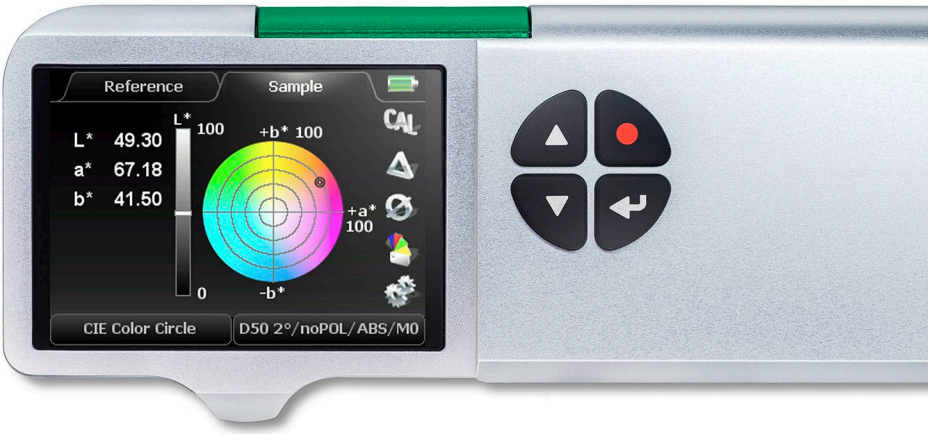
TECHKON

Erfolg ist messbar

Spectro-Densitometer
SpectroDens

Software
SpectroConnect



Manual

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You can reach us at the following address:
TECHKON GmbH
Wiesbadener Str. 27 • D-61462 Königstein/Germany
T +49 (0) 6174/92 44 50 • F +49 (0) 6174/92 44 99
info@techkon.com • www.techkon.com

Welcome

We welcome you among the worldwide community of users of TECHKON products. We are happy that you have selected this high-quality measurement instrument. It will be a valuable tool for your day-to-day quality control tasks. With this manual we invite you to learn how to use SpectroDens.

The manual is divided into three chapters:

CHAPTER 1: How to use TECHKON SpectroDens

CHAPTER 2: Description of the measurement functions

CHAPTER 3: How to use the Windows software SpectroConnect

For the first steps we recommend to read chapter 1; in particular paragraph 1.4.

You will be fascinated that after only 15 minutes you will know how to work with SpectroDens. The second chapter will show you detailed insight into the measurement functions and chapter 3 is about the Windows software SpectroConnect, which is part of the package.

Please get the device registered by using the registration card, which you will find in the appendix of this manual. That way we can keep you updated about product news.

Please visit us as well on internet at www.techkon.com. You will find useful information about the complete product range and new software versions.

Do you have any suggestions for improvements or do you require information that goes beyond the contents of this manual? We will be glad to hear from you. Your suggestions or questions make an important contribution to the continuous optimization of our documentation and products.

Your TECHKON Team

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Chapter 1

How to use TECHKON SpectroDens

1.1 Product description

With the new SpectroDens generation TECHKON continues the success story of the SpectroDens hand-held devices in the long term. The dictum during product development was: Pursue proven concepts and integrate new meaningful technologies. The result sets a new standard.

A measurement device for all applications

SpectroDens is an all-purpose measurement device, that is universally used for quality control in the printing industry as well as for other tasks, where colors have to be judged critically. SpectroDens is exceptionally suitable, no matter which application. Thanks to the individually adjustable display functions, you can quickly set up the device for your particular job. The solid aluminum unibody case makes the device a reliable tool even in a harsh industrial environment. Direct positioning of the measurement head on the measurement field ensures a secure and quick measurement. In addition to single measurements you can easily carry out scan measurements. Tracking wheels on the bottom of the device make it possible to scan very fast up to 100 color patches at once on a print control strip or test chart.

Two devices in one

As a spectro-densitometer, SpectroDens combines the qualities of a highly accurate spectro-photometer and an easy-to-use densitometer. Measurement is spectral, i. e. the entire color information – the spectral fingerprint of the color – is precisely registered. The data is converted into measurement data for descriptive analysis and display:

- Densitometric data is widely used in quality control during the printing process.
- Colorimetric data is used in the evaluation of print proofs, the creation of color profiles in color management as well as the color matching and formulation of inks.

Densitometry / Density measurement

A push of a button provides you with solid density as well as all useful additional information such as dot gain, dot area, gray balance and print contrast. In the automatic measurement mode the device always displays the relevant information instantly. You can even quickly and easily produce complete printing curves. The spectral measure-

ment technology calculates not only density values for CMYK, but also exact data for the density of spot colors.

Colorimetry

All standard colorimetric functions are displayed clearly. Even the entire CIE L*a*b* color circle appears in the high resolution color display. As a result understanding CIE L*a*b* values becomes very easy and clear. In the color library 25.000 reference colors and complete digital color books can be saved.

Standardized measurement

Thanks to its ISO-compliant measuring head SpectroDens works strictly according to the standards valid for the graphic industry. Select different status filters for density measurement in the device settings. A special technical feature is the polarization filter which can be switched on and off by a push of a button and makes SpectroDens particularly good at evaluating the Ugra/Fogra media wedge.

Using the latest LED technology SpectroDens provides D50 illumination and therefore fulfills the M0, M1, M2, M3 measuring conditions in accordance to ISO 13655. The lifetime of the LED illumination is nearly unlimited. Moreover the new design of the direction-independent measuring head provides reliable measurements of a wide range of print media.

Software SpectroConnect

The supplied Windows-software TECHKON SpectroConnect provides the connection between SpectroDens and the PC via the micro-USB connector or via the optionally available WLAN-module. Measurement data can thus be comfortably processed on the PC and transferred, for example, to Microsoft Excel™.

Use the color library to load complete digital color books quickly and easily into the device. An import of color values in CXF® format is possible as well. SpectroConnect is also the connecting module for other applications, e. g. programs for the production of printing curves, for colorimetric quality control or for checking the compliance of printing products to ISO standards.

Three different performance packages

We supply SpectroDens in three types of performance packages: The model **Basic** with all density functions and the **Advanced** version which adds essential colorimetric functions and a color library. The fully equipped flagship model SpectroDens **Premium** meets all demands with regard to quality control. All SpectroDens devices can also be used for scans and feature a brilliant color display. Optionally data transmission by means of a WLAN module is possible. SpectroDens can be upgraded post-purchase by program upload to higher versions (charged service).

SpectroDens Basic

▪ Automatic density ▪ Density CMYK (with reference measurements) ▪ Dot area ▪ Dot gain ▪ Print contrast ▪ Gray and color balance ▪ Ink trapping ▪ Printing curve ▪ Density spectrum ▪ Spectral density for spot colors ▪ Trend function ExPresso mini ▪ Slur/doubling ▪ Dot area to Yule-Nielsen for printing plates ▪ LED technology provides measurement conditions M0, M1, M2, M3 according to ISO 13655 ▪ Spot Colour Tone Value (SCTV) ▪ Spot Colour Tone Value (SCTV) Printing curve ▪ Average

SpectroDens Advanced

Same functions as SpectroDens Basic and additionally:

▪ CIE L*a*b* ▪ ΔE*a*b* ▪ CIE L*C*h*ab ▪ CIE XYZ ▪ CIE color circle ▪ ΔE*cmc ▪ ΔE*CIE94 ▪ ΔE*CIE2000 ▪ Remission spectrum ▪ InkCheck: Color control of spot colors ▪ Color library with up to 20 color books and a total number of 25.000 reference values ▪ Memory capacity for 3.000 sample values and 300 reference values ▪ G7™

SpectroDens Premium

Same functions as SpectroDens Advanced and additionally:

▪ Ugra/Fogra media wedge evaluation ▪ ISO-Check: Color control according to ISO 12647 ▪ CIE L*u*v* ▪ CIE L*C*h*uv ▪ CIE xyY ▪ DIN Lab99 ▪ Metamery index ▪ Whiteness ▪ Yellowness ▪ Pass/fail tolerance ▪ Opacity ▪ OBA-Check

1.2 Packing list

Contents of delivery

- Measurement device SpectroDens
- Charging console with integrated absolute white standard
- AC adapter with universal plugs for Europe, UK and USA
- This manual with ISO 9000 compliant certificate (pdf on CD)
- Manufacturer certificate
- Micro-USB cable for PC connection
- CD with Windows software TECHKON SpectroConnect

Contents of delivery of SpectroDens

Optional accessories

- Exchangeable apertures
- Print control strips TECHKON TCS (the digital print control strips TECHKON TCS can be downloaded free of charge at www.techkon.com)
- Device upgrades for **Basic**- or **Advanced** models to higher functionality
- Color reference SpectroCheck
- WLAN module

Replacement parts

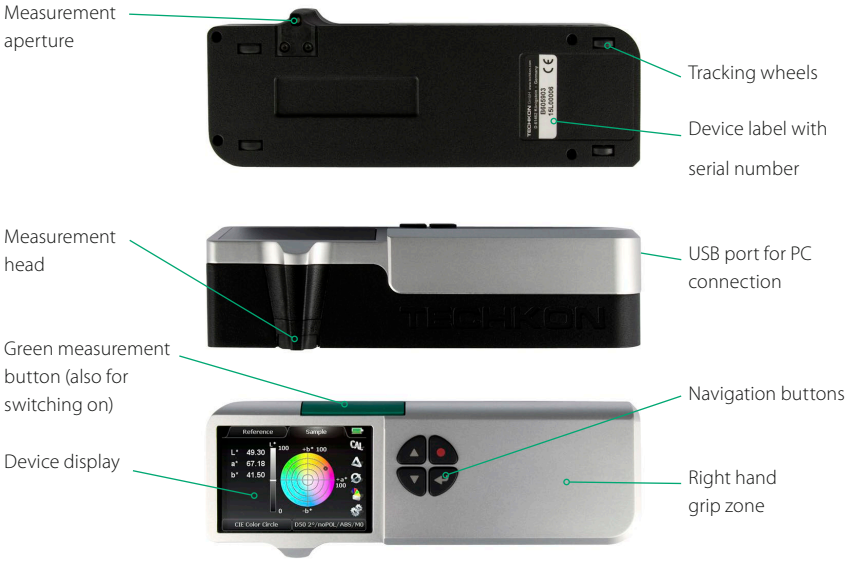
- Charging console with white standard
- AC adapter
- Rechargeable battery

You will find the technical specifications in the appendix of this manual.

1.3 Design of SpectroDens

SpectroDens is a solidly designed measurement device which is very functional and easy to use. It is compact in size; the buttons can be reached with the right index finger when the device is held with the right hand. The LCD display is inclined towards the user, so the display information can be read clearly.

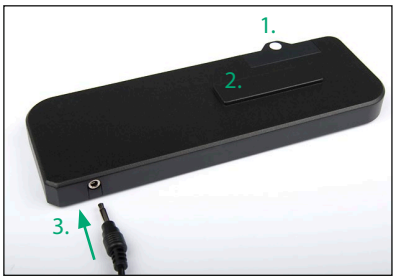
SpectroDens can be easily positioned on the measurement sample.



The device incorporates a high-resolution spectral sensor which analyzes the color spectrum of the measured sample. The spectral data is the base information for calculating densitometric and colorimetric data which is displayed. Densitometric values can be solid density, dot area, dot gain or trapping values. Colorimetric values are typically CIE L*a*b*- or ΔE*-color information.

The USB-connector is for linking with a PC. The USB-cable with a Micro-USB plug, which fits into the connector at the back of the device, is part of the package.

The charging console incorporates an absolute white standard, which should not be touched but should always be kept clean.



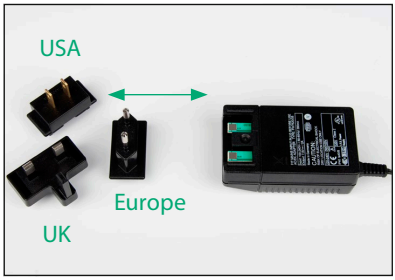
1. Absolute white standard
2. Charging contacts for wireless, inductive battery charging
3. Low voltage connector for the plug of the AC adapter

The above image shows how to connect the plug of the AC adapter with the charging console. The AC adapter can be used universally for 100 – 240 V and 47 – 63 Hz.

There are three adapter plugs for different countries. To change an adapter plug, just unlock the lock, pull the plug off the AC adapter and push in the new one. Make sure it is connected firmly.

Connect the mains plug to the power socket. The socket must be located near the facility and must be easily accessible. Do not use the power plug if the power cord is damaged.

Always use the original TECHKON SpectroDens AC adapter. The use of other power sources is hazardous.



AC adapter with three different mains plugs

Device in the state of charging

1.4 Working with SpectroDens

Switching on and off

SpectroDens is switched on by pressing the green measurement button. It is immediately ready to measure. In this state power consumption is very low.

If no button is pressed within one minute, the device will switch off automatically. Switching it on again with the green measurement button will show on the display the last measurement done. There is no button to turn SpectroDens off.

Charging

The **battery status** is displayed as a battery symbol in the upper right corner of the LC-display, when the unit is turned on.

When the battery turns empty, the battery symbol turns to red. In this state several measurements still can be obtained; but it is time to put it on the charging console to avoid a total discharge and damage of the battery.

Charging starts automatically by placing the device on the charging console. Please keep the charging contacts on the console and under the device always clean. Five seconds after placing the device on the console the display will show an animated battery symbol. When the symbol displays a full battery, the charging is completed and the battery is fully charged.

Up to 10.000 measurements can be carried out with one battery charge. Completely charging an empty battery will take approximately four hours.

SpectroDens has a regulated charging management. This means it will power-charge an empty battery, so the device can be used again after a few minutes. On the other hand, there is no overcharging of full batteries.

Disposal instructions: Please dispose of the battery only in a designated recycling center.

You can park the device on the charging console when not in use. This way it is guaranteed to have always an operational measurement instrument at hand.

How to measure

After switching on SpectroDens, it is instantly ready to measure. Just position the measurement aperture on top of the measurement sample and press shortly with the index finger the green measurement button. Within one second the resulting measurement value will appear on the display of the device.

Please ensure that the device always has a firm stand on a flat surface. There must not be a distance between the measurement head and the sample where light could pass through, because this can influence the measurement. On the bottom of the device there are tracking wheels which allow to drive easily and fast to the measurement point.

The color of the background material underneath the measurement sample can have an influence on the measurement result. Different technical standards describe which backing material to use.

In the printing industry the following procedure is widely used:
- white backing for proofs and
- black backing for prints.

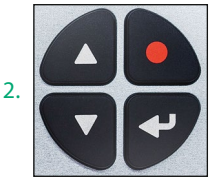
TIP:
By pressing the red Escape button and one of the Arrow buttons simultaneously (see p. 13), SpectroDens switches directly between the densitometric and the colorimetric measurement function that was last used.

Device settings with the display menu

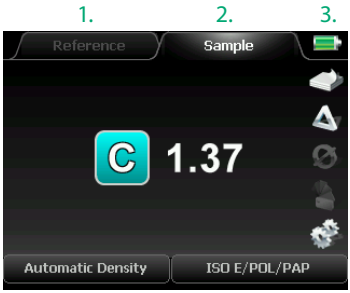
Thanks to the interactive device menu, settings are very easy to adjust. The display is divided logically into a center and a frame. The center displays the measurement results. It is framed by interactive “soft keys” and status information displays. Pressing shortly on one of the arrow buttons will move an active cursor from “soft key” to “soft key” around the frame. An active “soft key” is indicated by a frame.

By keeping an arrow button pressed, the cursor travels from “soft key” to “soft key” at a constant speed until the arrow button is depressed again. By pressing the enter button a function behind a “soft key” is selected and a selectable menu appears. Within such a menu again the navigation is done via the arrow buttons and the selections are made with the enter button. Some menu items or “soft keys” might be shaded in appearance and can not be selected, because they are only active in a higher performance package (Advanced or Premium) of SpectroDens.

Pressing the red, round escape button will always bring you one step back in the menu or will close a menu window. It can be compared to the escape button or undo-function on a PC. It will always bring you back to the measurement mode.



1. Escape button
2. Arrow buttons
3. Enter button



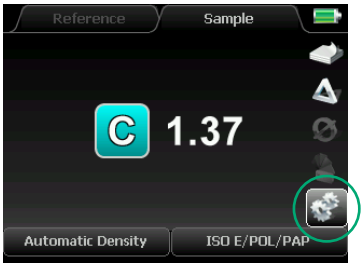
The center of the display shows the current measurements.

1. Reference measurement
2. Sample measurement
3. Battery and charging status
4. Stack of paper icon for paper white calibration;
   CAL icon for absolute white calibration
5. DELTA-mode (= for comparisons)
6. Average function
7. Color library
8. Device settings
9 Measurement conditions
10. Measurement functions

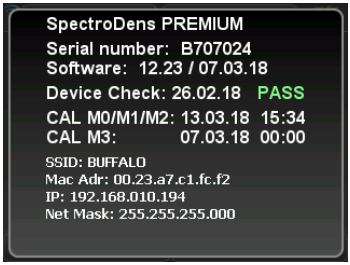
Menu: Device settings

The “soft key” with the cogwheel symbol opens the window for the device settings.

