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1. Basic introduction of the software

ScienceCube Studio- II is the specialized program to support Excel based science experimentations and it is supplied by Korea Digital Inc.

The method of use and analyze are remains the same as Excel and it can operate data intuitively with it's built in script language same as Excel.

Following is the composition of the program.

1)Managing the project.

Managing the save and load of the project.

2)Managing the interface

Managing the connection/disconnection of interface and the measurement area, zero point setup and unit transform of its connected sensor.

3)Managing the experimentation.

Managing the measurement intervals, method and time used for experimentation.

4)Managing the screen of experimentation.

It is made to manage the move and the changes in sizes of the elements that are collected during the experimentation to indicate it for the users needs.

5)Managing the script

It is programmed to manage the function to calculate the collected data in particular language as used in Excel.

6)Other

Manage the specific functions to run the program.

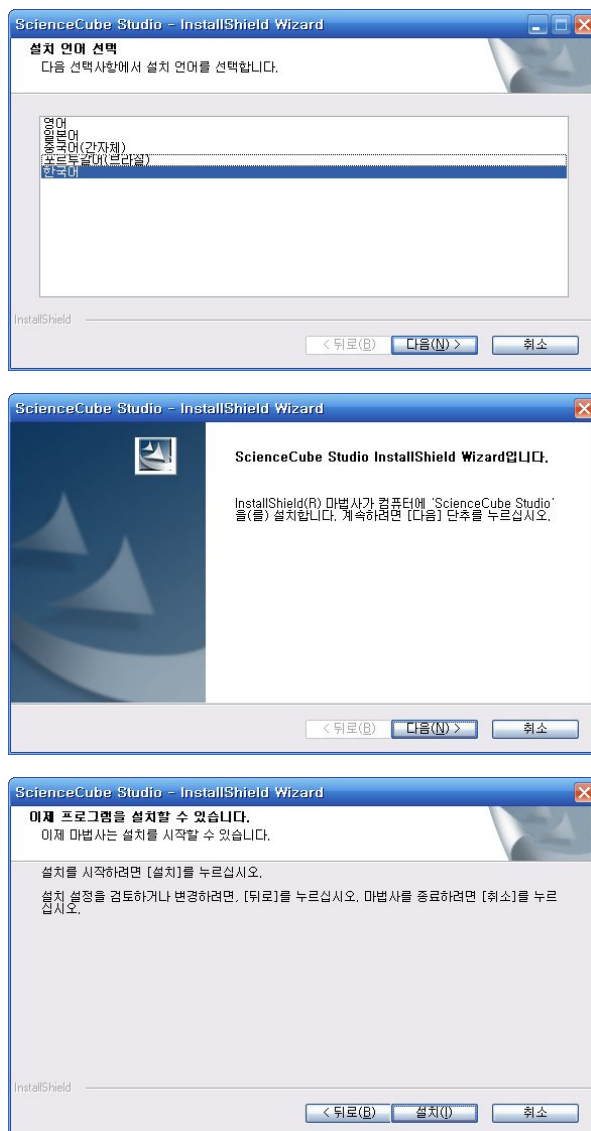
This software is designed to run many functions and it causes the speed of the processing of the software. Users need to set the proper interval, time and script in advance for precise experimentation.

(Depends on the capacity of the computer, processing speed might be slowed.)

2. Installation

Run Setup.exe in the \ Studioll folder from the provided CD to install ScienceCube Studio- II

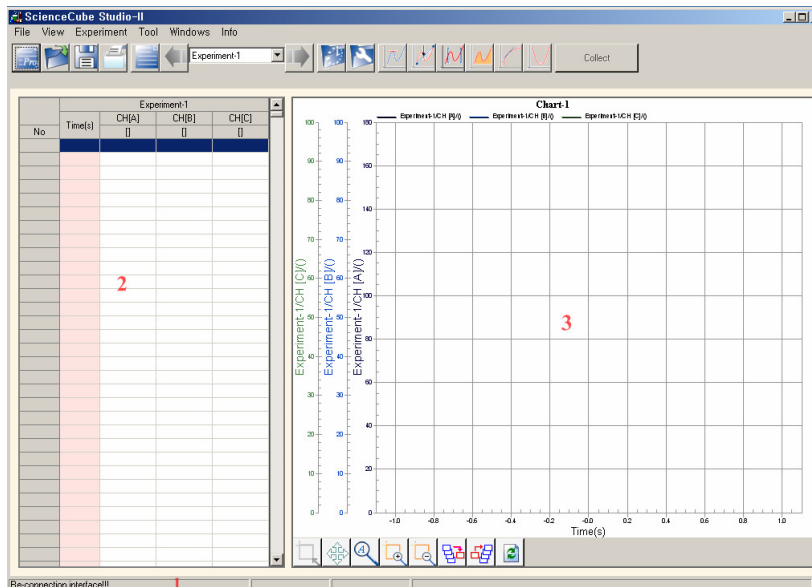
After run Setup.exe



The program will be installed by choosing install as in above order.

3. Experiment

1) Composition of the screen



Run Studio- II after connecting interface of Science Cube, experimental environment is setup to perform basic experimentations with connections and connected sensor as shown in the screen above.

