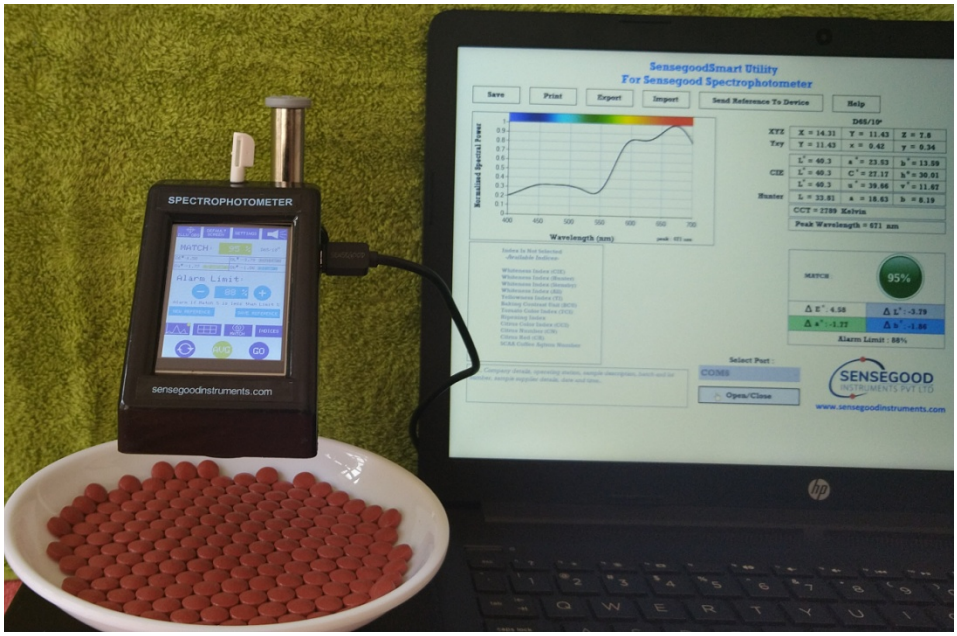
SensegoodSmart Utility
for Sensegood Spectrophotometer

User's Manual
Version 1.0



SENSEGOOD
INSTRUMENTS PVT LTD

www.sensegoodinstruments.com

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
31/10/2019	1.0	Initial release.

Copyrights and Trademarks

Caution: If the equipment is used in a manner not specified by the Sensegood, the overall safety may be impaired. The instrument is for indoor use only and not suitable for a wet location.

When reading a sample, the illumination flashes. Please avoid looking directly at the light. User's discretion is advised.

Safety Notes

For your safety when using the Sensegood spectrophotometer, you should pay attention to the following:

- General safety instruction that should be observed at all times while operating the instrument.
- Use of this equipment in a manner not specified by the manufacturer may impair the protection afforded by the equipment.
- Danger of electric shock if liquids are spilled and fire if volatile or flammable liquids are spilled. Use care when measuring liquid samples**.**
- Please take care to remove fingers, jewelry and clothing to prevent damage when sample platform is rotating.
- Sensegood spectrophotometer is for indoor use only at an altitude of up to 2000m and pollution degree 2.

SensegoodSmart Utility User's Manual

Overview

SensegoodSmart is a computer interface utility developed for Sensegood Spectrophotometer. Every time a new measurement is taken by the instrument, the utility automatically fetches the real-time information and compiles all the color analytical data and puts it on a single screen for the ease of understanding. This document briefly covers the operational aspects of the utility.

Operating Environment

Supported 64bit Operating Systems

- ✓ Microsoft® Windows® 10
- ✓ Microsoft® Windows® 8.1
- ✓ Microsoft® Windows® 8
- ✓ Microsoft® Windows® 7

Port

USB port communication

Cable

Micro USB Type-B to USB type-A cable

Prerequisite

For installation guidelines, please refer to the pdf documents; "Virtual COM port driver installation guide" and "Utility installation guide" available at:
https://sensegoodinstruments.com/support
We also suggest you to check for the latest version of this document at above mentioned link.

Organization of this manual

Features and Applications

Features:

- ✓ Easy to setup, easy to use.
- ✓ Supports real time measurement and update without human intervention.
- ✓ Supports data portability using export and import .sego measurement data files.
- ✓ Options to Print and Save (.jpg, .pdf).
- ✓ Using this utility, multiple color references can be saved in the computer and later the desired reference values can be loaded into the instrument for comparing the color of a reference with the sample under test.
- ✓ Once initialized, the utility does fully automated operation; it automatically detects the new measurement data, no commands/ no buttons to be clicked for fetching the data from the instrument.
- ✓ User can input desired information like: company details, operating station, sample description, batch and lot number, sample supplier details. Such information becomes a part of generated files like .jpg, .pdf, .sego; and the information can be retrieved by anybody to whom this file is shared with. This helps in supervision, tracing and documentation.
- ✓ Using SensegoodSmart utility one can export .csv data file containing spectral data from 380nm to 1100nm with 1nm resolution. Using any analytical tool like Matlab or similar, one can import .csv file and use it for further analysis. This feature is particularly developed for the researchers and university students.

