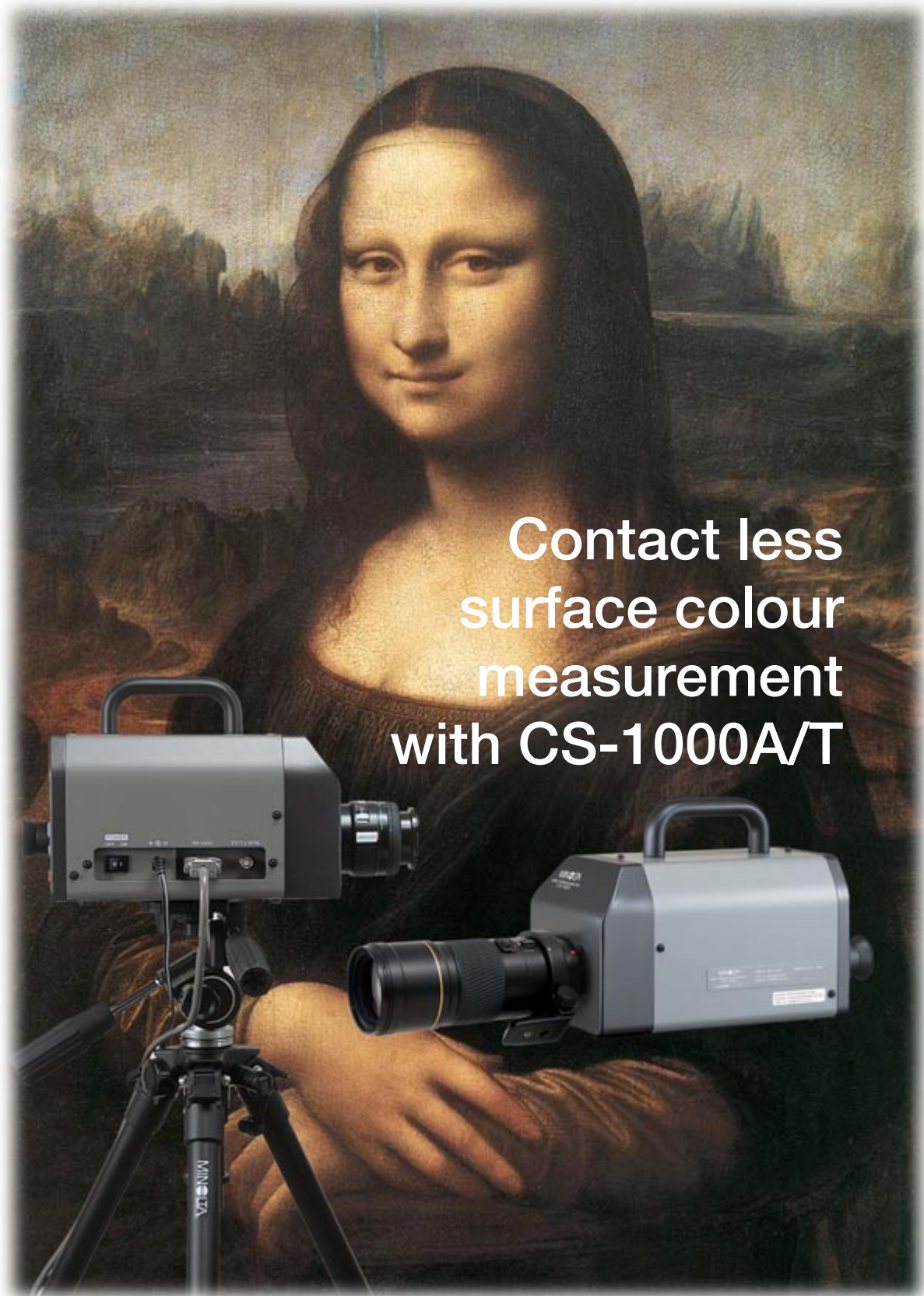


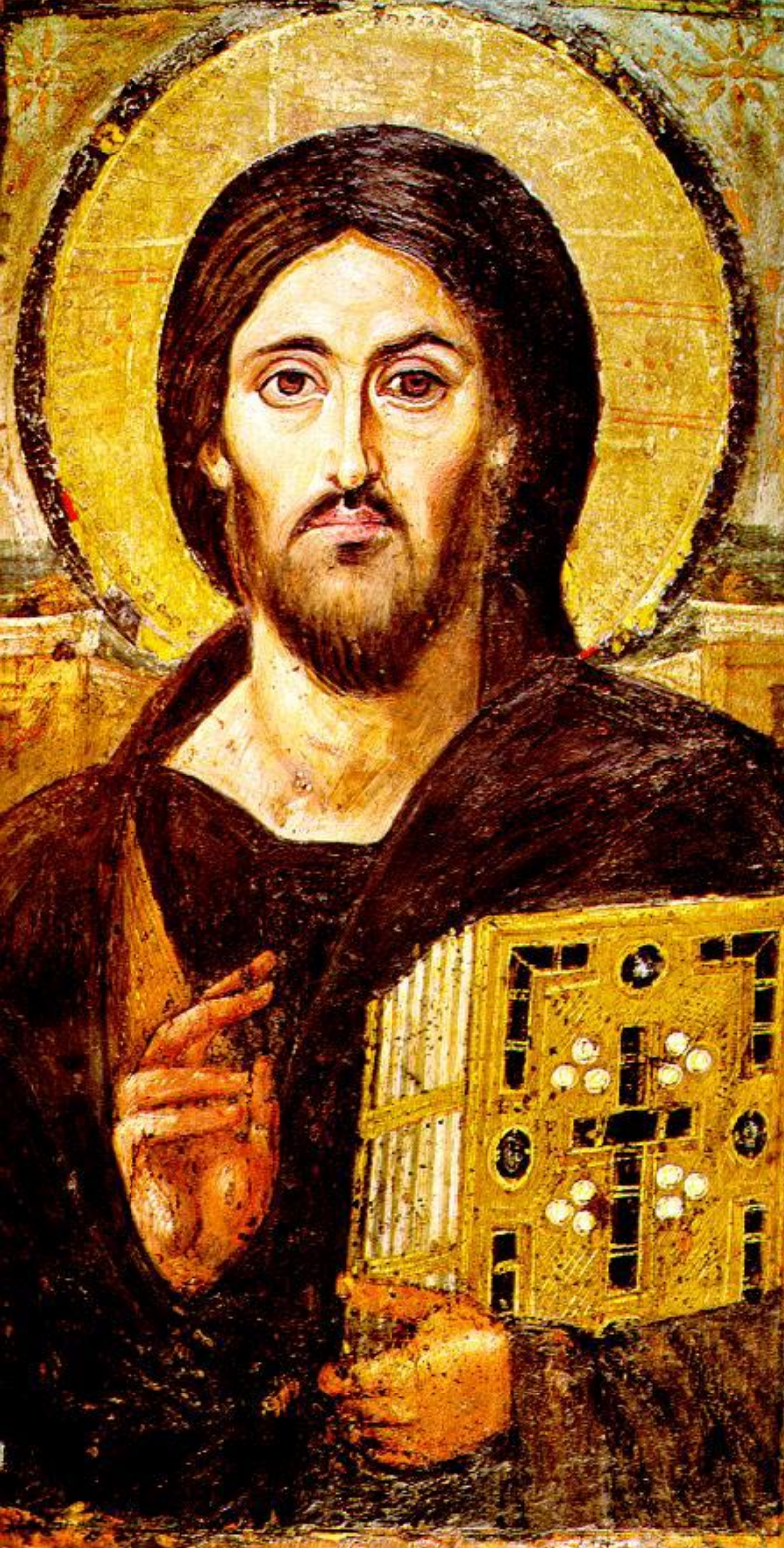


KONICA MINOLTA

Application note:  
ISD-APP-L-2004-01  
Light measuring instruments



Contact less  
surface colour  
measurement  
with CS-1000A/T



Main target application for a spectroradiometer (like CS-1000A/T) is of course light or display measurement.