Within this window you can navigate with the arrow buttons and select with the enter button. The red escape button brings you back to the measurement mode.



1. The **SpectroDens INFO** screen informs about the type of device (Basic, Advanced or Premium), the software- and hardware-version as well as the serial number. It also indicates whether a WLAN module is installed and informs about device checks.



2. **Sound** will activate an acoustic signal after each measurement.

3. With activated **Automatic Paper White Calibration** SpectroDens will always perform automatically a paper white calibration when a measurement on a paper white is made.

We recommend to activate this function only when the substrate to be printed is often changed.

Menu: Device settings

4. In the measurement function **Automatic Density**, the device recognizes %-patches, switches automatically to the display of the dot area and shows the calculated values.

The automatic switch to %-values can also be turned off using the device setting **% Measurement Automatic Density** to avoid switching caused by fluctuation. When the function is deactivated, the device will always show the density values and the dot area will not be calculated automatically.

5. SpectroDens can be connected to a **WLAN** network to send information via wireless data transmission to the PC. The WLAN module is available as optional accessory.

6. **Active Functions** allows the user to personalize the device by disabling those of the measurement functions that are not currently needed. So the handling is concentrated on the essentials. If necessary, the inactive measurement functions are simply reactivated.

7. Sets the menu **Language** of the device.

8./9. All measurement values get a **Date**- and **Time**-stamp. This information will be visible when the data is transmitted to the PC software SpectroConnect.

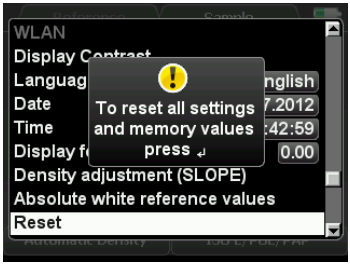
10. For the measurement of densities, the **Display format CMYK** can be selected.
The device can display two or three decimals. The information in the chosen format is carried out in all density modes.

11./12. The functions **Density adjustment (SLOPE)** and **Absolute white reference values** are for the internal device adjustment.
The device is correctly adjusted by the factory and changes of these settings should be made only in special cases (see page 20 f.: Setting of the Density adjustment (SLOPE)).

13. A **Reset** puts the device to factory settings.

Attention! All stored measurement values and a recently made calibration will be deleted and should therefore be saved on the PC if necessary, by using the Windows software SpectroConnect.

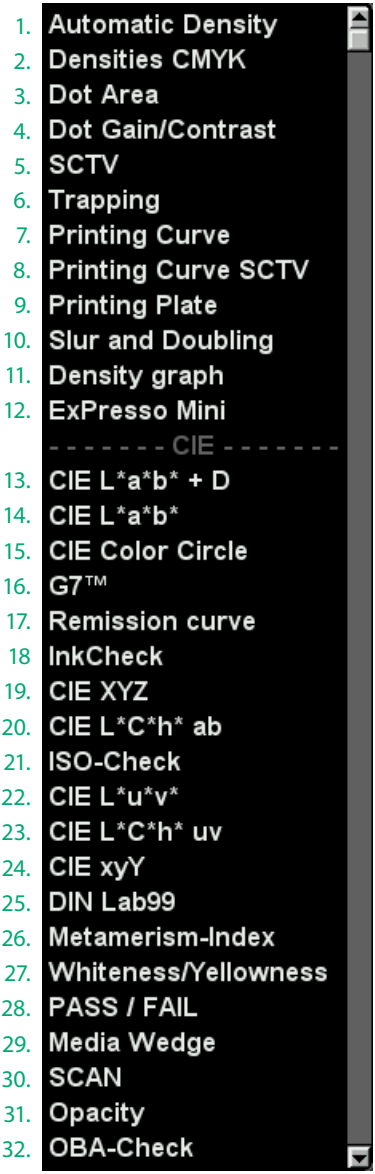
Only the factory-set calibration values are still valid. A reset may be useful, if SpectroDens does not work properly.



14. The information of **Device Voltages** is for device diagnosis by service personnel.

Menu: Measurement functions

When the "soft key" in the left section of the lower bar is activated, a window opens where you can select the measurement functions.
The measurement functions listed below are described in detail in chapter 2.



Index of the measurement functions:

1. Automatic Density p. 33
2. Densities CMYK p. 36
3. Dot Area p. 37
4. Dot Gain/Contrast p. 38
5. SCTV p. 39
6. Trapping p. 40
7. Printing Curve p. 41
8. Printing Curve SCTV p. 42
9. Printing Plate p. 43
10. Slur and Doubling p. 45
11. Density Graph p. 47
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13. CIE L*a*b* + D p. 51
14. CIE L*a*b* p. 51
15. CIE Color Circle p. 53
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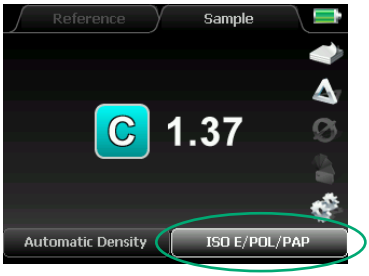
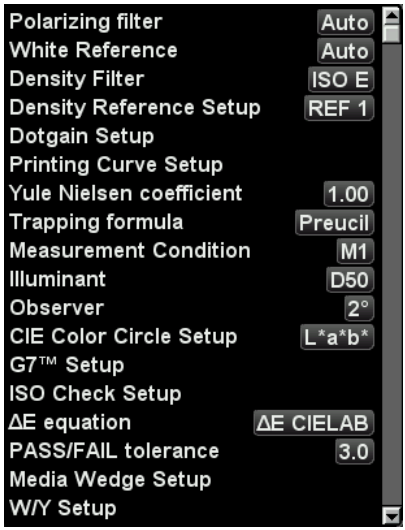
27. Whiteness/Yellowness p. 69
28. PASS/FAIL p. 70
29. Media Wedge p. 71
30. Scan p. 72
31. Opacity p. 74
32. OBA-Check p. 75

Menu: Measurement conditions

When the "soft key" in the right section of the lower bar is activated, a window opens where you can set the measurement conditions which define the parameters of the measurement, e.g. which filter will be applied.
The measurement conditions 4. – 18. are described in detail together with the corresponding measurement functions in chapter 2.





1. The device has an integrated **Polarizing filter**, which can be activated or deactivated by a push of a button. Polarizing filters compensate for measurement differences between glossy and non-glossy surfaces (e.g. freshly printed and dried sheets). The technical standards in Europe recommend the use of such a filter for densitometric measurements. On the other hand, colorimetric measurements (e.g. L*a*b*-measurements) should be taken without a polarizing filter.

By selecting **Auto** from the menu, this will be taken into account and there will be automatically the right filter setting.

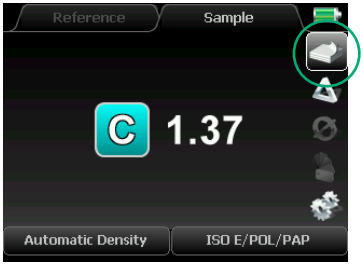
2. There are two possibilities for defining the **White Reference**: Density measurements usually are referred to the white value of the paper printed on. Colorimetric measurements refer to an absolute white reference which is supplied as a ceramic tile on the charging console.

By selecting **Auto** from the menu, there will always be the right setting according to the measurement mode which is selected.

3. Depending on the regional technical standards different **Density Filter** settings are required. SpectroDens as a powerful spectrophotometer has the great advantage that any filter specification can be exactly calculated out of the spectral data. There is no limitation known from conventional filter based densitometers with fixed filters built in.

In Europe filter ISO E is to be selected as the standard filter.

Menu: Calibration



Prior to every series of measurements a calibration should be carried out. After a calibration the device is long term stable, however it is recommended to perform a calibration before starting a new measurement task just to be sure the device is working properly.

For density measurements the calibration is carried out on paper white. This will ensure that the density values are in direct ratio to the ink thickness which is applied on the paper. When there is a change in the paper type, a new calibration has to be done. Only in a few cases density measurements are referenced to an absolute white standard.

A calibration is as easy to carry out as a measurement: Select the "soft key" **Calibration** and place the device with the measurement head on top of a blank area of the paper sheet. The calibration can be started now by pressing either the enter button or the green measurement button.

After one second there will appear a window with the message that the calibration has been done. The device is now ready for measurements. The message window will disappear with the next measurement.

During the calibration process always take care that the instrument is on a flat, stable surface and that the material backing the paper is the same as for the following measurements (white, gray or black). When the paper sample is printed on both sides, it is recommended to use a black backing material in order to avoid mismeasurements due to color shining through the back of the opaque paper.

1.5 Care and maintenance

SpectroDens is a highly-precise optical instrument. It is designed to work in harsh, industrial environments. However, it should be handled with care. Avoid mechanical shocks, heat, dusty or humid environments! Keep it always at a safe place, for example in the carrying case.

Cleaning

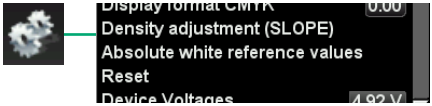
The measurement head with the optical system is sealed against dust and dirt. Take care that the visible, open measurement aperture is always free of dust. You can clean the measurement aperture with oil-free, clean compressed air and a brush used for cleaning photographic equipment. For easy cleaning the aperture can be taken off from the measurement head by unscrewing three screws with a special TORX T6 screwdriver (which is part of the package of a spare aperture set).

Clean the device casing and the display window only with a soft cloth and a non-aggressive plastic cleaner. Never use alcohol or chemically aggressive solvent-based cleaners which can destroy the surfaces. The same procedure is valid for the white standard which is integrated in the charging console. If the white standard should be defective, it has to be replaced completely.

Please do not stick any labels at the bottom of the device. This could lead to faulty measurements, because the direct contact – which is important for the correct optical field of depth – might not be maintained. The battery charge can be affected by a label as well.

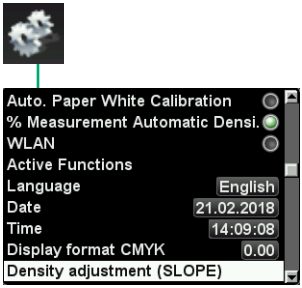
Device adjustment

Should SpectroDens do not work properly, first check, if all instrument settings and measurement conditions are set correctly. Especially the settings of the **Density adjustment (SLOPE)** and the **Absolute white reference values** influence the measurement result.

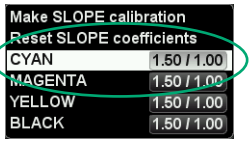


Setting of the Density adjustment (SLOPE)

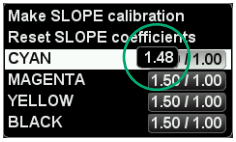
With the **SLOPE correction** values it is possible to adjust SpectroDens to the density values of other devices.



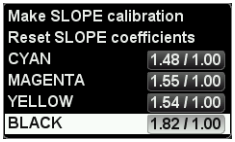
Activate the "soft key" with the cogwheel icon and select the menu item **Density adjustment (SLOPE)**.



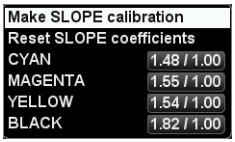
Select the menu item **CYAN**.



Enter the Cyan value, you find on the calibration chart. By pressing the arrow buttons the value can be increased or decreased.



In the same way enter the data given by the calibration chart for Magenta, Yellow and Black.

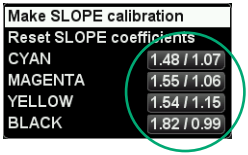


Select the menu item **Make SLOPE calibration**.

Carry out a paper white calibration as described in the device display.

Now measure consecutively the solid patches of Cyan, Magenta, Yellow and Black.

A correct measurement is indicated by a green dot behind the respective color.



The SLOPE correction values are shown.

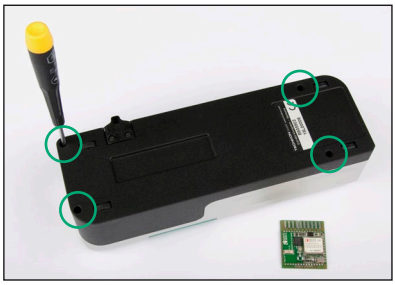
A reset of the SLOPE correction values is done by activating the menu item **Reset SLOPE coefficients**. You reset the device back to its original factory settings.

Setup of the SpectroDens WLAN connection

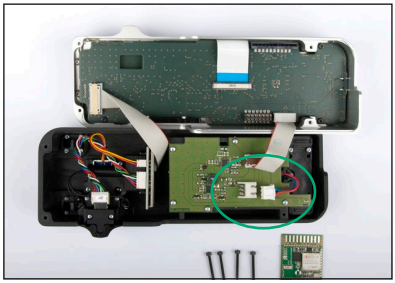
To be able to use the WLAN function in SpectroDens, a WLAN module has to be installed. The module is available as accessory from TECHKON. It is a small electronic board which can be inserted into the instrument easily.

Assembly of the WLAN module

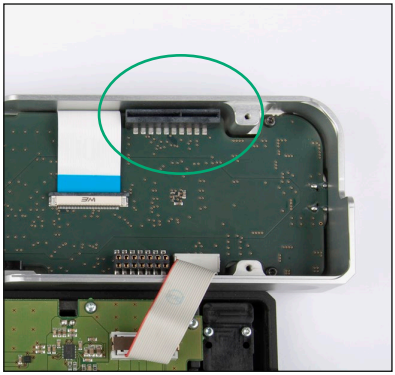
SpectroDens WLAN module



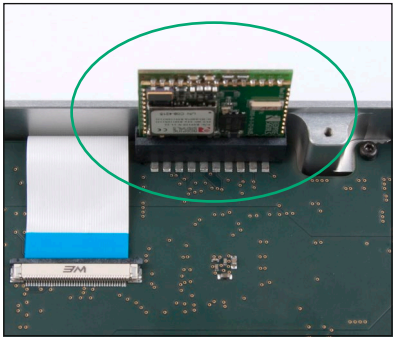
To insert the module the casing has to be opened.



Lift the upper case carefully and put the two casing parts side by side on the table.

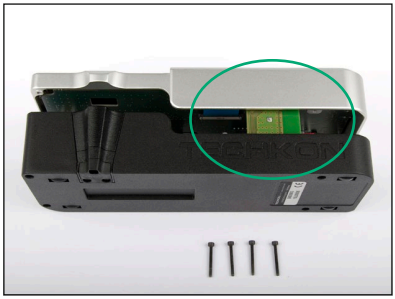


The slot into which the WLAN module has to be inserted is located on the main board.



Due to its reverse battery protection the board cannot be inserted in a wrong way.

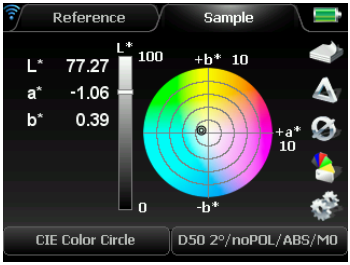
After the WLAN module is inserted in its slot, connect the battery cable again. The plug has to clip into the socket.



When putting the casing together, make sure the WLAN module fits properly in its compartment.

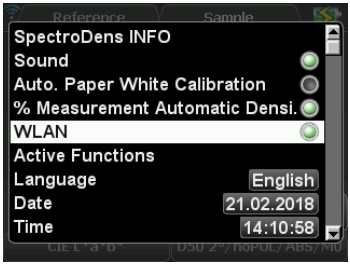
Tighten carefully all four screws on the bottom of the device. Now the instrument is ready to use.

Configuration of the device



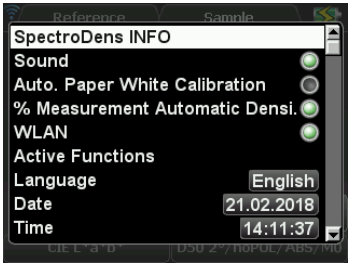
In the upper left corner of the device display the WLAN symbol will be shown when activated.

The color of the symbol depends on the status.
Gray: Searching
Blue: Connection established

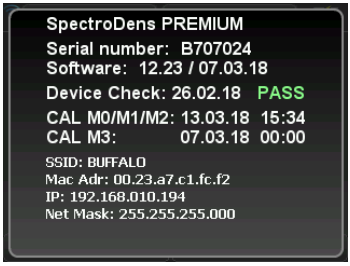


To be able to use the WLAN connection, the function has to be activated in the settings of the instrument.

Notice: To save power, it is recommended to turn off WLAN if not required.