Applications and uses:

- ✓ Real time automated color monitoring on computer screen
- ✓ Data portability
- ✓ Documentation
- ✓ Research and development
- ✓ Storing and retrieving reference color attributes for color management

SensegoodSmart is the potential utility for global color management and specifically useful for the companies having widespread production plants possibly across the globe.

Sensegood Spectrophotometer along with SensegoodSmart Utility is the complete color management solution that you could desire for!

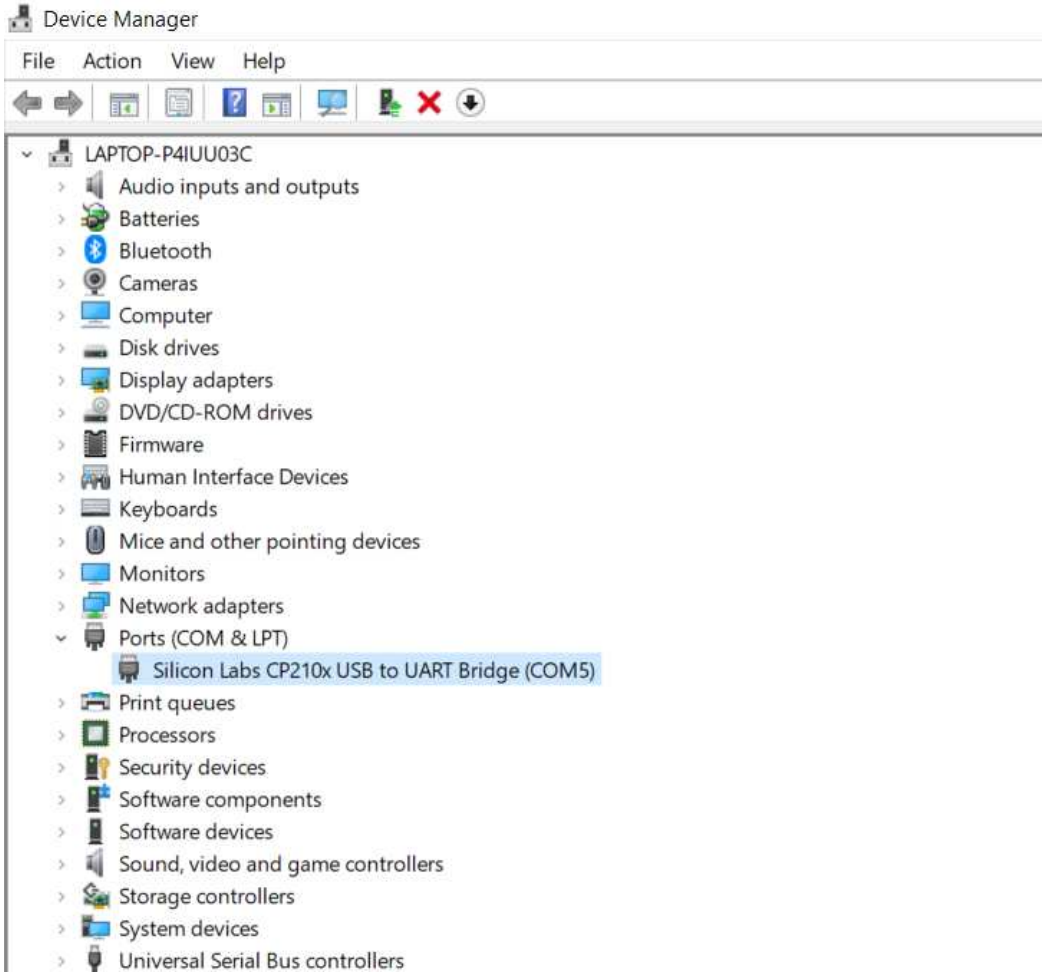
How Sensegood Spectrophotometer along with the SensegoodSmart Utility can be helpful in your application?
Find out industries that we serve at: https://sensegoodinstruments.com/color-measurement

Quick Start

1. Connect the computer with Sensegood spectrophotometer and turn on the instrument.

2. Click the Windows® “Start” button → Right-click “Computer” → Click “Properties”. Click “Device Manager” on the window that appears. Steps may vary in different operating systems.

3. On the Device Manager screen, double-click “Ports (COM & LPT)”. You should be able to see: “Silicon Labs CP210x USB to UART Bridge (COM **)” without any caution symbol. Where, COM port number (**) can vary case to case. This confirms the proper USB connection of the instrument with the computer.



