

ColorMaster Viewer Software for the Lambda 365

Users Guide



Release History

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Table of Contents

I. Introduction	1
I-1. Overview	1
I-2. Specifications of ColorMaster Viewer Software	2
I-3. ColorMaster Viewer Software Installation	4
II. ColorMaster Viewer Software	7
II-1. ColorMaster Viewer Software Interface	7
II-1-1. Main Menu	7
II-1-2. Select File	8
II-1-3. Color Measurement	9
II-1-4. Select Target/Sample	10
II-1-5. Color Result	10
II-2. Main Menu	15
II-2-1. Export	15
II-2-2. Import	17
II-2-3. Delete	18
II-2-4. Delete All	18
II-2-5. Print	18
II-2-6. Method	20
III. Color Analysis method using ColorMaster Viewer.....	25
IV. Color Calculation Software.....	27
IV-1. Color Calculation procedures	27

I. Introduction

I-1. Overview

ColorMaster Viewer software is one of the application software programs for Lambda 365 to be used to calculate and convert various color values using the imported measurement data by Perkin Elmer Lambda series UV-Vis Spectrophotometer. Therefore, it is necessary to acquire and save a spectrum of the sample before using this program.

ColorMaster Viewer software includes the module for color evaluation by CIE $L^*a^*b^*$, XYZ Tristimulus, Yxy Chromaticity, Hunter Lab and other standards. This software also enables the transmission spectra of liquids or clear solids, and the reflectance spectra of opaque materials to be evaluated with the industry standard CIE, ASTM and DIN methodologies.

This manual provides step-by-step instructions for the use of ColorMaster Viewer Software.

I-2. Specifications of ColorMaster Viewer Software

Operating Environment

Computer Requirements

- PC (1.5 GHz or faster Processor)
- At least 1 GB RAM
- CD-ROM disk drive
- HDD
- USB port for the data acquisition
- Microsoft® Windows compatible printer
- Microsoft® Windows compatible mouse & keyboard

Operating System

- Microsoft® Windows 7

Output Device

- Microsoft® Windows compatible printer

ColorMaster Viewer Software

Color Scales

- CIE L*a*b*, CIE L*C*h, CIE L*u*v*, CIE XYZ, CIE Yxy, CIE UCS 1976, Hunter Lab

Color Difference Scales

- CIE dEYxy, CIE dE*ab, CIE dE*CH, CIE dE*uv, CIE dE*94, CMC(l:c), BFD(l:c), FMCII, Hunter dLab, CIE dEXYZ

Color Indices

- Whiteness, Yellowness, Tint, Brightness, Dominant Wave, Purity, Metamerism, Gray Scale for assessing change in color, Gray Scale for assessing staining, Total Transmittance

Illuminants

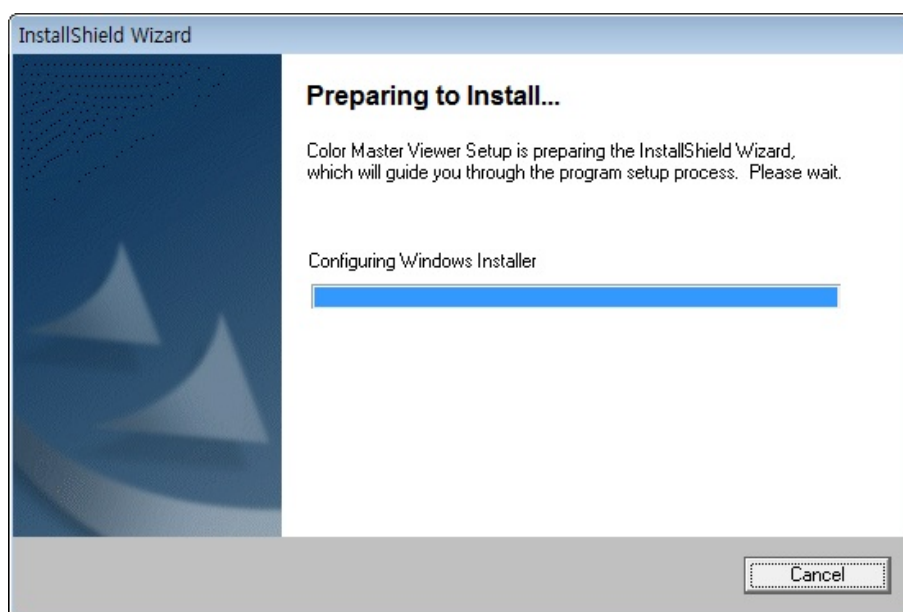
- A, C, D50, D55, D65, F1~F12

Observer

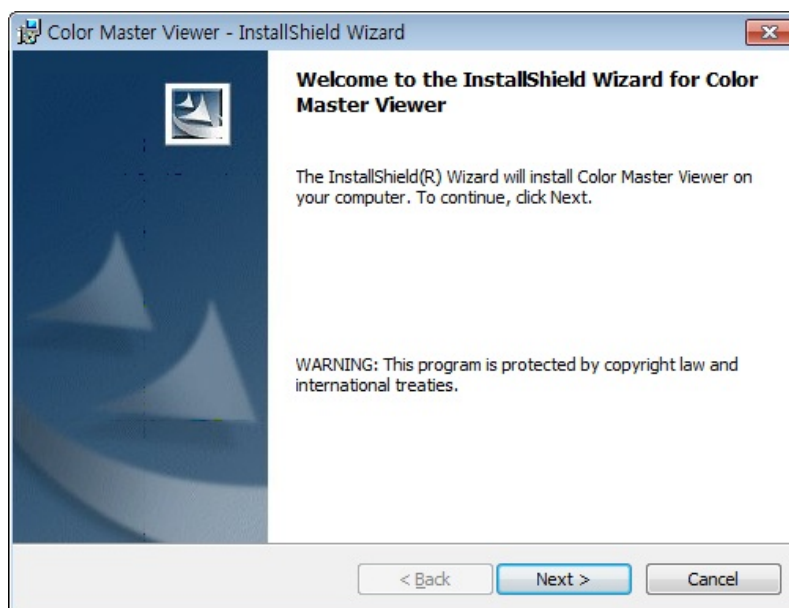
- CIE Standard Observers : 2° or 10°
-

I-3. ColorMaster Viewer Software Installation

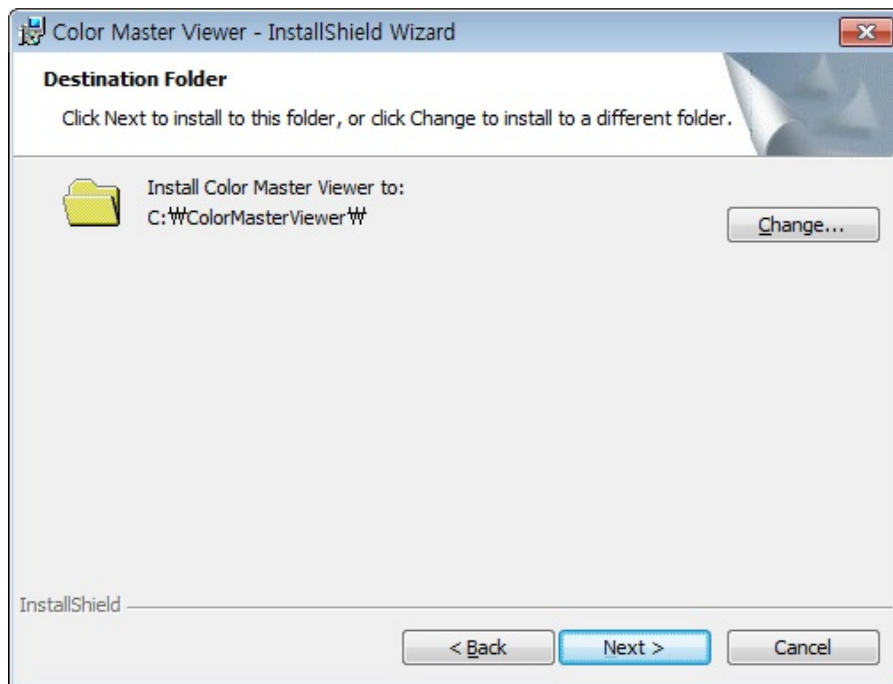
1. Insert the ColorMaster Viewer Software installation CD in the CD-ROM drive. InstallShield® Wizard starts automatically.
2. InstallShield® Wizard does not start automatically, click My Computer → CD Drive → **Setup.exe** and click **Next**.