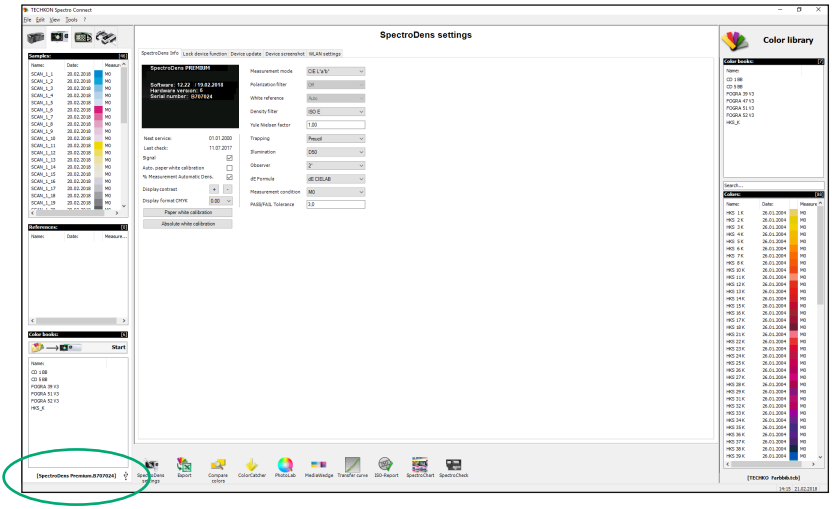


After a successful connection with the software SpectroConnect, the WLAN information can be checked in the **SpectroDens INFO** window.

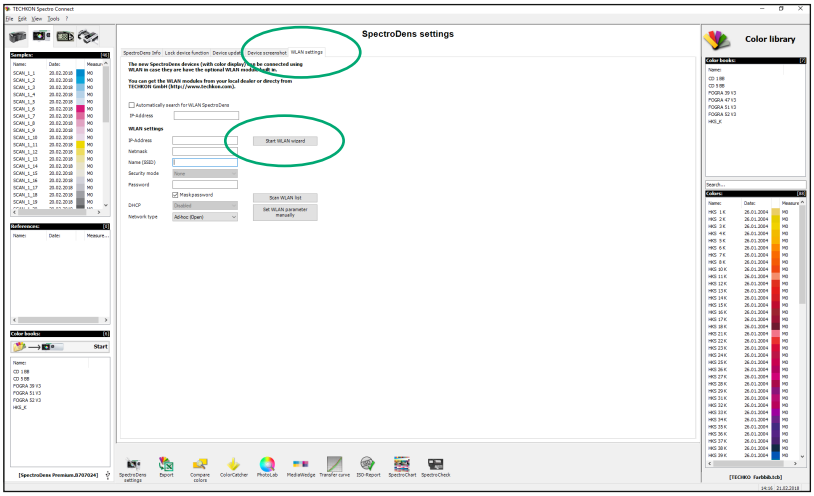


Setup of the WLAN connection

Start the software SpectroConnect, select **SpectroDens settings**, turn on the instrument and connect it with the USB cable to the PC.

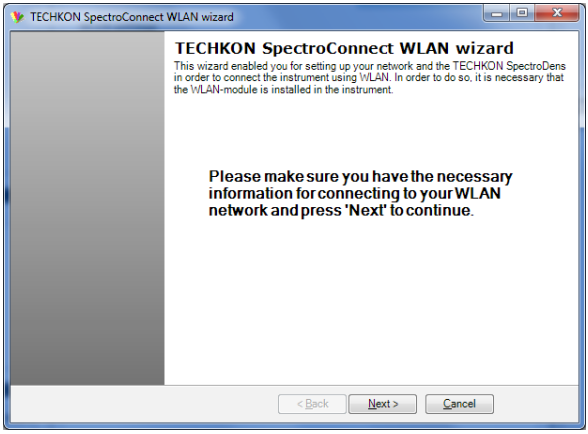


The symbol to the right of the serial number indicates the type of connection; in this example it is an USB connection.



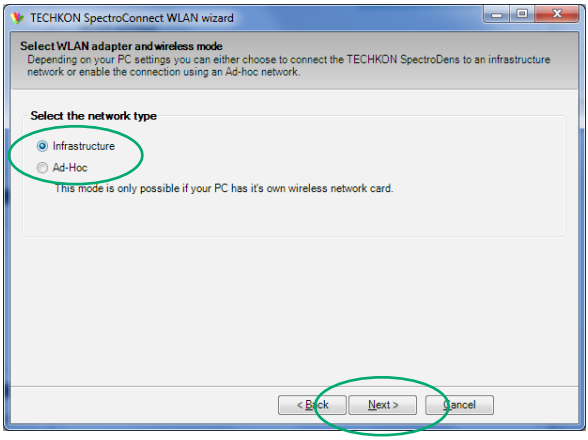
The WLAN settings folder is available after connecting the instrument via USB cable to the PC. To establish a WLAN connection, please **start** the **WLAN wizard**.

The WLAN wizard will guide you trough the setup process.
Make sure you have all information about your WLAN network available.



Two types of WLAN connections are possible: Infrastructure and Ad-Hoc.
Infrastructure should be selected if a WLAN network is already installed in the working area.
Ad-Hoc allows a direct connection to a PC using its WLAN module or any WLAN USB stick.

Infrastructure

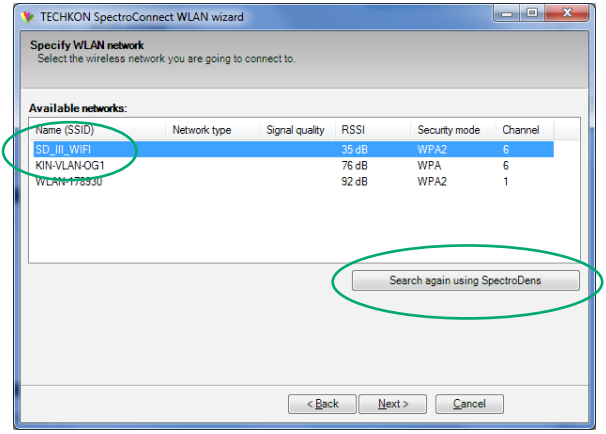


Select **Infrastructure** and click on the **Next** button.

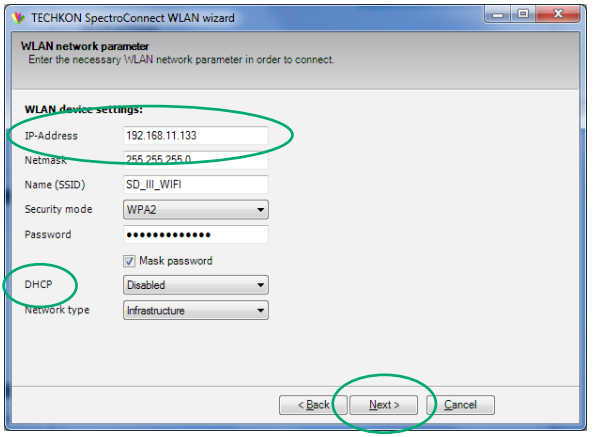
The wizard will show all WLAN networks which are available.

Select your network and click on the **Next** button.

Should your network not be listed you can try again by clicking on **Search again using SpectroDens**.



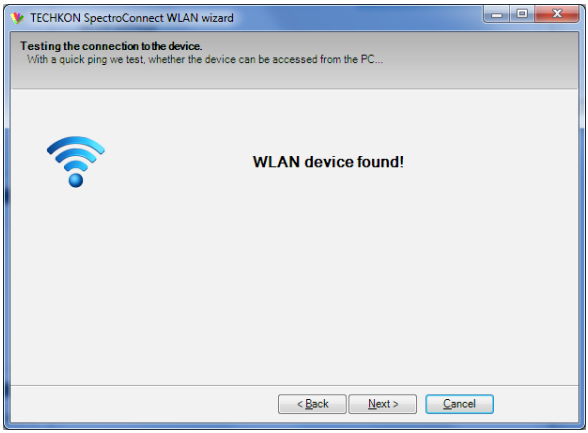
Please enter the IP-Address, the netmask and the password of your WLAN network in order to connect.
You can enable DHCP if your network is supporting this function. Then a free IP-Address will be used automatically.



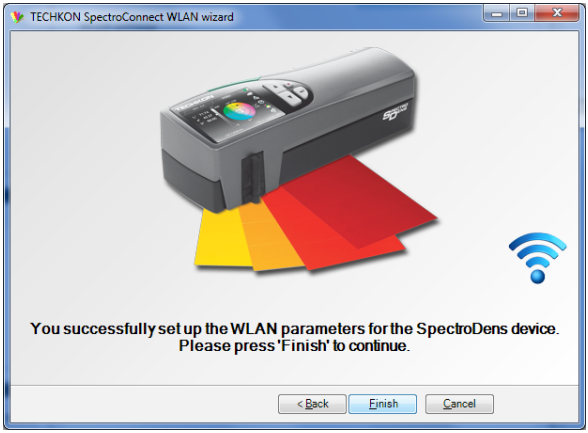
After entering the information, please click on the **Next** button.

SpectroDens is now looking for the WLAN network and if available will establish a connection.

The gray color of the symbol is indicating the search function. Once the WLAN network is found and the connection is established, the color of the symbol will change to blue.

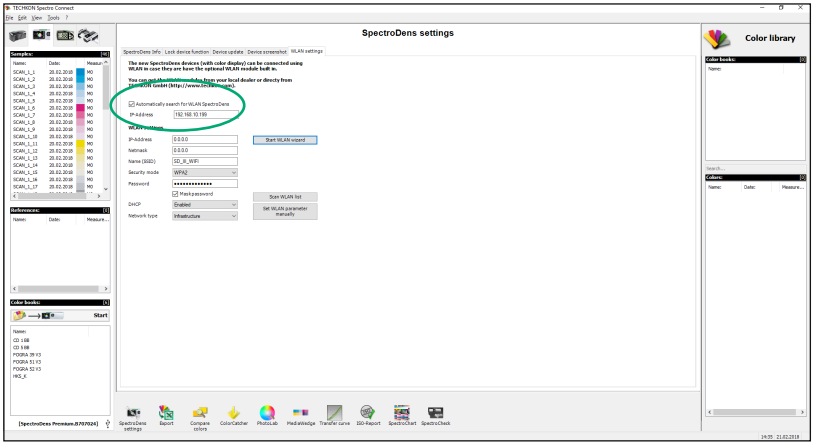


SpectroDens is now connected to the WLAN network and ready to be used wirelessly.

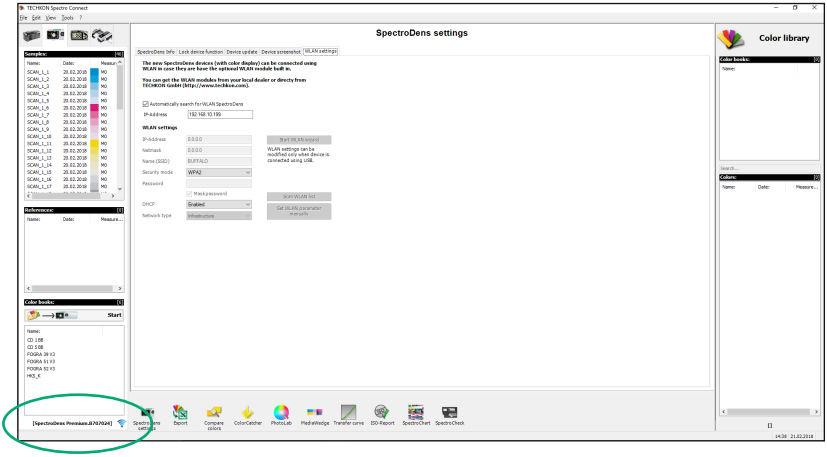


The settings will be applied and shown in the WLAN settings.

By activating the function **Automatically search for WLAN SpectroDens** the connection will be established automatically when used next time.

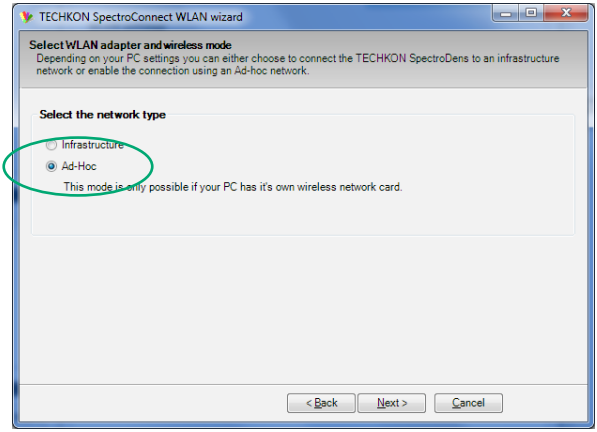


Now you can disconnect the USB cable.
The connection via WLAN will be indicated by the symbol next to the serial number. The blue color of the symbol indicates an active connection.



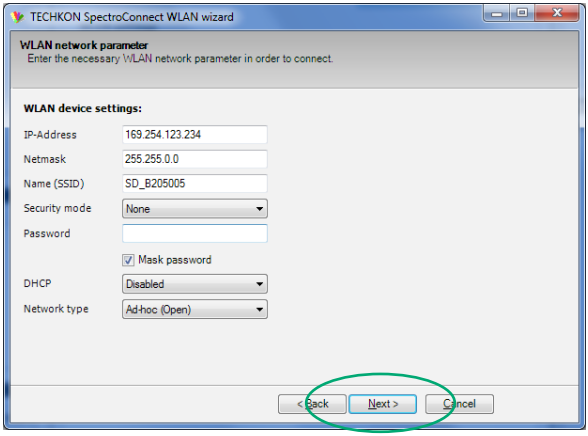
Ad-Hoc connection

To establish an **Ad-Hoc** network select this function during the wizard setup.



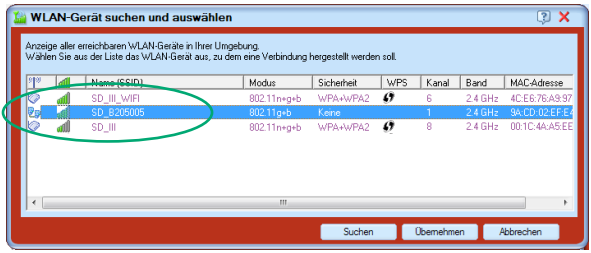
The IP-Address, the netmask and the name (SSID) of the network are predefined in this case and will be shown for your information.

Click on the **Next** button to continue.



Use the software of your WLAN network card or WLAN USB stick to setup the WLAN connection to your device

Select the WLAN network named after the serial number of your device.

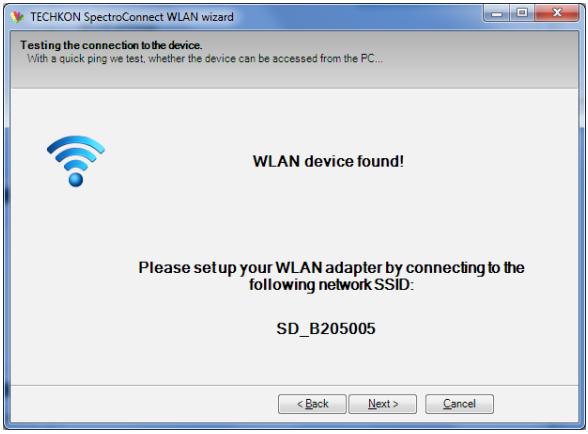


Confirm the settings and check the connection.

Once the connection with your network card or WLAN USB stick is established you have to go back and click on **Repeat search** to connect SpectroConnect to the WLAN network.

A successful connection will be indicated by the blue WLAN symbol.

Continue in the same way as described for the infrastructure network (see p. 29).



Device information and safety instructions

The use of this device in a different way than recommended by TECHKON GmbH can endanger the device safety.

WARNING: This device may not be used in potentially explosive atmospheres.

Please protect your eyes and do not look directly into the optics when the device is switched on.

Operating conditions: Ambient temperature: 10 to 35 °C, max. 30 to 85 % rel. humidity (non-condensing); storage temperature: -20 to 50 °C.

Reset

A device reset sets the device back to factory settings. All calibration data (including SLOPE values), stored measurement values, reference-, target-, and tolerance-values will be deleted.

If the reset procedure in the settings window is not possible, a hardware reset has to be carried out. This is done by pressing the Enter button and the green measurement button simultaneously for 8 seconds.

Warranty

The warranty for TECHKON products is 24 months starting with the date of purchase. Consumable and wearing parts are excluded from this. The invoice is the certificate of warranty. The warranty is invalid if the damage is caused by inadequate use of the device.

Should a TECHKON product do not work according to the specification, please contact us before sending us the device. In most cases we can solve the problem over the phone or via E-mail.

Inspection intervals

TECHKON SpectroDens is maintenance free. We recommend to **validate the complete functionality of the devices in a 24 months time interval** in the TECHKON service center.
Please send the device always securely in the carrying case with complete accessories. For a flat fee the device will be cleaned, checked and re-calibrated. In case a repair or exchange of components should be necessary we will inform you in advance.