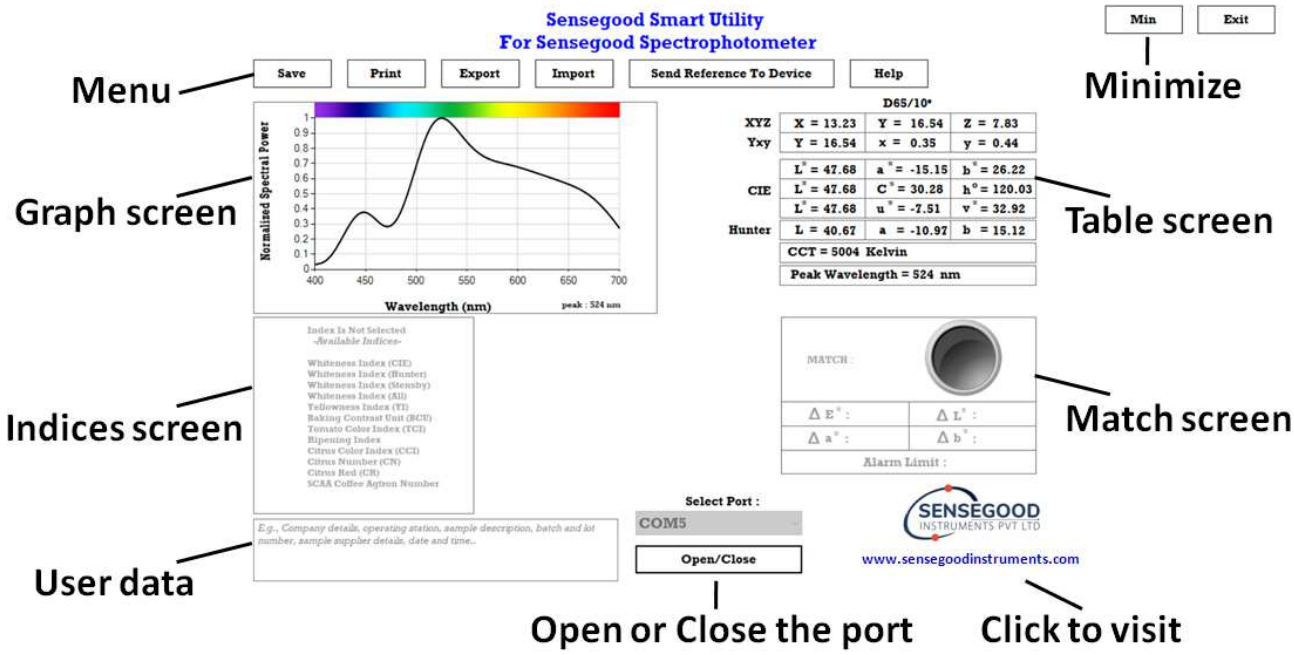
4. Open SensegoodSmart utility using the desktop shortcut as shown below. Alternatively you can open it by navigating through Windows® Start menu.

5. Select the Port using drop-down menu as shown below. The port here is the same port which is discussed in step 3. Then press “Open/Close” button once to open the selected port. The color will change to gray indicating the selected port is now configured and open to communicate with the instrument.

6. Take a measurement using Sensegood Spectrophotometer. Once the instrument screen is updated with the measurement data, the same should be automatically reflected to the SensegoodSmart screen.

1. Always connect the instrument with computer **before** opening the software. Software will not work if this sequence is not followed.
2. If you have multiple virtual COM port devices connected to your computer then make sure to select the right port using the information available in Device Manager.
3. Always close the port before physically disconnecting the instrument.

Annotation


Sensegood Smart Utility
For Sensegood Spectrophotometer
Min
Exit
Menu
Save
Print
Export
Import
Send Reference To Device
Help
Minimize
Graph screen
Normalized Spectral Power
Wavelength (nm)
peak : 524 nm
D65/10°
XYZ
Yxy
CIE
Hunter
CCT = 5004 Kelvin
Peak Wavelength = 524 nm
Table screen
Indices screen
Index Is Not Selected
-Available Indices-
Whiteness Index (CIE)
Whiteness Index (Hunter)
Whiteness Index (Stensby)
Whiteness Index (All)
Yellowness Index (YI)
Baking Contrast Unit (BCU)
Tomato Color Index (TCI)
Ripening Index
Citrus Color Index (CCI)
Citrus Number (CN)
Citrus Red (CR)
SCAA Coffee Agtron Number
MATCH :
Alarm Limit :
Match screen
User data
E.g., Company details, operating station, sample description, batch and lot number, sample supplier details, date and time..
Select Port :
COM5
Open/Close
Open or Close the port
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Click to visit

Navigation Bar

Menu: Save, Print, Export, Import, Send Reference to Device, Help

Save:

Save measurement data as an image file (*.jpg*). Image is constructed with optimized size (~100KB) hence it requires less space for storage.

Print:

You can print the screen using this option. You can also convert the measurement data to *pdf* using any pdf creator software. The generated pdf file is optimized in size (~100KB) so it requires less space for storage over number of measurements.

Export:

This menu exports two files back to back.
First file is with .sego extension. This *.sego* file is Sensegood Instruments' copyright file which is specifically developed for the SensegoodSmart utility. The measurement data is exported in specific format in small sized .sego file for future use. The information can be retrieved by anybody to whom this file is shared with. This helps in supervision, tracing and documentation.

Second file is comma separated *.csv* file. This file feature is specifically developed for the students and researchers. They can export measurement data to .csv file and then import it to any analytical tool like Matlab or similar for further analysis. Instrument LCD shows spectral graph for 400 – 700 nm while the generated comma separated file contains 721 spectral data values for 380 – 1100 nm with 1 nm resolution. First spectral value corresponds to the 380nm and the last corresponds to 1100nm.

Import:

One can import measurement data file .sego from computer to SensegoodSmart utility to study the corresponding color attributes. Importantly, importing a .sego file and viewing measurement data does not require the presence of instrument itself. This enables users to share measurement data file with somebody else (e.g., supervisors), and they can study the measurement data without having instrument.

Send Reference to Device:

This section is separately discussed.

