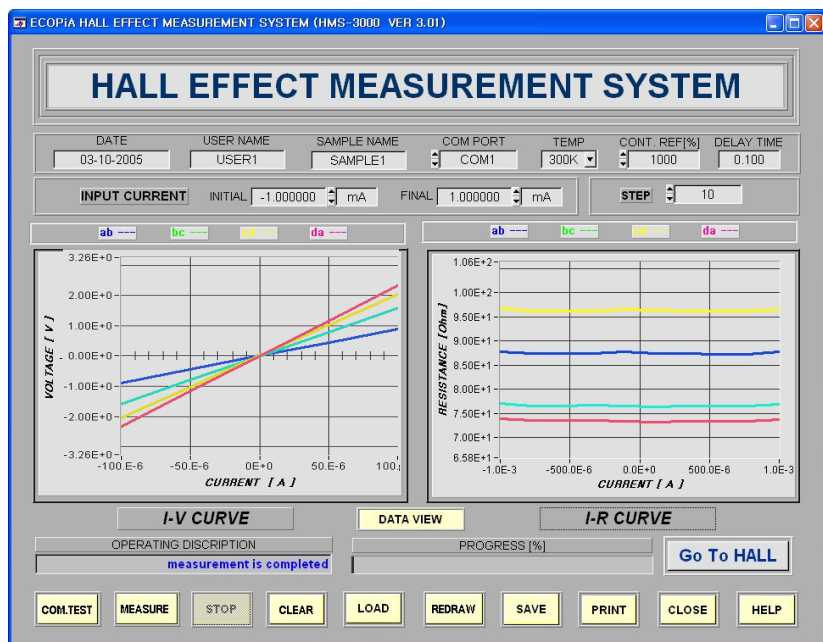
Print the screen contents



Program ending.



4 - 2. I - V Property measurement program



I - V measurement program screen

It shows s/w screen composition to measure I-V. The features of each part is as follow.

■ INPUT VALUE PART

DATE	USER NAME	SAMPLE NAME	COM PORT	TEMP	CONT. REF[%]	DELAY TIME
07-07-2004	USER1	SAMPLE1	COM1	300K	1000	0.100
INPUT CURRENT		INITIAL	FINAL	STEP		
		0.000 mA	0.000 mA	0		

DATE: Date is shown in month-day-year order.

USER NAME: User name input window.

SAMPLE NAME: Sample name input window.

COM PORT: Computer com port creation window

TEMP: Temperature condition creation window.

CONT. REF: Contact Fail condition creation window. Input the rate of the minimum and maximum value as condition.

DELAY TIME: The time that takes from applying input current to measurement.(Not important). "0.1" second will be recommended.

INITIAL: The initial applied current creation window (-20 mA ~ +20mA)

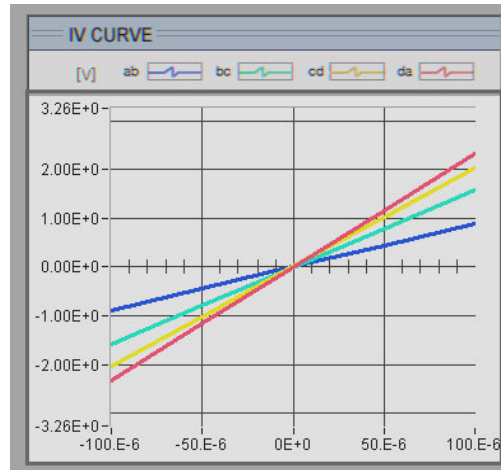
FINAL: Final applied current creation window (-20 mA ~ +20mA)

STEP: Current value applied stages (Including initial and final current value)

* Tips) Put "-1mA" in "INITIAL" blank and put "1mA" in "FINAL" blank. And then, put "10" in "STEP". If so, this system measures I-V and I-R value and it shows with graph and text data as well in 10 step.

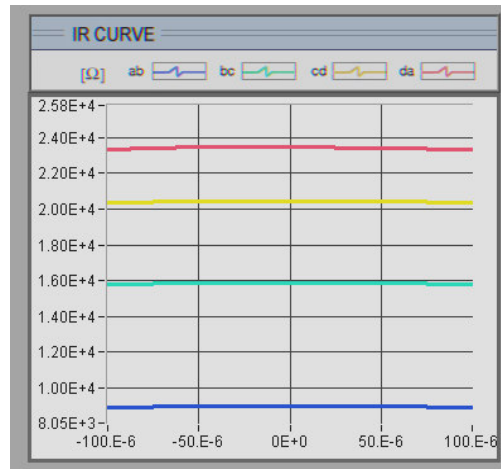
■ I-V CURVE Manifestation Part

It indicates hall voltage change as applied current change as graph.