To bring the data without connecting the interface, cancel the **Auto Search** from [Tool]-[Option]-[Interface].

① is the indication of the experimentation intervals and time with the sensor that is currently connected.

S is the interval (0.2 seconds) and E is the time (900 seconds).

② is the area to indicate the collected data in diagram.

③ is the area to indicate the collected data in chart.

2) Basic experimentation.

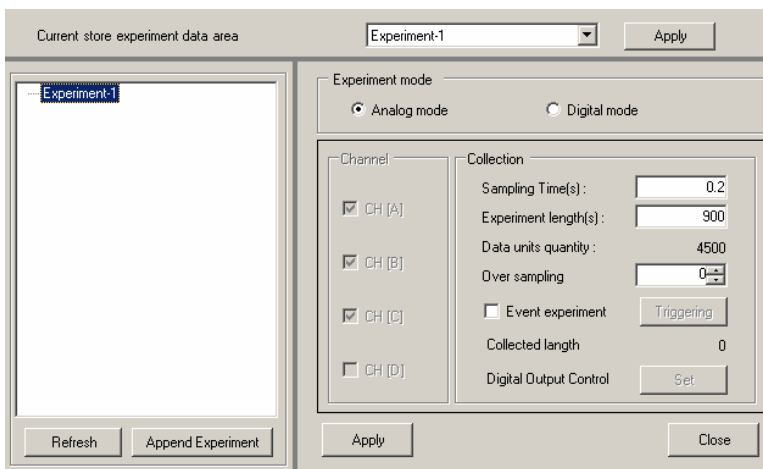
Choose Start Experimentation () on the top right corner or choose [Experimentation] - [Start Experimentation] from the Menu to start the experimentation.

This button or menu is not activated when interface is not connected. It will be automatically connected shortly after the confirmation of the proper connection. If the **Connect the interface automatically?** option is canceled, choose **connecting the interface** from [Tool] - [Interface Control].

When **Start Experimentation** is chosen, the button will be changed to **Stop Experimentation** (). If it is clicked one more time, it will be changed to **Start Experimentation** () and the experimentation will be stopped.

3) Setting the experimentation.

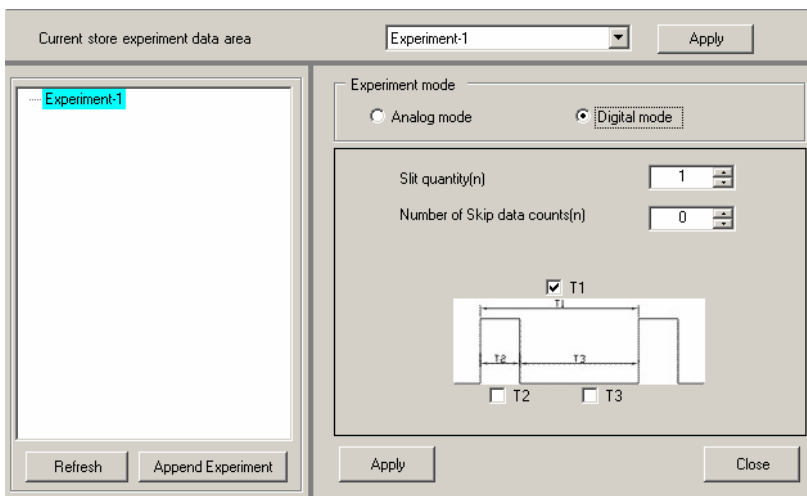
Choose [Experimentation] - [Experimentation Manager] from the menu or click , from the tool bar to bring the screen to set the experimentation.



The screenshot shows the 'Experimentation Manager' dialog box. At the top, there's a dropdown menu for 'Current store experiment data area' set to 'Experiment-1' and an 'Apply' button. The main area is divided into two sections: 'Experiment mode' and 'Collection'. Under 'Experiment mode', 'Analog mode' is selected with a radio button. The 'Collection' section contains several settings: 'Sampling Time(s)' is 0.2, 'Experiment length(s)' is 900, 'Data units quantity' is 4500, 'Over sampling' is 0, 'Event experiment' is unchecked, 'Collected length' is 0, and 'Digital Output Control' is 'Set'. On the left, there's a list of channels: CH [A], CH [B], CH [C], and CH [D], all of which are checked. At the bottom, there are 'Refresh', 'Append Experiment', 'Apply', and 'Close' buttons.

This is the screen to set the analogue method of the experimentation.

Analogue method is to measure data based on set time of interface and it is the most commonly used method for the experimentations.



The screenshot shows the 'Experimentation Manager' dialog box with 'Digital mode' selected. The 'Experiment mode' section now has 'Digital mode' selected with a radio button. The 'Collection' section contains settings for 'Slit quantity(n)' set to 1 and 'Number of Skip data counts(n)' set to 0. Below these, there's a timing diagram showing a sequence of pulses. The first pulse is labeled 'T1' and is checked. The second pulse is labeled 'T2' and is unchecked. The third pulse is labeled 'T3' and is unchecked. At the bottom, there are 'Refresh', 'Append Experiment', 'Apply', and 'Close' buttons.

This screen is to set the digital method of the experimentation.

Digital method is to calculate the changes of specific values to time with the measured data from the connected sensor and it measures the time of passage/intercept of photo gate.