Using this utility, one can generate these four types of files: .jpg, .pdf, .sego, and .csv which are sufficient for most of the applications and operations.

Introduction to Various Screens

Sensegood Spectrophotometer's LCD can display one screen (e.g., graph or table) at a time for better visual ergonomics. However, SensegoodSmart utility compiles all the color measurement attributes and places various sub-screens together on a single screen for ease of understanding. The figure in Annotation section represents four sub-screens associated with the utility, which are as follows.

Graph screen:

This screen represents the normalized spectral data as a function of wavelengths ranging from 400 to 700 nm.

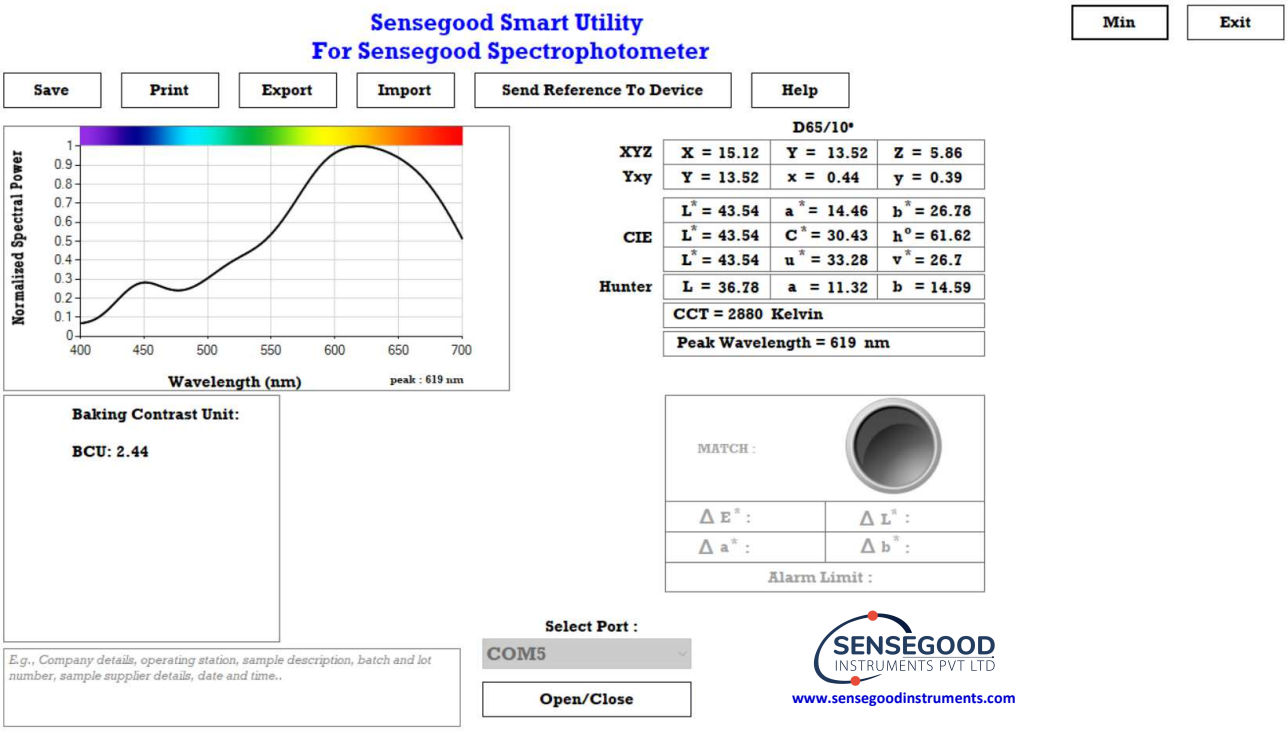
Table screen:

This screen represents the numerical values for measured color which include: XYZ, Yxy, CIE L*a*b*, CIE L*C*h^0, CIE L*u*v*, Hunter Lab, CCT - color temperature, and peak wavelength along with the selected illuminant and observer.

Indices screen:

This screen shows values corresponding to selected color index. Color index can be: Whiteness index CIE, Whiteness index Hunter, Whiteness index Stensby, Yellowness index (YI), Baking contrast unit (BCU), Tomato color index (TCI), Ripening index a*/b* and b*/a*, Citrus index (CCI), Citrus number (CN), Citrus red (CR), SCAA Agtron number.