Chapter 2

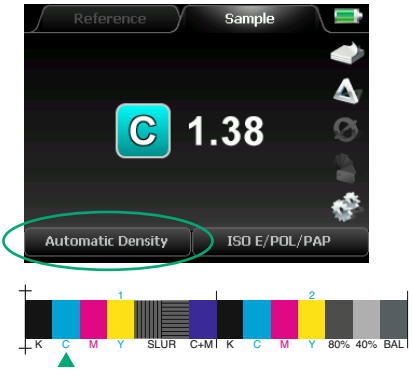
Description of the measurement functions

2.1 Measurement functions of SpectroDens Basic

Automatic Density

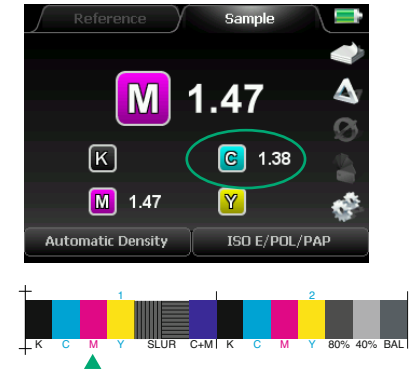
SpectroDens Basic comprises all functions related to density measurement. A very practical feature is the **Automatic Density** mode. By a push of the green measurement button the relevant measurement values are displayed. Depending on the type of measurement patch this can be:

- Solid density D
- Dot area in %
- Gray balance



In this example the measurement has been taken on a Cyan patch. SpectroDens recognizes the type of process color and displays the **solid density** value of Cyan, which is displayed with the "C" symbol. Values for Cyan (C), Magenta (M), Yellow (Y) and Black (K = key color) can be shown.

The density value is a value without a unit. It corresponds to the amount of ink applied on the paper surface. The higher the density value the higher the thickness of the ink layer. The correct density value is dependent on the printing parameters (paper, ink, printing process). Usually, density values are between 1.00 and 2.00.



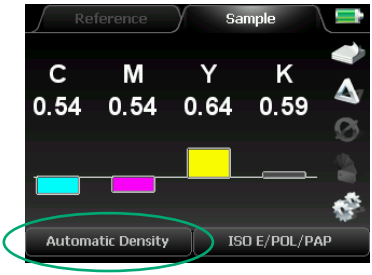
The second measurement has been taken on a Magenta patch. The former Cyan measurement still gets displayed. Measurements of a specific process color will be overwritten as soon as a new measurement of this specific color will be made.

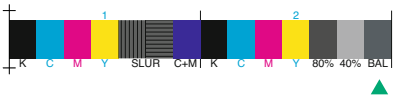
1. Measurement 2. Measurement

For the display of **dot area** (or dot percentage) in %, two measurements have to be made: First the solid density patch and then the %-patch, which is in this example a 80 %-patch. The resulting dot percentage is in this case 91.9 %; the referring **dot gain** is 11.9 %:

91.9 % - 80 % = 11.9 %

Should a solid density value be displayed instead of the desired dot percentage value, then the density measured first was significantly higher than the second one. In this case we recommend to delete the displayed value by pressing the red escape button and to measure again.





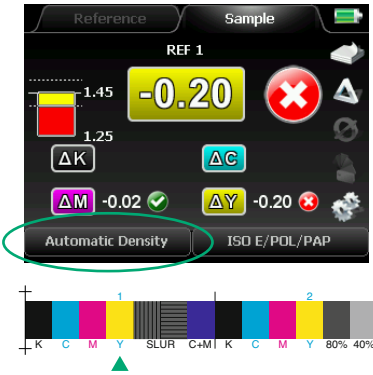
A gray balance patch is composed of different portions of Cyan, Magenta and Yellow. It does not include black ink.

When making a measurement on a **gray balance** patch, the referring density values for all four process colors are shown in a bar graph. The values for Cyan, Magenta and Yellow should be in close range to each other to ensure a neutral gray balance without a color hue.

It is important that the gray balance patch, on which the measurement is taken, comprises the right %-values to achieve a neutral gray when printed correctly. The process standard ISO 12647 for offset print defines the values as:
C = 50 %,
M = 40 % and
Y = 40 %.

The value for Black indicates how dark the gray color is. The higher the value for Black (= K) the darker the sample.

In **DELTA Mode** (= comparison mode) the measured values are compared to reference values. The mode is activated by navigating to the "soft key" with the triangle symbol and selecting it.



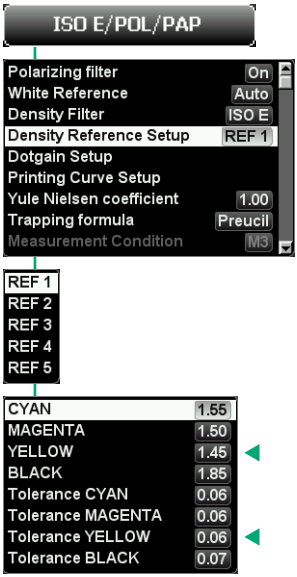
In the example on the left side a Yellow patch was measured.

The measured solid density is:

Y = 1.25

This is 0.20 less than the set reference (= target) density of Y = 1.45.
The measured value is outside the limits of the set tolerance of ± 0.06. Therefore it is marked with a cross symbol in the round icon.

A checkmark symbol would be shown in case of a measurement within the tolerance limits.



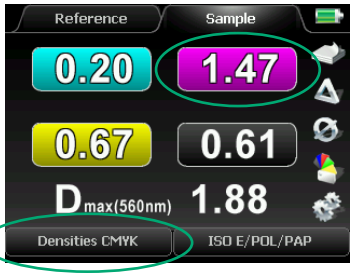
The setting of **reference values** and **tolerances** is done in the menu under the item measurement conditions.

In the **Density Reference Setup** up to five data sets (REF 1 – 5) for reference (= target) densities can be edited. Reference densities recommended for the five defined paper classes are already pre-set.

The tolerances define the lower and upper limits around the reference values. In this example for Yellow:
1.45 + 0.06 = 1.51
1.45 - 0.06 = 1.39

Densities CMYK

In the measurement function **Densities CMYK** all four partial densities for Cyan, Magenta, Yellow and Black are displayed.

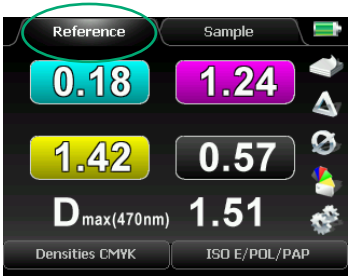


In this example, a solid Magenta patch was measured. The solid density is:

M = 1.47

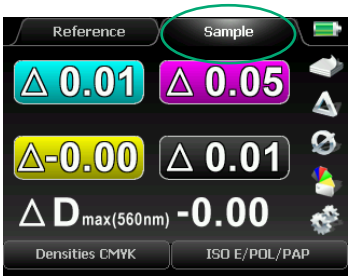
But why are densities for the other colors shown as well ? Shouldn't they have a value of 0 ? No. These are the so-called **partial densities**. No printing ink is 100 % spectrally pure. There will always be partial colors besides the actual main color.

This function also makes comparison between measurements and reference values. In this example the reference value was not taken from the reference memory but was measured just before by putting the "soft key" to **Reference**:



Patch for reference measurement

1. First select via "soft key" **Reference** and make a measurement on a patch which will be the future reference patch.



Patch for sample measurement

2. Now activate via "soft key" **Sample** and make a measurement on a sample patch. A triangle symbol in front of the measurement value indicates that delta values (difference between reference and sample) are shown. Future sample measurements will be compared to the once measured reference values as well.

3. Now activate the **DELTA Mode** by selecting the triangle symbol.

The function **Densities CMYK** is especially suitable for the measurement of multicolored composed CMYK colors, e. g. in logos, to find out the reason for possible color shifts.

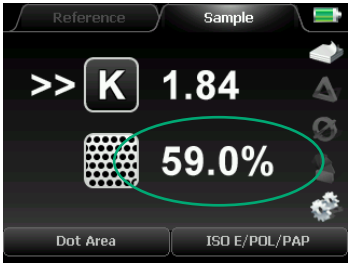
For information about the ΔDmax-function see page 47.

Dot Area

For the function **Dot Area** (= dot percentage) two measurements have to be carried out. First a measurement on a solid patch and then a measurement on a %-patch (= screen patch). The dot area value is calculated with the Murray-Davies formula.

1. First place the measurement head above a solid patch and start the measurement by pressing the green button. The solid density value will be displayed.

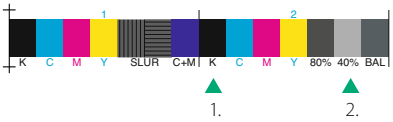
2. Now make a second measurement on a %-patch and the **dot area** in % will be shown.



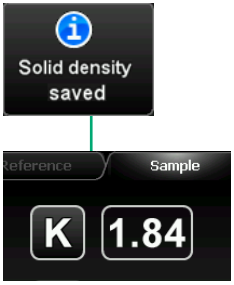
In this case a measurement has been taken on a 40 %-patch.

The resulting dot gain can be easily calculated: 59 % - 40 % = 19 %

The dot gain value gives the information to what degree a point is enlarged (or decreased) during each process step of the reproduction process chain.



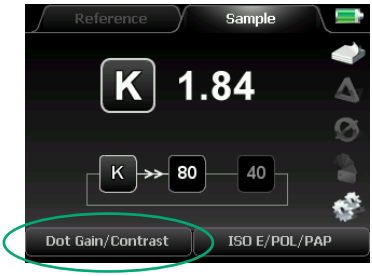
The double arrow on the left side of the device display indicates which measurement has to be done next.



Should several dot area values refer to the same solid density, this value has to be measured only once and can be saved for consecutive %-measurements. After a solid density measurement, just keep the enter button pushed for approximately 3 seconds until the density value is framed. Now an unlimited number of %-measurements can be made. Deactivating is done by keeping the enter button pressed again.

Dot Gain / Contrast

The function **Dot Gain / Contrast** is closely related to the previously described function of dot area. Here also, first a solid density measurement is carried out and then %-measurements follow.



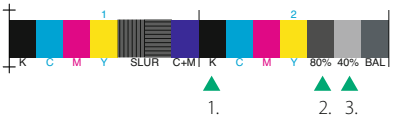
In the lower part of the device display there is shown which patch has to be measured next.

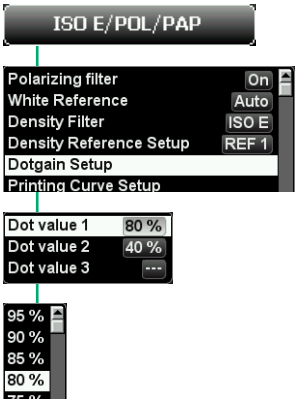
In this case there just has been measured a solid density patch with a density of 1.84.

The double arrow points to the 80 meaning an 80 %-patch has to be measured next.

After the last %-measurement has been done (in this case the 80 %-patch) additionally to the **Dot Gain** value the **Printing Contrast** will be calculated and displayed.

The round escape button will always lead back to the previous step in case a wrong measurement has been made.



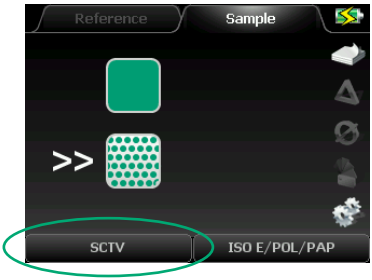


The setting for the %-patches to be measured is done in **Dot Gain Setup**.

Up to three percentage values can be edited. The TECHKON TCS print control strips include two different %-patches; 80 % and 40 %.

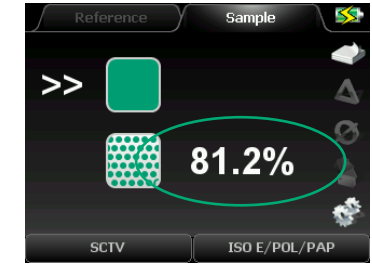
SCTV

The **Spot Colour Tone Value (SCTV)** function, which is defined in ISO 20654:2017, provides a precise colorimetric quality inspection for spot colors. SpectroDens supports SCTV for single tone value measurements and the SCTV printing curve (see page 42).



1. First place the measurement head above a solid patch and start the measurement by pressing the green button. The solid density value will be displayed.

2. Now make a second measurement on a %-patch and the **dot area** in % will be shown.

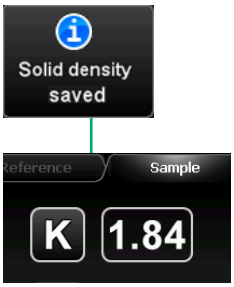


In this case a measurement has been taken on a 80 %-patch.

The resulting dot gain can be easily calculated: 81.2 % - 80 % = 1.2 %

The dot gain value gives the information to what degree a point is enlarged (or decreased) during each process step of the reproduction process chain.

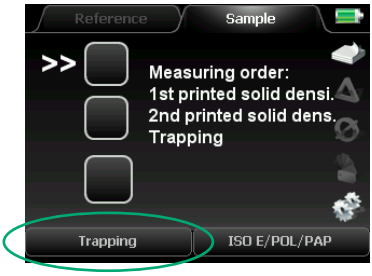
The double arrow on the left side of the device display indicates which measurement has to be done next.

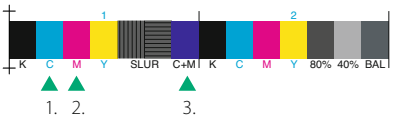


Should several dot area values refer to the same solid density, this value has to be measured only once and can be saved for consecutive %-measurements. After a solid density measurement, just keep the enter button pushed for approximately 3 seconds until the density value is framed. Now an unlimited number of %-measurements can be made. Deactivating is done by keeping the enter button pressed again.

Trapping

With the feature **Trapping** there can be checked, how good two layers of ink which are printed over each other represent the resulting mixed color.





Three measurements are necessary: Two measurements on each of the two separate process colors and finally one measurement on the resulting overprinted patch.

Here in this example first Cyan and second Magenta has been measured. The final measurement is done on a blue patch as the overprint of Cyan and Magenta. The trapping value is 73.2 %. The higher the value the better the overprint of two colors.

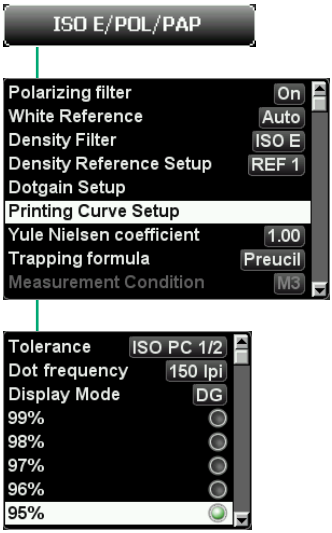
Additionally to the trapping value in % there are the densities for the separate color patches displayed. The densities are always displayed with the filter channel of the second printed ink; in this case Magenta. This explains why the density value for the first printed ink Cyan is so low. SpectroDens will recognize automatically the order of colors as they are printed. Switching the first and second measurement therefore will lead to the same result.

There are no standard values for the trapping measurement. The values which can be obtained depend on the printing process and particularly on the type of ink and paper used. Typical values for standardized print with Paper Class 1 (glossy, coated) are: C+M > 60 %, M+Y > 72 % and C+Y > 85 %.

SpectroDens offers extended trapping calculation according to Professor Ritz and Felix Brunner, which ensure a better comparison between C+M, M+Y and C+Y measurements. An alternative determination how well two separate colors overprint can be checked with a colorimetric function, such as the L*C*h*-feature, where the L*- and C*-values give the information of the printable gamut.

Printing Curve

The measurement function **Printing Curve** displays a complete transfer curve, which describes how screen dots (and tonal values) are transferred during the several process steps of the reproduction process.

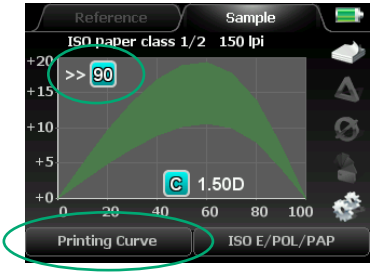


First, make the required settings in the **Printing Curve Setup**:

1. Tolerance range can be set according to standard values (in this case the ISO Paper Class 1/2 was selected)

2. Dot (screen) frequency (only relevant for the display of tolerance values)

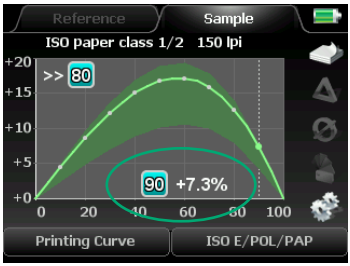
3. Increments of the wedge to be measured, e. g. in 5 % steps



In the first step a 100 %-(solid) patch is measured. SpectroDens recognizes automatically the color and displays the solid density. In this case D = 1.50 for Cyan.

The double arrow in the upper left corner indicates that the next patch to be measured will be a 90 %-patch. Now all other pre-set %-patches can be measured on the measurement wedge.

Step wedges with separation bars (as shown) can be measured by scanning. Just keep the green start-button pressed during the whole scanning procedure.



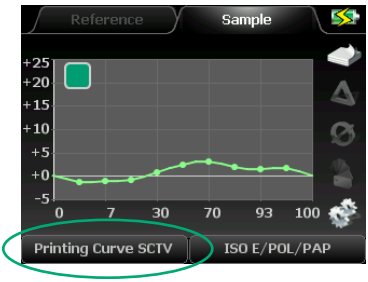
Now the corresponding current dot area is indicated in the lower right section of the display. In this case: + 7.3 % dot gain is displayed at 90 % dot percentage.
The shaded area close to the curve shows the tolerance range. The curve should be within this area.

A wrong measurement can be easily deleted by the red escape button and the device will be ready again to read the patch correctly.