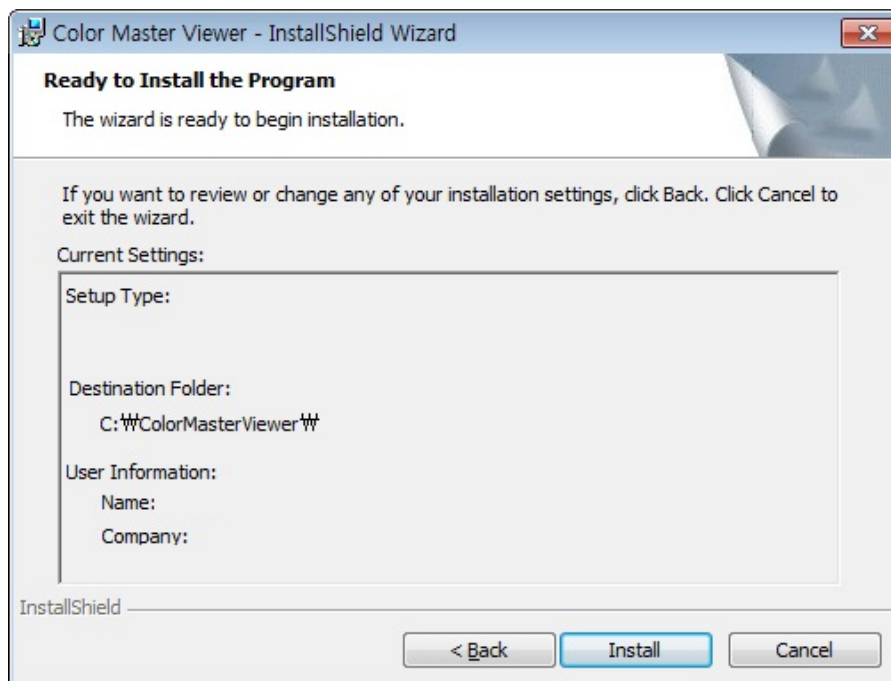
3. ColorMaster Viewer InstallShield® Wizard starts. Click **Next**.



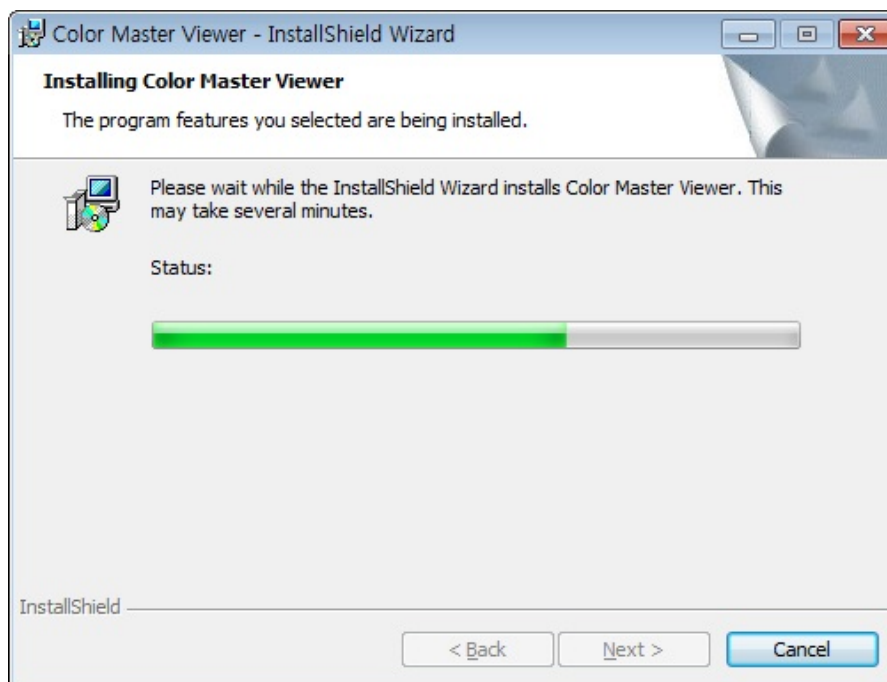
4. The software will be installed in C:\ColorMaster Viewer as a destination folder. To install the software to a different folder, click **Change** and select the desired folder.



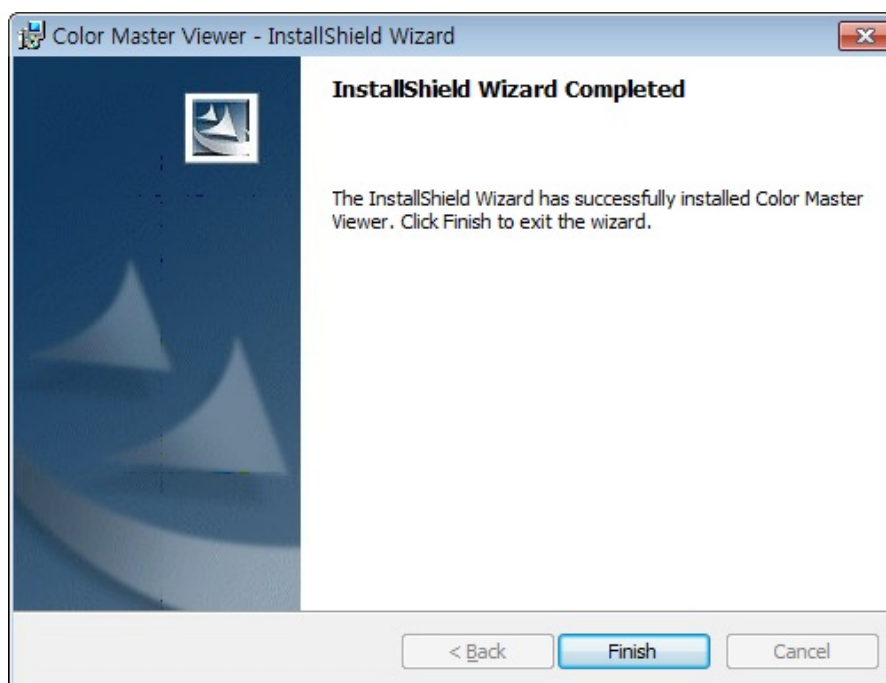
5. Verify the current settings and click **Install**.