There are 3 measuring ways for this method. (Refer the right- middle part of the above picture)

T1 is to measure intervals, T2 is to measure the time of passage of the particle and T3 is to measure the time in between of passage of the particle one after the other.

$$(T1 = T2 + T3)$$

Choose the method, interval and time, press **Apply** to renew the information and press **Close**.

4) Event experimentation.

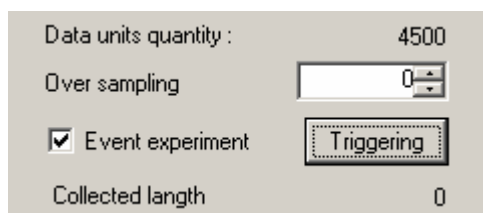
Event experimentation is the experimentation that not records the data from the analogue method experimentation and just shows the current value and let the user to save the data when he/she wants it.

Mostly, it is used when collecting the data with changes in experimental conditions, such as experimenting the power of the light depends on the distance which requires the change in the location of the bulbs and luminous intensity sensor and the data measured during changing the locations is not useful. Therefore, this kind of method is use for such experimentations.

There are two ways to perform event experimentation.

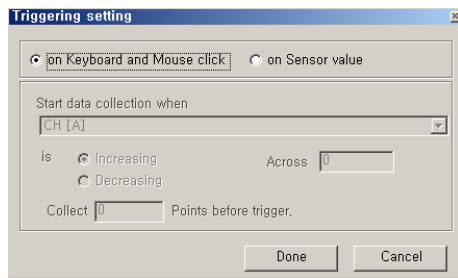
User press the **Save** from the **Experimentation** to save or save the data automatically when the value of the sensor changed to meet the specific condition.

To choose event experimentation, choose **Analogue method** and choose **Event experimentation** in the middle. The way to collect the data is to click **Method** located by the **Event experimentation** and it will bring the screen to choose the method.

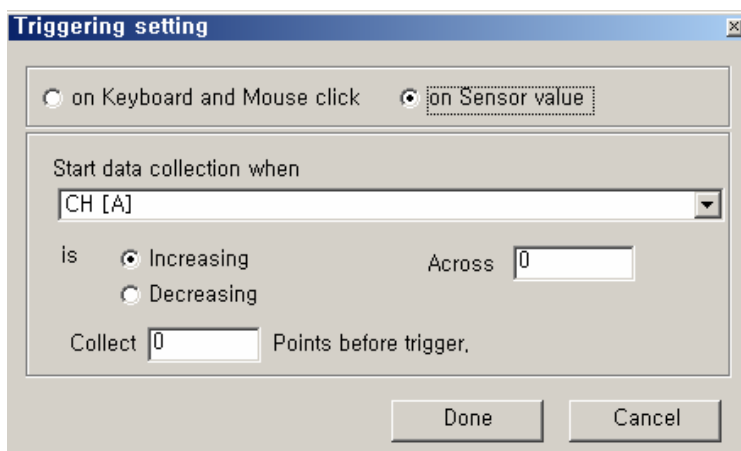


The screenshot shows a software window with the following settings:

- Data units quantity : 4500
- Over sampling : 0
- ☒ Event experiment : Triggering
- Collected length : 0



This screen will be appeared when **Save** is clicked to save by using mouse and keyboard.



This is the screen when the method is choose to save the data depends on the value of the sensor. This is the screen that to save the data for A channel when the value is change to greater than 0.5. Number 20 indicated on the bottom of the screen means to avoid the changes for the first 20 times after the measuring the data is started.

Press **Progress** after make corrections of the methods to close the setting window and save the data into experimental data.

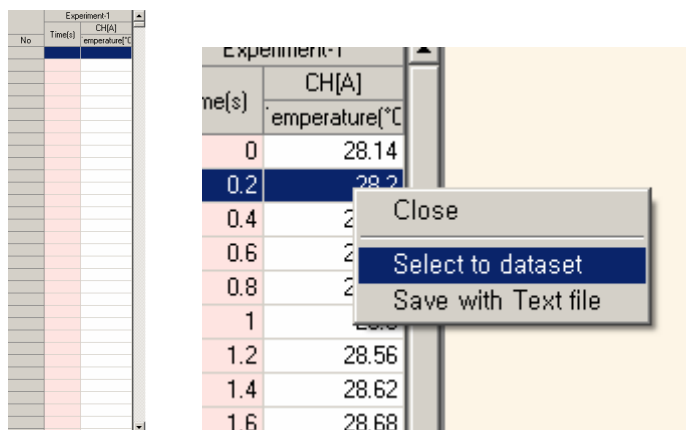
5) Composite the experimental screen

Basic screen need to be composed to observe the date at before or after the experimentation.

This software supports 5 objects.

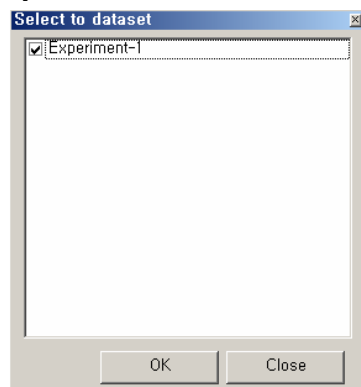
All the menu of the elements can be popped up by clicking the right button of the mouse from the selected object.