■ I-R CURVE Manifestation Part

It indicates sheet resistance change as applied current change as graph.



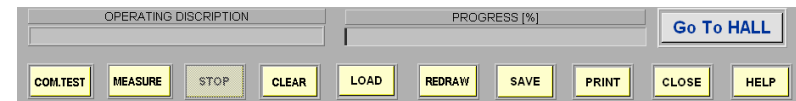
■ DATA VIEW

DATA VIEW

In I-V CURVE screen shot, Click **DATA VIEW**. And, data results is shown as below.

DATE	Username	Sampname	Temperature	Initial current	Final current	Step			
03-10-2005	USER1	SAMPLE1	300K	/,00000mA	1,00000mA	10			
current	Vab	Vbc	Vcd	Vda	Rab	Rbc	Rcd	Rda	
-1,000e-03	-8,773e-02	-7,700e-02	-9,671e-02	-7,385e-02	+8,773e+01	+7,700e+01	+9,671e+01	+7,385e+01	
-7,777e-04	-6,794e-02	-5,959e-02	-7,484e-02	-5,716e-02	+8,735e+01	+7,662e+01	+9,622e+01	+7,349e+01	
-5,555e-04	-4,853e-02	-4,257e-02	-5,345e-02	-4,083e-02	+8,736e+01	+7,663e+01	+9,622e+01	+7,350e+01	
-3,333e-04	-2,914e-02	-2,555e-02	-3,209e-02	-2,451e-02	+8,742e+01	+7,667e+01	+9,626e+01	+7,353e+01	
-1,111e-04	-9,744e-03	-8,499e-03	-1,072e-02	-8,152e-03	+8,769e+01	+7,649e+01	+9,653e+01	+7,338e+01	
+1,111e-04	+9,721e-03	+8,479e-03	+1,071e-02	+8,128e-03	+8,749e+01	+7,631e+01	+9,640e+01	+7,315e+01	
+3,333e-04	+2,911e-02	+2,554e-02	+3,208e-02	+2,448e-02	+8,734e+01	+7,663e+01	+9,625e+01	+7,346e+01	
+5,555e-04	+4,851e-02	+4,255e-02	+5,344e-02	+4,080e-02	+8,733e+01	+7,659e+01	+9,620e+01	+7,345e+01	
+7,777e-04	+6,792e-02	+5,957e-02	+7,483e-02	+5,713e-02	+8,732e+01	+7,660e+01	+9,621e+01	+7,345e+01	
+1,000e-03	+8,773e-02	+7,694e-02	+9,650e-02	+7,379e-02	+8,773e+01	+7,694e+01	+9,650e+01	+7,379e+01	

■ Order button part



Go To HALL

: Diversion to Hall effect measurement window.

Comm.Test

Confirm if system is connected and the communication is available.

MEASURE

Start measurement after setting up input value

SAVE

Save measured data and results value.

LOAD

Recursion existingly saved graph data.

REDRAW

Get the graph into line and regraph it again.

STOP

Toggle between STOP operating when measuring, and
CONTINUE measuring when stopped.

CLEAR

Clear measurement data and results value.

PRINT

Print the screen contents.

CLOSE

Program ending.

HELP

Open the "Help" window.



5. Measurement sequence.

■ An outline of the measurement sequence is as follows. Please refer to single step explanations for details.

5 - 1. Measurement Sample Arrangement.

5 - 2. System POWER On

5 - 3. Injection of liquid nitrogen (only 77K measurement)

5 - 4. PC Program operating and measurement.



5 - 1. Measurement Sample arrangement.

This following procedure should be completed before turning on the power of the device.

Cut the sample to be measured into a square that is a maximum of 20 mm x 20 mm, and then bond it to the Sample Board.

It is possible to measure samples that are not exactly square in shape, however, the measurement results will not accurately represent the true properties of the material. The resistivity of the material will especially be affected.

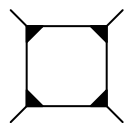
Bond the four vertexes of the sample.

Proper sample bonding is performed to insure good ohmic contact.