When using the scan function we recommend to use a patch width of 5 x 5 mm (min. 4 x 4 mm) with the standard aperture and a patch width of 4 x 4 mm (min. 3 x 3 mm) with the exchangeable 1,5 mm aperture.

Printing Curve SCTV

The measurement function **Printing Curve SCTV** displays a complete transfer curve of a spot color, which describes how screen dots (and tonal values) are transferred during the several process steps of the reproduction process.



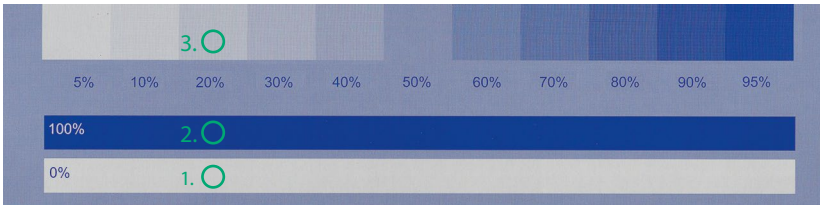
The measurement of the **Printing Curve SCTV** is carried out analogous to the regular **Printing Curve** (described on page 41 f.).

Only the calibration of the device is done on paper as well as on the absolute white standard.

Printing Plate

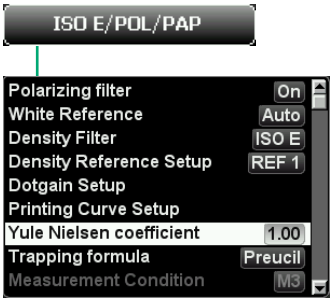
Beside energy and focus of the laser, dot gain is the most important information which has to be checked in plate exposure. Special plate measuring instruments working with video analysis have been developed for this application; for example TECHKON SpectroPlate. Compared to densitometers and colorimeters they offer big advantages. Nevertheless it is basically possible to make measurements with a densitometer on a printing plate. In doing so one should regard the following: Variations in the coating of the printing plates may result in strong influences on the measurements, especially in the crucial range under 10 %. Variations of 0.02 D can cause errors up to 6 %.
The values measured with a densitometer do not correspond with the geometric dot area, due to the fact that the densitometric measurement process is subject to optical influences, which increase the measurement value. Therefore densitometers measure always a higher value than video analysis devices. But the measurement value of the densitometer can be taken as a reference value for the tonal value adjustment.

For the measurement of the zero point (1.), the solid patch (2.) and the screen patch (3.) you should select areas on the printing plate which are located as close as possible to each other.



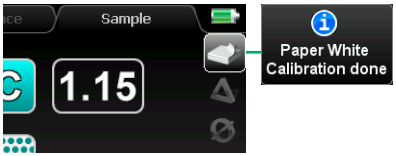
The measurement feature **Printing Plate** measurement allows reading values directly on printing plates. The process is comparable to reading on printed paper.

Before taking a measurement it is important, that the rubber coating is washed off the printing plate, because otherwise light gets lost and the measurement result will be distorted. In addition a correction factor, the so-called Yule-Nielsen factor, can be set according to the material characteristics of the printing plate. Usually the plate manufacturer will furnish the information about the factor for the different plate types.



The setting of the Yule-Nielsen factor is done in the settings window of the measurement conditions. If there is no information about the factor available from the documentation furnished with the plates, we recommend to keep the value in a neutral range at n = 1.00.

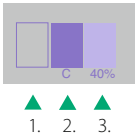
The measurement is performed as known from measuring on printed paper:



1. First, calibrate on a light, not imaged area of the printing plate, as it would be a paper white calibration.

2. Now measure a dark, 100 %-imaged patch. SpectroDens will select one of the four CMYK channels where the contrast signal is highest depending on the color shade of the plate. In this case the Cyan channel gave the highest signal, because the plate is blue/violet.

3. Now the measurement on a %-patch is carried out and displayed. Additional %-measurements can be easily made. It is not necessary to measure the solid density again, because it is already saved, which is indicated by the frame around the value.

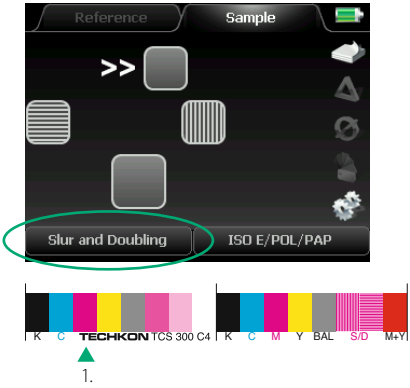


Slur and Doubling

With the measurement function **Slur and Doubling** printing deficiencies, caused by inexact, geometrical transfer of the image from the plate to the paper can by evaluated.

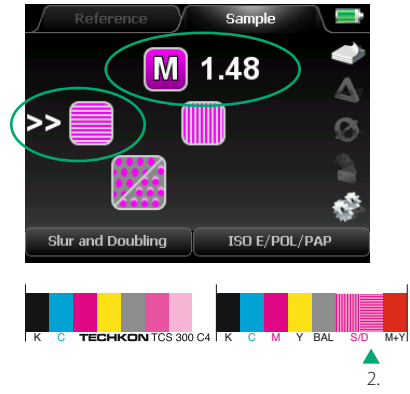
Slurring means that the printed dot deforms from the transfer of the printing plate to the rubber blanket or from the rubber blanket to the paper. The effect of doubling will be present when a printed dot is transferred a second time with less intensity geometrically slightly offset. This ghost image is caused by ink being re-transferred to the rubber blanket which should have stayed completely on the printed paper.

To make the slur and doubling measurement possible, it is necessary to have on the color bar vertical and horizontal lined patches with identical line thickness as it is the case with the print control strip TECHKON TCS.



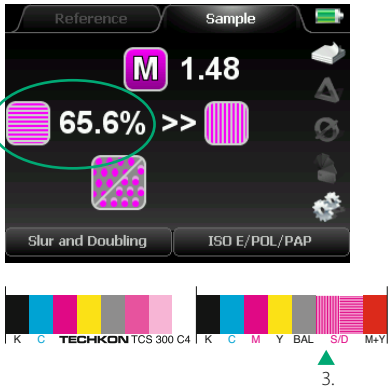
Three measurements have to be carried out:

1. The first measurement on the solid patch; in this case of Magenta.

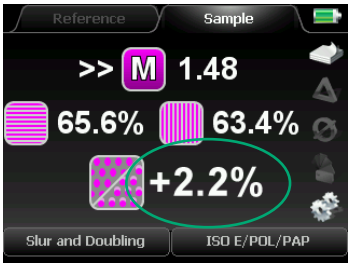


2. The second measurement on the horizontal lined patch of the same process color.

After the measurement of the horizontal lined patch the dot area of the patch is calculated and stored (see the following figure).



3. The third measurement on a vertical lined patch. After the measurement of the vertical lines again the dot area of the patch is calculated and stored (see the following figure).

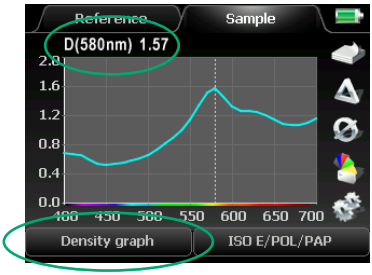


As a result the so-called slur/doubling factor in % is displayed.

0 % is the best achievable factor, meaning the dot transfer is perfect, the horizontal and vertical lines of the measurement patches have the same thickness and that neither slur nor doubling effects are present. Values up around 5 % still are acceptable. %-values higher than 10 % indicate significant geometrical errors in print due to slur or doubling effects. There are no standard values for the maximum allowable %-factor.

Density Graph

The function **Density Graph** enables the exact display of density values for any spot color. Usually the standards define density filter characteristics only for the process colors Cyan, Magenta, Yellow and Black. Thanks to the spectral measurement of SpectroDens, a virtual spectral density characteristic for any spot color can be obtained. The great advantage is that the process control of spot colors can now be as easily achieved as known from the four process colors.

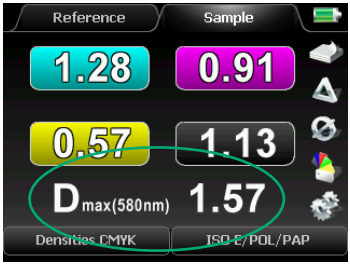


In the following example a measurement has been made on a blue spot color.

The density graph is derived from the remission spectrum and represents the density spectrum for wavelengths from 400 to 700 nm. The peak of the curve displays where the spectral density value has to be taken.

In this case the spectral density for the blue color is D = 1.57 at a peak wavelength of 580 nm.

Only spectral densities relating to the same peak wavelength (Dmax) can be compared.



SpectroDens displays the spectral density automatically as well in the **Densities CMYK** measurement mode.

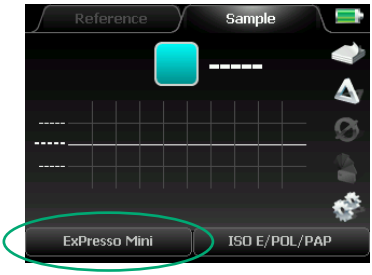
The density values for CMYK show to what extent the spot color can as well be registered by the CMYK-color related standard density filters.

Here in this case, the blue color is close to a Cyan, therefore the density value in the Cyan channel is quite high.

ExPresso Mini

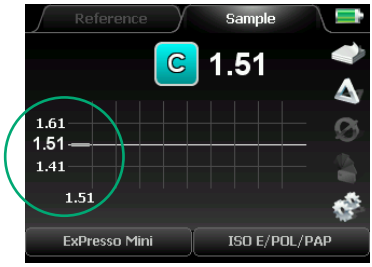
The measurement function **ExPresso Mini** allows the fast control of the printing quality during the printing process. The last ten consecutive measurements of a printing color can be taken on a print control strip of a printed sheet for the ink zone control. In addition ExPresso Mini provides the opportunity to get an overview of the stability of the print run, by measuring the last ten printed sheets.

Advanced functions for the fast and comprehensive control of the printing quality during the printing process features the software TECHKON ExPresso 4.0 in connection with the automatic measurement system TECHKON SpectroDrive.

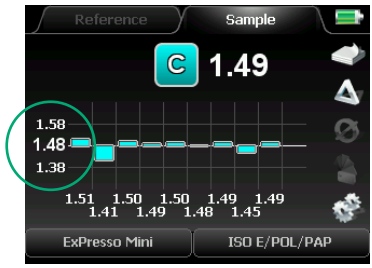


ExPresso Mini can display the last ten measurements per color.

When, after the tenth measurement, the display is filled up with measurement values, the already existing values shift with every new measurement one step to the left, and the first value falls away.



The reference line marks the average value of all measurements.

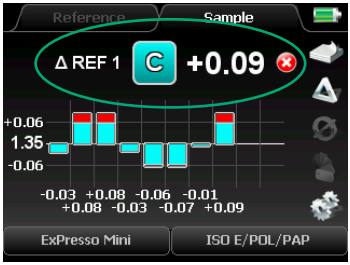


The tolerance area is defined with ± 0.10 density.

The average value is recalculated after every measurement.

In ExPresso Mini the **Delta Mode** can be activated.

Taken measurements will then be compared to reference densities, pre-set in the **Density Reference Setup**.



The reference data and the result will be displayed. The reference line is always the reference value and the corresponding tolerance.

The figure describes the situation inside and outside of the tolerance and the situation outside of the graphic space.

The measurement conditions M0, M1, M2, M3 according to ISO 13655-2017

Many types of paper contain optical brighteners or pigments to improve the visual performance of the paper. The brighteners and pigments are used to make the paper look brighter and whiter. But for the accurate color adjustment they are quite a challenge, because the type of ambient light influences the color perception in most cases to a large extent. To be able to evaluate these printing substrates precisely when measuring, new standards have been defined concerning the measurement conditions.

The following measurement conditions are selectable in the measurement parameter menu of the SpectroDens color measurement device.

Measurement condition M0 is used when the printing substrate contains no or only little optical brighteners. The measurement light corresponds to the standard illumination type A and the UV component of the source, which activates the optical brighteners, is not specified. Almost every color measurement device in the graphic industries works so far with this measurement condition. This measurement condition should also be used, when measurement values have to be compliant to older devices.

Measurement condition M1 was defined to activate optical brighteners with a specified component of UV light, to be able to evaluate the effect of the brighteners more precisely. The measurement light conforms to the illumination type D 50 with a specified UV component.

Measurement condition M2 describes the measurement without UV light. In older devices this measurement condition was realized using an UV-Cut filter. The comparison of the measurement value M1 to M2 shows clearly how strong the effect of optical brighteners is.

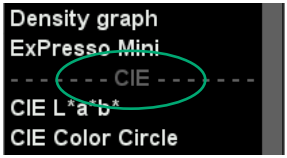
Measurement condition M3 is mainly used for densitometric measurements and only to a less extent for colorimetric measurements. It describes the use of polarization filters which reduce surface reflections to minimize measurement deviations between wet and dry printing sheets.

2.2 Additional functions of SpectroDens Advanced

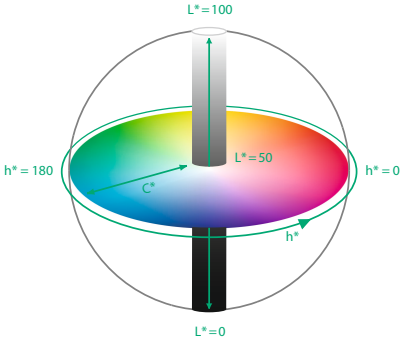
CIE L*a*b* + D and CIE L*a*b*

The previously described measurement functions all were based on densitometry.

Thanks to the spectral performance of SpectroDens it is possible to calculate and display colorimetric values as well. Measurements in **colorimetry** modes have the advantage of an absolute description of color based on characteristic values.



The thematic separation between densitometric and colorimetric functions is displayed by a dotted line within the measurement function window. CIE stands for the international color institute Commission Internationale de l'Eclairage which publishes the standards for colorimetry.

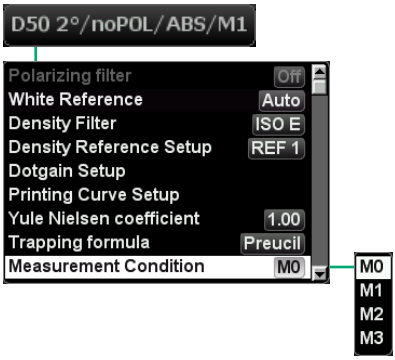


The most popular color system in the printing industry is the CIE L*a*b* color space. Every color is precisely described by three values: The L*-value stands for the luminance and can have values between 0 (a theoretical, absolute Black) and 100 (a theoretical, ideal White). The a*-value describes the color value on the Green/Red-axis (- a*: Green, + a*: Red) and the b*-value the color value on the Blue/Yellow-axis (- b*: Blue, + b*: Yellow).

Colorimetric L*a*b*-measurement on a blue sample.

If instead of the measuring function **CIE L*a*b*** the measuring function **CIE L*a*b* + D** is selected, in addition to the CIE L*a*b* values, the density value of the sample with respect to the prevailing CMYK color will also be displayed.

In colorimetry the white reference is absolute in contrary to densitometry where the white is usually referenced to paper white. Before making colorimetric measurements, an absolute white calibration has to be carried out by placing SpectroDens on the charging console and calibrating on the round, white ceramic standard.



Colorimetric measurements can only be compared when the measurement conditions are the same:

- Polfilter: off
- White reference: Absolute
- Illuminant: D50
- Observer: 2°

When selecting **Auto** in the polarizing filter setting, there will be automatically the polarizing filter inactivated when making colorimetric measurements.

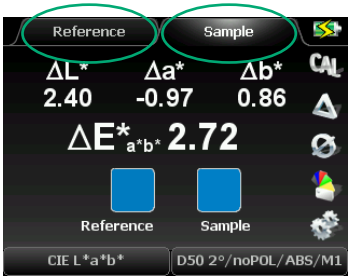
The color distance ΔE* describes how close two different colors match. A value of 0 means that they are identical. ΔE*-color differences in the range of 5 result in considerably perceptible deviations when reference and sample are close together and observed at the same time.

For measurements of the color distance ΔE* of two different colors, activate the **DELTA Mode** first by selecting the "soft key" with the triangle icon.

Color comparison:

Reference Sample

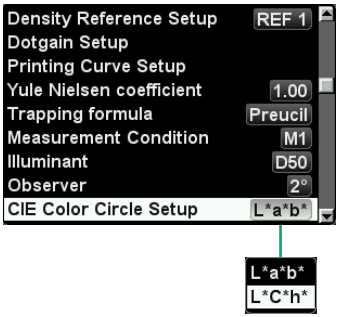
Now two measurements are made:
1. Reference measurement
2. Sample measurement



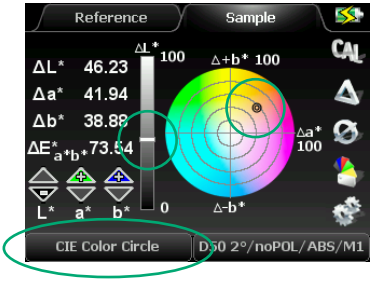
The color distance ΔE* is displayed with two digits. Additionally the components ΔL*, Δa* and Δb* can be seen.