6. The following window shows the status of the ColorMaster Viewer installation.



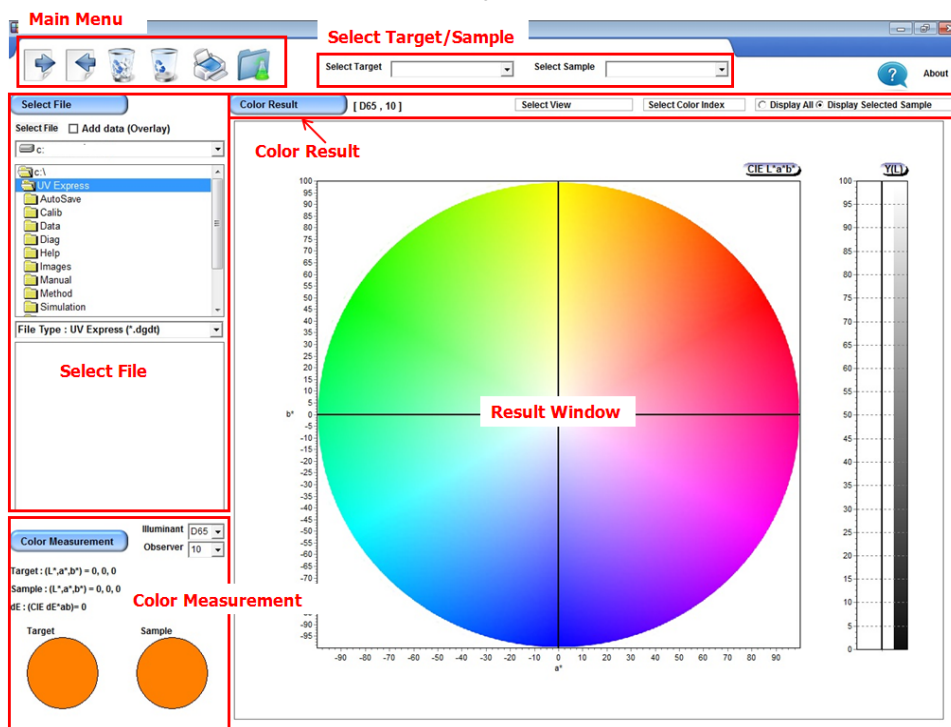
7. After the set up is completed successfully, click **Finish**. The ColorMaster Viewer folder will appear on the Desktop.



II. ColorMaster Viewer Software

II-1. ColorMaster Viewer Software Interface

This chapter describes the unique display features of ColorMaster Viewer software.



II-1-1. Main Menu

Main Menu consists as follows. Each icon provides quick access to basic command. When putting the mouse pointer on the icons, descriptions of each command are displayed. For more details, refer to chapter II-2. Main Menu.

Icon	Command	Function
	Export	Export the data file (*.csv) and graph image (*.bmp)
	Import	Import the raw data file (*.csv) to evaluate the color value
	Delete	Delete a selected spectrum from a window
	Delete All	Delete all spectra from a window
	Print	Print results
	Method	Open the method window

II-1-2. Select File

Open the saved sample data.

Select File

Select File ☐ Add data (Overlay)

c:

c:\

ColorMasterViewer

Data

UV Express Data

File Type : UV Express (*.dgd)

20141212_Holmium.dgd

Icon	Function
<input type="checkbox"/> Add data (Overlay)	Check if overlay multiple data.
<div>c:</div> <div><div>c:\</div><div>ColorMasterViewer</div><div>Data</div><div>UV Express Data</div></div>	Find the folder that contains saved data.
<div>File Type : UV Express (*.dgd)</div> <div>File Type : UV Lab(*.gdt)</div> <div>File Type : UV Express (*.dgd)</div> <div>File Type : WinLAB(*.sp)</div> <div>File Type : WinLAB(*.spa)</div> <div>File Type : WinLAB(*.dx)</div>	Select the file format. The following file types are available. *.dgd (of UV Express Software) *.gdt (of UV Lab Software) *.sp, *.spa and *.dx (of WinLab Software)
<div>integrating sphere.dgd</div> <div>methylene blue fiber.dgd</div> <div>methylene blue test tube.dgd</div> <div>reflectance 5 percent.dgd</div> <div>reflectance.dgd</div> <div>transmittance.dgd</div>	Select the saved data file name.

II-1-3. Color Measurement

Color Measurement shows the Color Scale value and the Color Difference value. Not only the Color of Target/Sample can be verified but also the Pass/Fail result can be checked using the Tolerance value.

Color Measurement

Illuminant

D65

Observer

2

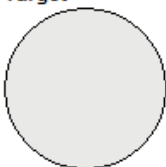
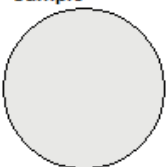
Target : (L*,a*,b*) = 92.2443, -0.1749, 0.5014

Sample : (L*,a*,b*) = 91.6534, -0.1806, 0.5224


dE : (CIE dE*ab)= 0.5913

Target

Sample

Result : Pass

Mode	Functions
Illuminant	Select illuminant. (A, C, D50, D55, D65, F1~F12) A: Incandescent, or tungsten, light (Color Temperature : 2856K) C: North sky daylight, or average daylight (6774K) D50: Horizon light (sunlight at sunrise or sunset) (5000K) D55: Mid-morning or mid-afternoon daylight (5503K) D65: The most commonly-used daylight illuminant; average of moon daylight all over the world (6500K) F1 ~F12: Cool white Fluorescent illuminants (2940 ~ 6500K)
Observer	Select the CIE standard observer's angle either 2 or 10 degree.
Target	Shows the selected color scale value of the Target.
Sample	Shows the selected color scale value of the Sample.
dE	Shows the Color Difference value.
<div> <div>Target</div> <div>Sample</div> </div> 	Check the Color of Target/Sample with the monitor. (The colors on the monitor screen can be slightly different from the real colors, depending on the monitor setup values.)
Result : Pass	Check the Color Pass/Fail result of the Sample by comparing it with the Tolerance value.

II-1-4. Select Target/Sample

Select Target color data and compared sample color data in the open file.

Select Target	L-Red 1	Select Sample	L-Red 2
	L-Yellow 1		
	L-Red 1		
	L-Blue 1		
	Red 2		
	Blue 2		
	L-Red 2		
	L-Blue 2		
	L-Yellow 2		

NOTE: In case that there is only one data in the open file, then the data shall be Target and also Sample.

Select Target	Sample	Select Sample	Sample
---------------	--------	---------------	--------

II-1-5. Color Result

Color Result shows the color result value based on the user-selected view and color index.

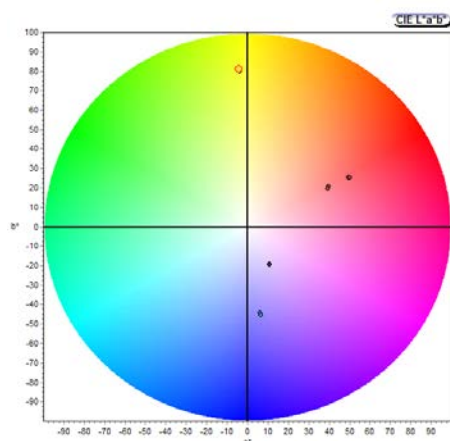
Color Result	Select View	Select Color Index	<input checked="" type="radio"/> Display All <input type="radio"/> Display Selected Sample
--------------	-------------	--------------------	--

1. Select View

Select View
Color Chart
Color dE Chart
Color dE Table
Spectrum(%T)
Kubelka Munk
Statistics

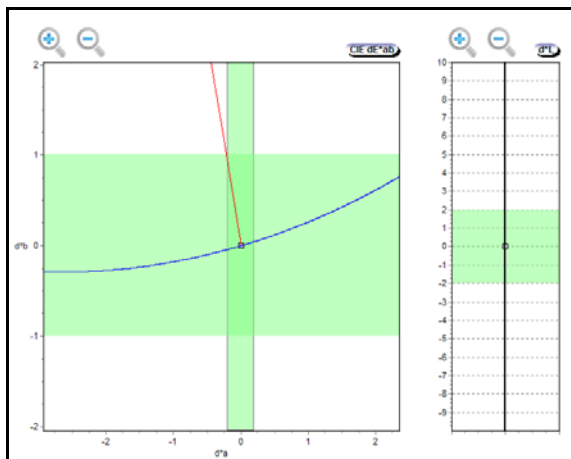
1) Color Chart

Display the selected Color Scale (CIE L*a*b*, CIE L*C*h, CIE L*u*v*, CIE XYZ, CIE Yxy, CIE UCS 1976 and Hunter Lab) value in the chart. The color scale value of a selected Sample data is displayed with a red dot in the selected color chart.