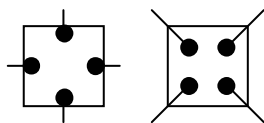
An Indium compound is normally used in bonding the vertexes so that good ohmic contact is maintained at LN₂ temperatures.

Annealing of the sample at the appropriate temperature and length of time can also improve ohmic contact.

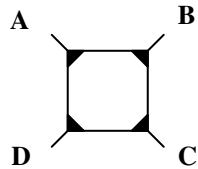
The recommended way of bonding of the sample is presented below.



<Acceptable>



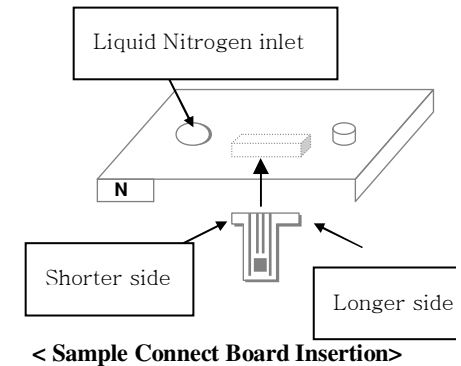
<Not Recommended>



< Name of sample bonding part >

Bond the material sample to the Sample Board and then insert Sample Board into the magnet set lid as shown.

Make sure that the shorter arm on the sample board edge connector is inserted towards the N direction (the lid has a drawing to show this)



< Sample Connect Board Insertion >



5- 2. System POWER On

This equipment is a precision measurement instrument, so please allow a 10 minutes warm-up time before starting measurements.

All the measurements should be taken in a state that Sample Board is connected to.

After closing the lid of the magnet set measuring case with the sample board installed, turn the ①Power "On".

Check to see if the ②Main power LED is turned on and ③Operation LED is turned off (every single 0.4second) in the main body front side.

Check to see if ④Contact Failure LED in main body front side is turned off.

If ④Contact Failure LED is on, measurements can not be made, so please check the following.

Is the contact between the sample and ⑤Sample Connect Board prepared correctly for good Ohmic contact?

Ohmic contact is okay if the resistance measurements are similar when checking each terminal using a DVM.

Is the ⑥Sample Board correctly installed into ⑦the Sample Connect Slot?

Refer to “1-1. Preparations for Measuring Sample” for further explanation.

Is the Current Range set correctly?

Reset by pressing the ⑧Reset button in if there was a previous operation.



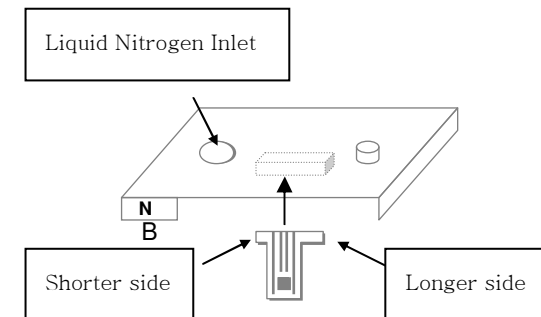
5- 3. Liquid Nitrogen Input.

The following procedure is only necessary if you are interested in performing the Hall effect measurement at 77K (LN₂ temperature). It is not necessary for measuring at 300K.

Pour the liquid nitrogen through the ①Liquid Nitrogen Inlet using funnel.

Pour enough to submerge the sample.

Fill the sample measuring case considering that some liquid nitrogen will evaporate during the test time. It takes approximately 10-15 minutes for the entire reservoir to evaporate.





5- 4. Operation of the PC Program and Making Measurements.

Start the PC program.

Click the “Comm. Test” button in program.

Select the current range and input value of the current

Input the applied magnetic flux density and the thickness of the sample.

Click the “Measure” button (prior to inserting the magnet.)

The data of horizontal, vertical, and diagonal directions will be measured.

After the first data measurements, the measured values will be displayed automatically and the message, 'Insert Magnet N ▷ S', will be shown on the screen (It takes under two minutes)

After inserting the magnet in the forward direction (N→S), please click the "OK" button.

The system measures the data of the diagonal direction.

After the second data measurements, the measured values will be displayed automatically and the message, 'Insert Magnet S ▷ N', will be shown on the screen (It takes approximately one minute)

After the magnet is inserted in the reverse direction, please click the

"OK" button.

The system measures the data of the diagonal direction.

The Measured values are gradually displayed on screen and the results is automatically displayed on results part.