CIE Color Circle

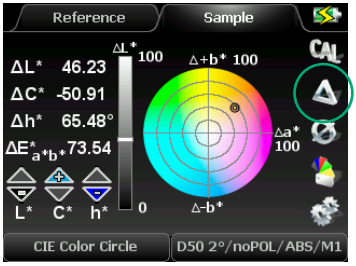
The function **CIE Color Circle** shows the L*a*b*-color values as well. Optionally L*C*h*-values can be displayed. Additionally there is a graphic display and a color is shown as a spot within the color circle.



Select the **CIE Color Circle Setup** function out of the list of measurement conditions. Then choose **L*a*b*** or **L*C*h***.



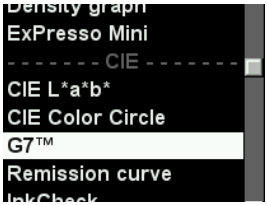
As a result the **CIE Color Circle** feature displays L*a*b*, L*C*h* or L*C*H* values.



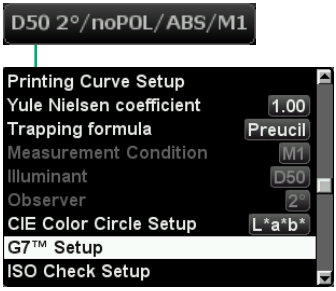
The measurement function **CIE Color Circle**, (as well as **CIE XYZ** and **Remission Curve**), can be operated in absolute mode with DELTA ON or in comparison mode with DELTA OFF.

G7™

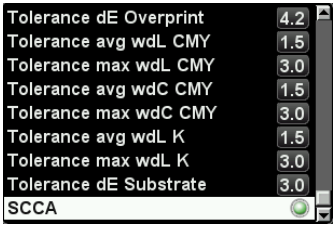
The measurement function **G7™** supports the calibration of presses and proofs according to the method developed by the IDEAlliance (International Digital Enterprise Alliance).



The **G7™** mode can be selected out of the list of measurement functions.

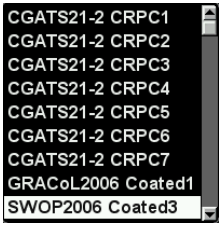


In the pop-up window of the measurement conditions the item **G7™ Setup** can be chosen. Now target values can be edited and printing conditions can be selected.



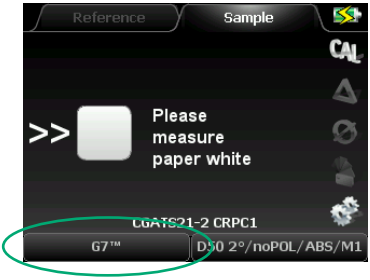
Edit the target values for **SC**, **HR** and **HC** for K and CMY. For **Auto Set a*/b*** use half a*/b* values of measured paper as target value.

You will find a comprehensive description of the **SCCA** function on page 59.



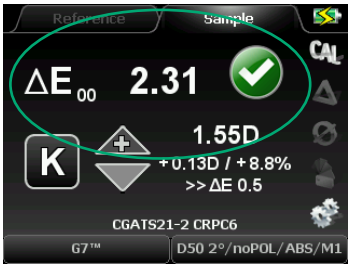
For the comparison to the right ISO reference values the used paper type must be selected.

In order to take correct measurements an absolute white calibration must be performed and will be confirmed in the display when done.

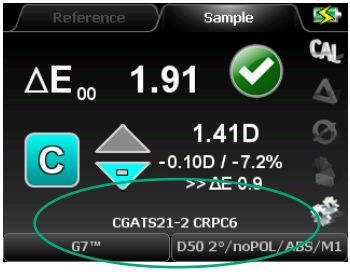


A measurement of the paper white is necessary for correct calculations.

Now the instrument is ready to measure. The selected paper type and backing are indicated in the display.

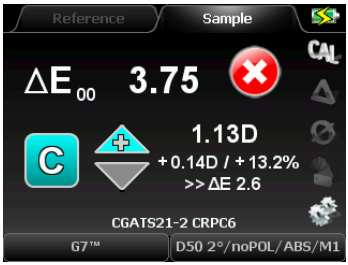


When measuring solid inks the values are compared to the ISO reference values. The ΔE*-value is indicated and the symbol shows if the value is within or out of tolerance.



The recognized color and L*a*b*-value of the measurement are displayed as well.

The selected paper type is always indicated.



The ΔE*-value is calculated as long as the difference is in a reasonable range.

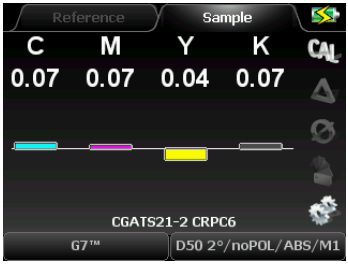
If the difference exceeds a limit, then only the measured density value is displayed without comparison.

This procedure works for all CMYK colors.

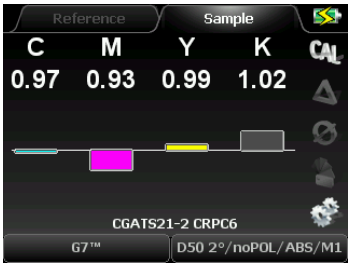
The selected paper type is always indicated.

The color detection works for trapping patches as well. The recognized type of patch is displayed in the printing order of the two colors.

The measured value is compared with the ISO reference and the difference is displayed as ΔE*.



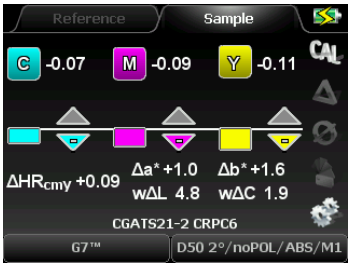
If paper white or **any other** undefined patch is measured then all four densities are displayed simultaneously.



If a gray balance patch is measured all four densities are displayed in a bar chart.

If the value is close to the SC_cmy "neutral density" target it will be displayed with recommended adjustments.

SC stands for "Shadow Contrast".



The HR_cmy is detected as well. The recommended adjustments are shown by the arrows and numbers.

HR stands for "Highlight Range".

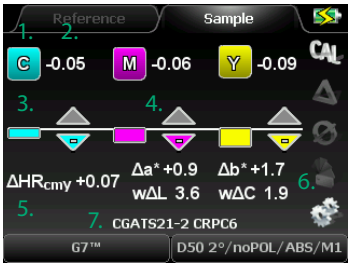
As soon as the value is close to the HC_cmy "neutral density" target it is recognized and displayed.

HC stands for "Highlight Contrast".

The recommended density adjustments for black patches of SC_k, HR_k and HC_k are displayed in the same way.

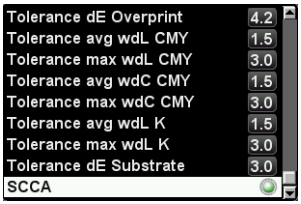
1. Detected color
2. Measured density
3. ΔE*-difference compared to ISO reference
4. Indication in/out tolerance
5. Paper type

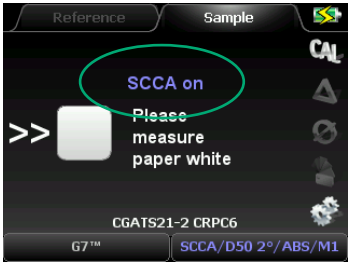
1. Detected color
2. Direction of adjustment
3. Recommended adjustment
4. Detected patch type
5. Measured value
6. Paper type



1. Color
2. Recommended adjustment
3. Adjustment as bar graph
4. Direction of adjustment
5. Detected patch type
6. Differences of HR_cmy and a*b* values compared to target values
7. Paper type

1. Indicator for neutral density ND CMY
2. Direction of adjustment (+/-)
3. Recommended adjustment
4. Detected patch type
5. Measured value
6. Paper type





SCCA reference value correction

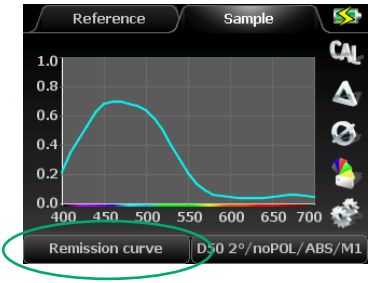
The practice of following print standards like ISO 12647 that pre-defines the combination of ink, paper and target reference colors for commercial printers to use in production is invaluable. But if the paper does not fall within the specified target values the accuracy of the press run is greatly diminished. The more out of spec the paper is the worse the color match will be.

One member of the IDEAlliance Print Properties & Colorimetric Committee, David McDowell, developed a formula that recalculates the data set with new aim points based on the specific paper color being used on press. It is called **SCCA** (Substrate Corrected Colorimetric Aims).

Techkon became aware of this new specification and implemented the ability to measure the paper and based on those measurements and using the **SCCA** formula calculates new aim points right on the instrument. This feature will allow printers to quickly and easily achieve an acceptable color match regardless of the presence of optical brightening agents in their substrates.

Remission Curve

The function **Remission Curve** offers the complete spectral graph.



Remission values are shown in 10 nanometer steps in the spectral range of 400 to 700 nm. A remission value has a range between 0 (no remission, absolute darkness) and 1 (total remission of the emitted light).

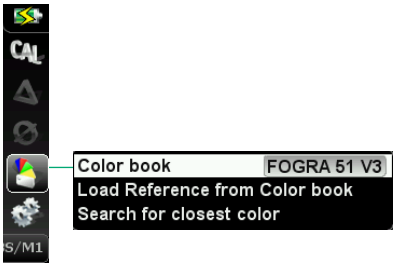
The remission curve is the most exact and total description of a color.

InkCheck

The measurement function **InkCheck** combines in a very easy way the advantages of colorimetry with the familiar densitometry. Thanks to this helpful function, working with the process standard ISO 12647 is simply achieved. The colorimetric deviations are reported and additionally recommendations for amounts of ink supplied in terms of density values are given.

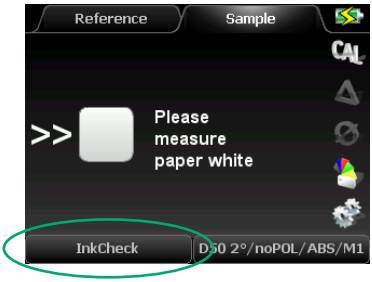
In contrast to the measurement function ISO-Check (see p. 63) the measurement function InkCheck is not only able to check the CMYK print ink, but also spot colors, provided that the appropriate spot colors were chosen as references in advance. In addition to the color books which are included in the contents of delivery, for example the HKS-color books, you can create your own color books for spot colors and use them as a reference.

The recommendations for amounts of ink supplied in terms of density values for spot colors are based on CIE L*a*b* measurements.

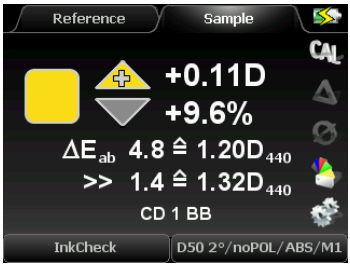


First, a color book which holds the reference color data has to be selected in the reference menu. The reference values for the 5 paper classes defined in the ISO standard are pre-set in the device memory. The data set “Proof” is for measurements on white backing and the data set “Print” for measurements on black backing.

Notice: If they can not be found in the device memory, they can be uploaded with the Windows software SpectroConnect.



First, a calibration on paper white has to be made. Position the device on the paper white and confirm the request to measure the paper white by pressing the green measurement button.



Now the device is ready for measurements on solid color patches. In this case a yellow patch was measured.

Density trend: It is recommended to increase the density by 0.11.

Color deviation: The color distance to the reference is 4.8 ΔE*. After following the density trend it can be as low as approx. 1.4 ΔE*.

A closer color match will be limited because the paper and ink characteristics do not allow to get closer to the reference standard.

Please note that the density values are obtained without the polarizing filter activated and therefore are lower as values obtained with polarizing filter. Please ensure that the right measurement conditions are set.

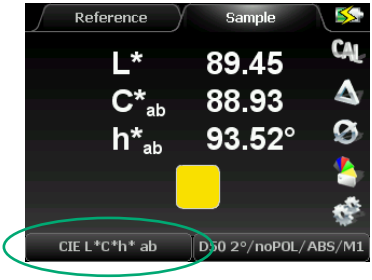
CIE XYZ

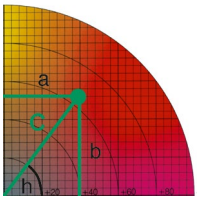
The **CIE XYZ** will display standard color values.

XYZ standard color values are (beside L*a*b*-values) a different way of describing the color values. They are not as practical to use and therefore not as widely used in the printing industry.

CIE L*C*h* ab

The **CIE L*C*h* ab** display is closely related to the CIE L*a*b* display (see p. 51).
Instead of Cartesian coordinates, polar coordinates are used. The value C* stands for Chroma and the angular value h* for hue.



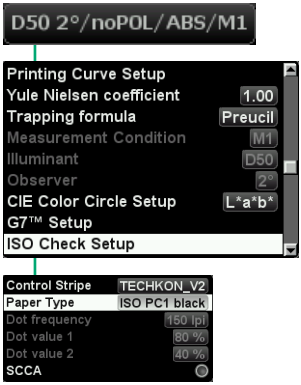


L*C*h*-values are very popular, because they describe colors in a simple way. The further the color is located from the center of the color circle, the more saturated and vivid it appears.

2.3 Additional functions of SpectroDens Premium

ISO-Check

The measurement function **ISO-Check** provides the fast check of a print with regard to the compliance with the ISO standard values ISO 12647-2. The L*a*b*-values, the dot gain and the dot spread of the printing inks CMYK are documented.

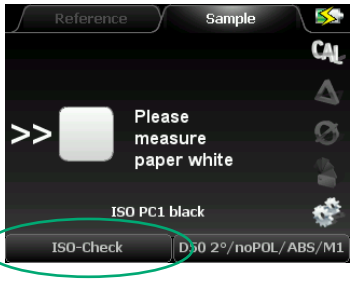


First the **ISO Check Setup** in the menu section of the measurement conditions has to be set.

You can select the control strip and the paper type. If you choose the TECHKON print control strip you can select two dot values additionally.

ISO 12647-2 defines the following standards:

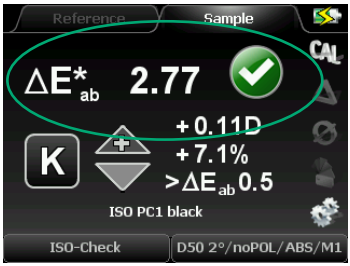
- Dot frequency 150 lpi (60 L/cm)
- Dot values 80 % (75 %) and 40 % (50 %)



In the next step the paper white **must** be measured. When the message for measuring the paper white is displayed, please confirm it by pressing the green measurement button.

When the ΔL*a*b*-values are marked with checkmarks, the paper white is in accordance with the ISO-standards.

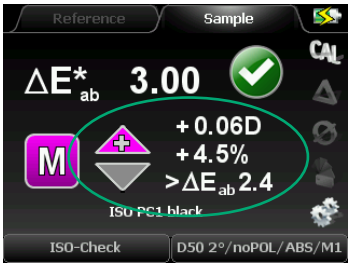
A special ISO/PSO control strip (as shown) can also be measured by scanning. Just keep the green start-button pressed during the whole scanning procedure.



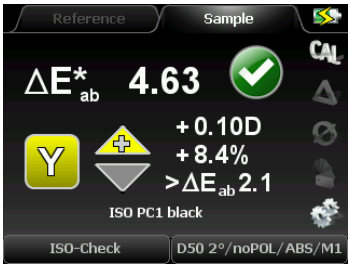
When the solid density is measured, the compliance with the tolerances is checked.

In this example the measurement has been taken on a black solid patch.

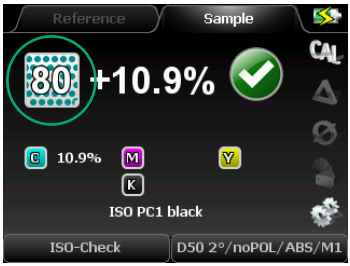
At the same time the recommendation how to adjust the density is calculated.



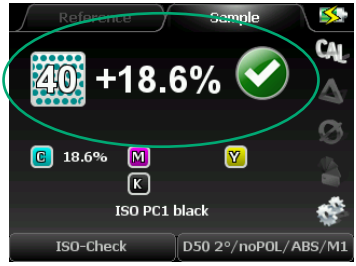
The smallest possible ΔE*-value is calculated in advance.



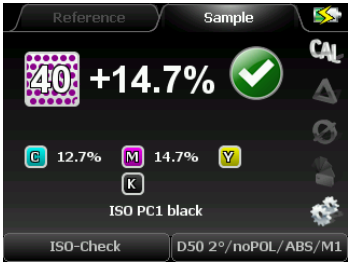
The measurement function ISO-Check recognizes, whether the given tolerances can be achieved with the set of print ink in use. If this is not the case, another set of print ink must be used.