2) Color dE Chart

Based on the selected Color Difference, the difference value is displayed in the chart. The light green zone is the boundary for determining Pass/Fail depending on the tolerance which is set in the Method window.



3) Color dE Table

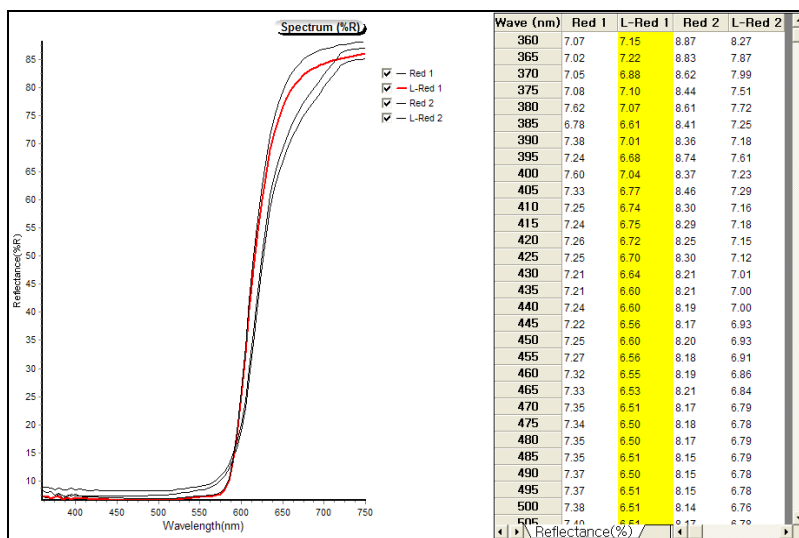
Color result values such as Color space, Color Difference value, Color Index value and Pass/Fail result are displayed.

No	Name	L*	a*	b*	CIE dE*ab	d*L	d*a	d*b	Result
1	Red 1	44.4448	39.6045	20.6899	0	0	0	0	Pass
2	L-Red 1	45.4256	49.3298	25.1943	10.7625	0.9808	9.7252	4.5044	Fail
3	Red 2	45.7517	39.4978	19.6341	1.6834	1.3068	-0.1067	-1.0558	Pass
4	L-Red 2	46.1887	50.1392	25.1701	11.5798	1.7439	10.5347	4.4802	Fail

Color Color Difference

4) Spectrum

Display reflectance (or transmittance) spectrum and data.

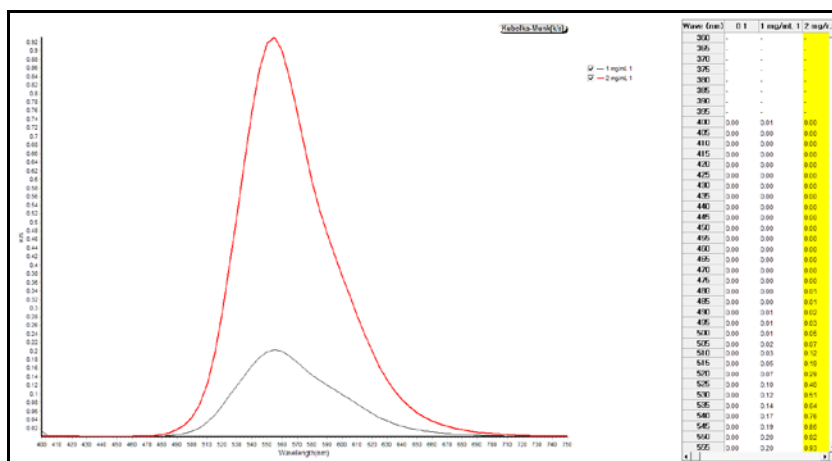


NOTE: Data is displayed at the selected wavelength interval (5, 10, 20 nm) which can be set at the Graphics Setup tab of the Method window. For more details, refer to Chapter II-2-6-5. Graphics Setup.

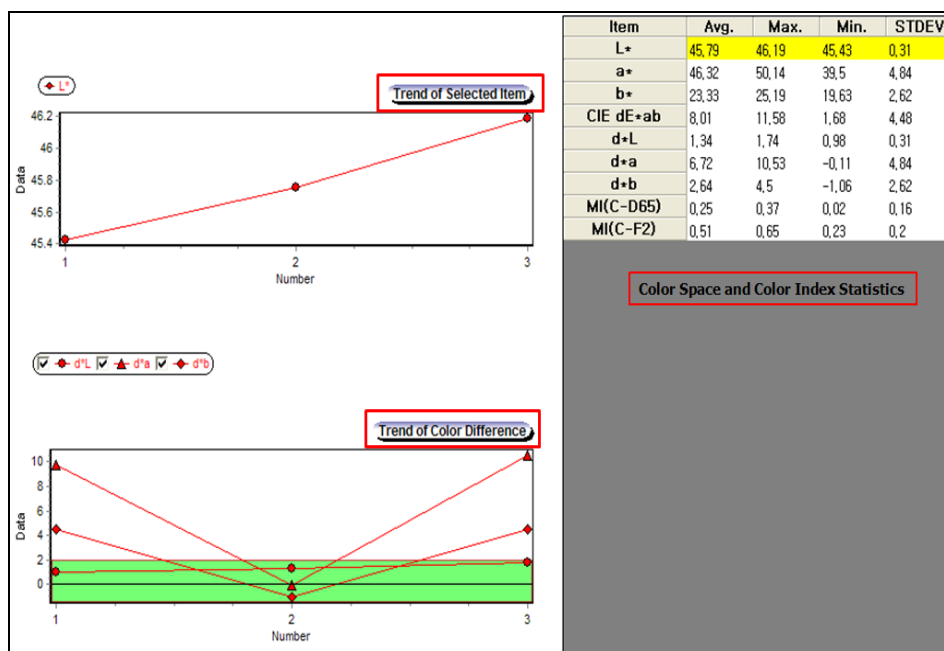
NOTE: Reflectance (Transmittance) values only from 360 nm to 750 nm are used for the color value calculation, so the spectrum values are also displayed from 360 nm to 750 nm even though the imported data from the measurement by UV Vis Spectrophotometer has more spectrum values at the wider range of wavelength.

5) Kubelka Munk (k/s)

The Kubelka-Munk is generally used for the analysis of diffuse reflectance spectra obtained from low concentration of dyes [unit: K/S].



6) Statistics



Trend of selected Item:

Display the trend of the selected Item in the “Color Space and Color index Statistics” list. User can select an item by clicking on each item line in the list.


Trend of Color Difference: Display trend of each color difference value.