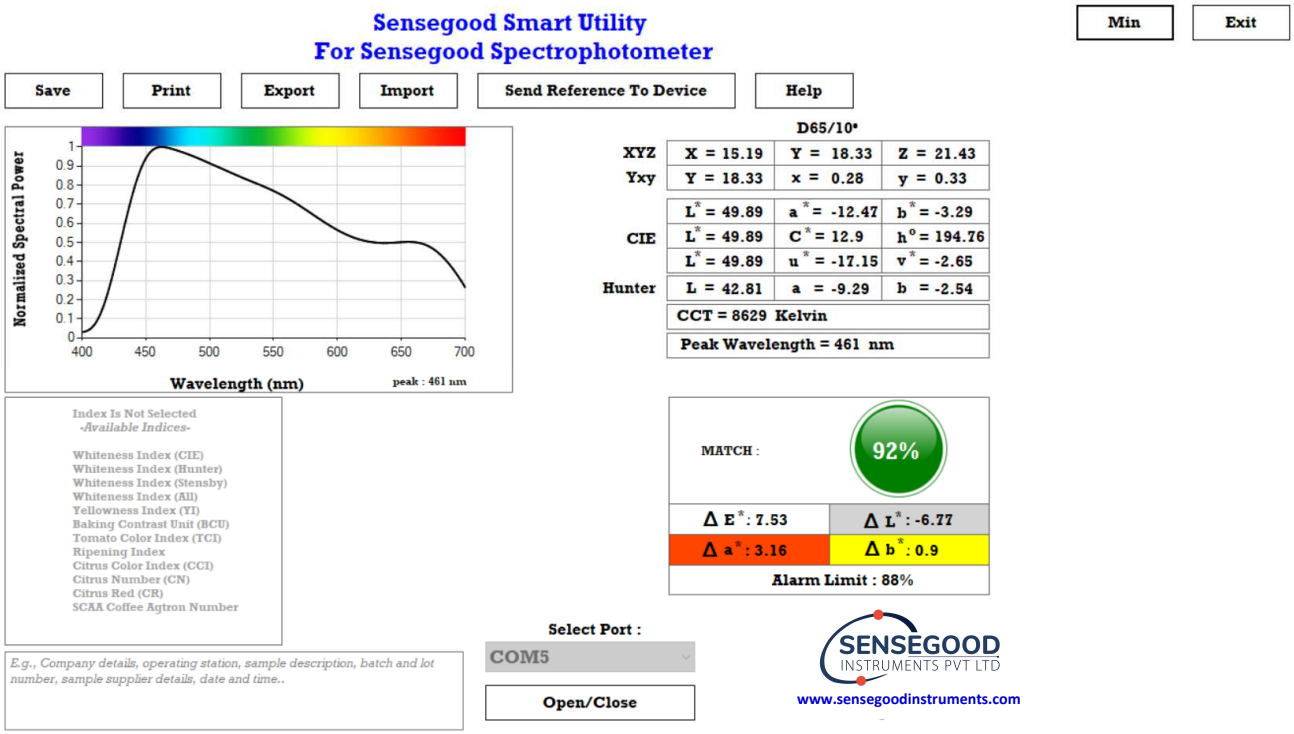
Figure below shows the screen with user selected BCU color index.

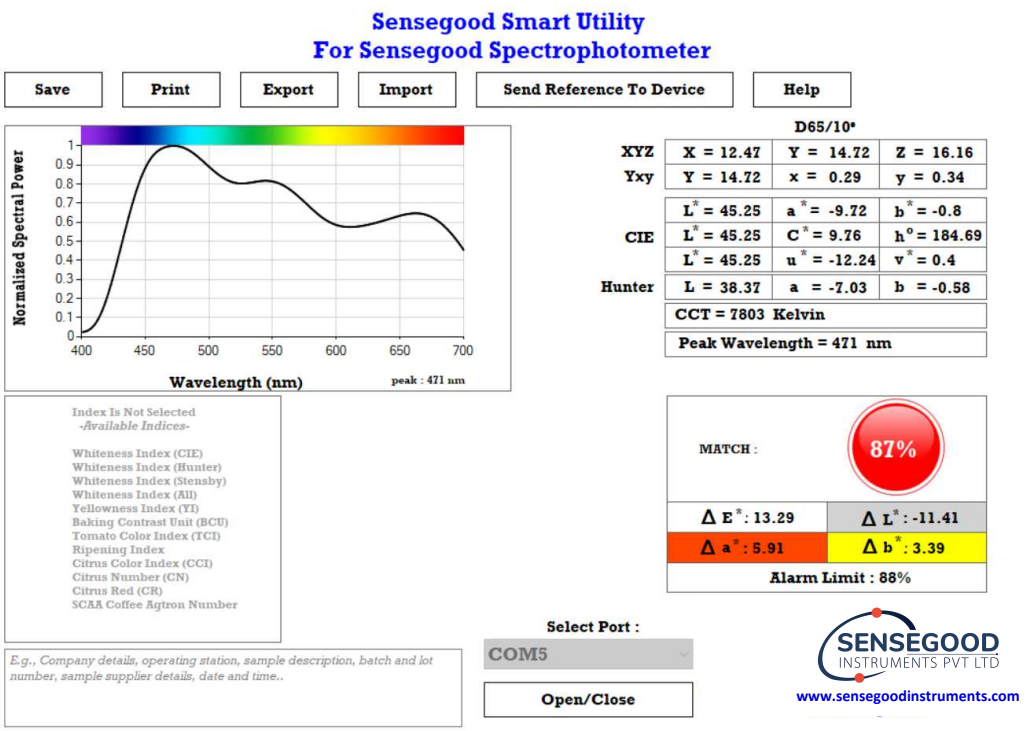


Match screen:

This screen shows the amount of percentage match by comparing desired reference with the sample under test. It shows: Match%, ΔE*, ΔL*, Δa*, Δb*, and user set Alarm Limit. It also indicates whether the sample is Lighter/Duller, Redder/Greener, and Yellower/Bluer than the reference. It displays Match% in green (Pass indication) if it is greater than the set Alarm Limit. Same way, it displays Match% in red (Fail indication) if it is less than the set Alarm Limit.

Figures below show the activated Match screens.