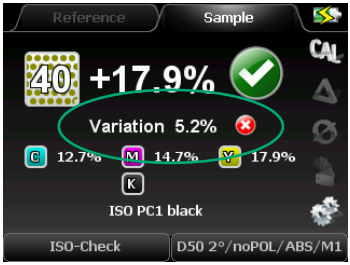


After the measurement of the solid patch, you can measure the %-patch, which you have defined in the setup.



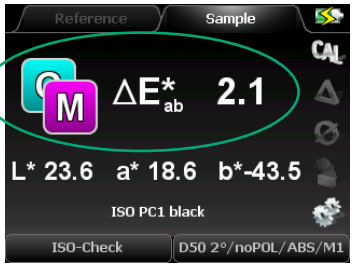
The dot gain is checked in regard to its conformity to the ISO-standards.



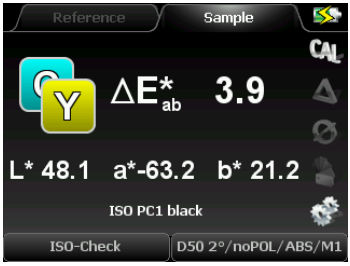


Concerning the midtone the spread will be displayed additionally (CMY).

The deviation of the colors CMY is allowed to reach ± 4 % in the middle-tone of 40 % per ink .
But to avoid that the gray balance is disturbed too much, the spread limits the permitted difference between the highest and the lowest tonal value to 5 %.

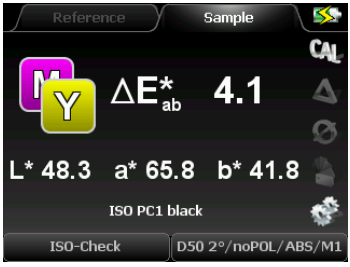


By measuring the trapping only the variation from the reference will be displayed.

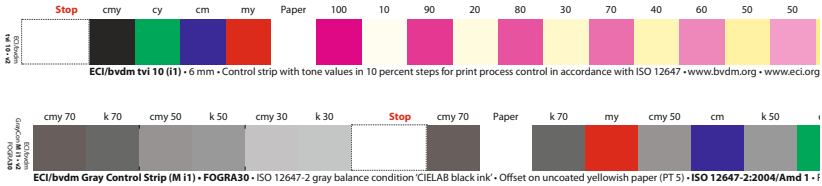


The ISO standards define no tolerances for trapping, only informative reference values are given.

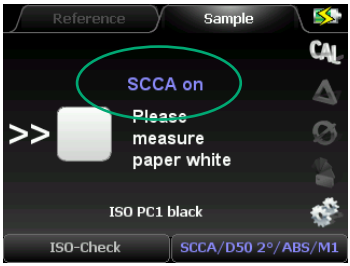
But it is recommended, not to exceed a ΔE*-value of 10 in the secondary colors, which corresponds with the sum of the permitted ΔE*-deviations of the primary colors.

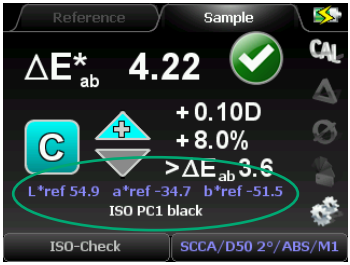


Instead of scanning the TECHKON strip the measurement function ISO-Check can also capture the ECI/bvdm Gray Control Strip version tvi 10 (i1) and (M i1).
When using the scan function we recommend to use a patch width of 5 x 5 mm (min. 4 x 4 mm) with the standard aperture and a patch width of 4 x 4 mm (min. 3 x 3 mm) with the exchangeable 1,5 mm aperture.



ECI Gray Control Strips: ECI/bvdm tvi 10 (i1) and M i1



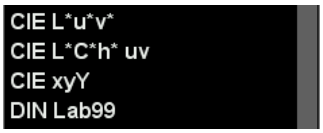


The **ISO-Check** function features the use of the **SCCA** reference value correction (selectable in the **ISO-Check** setup).

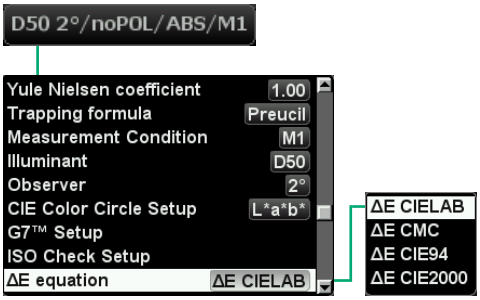
You will find a comprehensive description of the **SCCA** function on page 59.

CIE L*u*v*, CIE L*C*h* uv, CIE xyY and DIN Lab99

The Premium-version of SpectroDens enables the display of additional color spaces, which might be used mainly in industries outside printing:
CIE L*u*v*, **CIE L*C*h* uv**, **CIE xyY** and **DIN Lab99**.



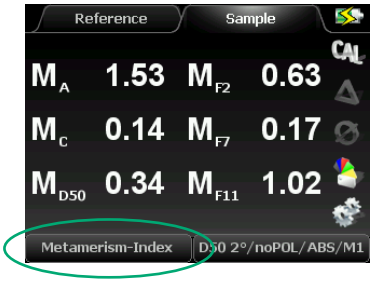
Different formulas for calculating the color distance ΔE* can be selected as well. The Euclidean color distance ΔE* a*b* is the most widely used, although it is criticized that for certain areas in the color space the visual perception of color distances does not match the ΔE* a*b* color distance accordingly.



Metamerism-Index

Metamerism is the visual phenomenon that two colors match under certain light conditions and differ under different light conditions.

Colorimetry offers the possibility to detect this effect by measuring the color distance between the two color samples under two exactly defined light sources. The result of this operation is the **Metamerism-Index**.



For the determination of the **Metamerism-Index** there are two measurements to be made.

1. A reference measurement, which refers to illuminant condition D65.
2. A sample measurement on the sample patch.

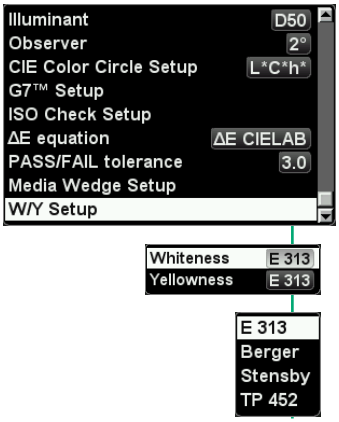
As a result the color distances in ΔE* a*b* for illuminant conditions A, C and D50 are shown.

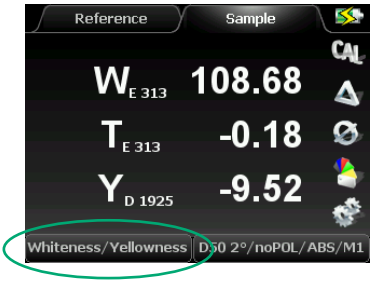
Identical color impression under light condition 1:

Color deviation under light condition 2 caused by metamerism:

Whiteness / Yellowness

Whiteness- and **Yellowness**-indices are quality parameters important for the paper industry. SpectroDens Premium will display the whiteness and yellowness indices according to the following standards: Whiteness: E 313, Berger, Stensby, TP 425 – Yellowness: E 313, D 1925.





Whiteness index:
Values are usually between 90 and 120 for "white" paper. The higher the value, the "whiter" (= the brighter) the paper. Artificial optical brighteners in the paper will lead to high values as well.

Yellowness index:
Positive value: the paper has a yellow cast
Negative value: the paper has a blue cast

Whiteness Berger, Stensby
Paper Whiteness is defined by how closely a surface matches the properties of a perfect reflecting diffuser, i.e. an ideal reflecting surface that neither absorbs nor transmits light, but reflects it at equal intensities in all directions. For the purposes of this standard, the color of such a surface is known as preferred white. Whiteness is closely related to our visual perception of the color of paper. Sometimes these variations in whiteness are subtle. For instance two pieces of paper that fall at different ends of the spectrum on the CIE whiteness index may appear white by themselves however when juxtaposed; their variations are revealed.
The type of light paper is viewed under can affect how it looks to the human eye along with other elements like optical brightening agents (OBAs) used in paper production. For example, when OBAs are applied to a dull sheet of paper it will look brighter in natural light and dull in artificial light. When there are little to no OBAs applied the paper will look brighter in artificial lighting when compared to its counterpart with larger amounts of OBAs.
The Techkon SpectroDens uses the Stensby and Berger formula's for quantifying the whiteness of a print substrate.

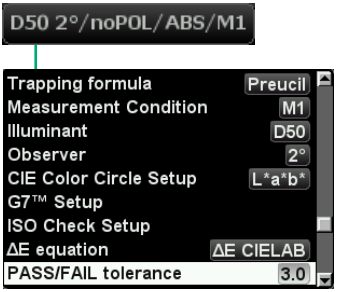
Brightness T (TAPPI 452)
Like whiteness, paper brightness is also a measurement of the amount of light reflected from paper. Unlike whiteness, it is focused on a narrow wavelength of blue light as opposed to all wavelengths in the spectrum. The higher the number on the brightness scale, the more light a particular sheet reflects. Brightness is just one part of the equation when determining the visual aspects of paper. Two sheets with identical brightness can look drastically different because shade and whiteness are not taken into account.

In general, there are two measurement systems that are widely used for determining paper brightness. One (used in North America) is the TAPPI scale. The other (used primarily in other parts of the world) is the ISO system. Some papers can have a rating higher than 100 on the brightness scale. This is due to optical brightening agents present in the paper. When these are applied, the paper can actually reflect more light than is coming from the source. An easy way to remember this is the brighter, the whiter.

Yellowness CIE
Yellowness is the degree that the color of a surface is shifted from preferred white (or colorless) towards yellow.

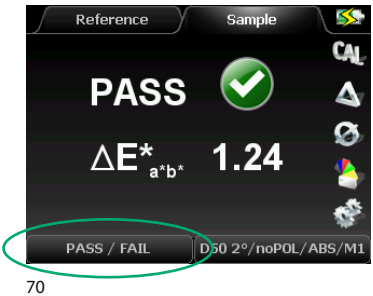
PASS / FAIL

The **PASS / FAIL** function shows at a glance if a measured sample is in or out a set tolerance compared to a reference value.



First, set the allowable limits of the ΔE*-tolerance.

Select in the menu section of the measurement conditions the item **PASS / FAIL tolerance** and edit the desired tolerance value by pressing the arrow buttons.



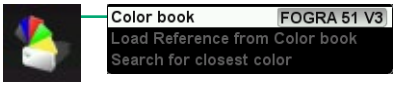
Every sample measurement is compared to the reference.

If the color distance is within the set tolerance (in this case 1.24 < 3.0), PASS will be displayed.

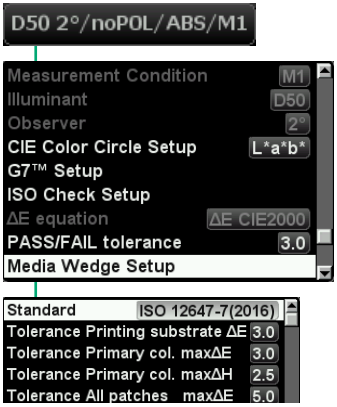
For out of tolerance measurements, accordingly FAIL will be shown accompanied by an acoustic signal of three short beeps.

Media Wedge

The **Ugra / Fogra Media Wedge** CMYK is a control element for checking the color consistency of digital proof systems issued by the printing institute Fogra. This practical function is for measuring and analyzing the patches of this control element.

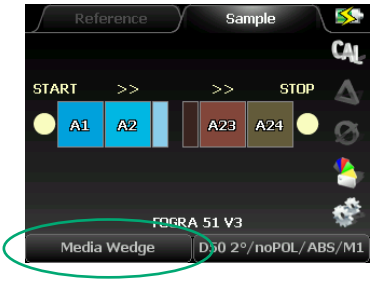


First, a **Color book** has to be selected which contains the Fogra reference data. If not found in the device memory, the color book which is valid for the paper class to be measured, can be uploaded from the Windows software SpectroConnect.



Additional settings have to be made in the **Media Wedge Setup** window. The settings for ΔE*-tolerances are according to Fogra specifications.

By activating **Automatic Measurement** the device will make consecutive measurements automatically with **Measurement Interval** to be set. Starting and stopping a measurement series is done by pressing the green measurement button.



The reading of the media wedge is from left to right and from first to second row. The measurement begins with patch A1, then A2, etc.. Wrong measurements can be corrected by pressing the red escape button and re-measuring.
After all measurements have been performed, the total result will be displayed.

Media Wedges with separation bars can also be measured by scanning. Just keep the green start-button pressed during the whole scanning procedure.

SpectroDens recognizes the version 2 as well as the version 3 of the media wedge by the different number of reference values. The Windows software SpectroConnect allows to analyze the measured data in detail and to print a report (see p. 89 f.).

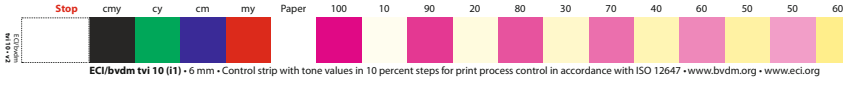
Scan

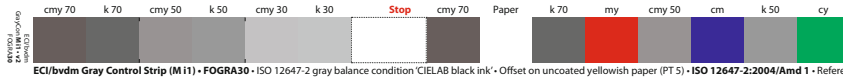
The measurement function **Scan** provides the scanning of individual control elements.

The scanning procedure is very easy. Choose the measurement function **SCAN** in the device menu. Then place the measurement device on the print control strip. Take care that the measurement aperture is positioned on the first measurement patch (= start position) and that the device edge is aligned to the print control strip (see picture).

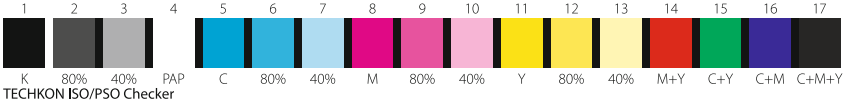
Now press and hold the measurement button, move the device in constant speed along the print control strip until you reach the last patch to be measured (= stop position) and release the measurement button. If the measurement was carried out successfully a short acoustic signal can be heard and all color patches are displayed in the device. Using the SpectroConnect **Export** module measurement data can finally be exported in any other Windows application e. g. Microsoft Excel™, Word™ or other programs which can handle color data, e.g. a RIP calibration software.

Examples of control elements which can be scanned:

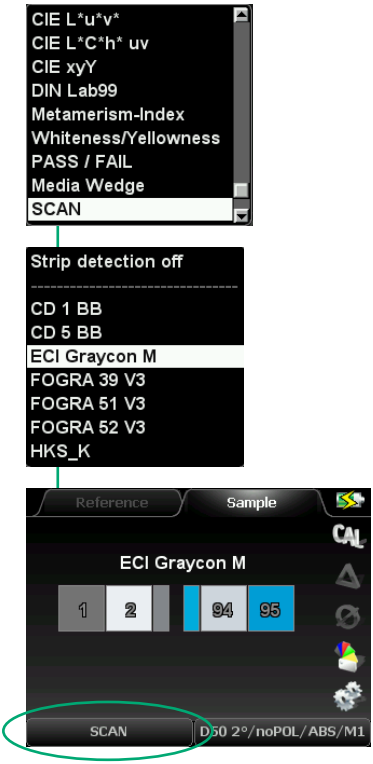




ECI Gray Control Strips: ECI/bvdm tvi 10 (i1) and M i1



TECHKON ISO/PSO Checker



SCAN function with strip detection

The SpectroDens enhanced scanning feature includes:

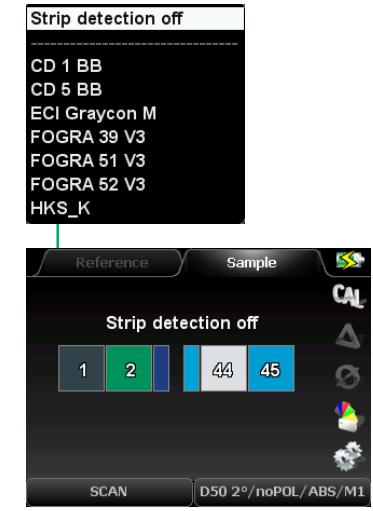
- Define the color bar by uploading a color library to the SpectroDens or by scanning a color bar with the instrument.

- Advanced pattern recognition algorithm's that automatically detect that the color bar being scanned is correct, has the correct number of patches and the colors are in the right sequence.

- If the incorrect number of patches are scanned or the scanning speed is too fast or too slow the SpectroDens will display an error message informing you.

- No guide bar required. The 4 wheels keep straight alignment while scanning.

- Easily export scanned measurement data to other software applications automatically with SpectroConnect software (included with the instrument at no cost).



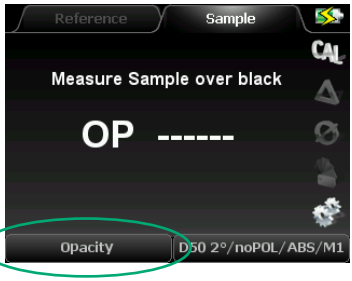
It is possible to scan a sequence of 100 patches.