However, there are applications where CS-1000A/T is well accepted for surface colour (reflectance) measurements.

When working on restoration of historical paintings, wall paintings, cave paintings, icons etc, it's essential to capture original colour information without damaging the surface of the image by touching it!

Also in medical area there are applications where it is essential to capture for example skin colour information without touching the surface! Just recently a CS-1000A was implemented in a system for doing research work on human teeth!

The main issue for surface colour measurement is to create a proper environment! Calibration standard, a light source for illumination and a proper set up are required to reach reliable measuring results.

On the following pages we will explain how to build a system for non-contact surface colour measurement with the Konica Minolta Spectroradiometer CS-1000A/T.

**Note!**

Small area measurements with CS-1000S are not possible because the short measuring distance makes it almost impossible to set up a 45/0 illumination system.

## White calibration plate

Of course a perfect white matt diffuser with a reflectance of 100% should be best surface for white calibration. However, as such diffuser only exists in theory, there are different materials used for calibration standards.

Because of its less sensitive surface, Konica Minolta selected “Yoneda glass”, which is like a kind of white ceramics. Therefore the standard has a glossy surface! Calibration values supplied with the white calibration plate are therefore only valid for **45/0** geometry, which was used for creation of calibration values.

Konica Minolta supplies calibration plate with 3 variations:

- CS-A5 White calibration plate (without calibration data)
- **CS-A5 White calibration plate (with calibration data [45/0])**
- CS-A5 White calibration plate (with calibration data [45/0] and certificate)

Of course customer also might use other own standards. In such case the standard value must be given and specified for the CS-S1W software in a file named \*.wcb with correct file format:

*Reflectance values must be written as decimal values, not percentage values. For example, if the reflectance is 35%, the value must be written as 0.35.*

*(Example):*

*0.1414 (Reflectance at 380nm : 14.14%)*

*0.1732 (Reflectance at 381nm : 17.32%)*

*0.2000 (Reflectance at 382nm : 20.00%)*

*...*

*(401 data items in total)*

*...*

*0.2236 (Reflectance at 779nm : 22.36%)*

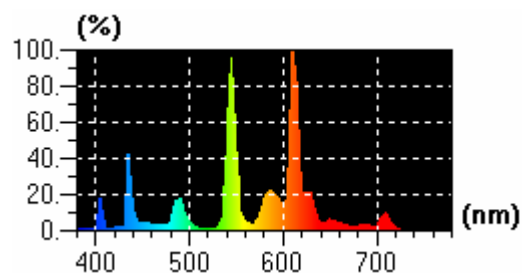
*0.3142 (Reflectance at 780nm : 31.42%)*

*Please only write the numbers into the calibration file!*

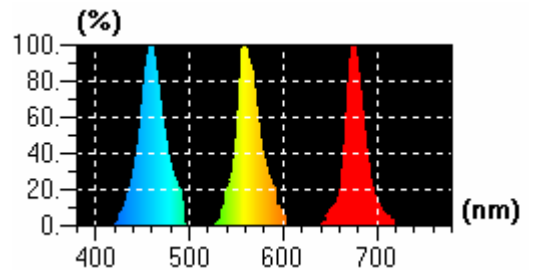
## How to select light source for illumination?

Coming to the question which kind of light source is best for reflectance measurements, we have to consider the following issue: We want to capture surface reflection for the complete visible range, thus our light source must provide radiant energy over the complete spectrum!