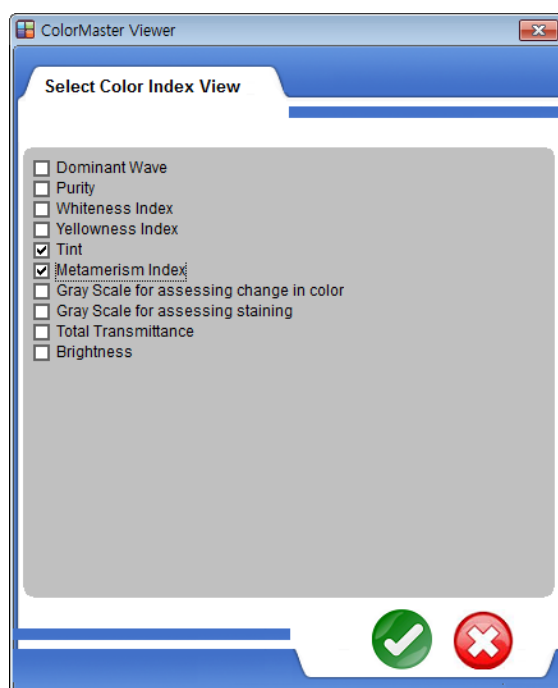
Color Space and Color Index Statistics

Display average value, maximum value and deviation value of the Color Space and Color Index values.

2. Select Color Index



Click on the Select Color Index menu and after selecting the desired Color Index(s), click  to apply the changes. The selected Color Index(s) are shown when selecting Color dE Table or Statistics in the Select View menu.



Color dE Table

	Name	Tint	MI(C,2-D65,2)	MI(C,2-F2,2)
1	Blue	11.25	1.22	10.55
2	Red 1	-143.11	0	0
3	L-Red 1	-177.63	0.35	0.65
4	Red2	-137.78	0.02	0.23
5	L-Red 2	-177.65	0.37	0.65

Statistics

Item	Avg.	Max.	Min.	STDEV
L*	44,59	45,28	43,61	0,62
a*	42,08	47,34	37,12	4,89
b*	21,11	23,55	18,17	2,44
CIE dE*ab	5,77	11,06	0	4,96
d*L	0,98	1,66	0	0,62
d*a	4,8	10,06	-0,16	4,89
d*b	1,89	4,33	-1,04	2,44
Tint	-159,04	-137,78	-177,65	18,69
MI(C-D65)	0,19	0,37	0	0,18
MI(C-F2)	0,38	0,65	0	0,28

3. Display Data

☒ Display All
 ☐ Display Selected Sample

1) Display All

Display all the data in the Color Chart, Color dE Chart, Spectrum and Kubelka Munk window.

2) Display Selected Sample

Display the only selected data in the Color Chart, Color dE Chart, Spectrum and Kubelka Munk window.

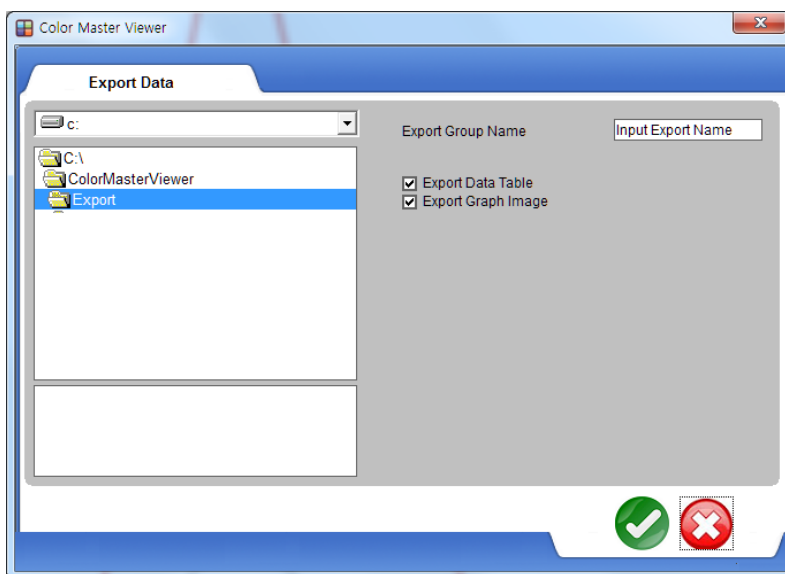
II-2. Main Menu

The Main Menu includes commands to perform general file functions.



II-2-1. Export

Use the Export command to export the data as a *.csv file or the graph image.



Export Data: Designate a folder location to export the data.


Export Group Name: Create the data folder name to export.


Export Data Table: Check (✓) to export a transmittance or reflectance raw data, Color Scale, Color Difference Scale, Color Indices, Color Statistics as a *.csv file.

NOTE: *Data only from 360 nm to 750 nm can be exported even though spectrum values at the wider range of wavelength are originally imported from the measurement by UV Vis Spectrophotometer.*

Export Graph Image: Check (✓) to export images of Color scale, Color dE chart, spectrum, Kubelka Munk and Statistics as *.bmp file.

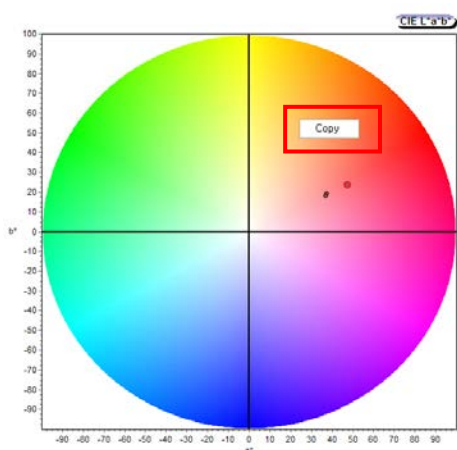
• Procedure

1. Click the **Export**  icon.
2. Select a folder to export data. Default folder is C:\ColorMaster Viewer\Export folder.

3. Input the folder name on the Export Group Name and select export type and click .
4. Click **OK**.

NOTE: Image or data in the Result window are easily copied and pasted in other programs such as Microsoft® office.

- a. Right click on the image or data in the Result window.
- b. Click **Copy**.



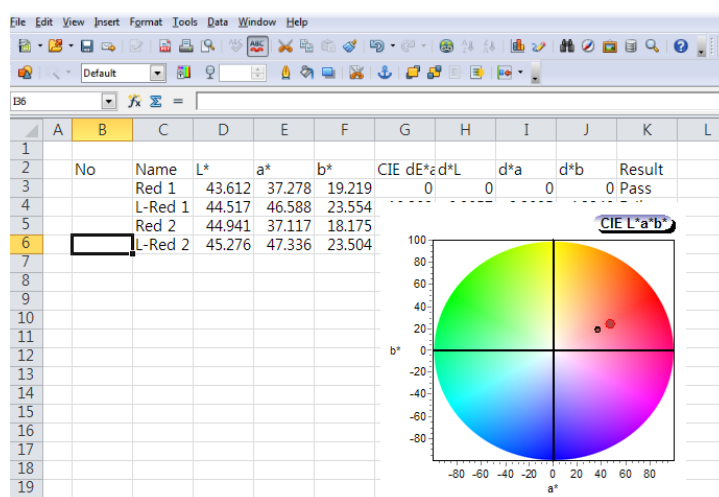
P

Color Result [D65 , 10]

No	Name	L*	a*	b*	CIE dE*ab	d*L	d*a	d*b	Result
1	Red 1	43.6115	37.278	19.2191	0	0	0	0	Pass
2	L-Red 1	44.5172	46.5875	23.5539	10.3091	0.9057	9.3095	4.3348	Fail
3	Red 2	44.941	37.1169	18.175	1.6981	1.3295	-0.1611	-1.0441	Warning
4	L-Red 2	45.2755	47.3356	23.504	11.0582	1.664	10.0576	4.2847	Fail

Color Color Difference

- c. Paste the copy into a program (Excel, Power Point, Word, etc.).