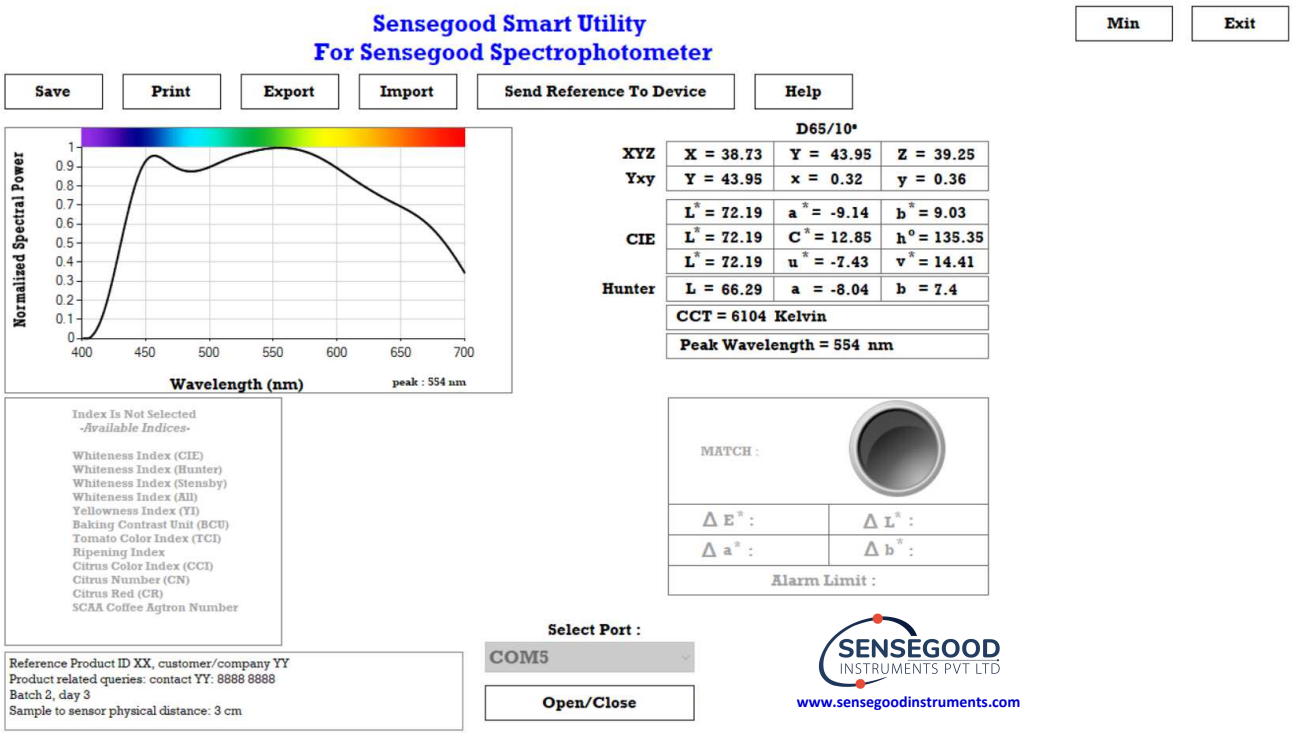




Note:
Graph screen and Table screen always remain active i.e., always display measurement data. However, either Indices screen or Match screen only gets activated if one of these screens is currently being displayed on instrument's LCD.

User Data Field

Once the communication port in the utility is open, it can fetch measurement data from the instrument. Once the measurement data is displayed, user can mention the measurement related information in the user data field. User can input desired information like: company details, operating station, sample description, batch and lot number, sample supplier details etc. Such information becomes the part of exported files like .jpg, .pdf, and .sego. If the measurement data file (.sego) is imported to the utility, the same user data gets reflected in this field.



Send Reference to Device

This feature enables users to download the desired reference color information to the Sensegood Spectrophotometer. First it requires saving the reference color information to the computer hence it can be imported to the utility and further it can be sent to the device. This reference color information is a part of .sego file, hence no separate data input is required.

Step 1: Save desired reference to the computer:

First take the product/surface/color/sample/substrate which you want to consider as a reference. In Sensegood Spectrophotometer, go to Match screen and Press "NEW REFERENCE" to record its color attributes. User can also set the Alarm Limit to establish the permissible tolerance. The instrument keeps the reference data in its RAM, if required, further it can be saved to the memory using "SAVE REFERENCE". Once the reference is recorded, you must take at least one measurement so that the SensegoodSmart utility can fetch the measurement data including the recorded reference. Once the measurement data reflects in the utility, user can export the same to .sego file. This exported .sego file contains reference color information along with the Alarm Limit. Before exporting to the .sego file, user can also consider mentioning reference specific information in the user data field.

Step 2: Send reference to device:

A user can have any number of reference files stored in the computer, specific to different projects or specific to the customers. User can select and import the desired reference file from computer to the SensegoodSmart utility. The imported .sego file has the reference color information and the allowed tolerance – Alarm Limit along with the user data narrating the information about that specific reference. Now press "Send Reference to Device" to download the reference data to the Sensegood Spectrophotometer.

Step 3: Acknowledgement

Once the reference is sent successfully, the instrument should display following message:

"Reference saved to the memory."

And the utility should display the following message:

"Reference sent to the device successfully."