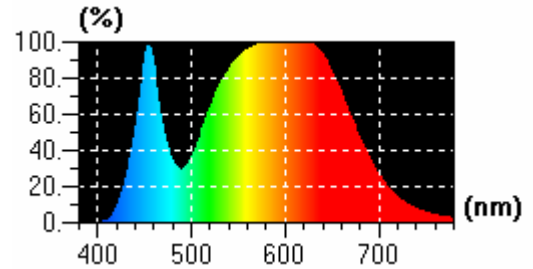
- Discharge lamps are not suitable as they have some very high spikes within their spectrum and only very limited radiant energy in the remaining areas of the spectrum.



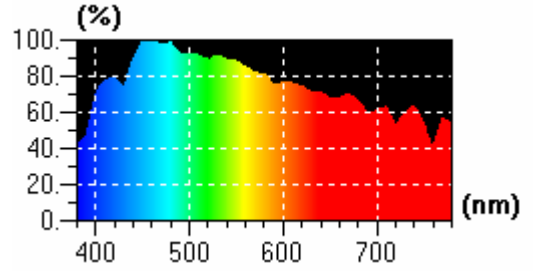
- LED has radiant energy only in limited areas of spectrum. Combining red, green and blue LED still does not cover all.



- Even latest technology LED does not emit light in some area of the spectrum.



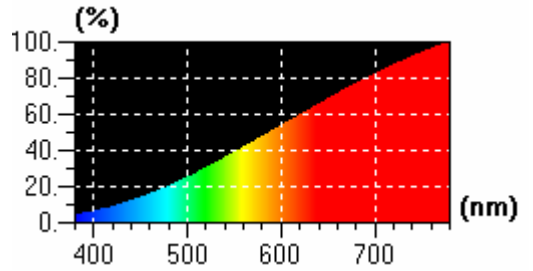
- A Xenon lamp with correction filter (like for example used in Konica Minolta's spectrophotometer CM-3600d) should be fine in terms of spectral distribution and energy, but synchronization of measurement with CS-1000 would almost be impossible.



- Incandescent lamps (thermal radiators) are fine in terms of spectral distribution (energy in complete spectrum) and energy.

**So please select incandescent lamp!**

For highest reading accuracy and repeatability a constant voltage power supply should be used!



Note!

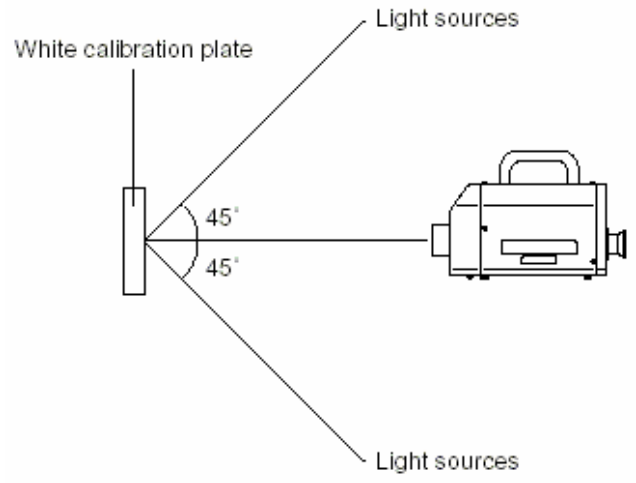
Please do not mix the meaning of light source used for illumination with the illuminant used for CIE chromaticity calculation! Light source for illumination is just used to capture spectral reflectance values for each wavelength compared against a calibration standard! Illuminant C, D65 and others are later used during calculation of chromaticity.

## Set up of the complete system

The next step is to set up the system. This of course must be done at the location of measurements, i.e. conditions for calibration and measurement must be same. Calibration set up is shown in the picture on the right.

### 1. Calibration:

Calibration plate should be placed to the location where you later want to measure. Ideal would be to measure in a dark room, but in any case you have to take care for ambient light conditions, which should not change between calibration and measurement!