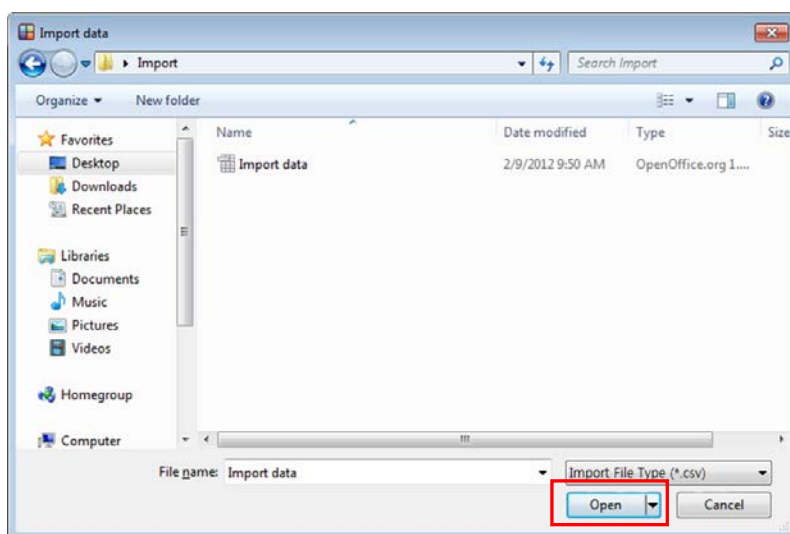
II-2-2. Import



Use the Import command to import the data. The imported file should be formatted in *.csv file.

- **Procedure**

1. Click **Import** to import a data.
2. Select data to import and click **Open**.



NOTE: Import only one data at a time. The data in an imported file (*.csv) should be formatted as shown in the picture below.

Column A: Wavelength (Arrange wavelengths in ascending order)

Column B: %T (Transmittance) or %R (Reflectance)

	A	B
1	360	16.13
2	365	16.44
3	370	16.86
4	375	17.3
5	380	18
6	385	17.89
7	390	18.11
8	395	18.16
9	400	18.43
10	405	17.61
11	410	17.14
12	415	16.44
13	420	15.52
14	425	14.42
15	430	13.28
16	435	12.08
17	440	11
18	445	10
19	450	9.01

II-2-3. Delete

Use the Delete command to delete the selected data from the active window.

- **Procedure**

1. Select data to delete and click **Delete**.

II-2-4. Delete All

Use the Delete All command to select all spectra in the active window.

- **Procedure**

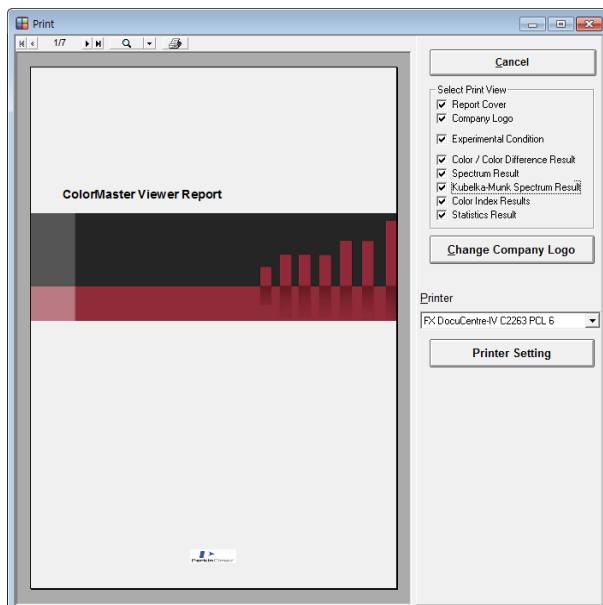
1. Select a file to delete.
2. Click **Delete All**.







II-2-5. Print

Use the Print command to print or preview data in the current window.

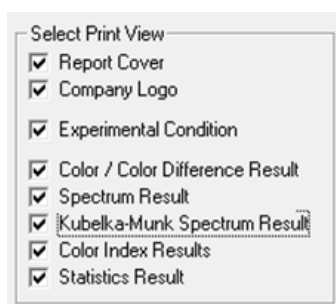
- **Procedure**

1. Click the Print icon, and then the following print-preview window will be displayed.



Function	Description
	Go to the first page
	Go back to the previous page
	Go to the next page
	Go to the last page
	Zoom in and out the window
	Print
Select Print View	Select the required print contents
Change Company logo	Change the company logo

2. Select the required print contents in the Select Print View tab and click **Print**.








NOTE: User can change the company logo.

- Click **Change Company Logo**.
- Select the desired company logo. The selectable logo file is *.bmp file and the recommended size is 110x50 pixels.
- "Now current report window will be closed" message will appear. Click **OK**.
- The print window will be closed.
- Click the Print icon again and confirm the company logo is changed.

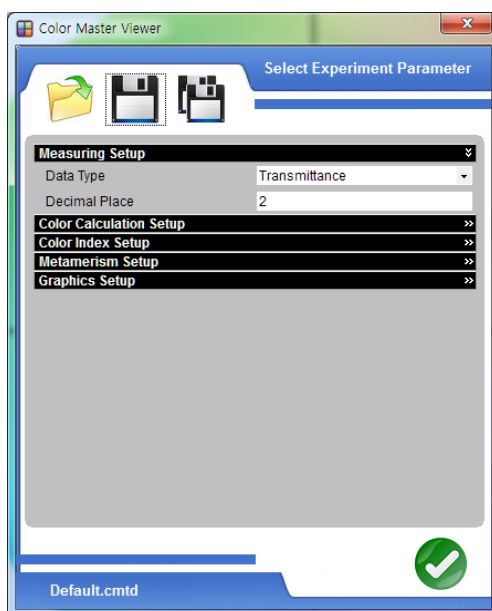
II-2-6. Method

Use the Method command to set modes and parameters to control data collection.

• Procedure

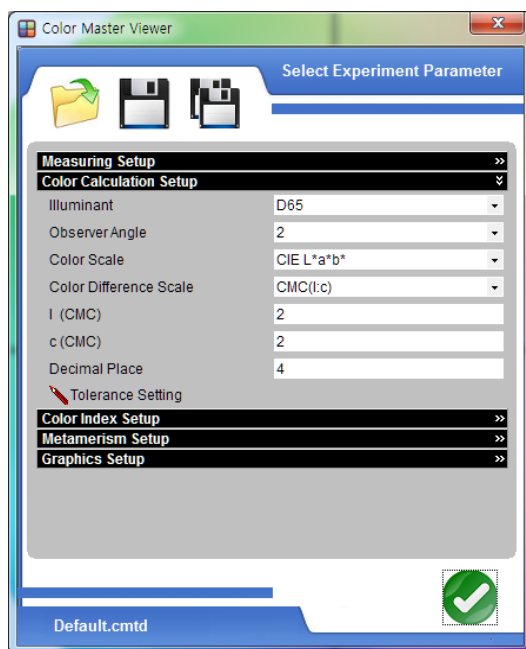
1. Click **Method** .
2. Set each parameter and click .
3. Open or save a method using the  and  icons. The method will be saved as a *.cmdt file. If user wants to set this method to the default method, click  icon.