- Chart



Choose [View] - [Chart] to make a chart with base on the current data.

If different experimental data is needed, choose Chart and click the right button to make the above menu in the right- hand side to appear. Select the **Type for composition of data**, window as shown in the below will appear.

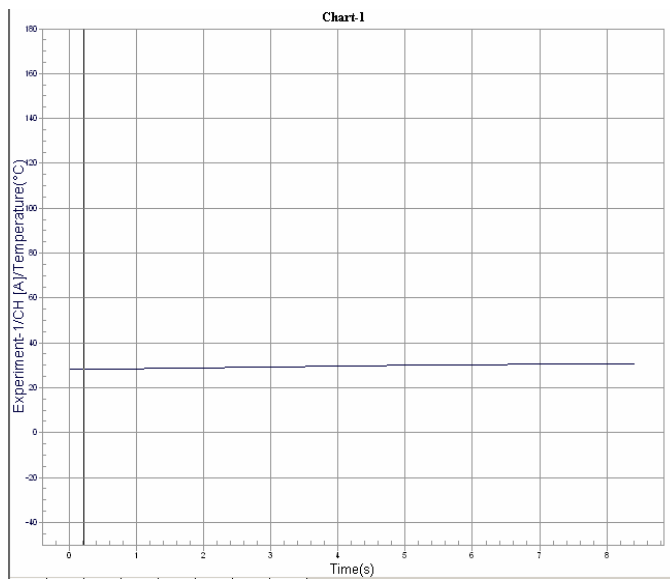


Choose the type for the composition of data and press **Confirm** to see it on the chart.

Latest experimental data will be outputted first in the chart as in order..

Save as test file is the menu to save the current data as in CVS file (compatible with Excel).

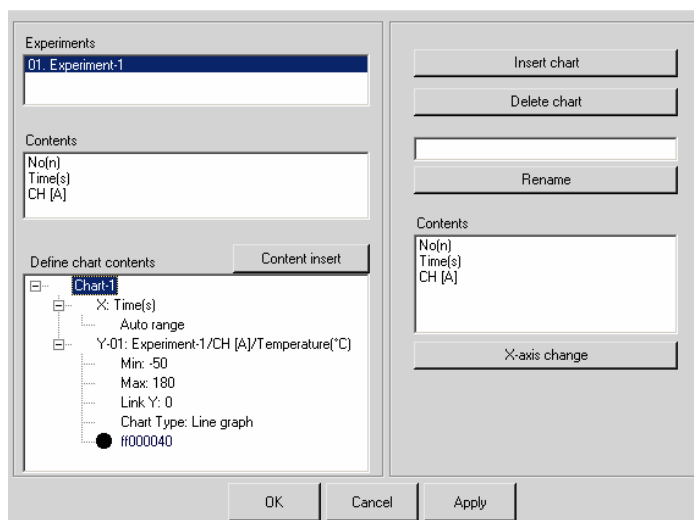
- Chart



X axis of chart only can be either number, time of specific sensor.

20 items can be selected all at once of the Y axis of the chart, but please make it minimal. 10 charts can be created as shown in the above chart.

Click the right button of the mouse and choose **Chart option** to control the each elements of the chart.



Add Chart is an option to add 1 group of X and Y and it copy the current data to create one.

Delete Chart is an option to remove 1 group of X and Y that is currently choose.

Change name is an option to change the name of the current group as shown in above picture.

Change X axis is an option to change the output of the information on X axis with items that are chosen from right- hand column.

If compositions are required from different experimental figures, choose

Experiments from the left and the composition for that experimental will shown in right column.

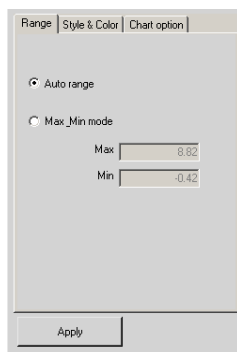
There are many elements in 1 group of chart, if you want to add figure,

- ① Choose Experiments
- ② Choose a element from the left
- ③ Choose the name of the chart which will be added
- ④ Choose **Add figure**

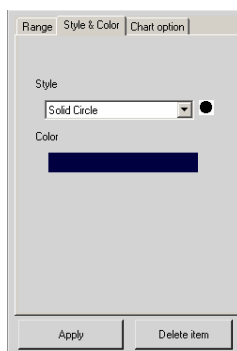
Will be adds a figure.

To delete an element, choose the element and click **Delete figure** to delete.

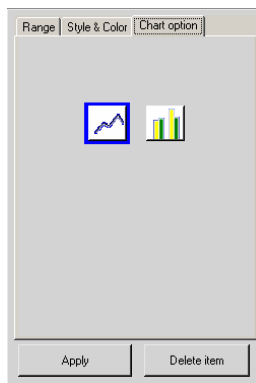
Choosing the element of the figure will show the information can be changed for each element on the right- hand side.



Extent is to setup the area of the chart that will be outputted and it will be automatically calculated with maximum value and minimum value by clicking the **Choose the extent automatically**. If **Maximum Minimum** is chosen, extent can be selected manually. It is possible to use **Reference object** to use same elements in Y axis from the elements used previously.