Now the instrument is ready to measure the samples and evaluate the amount of percentage match considering set Alarm Limit, by comparing the sample with the downloaded reference. This downloaded reference in the device remains saved in its memory until either new reference is saved using "SAVE REFERENCE" in the instrument or new reference is downloaded to the instrument using the utility.

To summarize, the utility enables users to save multiple references to the computer and load the desired reference into the instrument whenever required for determining the amount of matching with the sample under test.

Caution: If you do not receive acknowledgement, wait for at least 30 seconds before pressing again "Send Reference to Device". Or else consider reconnecting the instrument with computer.

Automated Measurement

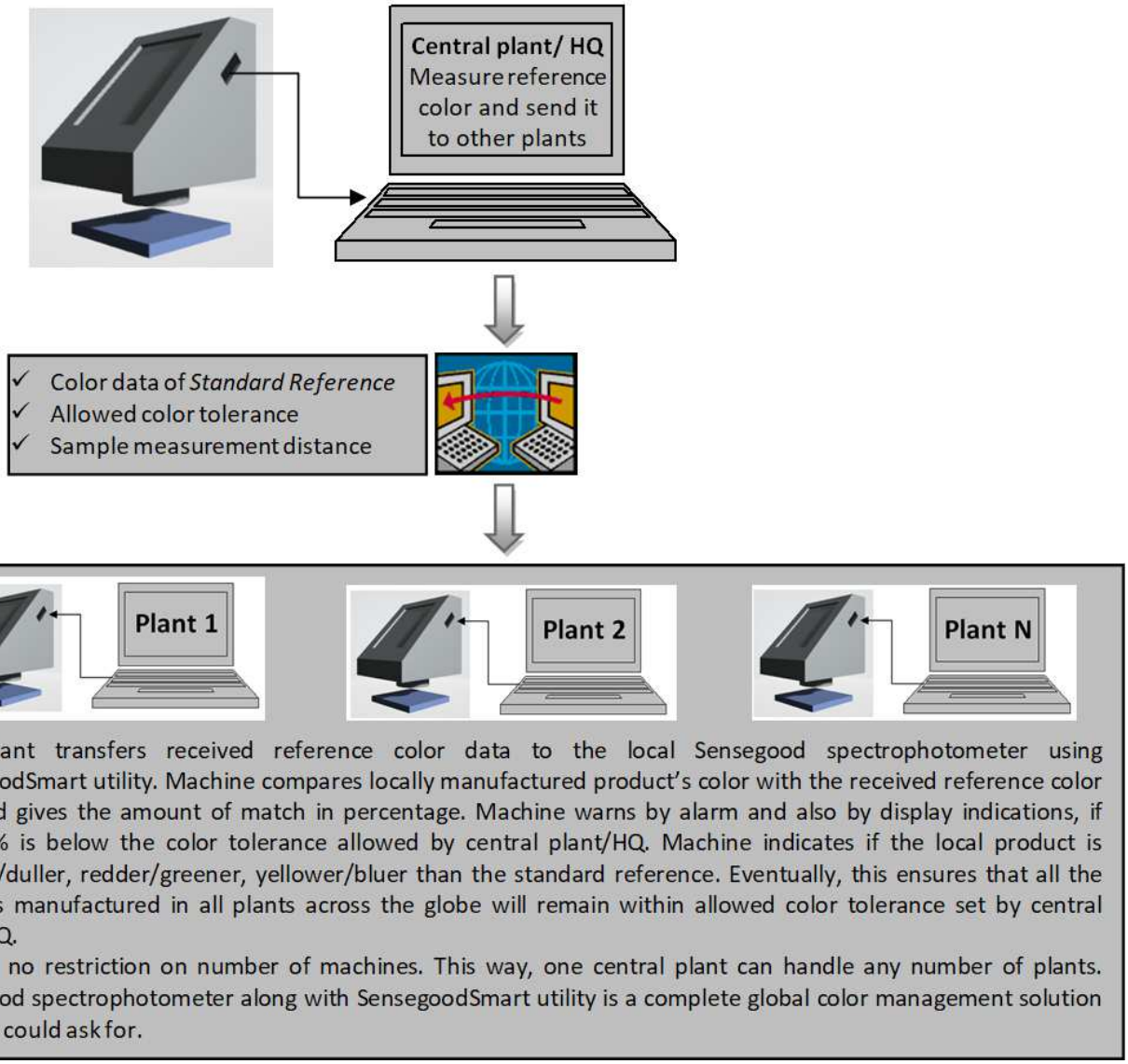
The SensegoodSmart utility along with the Sensegood Spectrophotometer supports automated measurements without human intervention.

To use this feature, put the instrument in auto measurement mode. User can select the desired auto repeat measurement interval. The instrument will automatically wake up at set intervals and it will take measurements. On the other hand once the utility is initialized, it does fully automated operation, it automatically detects the new measurement data, no commands/ no buttons to be clicked for fetching the data from the instrument.

This feature is particularly helpful in online/in-process continuous automated measurements. Manufacturer or quality supervisor can set tolerance by setting Alarm Limit. Instrument will automatically wake up, measure and compare the color attributes with desired reference against the set tolerance and represent the color difference as a single number representation – as match percentage. If it is less than the set threshold, the same will be reflected in the utility by indicating match percentage in red (Fail). If it is within specified tolerance limit, the value will be shown in green (Pass). This color code for Pass/Fail makes easy for production-line-operator to take decision whether to accept, reject or reprocess the sample.