1. Measuring Setup



- a. **Data Type:** Set Y-axis (Transmittance or Reflectance).
- b. **Decimal Place**
Enter the digit number of decimal places. Maximum decimal place is 5.

2. Color Calculation Setup



a. Illuminant

A: Incandescent, or tungsten, light (Color Temperature : 2856K)

C: North sky daylight, or average daylight (6774K)

D50: Horizon light (sunlight at sunrise or sunset) (5000K)

D55: Mid-morning or mid-afternoon daylight (5503K)

D65: The most commonly-used daylight illuminant; average of moon daylight all over the world (6500K)

F1 ~F12: Cool white Fluorescent illuminants (2940 ~ 6500K)

b. Observer Angle: Select 2 or 10 degree.

c. Color Scale

Select the desired Color Scale; CIE XYZ, CIE Yxy, CIE L*a*b*, CIE L*C*h, CIE L*u*v*, CIE UCS1976 or Hunter Lab

d. Color Difference Scale

Set the Color Difference Scale; CIE dEYxy, CIE dE*ab, CIE dE*CH, CIE dE*uv, CIE dE*94, CMC(l:c), BFD(l:c), FMCII, Hunter dLab or CIE dEXYZ

e. CMC (l:c)

It is generally used in the textile and dye industry mainly with the set value of CMC(2:1).

You can set the l, c value only in case of CMC and BFD scale.

f. Decimal Place

Enter the digit number of decimal places. Maximum decimal place is 5.

g. Tolerance Setting

Enter the tolerance limit value, which is used to decide Pass/Fail depending on the color difference scales.

The screenshot shows the 'Tolerance Limit' dialog box in the Color Master Viewer software. It contains eight input fields for different color difference scales, each with a positive and negative tolerance value. The scales are: Delta E*ab, Delta E CIE94, Delta EYxy, Delta E FMCII, Delta E*UV, Delta E CMC(l:c), Delta E LCH, and Delta E BFD(l:c). All fields are currently set to 2. At the bottom right, there are green and red checkmark buttons.

Scale	Positive Tolerance	Negative Tolerance
Delta E*ab	2	-2
Delta E CIE94	2	-
Delta EYxy	2	-2
Delta E FMCII	2	-
Delta E*UV	2	-2
Delta E CMC(l:c)	2	-2
Delta E LCH	2	-2
Delta E BFD(l:c)	2	-2

3. Color Index Setup

The screenshot shows the 'Color Index Setup' dialog box in the Color Master Viewer software. It features a 'Select Experiment Parameter' section with icons for file operations. Below this, there are several expandable sections: 'Measuring Setup', 'Color Calculation Setup', 'Color Index Setup' (which is expanded), 'Metamerism Setup', and 'Graphics Setup'. The 'Color Index Setup' section contains five rows of settings: Whiteness (ASTM E313), Yellowness (ASTM D1925-70), Tint (ASTM E313), Brightness (%Z), and Decimal Place (2). At the bottom right, there is a green checkmark button.

Parameter	Value
Whiteness	ASTM E313
Yellowness	ASTM D1925-70
Tint	ASTM E313
Brightness	%Z
Decimal Place	2

a. Whiteness

These indices are often used by the textile, paint and plastics industries.

(Requirement of CIE, ASTM 313, Stephansen, Taube, Harrison, Hunter, Stensby, and Berger)

b. Yellowness

These indices are often used by the textile, paint and plastics industries, but may be

used for measurement of any nearly white or nearly colorless object.

(Requirement of ASTM D1925-70, ASTM E313-73, ASTM E313-96, and DIN 6167)

c. **Tint:** Requirement of ASTM E313-73 and CIE.

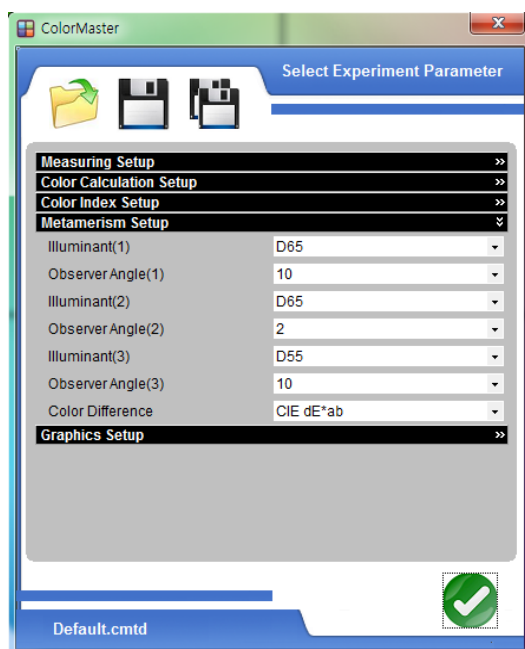
d. **Brightness:** This is a single-number index that is used to measure the brightness of white materials that tend to yellow with age and / or degradation (%Z).

e. **Decimal Place**

Enter the digit number of decimal places. Maximum decimal place is 5.

4. Metamerism Setup

Metamerism is phenomenon in which two colors appear the same under one light source, but different under another light source. Result is displayed in the Color dE Table.



a. **Illuminant (1):** Light source of condition 1

b. **Observer Angle (1):** Observer's angle of condition 1

c. **Illuminant (2):** Light source of condition 2

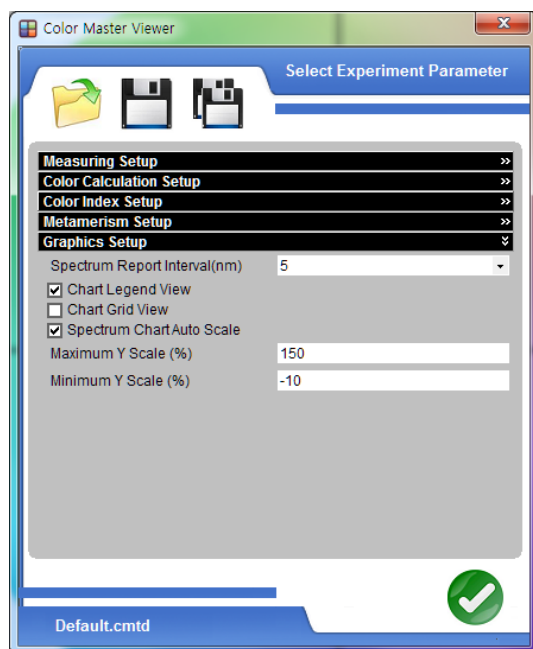
d. **Observer Angle (2):** Observer's angle of condition 2

e. **Illuminant (3):** Light source of condition 3

f. **Observer Angle (3):** Observer's angle of condition 3

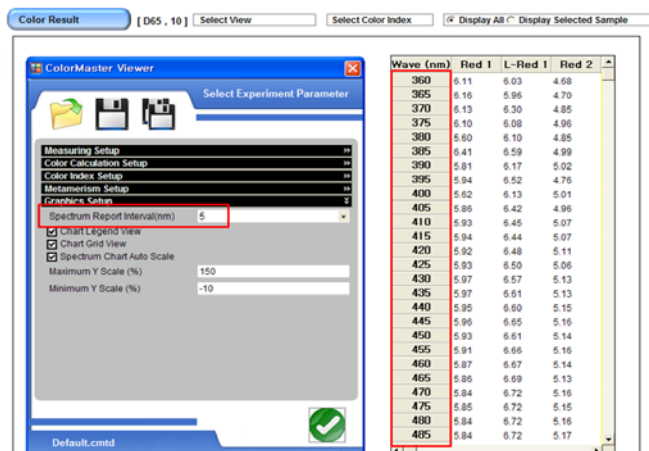
g. **Color Difference:** Select color difference scale.