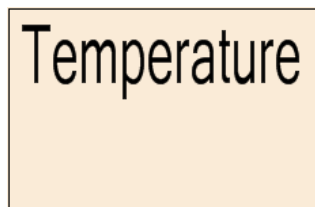


If **Use data mark in the chart?** From [Tool] - [Option] - [Chart] is chosen, the chosen mark will be appear in the chart. Color of the scale and the line in the graph can be changed in **Color**.



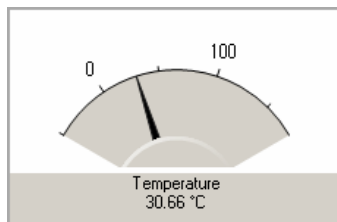
This option is to choose whether to choose line chart or statistical chart.

- Indicator



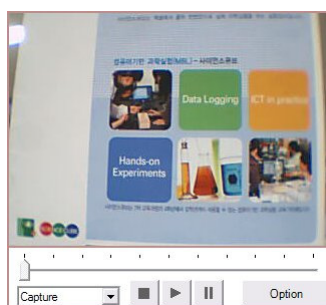
Choosing [View] - [Indicator] will set indicator as a chosen option. This element is used in experimentation to indicate the data. Channel can be selected by clicking the right mouse button after it has been chosen.

- Meter



Choosing [View] - [Meter] will set meter as a chosen option. This option has the same purpose with the indicator which to show data during experimentation.

- Video



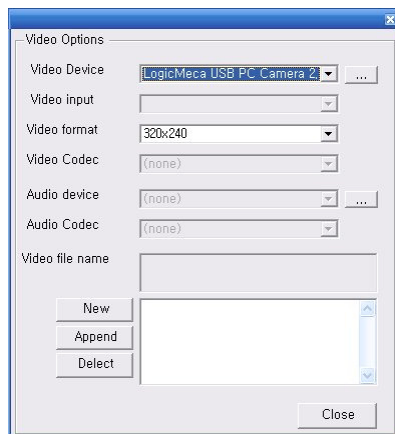
Element will be appeared when [View] - [Video] is chosen.

It will show the latest save video file if there are saved video files. It will show the

current recording screen if there aren't any saved video files but the computer is connected to PC- Cam. When there aren't any saved video files nor the computer is not connected to PC- Cam, the display will show the black screen.

Caption and **Play** can be selected and be used from the combo- box located on bottom left.

Normally, video files are supposed to save in one file. However, to save it in separated files for repetitive tests of comparative tests, choose **Option** from bottom right and declare the new file.



Options are activated depends on the video equipments.

Size of the video for experimentation will be determined by **Video format** and the number of frames (number of frames saved / 1 sec) will determined by the size and it will also lead to set the size of the video file.

(The size of the video file is approximately 320*240 in 10 seconds and 30 frame is about 40MB.)

New is to declare the name of the new video file.

Append is to bring video files that are previously saved.

Delete is the option to separate the video files that are added on the right hand side from the current subject.

Video file name is to Capture or Play the files that are located on the right- hand side.

If experimentation is started without declaring the name of the file, system will automatically create the video file and save.

4. Analysis

1) Analyze in the chart

Analysis tools that can be used in chart

- View the chosen value ()
- View the tangent value ()
- Statistic ()
- Integral calculus ()
- Liner Fit ()
- Curve Fit ()

are available.

These options can be used by clicking the above icons from the Toolbar, or click the right button of the mouse on the chart and choose [View] to use it.

By following the line with mouse will change it into hand shape to choose value on the chart. That point is the confrontation of the real value. The value and the section can be chosen by this way.

‘View chosen value’ is to see the value of the point and the slope of the tangent line.

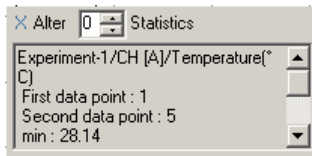
‘View the value of tangent line’ is to see the value of the start and the end of the section and changed amount arithmetically.

‘Statistic’ is to see the statistic value of the start and the end point of the section.

‘Integral calculus’ is to see the data of the sum of the start and the end point of the section.

‘Liner Fit’ output the mean by straitening the curve in between the start point and the end point of the section.

‘Curve Fit’ output the mean by straitening the irregular curves in between the start point and the end point of the section.

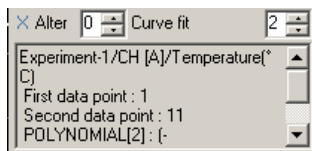


Many of the above windows can be outputted on the chart all at once and the value changes in the same time with the mouse selection.

Click 'X' to close the window.

'Lock' will appear when 'Change' is chosen and the value won't be changed by mouse selection.

Numbers in between Change and Title is represents the system number of the figure in the Y axis and when there are many numbers, the needed on can be chosen from the list.