If the input data need to be changed after finishing the measurement, enter the revised data into the program and click the 'CALCUL.' button. The revised results will be displayed. (Ex : D ; 3 → 6)

In order to stop the measurement while the system is running, click on “Stop”. If you click “Stop” again, it restarts at that point.

In case the “Contact Failure” lamp turns on during the measurement, check the ohmic contact of the sample and click the “Reset” button on the front of the Main Body. The system will reinitialize.

The “Clear” button in the program makes all of values become zeros.



6. Precaution in usage

Use a standard AC outlet.

The inside of the magnet set has a strong magnet field. Be careful not to place objects that are sensitive to magnetism such as credit cards or electronic devices near the magnet.

Keep the surface of the sample clean. Touching its surface with fingers can affect the accuracy of data value.

Use proper safety procedures in storing and handling liquid nitrogen. Ecopia does not accept responsibility for any injuries that occur from the use of liquid nitrogen.

Avoid using or keeping this product under conditions where the product is exposed to the direct rays of the sun or any hot, humid place, or where a vibration hazard may exist.(25°C recommendable)

Do not attempt to repair or disassemble this equipment on your own without express instructions from the factory.

In the event that an unauthorized person dismantles or attempts to repair this equipment, malfunctions can occur and the normal warranty will be void.

Putting on glove is actually needed when measuring.. It protects user's unexpected damage. And, it also protects magnet's oxidization.

We are not in charge of damage from handling magnet carelessly.

Use proper fuses.

To prevent failure or fire from over-current, a fuse ① is built in-line with the AC power source.

If you need to replace a fuse, remove the power cable connected to the AC power and remove the fuse① located at the rear of the Main Body.

When changing on account of broken wires, use the product with 250V/ 2A.





7. Product Specification & Composition

Product Specifications

Size (W×D×H) : 360×300×105 [mm] (Main Body)

Magnet flux density : 0.51T (options : 0.31T, 0.37T, 0.51T, 1T)

Measurement Temperature : 300K and 77K (Liquid Nitrogen)

Sample Size : Max. 20mm × 20mm

Measurement Material : Si, SiGe, SiC, GaAs, InGaAs, InP, GaN and besides semiconductors (N type & P type can be measured)

Power Supply : AC 110 - 240 V / 50 - 60Hz 2A

S/W Operation Environment & Measurement Information

Operation Environment : Windows 98 / Me / 2000 / XP

Measurement Types : Bulk Carrier Concentration, Sheet Carrier Concentration, Mobility, Hall Coefficient, Bulk Resistivity, Conductivity, Magnetoresistance, V/H ratio of resistance.

Product Composition

Main Body

Funnel for liquid nitrogen

Power source cord.

Manual Book

Magnet Set (Permanent magnet, Magnet Set case, Magnet Set cover)

Connection cable between Main Body and Magnet set.

Sample Board

Hall Effect Measurement Program CD (S/W)

Serial Cable, USB Cable

WARRANTY

Hall Effect Measurement System Model NO: HMS-3000

Purchase Date :

Customer Name : Tel No: Address:

Dealer Name : Tel No: Address:

Keep this book for the case that you call to request repairs. You need to have this book with purchase date recorded for appropriate service.

1. Length of warranty is one year.
2. Service is provided according to the contents in this warranty.
3. Length of free warranty is from purchase date. So please record purchase date. (In case that purchase date is not recorded, length of free warranty starts from 3 months after the date of manufacture)
4. This warranty is not reissued.

Consumer Damage Compensation

Kinds of Damage		Compensations		
		Within length of warranty	After length of warranty	
In the case of function/performance failure in the normal use	In case that repairs to major parts should be needed within 10days after purchase	Product replacements	-	
	In case that exchange is not available.	Refund		
	Defects in product	Repairs are possible.	Free Repair	Repair to be paid for
		Repairs are impossible.	Product replacement	Fixed depreciation According to the Years of product used.
	In case that the dealer loses the product that customer asks for repairs.			
In case that damage happens by delivery or installation of the product.			-	
In case that performance/function failure by the customer's carelessness or deliberate intention.		Repair to be paid for	Repair to be paid for	
<ul style="list-style-type: none"> - In case that damage happens by natural disasters(ex. fire, flood, earthquake etc.) - Replacement of expendable parts. - Damage by other exterior causes that are not of product's. 		Repair to be paid for	Repair to be paid for	

Particulars relevant to usage manuals are not applied to damage compensation warranty

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Hall Effect Measurement System

HMS - 3000 MANUAL Ver 3.1

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