5. Graphics Setup



a. Spectrum Report Interval (nm)

Select the displayed and exported wavelength interval (5, 10, 20 nm) in spectrum result window.



b. Chart Legend View

Select whether the legend is displayed on the chart or not.

c. Chart Grid View

Select whether the grid is displayed or not.

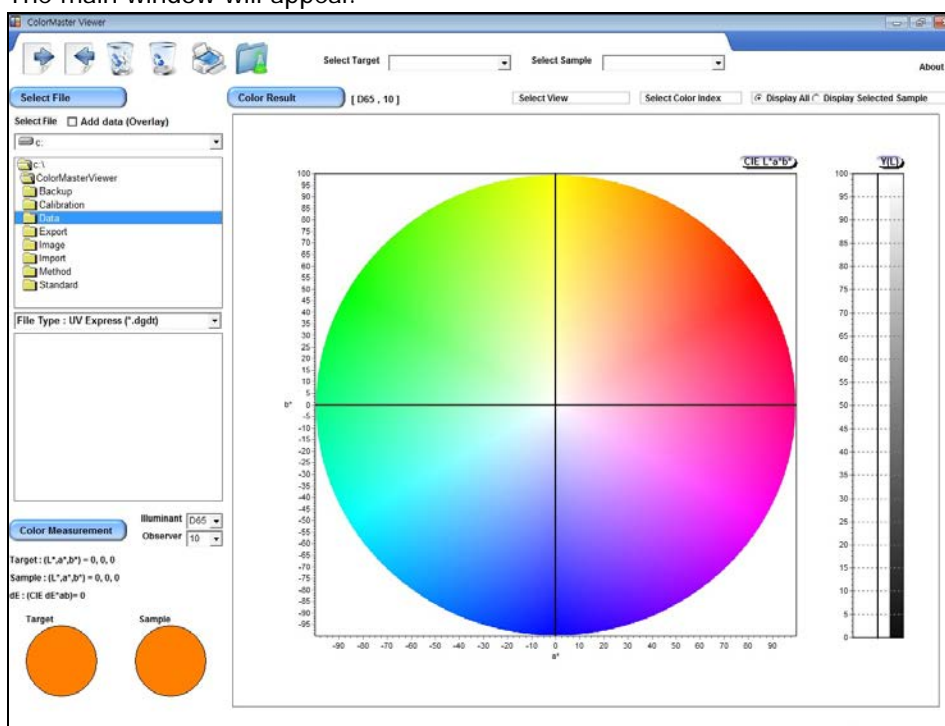
d. Spectrum Chart Auto Scale

Select whether the Y-axis range is set automatically or not. If Y-axis range is set as desired, the maximum Y scale (%) and minimum Y scale (%) need to be set.

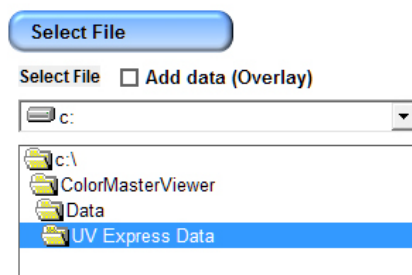
III. Color Analysis method using ColorMaster Viewer

NOTE: As application software, ColorMaster Viewer software does not need to connect the instrument.

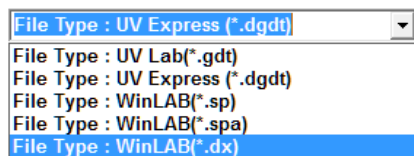
1. Double-click on the ColorMaster Viewer folder and select the ColorMaster Viewer icon.
2. The main window will appear.



3. Select the folder that contains saved data.

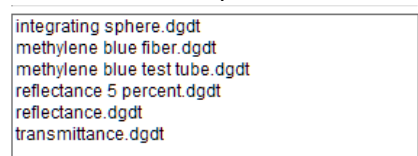


4. Select a file type to import.




NOTE: *ColorMaster Viewer software can reproduce the color values from measurement data by Lambda series UV Vis Spectrophotometers. The available data formats are *.dgd, *.gdt, *.SP, *.spa or *.dx files.*

5. Select the file to open.



6. Click **Method**. 

7. Set each parameter referring to chapter II. ColorMaster Viewer Software and click .



8. Check the color values and print the results as desired.

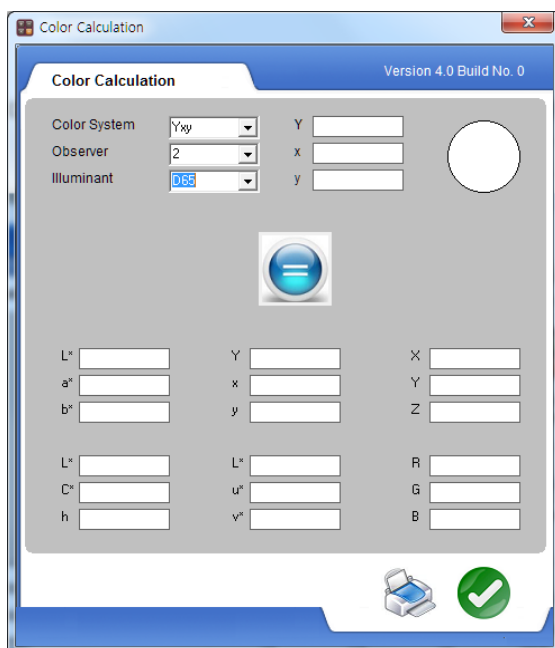
NOTE: *As the application software to reproduce the color values, ColorMaster Viewer software does not have the save function. To save the reproduced data, use the Export function instead.*


IV. Color Calculation Software

Use the Color Calculation Software to convert the color results in one color scale to the others. This software has the only color convert function, so it does not require any measurement data file.

IV-1. Color Calculation procedures

1. Double-click the Color Calculation icon  in the ColorMaster Viewer folder  .
2. The following window for Color Calculation is displayed.



- a. **Color System**
Select the Color Scale (XYZ, Yxy, $L^*a^*b^*$, L^*C^*h , $L^*u^*v^*$, RGB)
- b. **Observer:** Select the Observer Angle (2° or 10°).
- c. **Illuminant:** Select the Illuminant (C, D65, F2 ~ F11).
- d.  **Color Calculation:** Execute the Color calculation.

- After selecting the Color System, Observer and Illuminant, enter the color values which are desired to convert, and then click the **Color Calculation** icon.

Color Calculation Version 4.0 Build No. 0

Color System: XYZ Observer: 2 Illuminant: C

X: 81 Y: 65 Z: 67

Color Calculation icon

L* a* b* L* C* h L* u* v* R G B

Printer icon and Green Checkmark icon

- The calculated color values for each color scale are displayed as shown below. Click the print icon to print the calculated results.

Color Calculation Version 4.0 Build No. 0

Color System: XYZ Observer: 2 Illuminant: C

X: 81 Y: 65 Z: 67

Color Calculation icon

L* 84.4837 a* 35.9966 b* 7.7433 L* 84.4837 C* 36.82 h 12.14 L* 84.4837 u* 62.4449 v* 4.9355 R 255 G 181.5099 B 206.8523

Printer icon and Green Checkmark icon