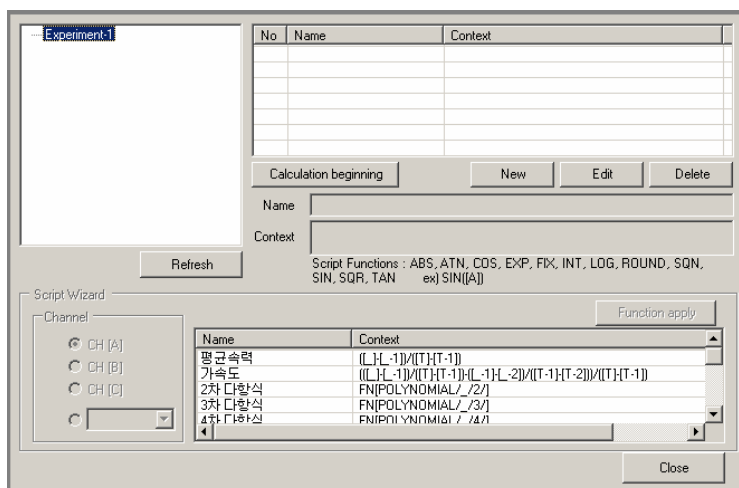


Number can be outputted on top left only in **Curve Fit**. This number represents the difference of Curve Fit.

Click right button of the mouse to see menu, if improper analysis window has been chosen. Choose different analysis option to use it.

2) Use script to Analyze

Below screen will appear by choosing [Tools] - [Script manager].



Analysis by using the script is different from analyzing the whole data.

Different scripts must be applied for each experimental data. It can not be analyzed

with any other experimental data.

Below is how to register a new script.

First choose **New**, and then input the name.

Put below calculation from into the figure.

$$([A-4]+[A-3]+[A-2]+[A-1]+[A])/5$$

This command allows calculating the average of the values that are coming into channel A with 5th degree.

'[A-4]' means 4th value from the starting point.

'[]' numbers in between this sign will be recognized as a variable.

'[A]' -> Current value of channel A

'[CC1]' -> Current value of the first script.

'[B-1]' -> The very before value of channel B

'[C+1]' -> The very after value of channel C

'[T]' -> The value of current time

'[N]' -> express the current number of data.

Press **Change** after make all the inputs, contents will be added to the figure and the calculated result will be added in current data system.

Apply Function is the function to load the previous saved calculation form and to use it.

Our company saved complex function calculations in programs and they starts with 'FN[' in the figure.

If the user wants to register the often used format, describe the format fits with Config.ini form in the folder where Studio-11 is installed to used it conveniently.

'_' Name of the chosen channel or the calculation column goes into this section.

Below are programmed functions.

- Polynomial 2nd degree to 6th degree
- Exponential [$y=a*\exp(bx)$]
- Power [$y=ax^b$]
- Logarithmic [$y=\ln(x)+b$]
- Beats Per Minute

In the figure of each function contains contents such as **FN[POLYNOMIAL/_/4/]**.

'FN[]' : The saved functions that are programmed.

'POLYNOMIAL' : Name of the function

'_' : means the computing object (Ex : Name of the data system such as A, B,

C, CC1, CC2)

'4' : Means the degree (Ex : 0 means a function without any degree, 4 means 4th degree function)

5. Operating the product.

1) Making the new project

Choose [File] - [New project] or '  ' from the tool bar will make the new project.

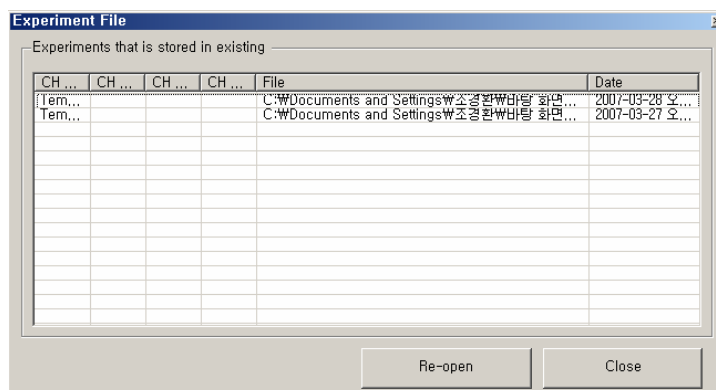
Use this menu when sensor is changed from the interface but the screen did not renew. This is the case where previous experimental data recognized as a output status.

If there is a change occur in data or environment,



This window pops up and waits for an order.

If the current sensor is same as the previous saved experimentation,

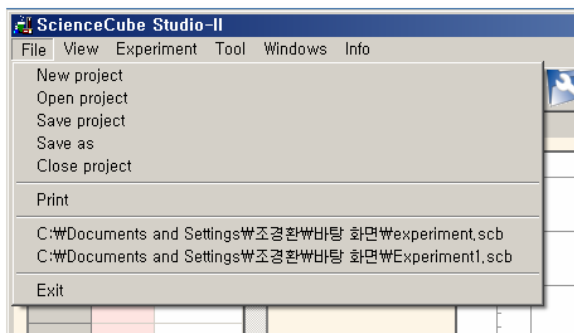


This window appears. If the previous file is correct, select the file and click **Bring it back** to open the file. If it is not, choose **Close** to create a new project.

2) Saving the project

Choose [File] - [Save Project] or '  ' and [File] - [Save with different name] to save the current data system.

After the save procedure is done, maximum of 10 files can be shown from the [File] menu as in order from the latest one.

