



## Comparison of monitor calibration with I1Pro, CS-200 and specbos 1211 L

It is widely accepted that a precise monitor calibration is only possible with an accurate color meter. Furthermore, it is known that spectral resolving instruments have advantages compared to tristimulus units due to the missing f1 (color matching) error.

The present note compares three spectral measuring instruments – I1Pro of X-rite, CS-200 of Konica Minolta and specbos 1211 L of JETI.



specbos 1211 L



I1Pro



CS-200

### Measuring geometry

We see a basic difference between the instruments when set to operating position – CS-200 and specbos 1211 are noncontact units and have to be placed in front of the screen perpendicular to its surface in a distance of 3 ... 4 times picture height. The measuring spot of specbos 1211 is marked as a red circle on the screen, meanwhile the spot of the CS-200 can only be seen as a black area viewing through the instrument. In contradiction X-rite's I1pro is a contact instrument and must be positioned directly on the monitor. The EBU publication 3325 recommends the distance measuring geometry rather than the contact method.

CS-200 allows to select between 1°, 0.2° and 0.1° viewing angle, specbos 1211 L offers only 1.8°. A selection of the viewing angle is not necessary for monitor measurement and calibration, because small measuring areas are not needed.

The CS-200 must be focused on the screen, meanwhile the optics of specbos 1211 L has a fix focus, so a setting is not necessary.

### Wavelength/ Luminance range and optical resolution

specbos 1211 and CS-200 cover the full visible part of the spectrum (380 ... 780 nm), I1Pro is limited to 730 nm. It has an optical resolution of 10 nm. CS-200 is called chromameter rather than spectroradiometer, because it has only 40 sensors for the whole spectral range. Therefore, its optical resolution cannot exceed 10 ... 15 nm. specbos 1211 has a much better optical resolution of 5 nm, which is essential for the

accurate measurement especially of CRTs, CCFL backlighted LCDs and plasma displays.

The special spectral adaption of the sensors to the CMFs by individual compensation factors results in an excellent f1 number, but the missing optical resolution is still a limiting factor.

The luminance ranges of all three instruments will exceed the maximum intensities of monitors and projectors, so this is no limiting factor.

### **Measuring accuracy, repeatability and speed**

The accuracy and repeatability of luminance and chromaticity for all three units are given in the following table. It can be seen that the values are in the same range.

Instrument	Accuracy @ 10 cd/m <sup>2</sup>		Repeatability @ 10 cd/m <sup>2</sup>	
	Luminance	Chromaticity	Luminance	Chromaticity
specbos 1211 L	± 2 %	± 0,002	± 1 %	± 0,0005
CS-200	± 2 %	± 0.004	± 0.5 %	±0.0004
I1Pro		± 0.002		

specbos 1211 L and CS-200 have a similar measuring speed, the I1Pro measures faster, but its repeatability, especially at low lights is worse. The modulation of a monitor can create fluctuating readings of the meter. CS-200 and specbos 1211 L allow to synchronize their measurement scans to the modulation frequency and hence stabilize the values. specbos 1211 L has the additional advantage that it has an additional sensor which can be used to measure the repetition rate of the monitor.

### **Handling and software (including operation with external programs)**

CS-200 is a stand-alone unit and can alternatively be used with the radiometric software CS-S10w of Konica Minolta. Operation of I1Pro and specbos 1211 needs a PC or laptop. If automatic calibration programs are used a computer is necessary anyway. So, the stand alone property of the CS-200 is no big advantage for this application.

The small sizes of I1Pro and specbos 1211 L make them very convenient for portable applications like monitor calibration in remote studios, because they can easily be transported. The weight of CS-200 is about three times as of specbos 1211 L and I1Pro.

All three instruments can be used with different external software packages – monitor calibration software and device independent calibration software.

specbos 1211 L can be used with the following external software:

Manufacturer specific calibration software of

- JVC
- TVlogic
- Sony (under preparation)
- BON
- VTS
- Penta
- Boland
- Plura (under preparation)
- Filmlight

#### General calibration software

- Lightspace CMS
- CalMAN
- ChromaPure

I1Pro has the advantage against both other units that it can be used for printer calibration too and that it is implemented into the full color management system of X-rite.

#### **Purchase cost**

A main issue of measuring instrument are their costs. The three instruments, compared in this report, lie in very different price categories:

I1Pro	around EUR 1 200
specbos 1211 L	around EUR 7 000
CS-200	around EUR 13 000

It arises the question whether the higher price is justified by higher quality and additional important parameters and features. In addition to this comparison the following article gives practical hints to answer this question:

<http://www.curtpalme.com/forum/viewtopic.php?t=11436>

#### **Conclusion**

This report compares three different spectral measuring colorimeters. It shows the main features and parameters of the instruments. In summary JETIs specbos 1211 L is the most affordable reference color analyzer on the market.