Global Color Management

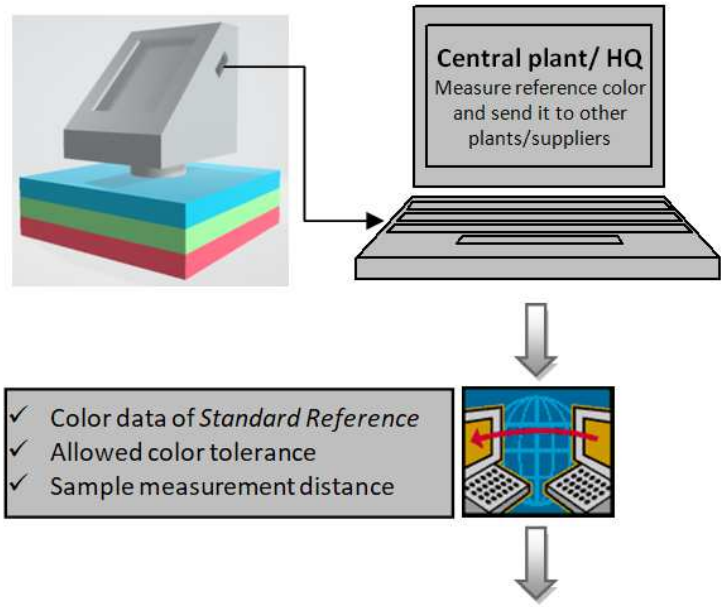
SensegoodSmart utility lets you to convey numeric color data across all production plants that may be located at multiple places across the globe. Central plant generates .sego file considering the desired reference and allowed tolerance. It further shares the same file with different production plants. Each production plant downloads received .sego file (Refer: Send Reference to Device) to the Sensegood spectrophotometer to compare color attributes of the product manufactured in their plant with the numerical color information received from central plant or management. This enables them to reproduce each product consistently across all the plants.

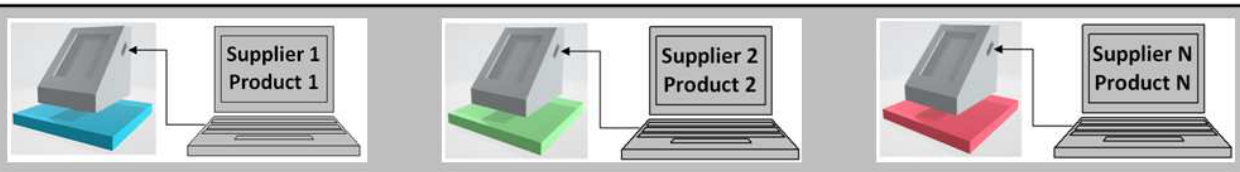


Each plant transfers received reference color data to the local Sensegood spectrophotometer using SensegoodSmart utility. Machine compares locally manufactured product's color with the received reference color data and gives the amount of match in percentage. Machine warns by alarm and also by display indications, if Match % is below the color tolerance allowed by central plant/HQ. Machine indicates if the local product is brighter/duller, redder/greener, yellower/bluer than the standard reference. Eventually, this ensures that all the products manufactured in all plants across the globe will remain within allowed color tolerance set by central plant/HQ.

There is no restriction on number of machines. This way, one central plant can handle any number of plants. Sensegood spectrophotometer along with SensegoodSmart utility is a complete global color management solution that you could ask for.

This feature is helpful in any industry having operations at multiple locations and the color quality of the product is to be maintained throughout the supply chain (e.g., paper, plastic and packaging industry) and also where the product is built by assembling the parts from different suppliers (e.g., automobile industry). In automated measurement, further one can also use remote desktop application like AnyDesk to remotely check the real time measurement status and product's color consistency.





Each supplier plant transfers received reference color data to the local Sensegood Spectrophotometer using SensegoodSmart utility. Machine compares locally manufactured product's color with the received reference color data and gives the amount of match in percentage. Machine warns by alarm and also by display indications, if Match % is below the color tolerance allowed by central plant/HQ. Machine indicates if the local product is brighter/duller, redder/greener, yellower/bluer than the standard reference. Eventually, this ensures that all the suppliers supply products manufactured in their plants across the globe that remain within the allowed color tolerance set by manufacturer/HQ/central plant.

There is no restriction on number of machines. This way, one central plant can handle any number of suppliers. Sensegood spectrophotometer along with SensegoodSmart utility is a complete global color management solution that you could ask for.

Find Commercial Colors

This section explains how to find a closest commercial color to that of a color measured of a sample.

Measured color attributes are represented as numerical values in Table screen. Sensegood Spectrophotometer follows Commission Internationale de l'éclairage (International Commission on Illumination) CIE1931, CIE1964 and CIE1976. Hence generated numerical values are in compatible standard color space coordinate format and the values can be fitted in any third party tool which follows CIE.

For an example, one such tool is available at https://www.easyrgb.com/en/match.php#inputFORM. Select appropriate data type and provide numerical color data measured by the instrument and press MATCH to find out available closest commercial colors.

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