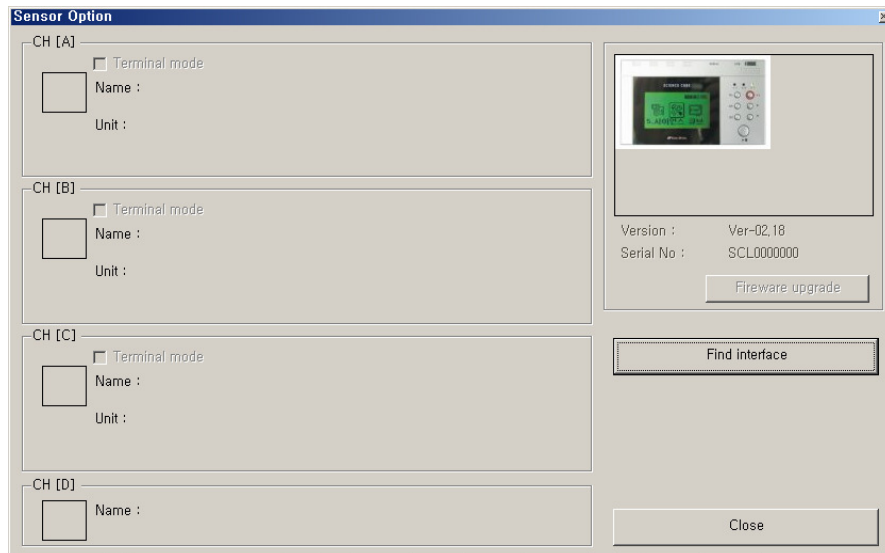


3) Loading the project

Select [File] - [Open the project] or  or from the [File] menu as shown in the window above to load a project.

6. Other Functions

1) Connecting the interface

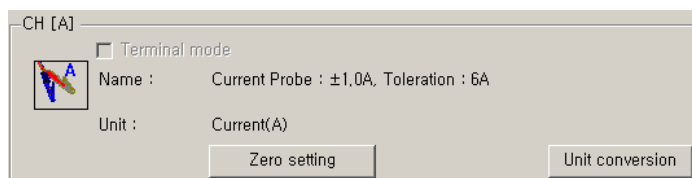


If 'Connect the interface automatically?' from [Tools]-[Option]-[Interface] is canceled, it will not look for the interfaces that are not connected to Studio- II or the ones that compulsorily removed because an error.

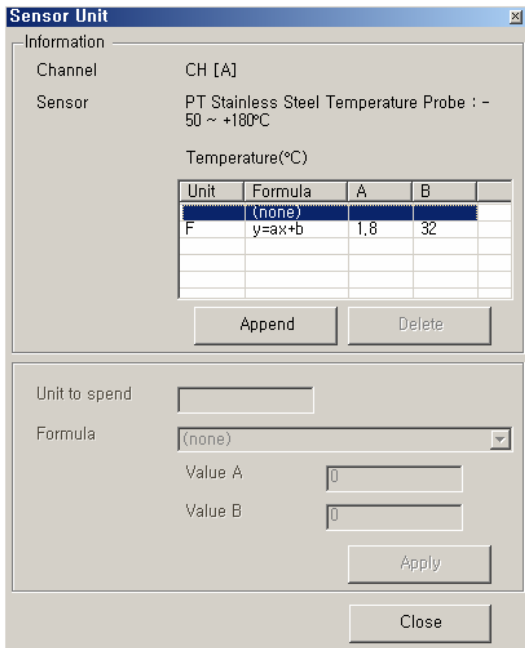
In this case, the way to connect the interface manually can be shown by selecting [Tools]-[Interface Control] or click on  and it will show the above window. Click **Connect the Interface** on the right- bottom side to search and connect the interface.

2) Unit Transformation

If units has to be used other than basic units, they can be declared in interface control to be used.



Choose **Unit transformation** from each sensor,



Sensor Unit

Information

Channel: CH [A]

Sensor: PT Stainless Steel Temperature Probe : -50 ~ +180°C

Temperature(°C)

Unit	Formula	A	B
(none)			
F	y=ax+b	1.8	32

Append Delete

Unit to spend:

Formula: (none)

Value A:

Value B:

Apply

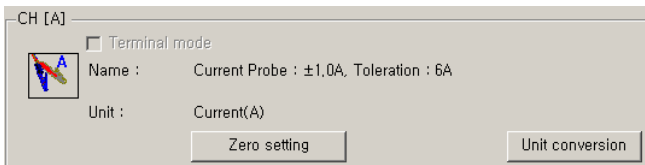
Close

above window will appear.

When adding the new unit, select **Append** to activate the input area at the bottom.

Input unit, calculation form and calculation factor by an order then press **Apply** to save and choose new unit from the top and click **Close** to converse the new inputting data.