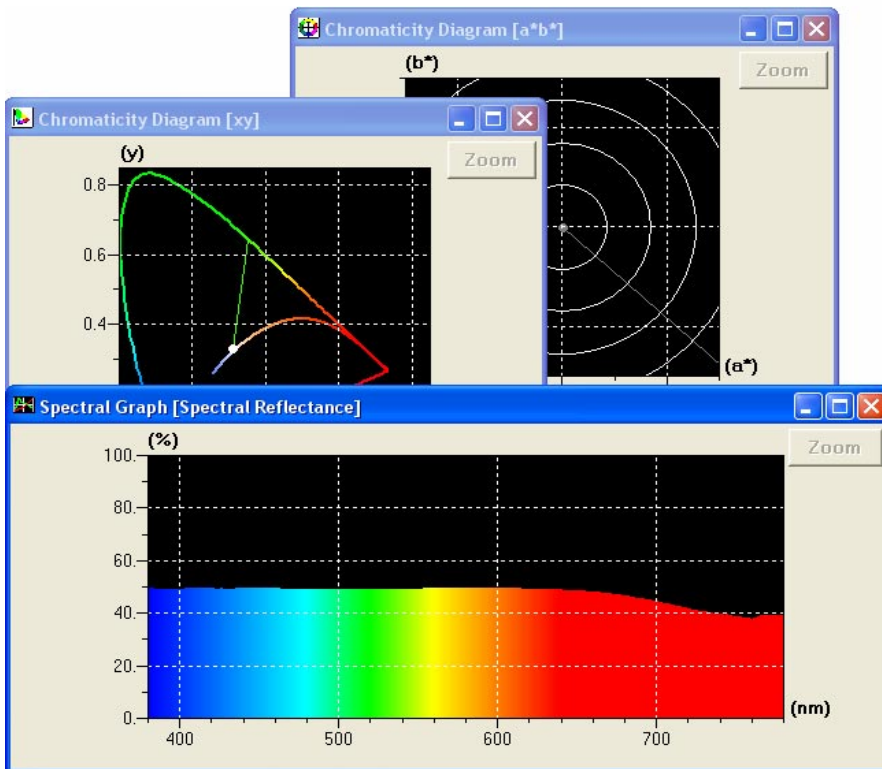
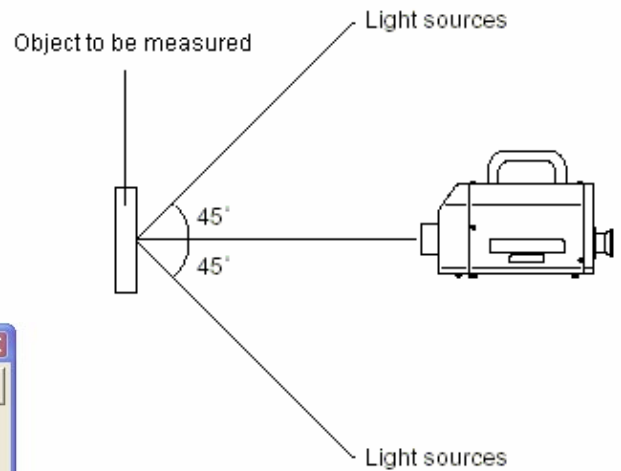
## Example of wrong calibration / environment:

You are performing measurements in a normal room with window. Sun light coming through the window is influencing your calibration measurement. Next during normal measurement the sky is clouded or people are moving between window and measurement object. Such condition will lead into non reliable measurement results!

## 2. Measurement:

Next is to place the object to be measured in the place where before the calibration plate was located!

CS-S1W software offers all functionality from calibration, measurement and data processing to final display of measurement result!



Measurement Conditions

Observer

2°

10°

OK

Cancel

Colorimetric

Light-Source Color

Object Color

Luminance Units

cd/m<sup>2</sup>

ft-L

RI Reference Illuminant

F12

Reflectance/Transmittance

Reflectance

Transmittance

Measurement Light Source

A

B

C

D50

D55

D65

D75

D95

E

F2

F6

F7

F8

F10

F11

F12