3) Setting the zero point



CH [A]

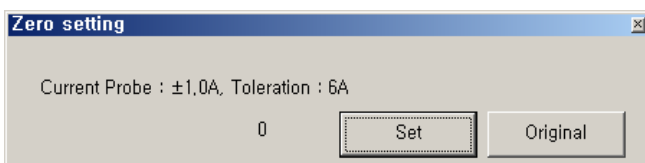
☐ Terminal mode

Name : Current Probe : ±1.0A, Toleration : 6A

Unit : Current(A)

Zero setting Unit conversion

If **Setting the zero point** is selected,



Zero setting

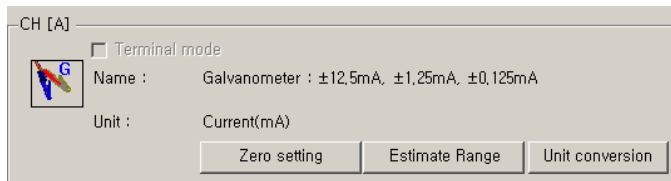
Current Probe : ±1.0A, Toleration : 6A

0 Set Original

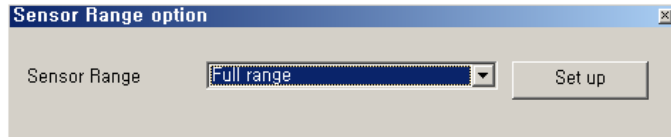
Above window will appear.

Press **Setup** to set the zero point, and press **Original copy** to cancel the zero point setting.

4) Changing the extent of measurement.



If **Change the extent of measurement** is chosen,



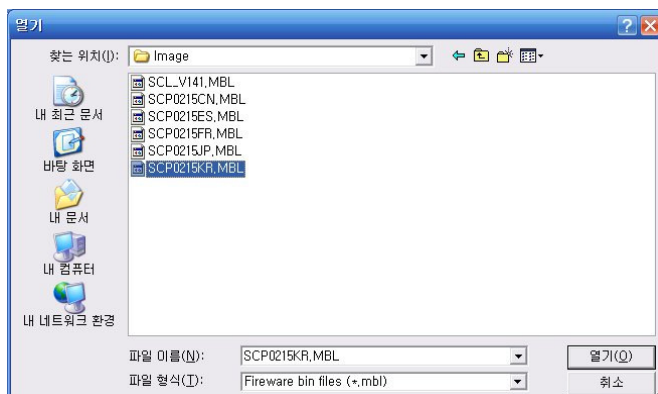
above window will pop up. Choose the willing extent of the measurement, and click **Change**.

It will be initialized when sensor is detached and reconnected or switching to the other channel.

5) Changing the firm- ware



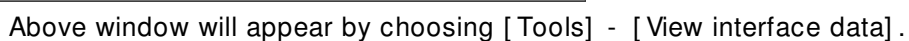
If **Change the firm- ware** is selected,



Open window will appear.

Move to the folder where new firm ware will be saved, then select the image and click open.

6) Loading the experimental data.



Choose the item and click **Load**.

We recommend that open a **New project** and Load.

When experimentation is over, this window will popup automatically.

Current store experiment data area

Experiment-1

Apply

Experiment mode

☒ Analog mode ☐ Digital mode

Channel

☒ CH [A]

☒ CH [B]

☒ CH [C]

☒ CH [D]

Collection

Sampling Time(s): 0.2

Experiment length(s): 900

Data units quantity: 4500

Over sampling: 0

☐ Event experiment

Triggering

Collected length: 17

Digital Output Control: Set

Refresh Append Experiment

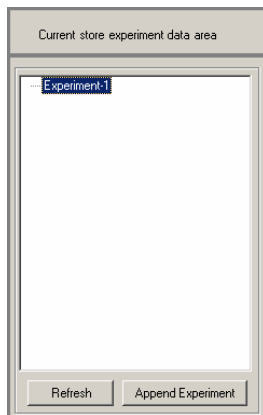
Apply Close

Studio- II has 10 type of data system in a single project, and it can measure 10 different experimental materials.

This function can be controlled in Experimentation manager.

Choose Add experimentation from the bottom of Experimentation manager to create new experimentation onto current experimentation.

To classify the experimentations, changing the name of the experimentation is required. From the list on the left- had side, click the name of the experimentation twice with an interval of 1 second to change the name.



To setup the type of the system for the newly measuring data, choose from **Type of the system for current collecting data** from the upper part to save chosen type of system.

These functions can be selected from the Tool bar.



Add experimentation.

Buttons available for change the type of system for collected data.



Type of system for previous experimentation



Choose directly



Type of system for afterwards experimentation

8) Controlling the chart

There are two modes for chart.

Select Mode and Zoom Mode.

Both modes can be selected to choose an extent with click of left button of mouse.



Restore the chart to original status



Activate with Select mode



Activate with Zoon mode

Functions of the arrow in the chart varies depends on modes.



In Zoom mode, it increases the extent of output 10% to the chosen direction.

In Active mode, it moves the chart 10% towards to the chosen direction.

9) Option

[Tools] - [Option] has 4 sections in it.

- **Collecting the experimentation** is to limit the number of data that can be collected at once, maximum of 50,000 is possible but restrict it to 5000 and less to not to effects computer performance.
- **Find interface** from the interface is to restrict to find interface automatically.
- **Use mark on the chart or shape of the chart?** Is to control for using different marks for confront point instead of lines or dots.
- **Output the line appears on the chart as in curve shape?** Is to control the lines that connects the confront points for each data as in straight line or curve line.
- **Output the script data during script experimentation?** Is used when user decides to weather or not output the format that is declared in the script during the experimentation.