Just select **Strip detection off** in the SCAN measurement function.

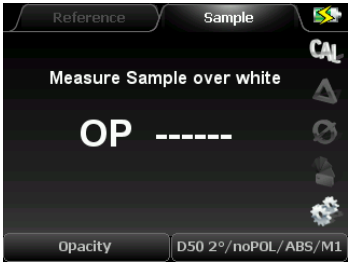
Opacity

Opacity refers to the transparency or opaqueness of paper. Papers with lower opacity tend to let text and images show through more than papers with higher opacity. Opacity is expressed as a percentage in paper. For example, paper with 98 % opacity means that 98 % of light is not allowed to pass through the paper.

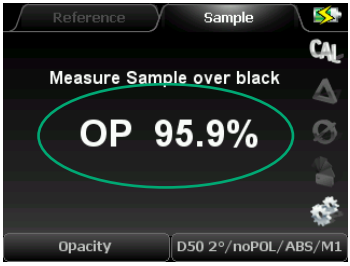
Select the **Opacity** function from the measurement functions menu.



Place the sheet of paper to be a measured on a black backing.



In the next step take a measurement of the same sheet of paper after you have placed it on a stack of white paper (minimum 50 sheets).

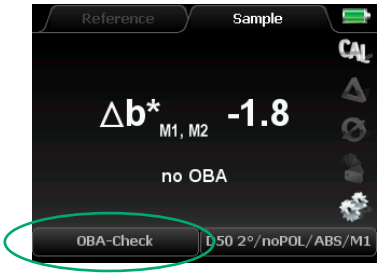


Now the measurement device displays the result of the opacity measurement.

For further measurements just press the enter button and repeat the whole procedure.

OBA-Check

Optical Brightening Agents (= OBAs) which are used more and more in the paper production, have a significant effect not only on how we perceive the paper under different illuminants, but also on the results of the printing process. The measurement function **OBA-Check** provides precise information about the intensity of the optical brightening agents used and the shade of the paper.



Choose the function **OBA-Check** from the menu measurement functions.

First you have to switch to the „soft-key" **CAL** to carry out a calibration on the absolute white standard.

SpectroDens performs the **OBA-Check** applying the measurement conditions M1 and M2, i. e. with and without stimulation through UV light (see p. 50). The difference between the two CIEb*-values leads to the final measurement result.

The amount of optical brightening agents according to ΔB (ISO 15397) and its categorization according to ISO 12647-2:

- (0 ≤ ΔB < 1) no OBA
- (0 ≤ ΔB < 4) OBA faint
- (4 ≤ ΔB < 8) OBA low
- (8 ≤ ΔB < 14) OBA moderate
- (14 ≤ ΔB < 25*) OBA high

The table shows the relation between ΔB- and CIEb*-values for the practical application.

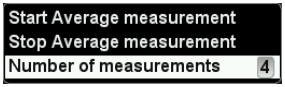
OBA amount	no OBA	faint	low	moderate	high
ΔB	0 to 1	1 to 4	4 to 8	8 to 14	14 to 25*
ΔCIEb*	0	-0,3 to -2,0	-2,0 to -3,7	-3,7 to -6,2	-6,2 to -10,4*

* and beyond

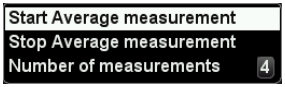
Average values

From a series of single measurements **Average values** can be calculated and displayed. This function may be used when the surface of the sample has no even distribution of color.

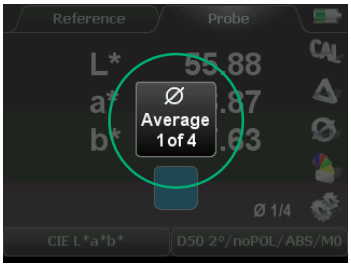
By selecting the "soft key" with the average symbol a pop-up window will appear where **Average measurement** can be set, started and cancelled.



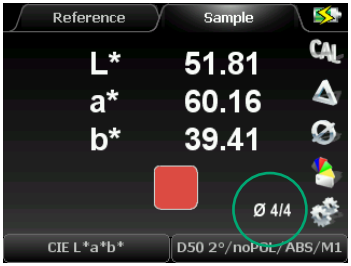
Here the **Number of measurements** to be calculated to one average value is set. The maximum number of single measurements is 9.



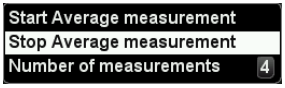
Now activate **Start Average measurement**.



The central window indicates how many single measurements have been taken.



After the last single measurement has been taken, the resulting average value will be displayed and the procedure can start again from the beginning.



Activating the menu item **Stop Average measurement** you quit this measurement mode.

2.4 Storage of measurement values

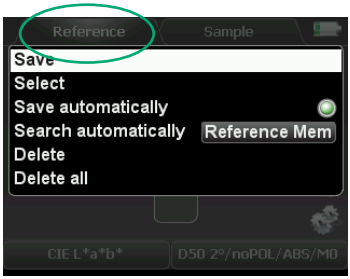
The versions SpectroDens Advanced and Premium include a **Color library**. This is a **digital memory** for storing color values, which can be compared or exchanged with the Windows software SpectroConnect.

There are three different sections where color values can be stored:

- Reference memory for up to 300 reference values
- Sample memory for up to 3000 sample values
- Color book memory for up to 20 color books with a total number of 25000 reference values

Reference memory

To access the **Reference memory**, you have to select **Reference** in the display. A memory capacity for 300 references is at your disposal. After the 300th color value is stored, the message indicates that the memory is full.

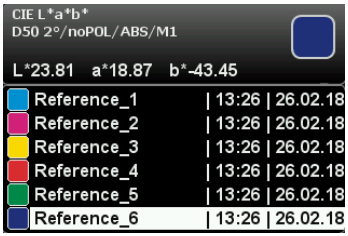


By pressing the enter button with the device in **Reference** mode a pop-up window opens. Within the window navigation is done with the arrow keys.

1.

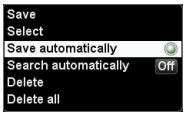
1. With **Save** the last reference measurement is stored.

2.

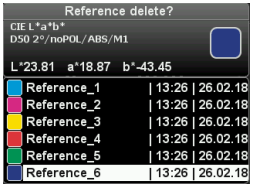


2. **Select** shows a list of stored color values. Within the list, values can be selected and displayed by using the arrow- and enter-buttons.

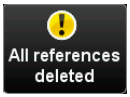
3.



5.



6.



3. By activating **Save automatically** all future reference measurements will be stored automatically.

4. By activating **Search automatically Reference Mem** the closest matching reference color when making a sample measurement will be displayed. This feature is active in the sample mode with DELTA Mode on.

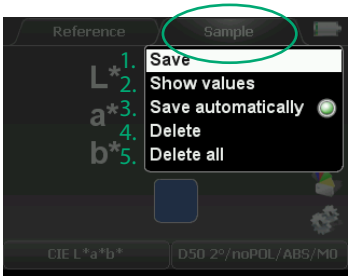
5. **Delete** will remove selected color values from the list.

6. **Delete all** will remove all values in the list.

Sample memory

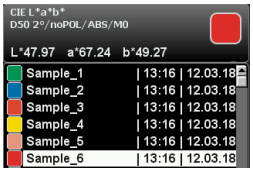
The **Sample memory** has almost the same functions as the reference memory. Here up to 3000 sample color values can be stored. However the sample memory is a ring memory, i.e. maximum 3000 samples can be stored before the first sample will be overwritten by a new measurement.

The pop-up window opens by pressing the enter button with the device in **Sample** mode.



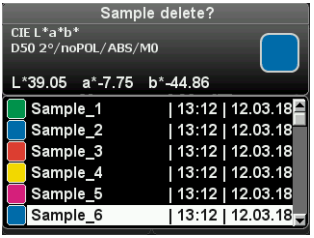
1.

2.



3.

4.

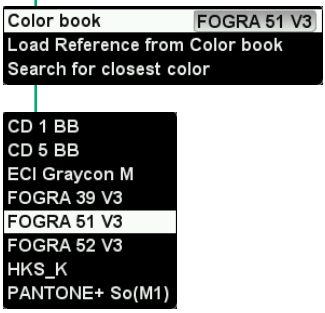


5.

Color book memory

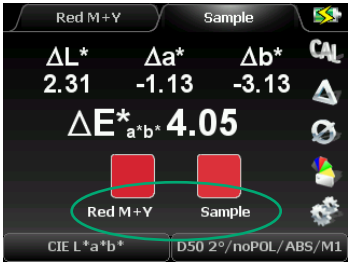
Additionally to storing reference and sample color values, complete **Color books** can be managed. A color book is a folder which can hold up to 25000 single color values. An example are the HKS® spot color collections which are included in SpectroDens with the software package SpectroConnect. New color books can easily be edited and transferred into the device. Up to 20 color books can be stored in SpectroDens; there is no limitation of storing color books in the Windows software SpectroConnect.

The "soft key" with the color book symbol opens the window for the settings of the color book memory.



1. Here a **Color book** is selected from the list.

2. With **Load Reference from Color book** a single color value from a color book is loaded into the reference memory.



3. **Search for closest color** determines the closest color match in a color book compared to a sample value.

Chapter 3

How to use the Windows software SpectroConnect

3.1 Software description

The supplied Windows software **TECHKON SpectroConnect** allows to transfer measurement data to the PC and to make device specific settings via the PC. The measurement values can be displayed on the computer monitor. Color information is displayed, colors can be compared and data can be exported into other software applications, e. g. Microsoft Excel™.

When using **SpectroDens Basic** the device has to be connected via the USB cable to the PC when working with SpectroConnect. When performing a measurement with the device, the value will be displayed immediately on the computer screen.

The models **SpectroDens Advanced** and **Premium** have an internal memory for up to 300 reference values, 3000 sample values and 20 "digital" color books, which can contain up to 25000 color values. When connecting the device to the PC via the USB cable, all stored values will be uploaded to the software and displayed on the computer screen. Of course, the device can be operated as usual when connected to the PC.

The software requires a computer with a free USB port and a completely installed Microsoft Windows 7, 8 or 10 operating system.

3.2 Installation

It is important, to carry out the following steps in the right order, to make sure that the USB device driver will be installed properly.

1. Make sure that the device is **NOT** connected to the PC.
   Insert the supplied SpectroConnect CD into the CD drive of the running computer.

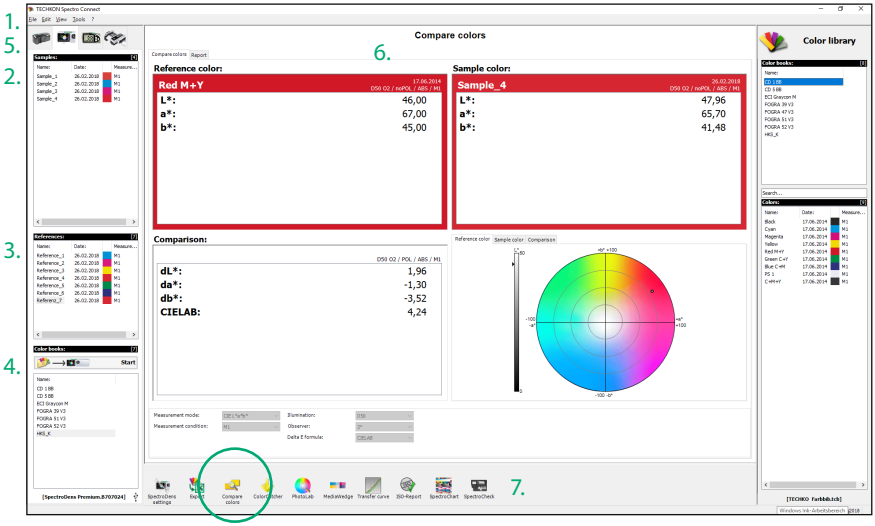
2. The installation routine will start automatically.
   Follow the steps of the installation, until it is completed.

3. Now, after the installation was finished successfully you can connect the device with the Micro-USB cable to the computer.

3.3 Overview / Software module: Compare colors

Software symbol SpectroConnect

The application will be installed in the Windows program files section in the folder **TECHKON GmbH / TECHKON SpectroConnect**. After starting the program the software module **Compare Colors** will appear. Like all the SpectroConnect software modules it is divided into four logical segments: On the left side you see the memory content of the connected device, in the center the active program module, on the right side the color library which is stored on the PC and in the section at the bottom a bar which lists all available and selectable program modules.



1. The menu bar includes functions known from standard Windows applications. They comprise: New, Open, Save, Print and Quit.

2. The window **Samples** shows samples which are stored in the device. Only in SpectroDens Advanced and Premium available.

3. The window **References** shows stored references. Only in SpectroDens Advanced and Premium available.

4. The window **Color books** displays the color books which are stored in the color library of the device. Per Drag and Drop you can copy references and complete color books from here.

5. In this section, the appropriate measurement device can be selected.

6. Window of the active program module

7. This bar shows the list of available program modules. They can be selected from this bar directly via mouse click and the application will appear in the middle of the display.

After launching SpectroConnect it is pre-set to display the module **Compare colors**.

3.4 Software module: SpectroDens settings

In this module device specific settings can be made.

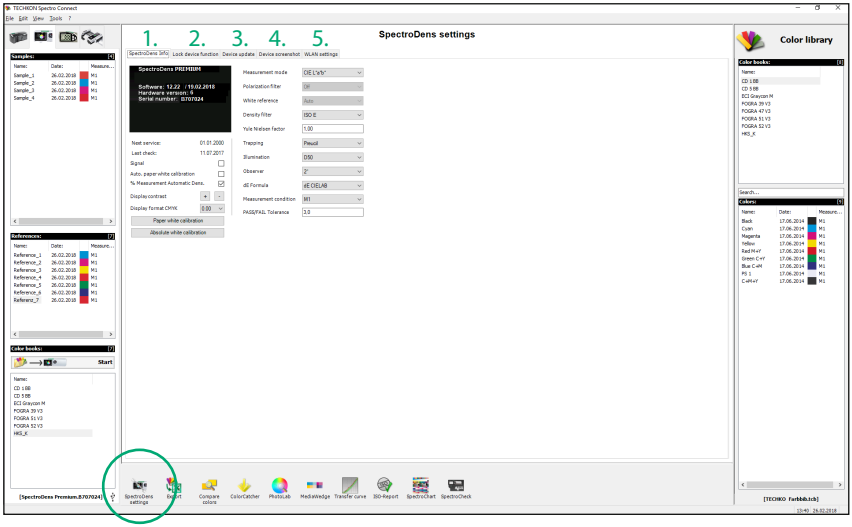
1. **SpectroDens Info:** All settings, which can be made at the device can also be made with this software feature.

2. **Lock device functions:** Device functions can be locked and unlocked with this feature. Locked functions will appear in shaded gray on the LCD display.

3. **Device update:** New device software can be uploaded into the device. There are two different types of files to upload:
   - Device update: loads the new version of device software
   - Device upgrade: upgrades to SpectroDens Advanced or Premium (must be purchased)

4. **Device screenshot:** This shows the device display on the computer screen. All measurement buttons can be remotely operated by the mouse pointer. The screenshot can be saved. This is a very useful feature for product trainings.

5. **WLAN settings:** Window for the configuration of the WLAN connection (see p. 22 ff.)

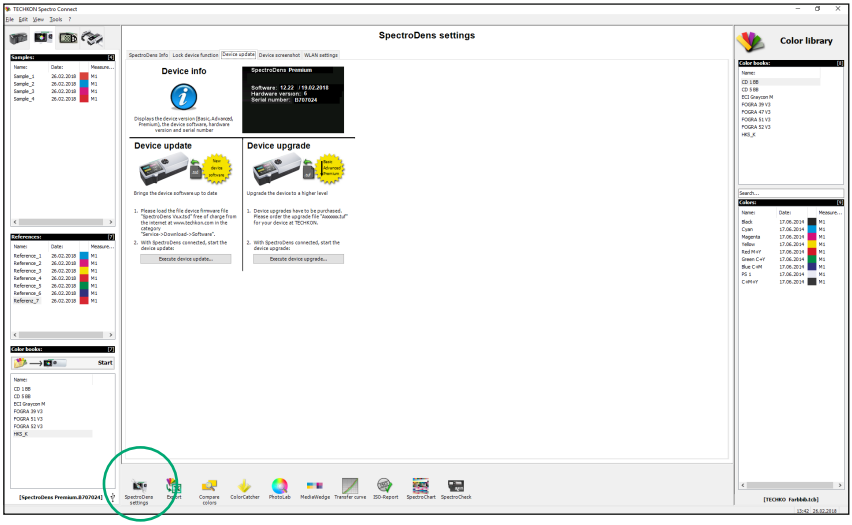


3.5 Device update and device upgrade

By the application of this module SpectroDens can be loaded with a new internal firmware which is selected by **Device update** or SpectroDens can be expanded in functionality by **Device upgrade**.

The SpectroDens **Basic** model can be extended via data upload to **Advanced**- or **Premium**- functionality without the need to send the instrument to the TECHKON service center. Of course, the same procedure applies for upgrades from **Advanced** to **Premium**.

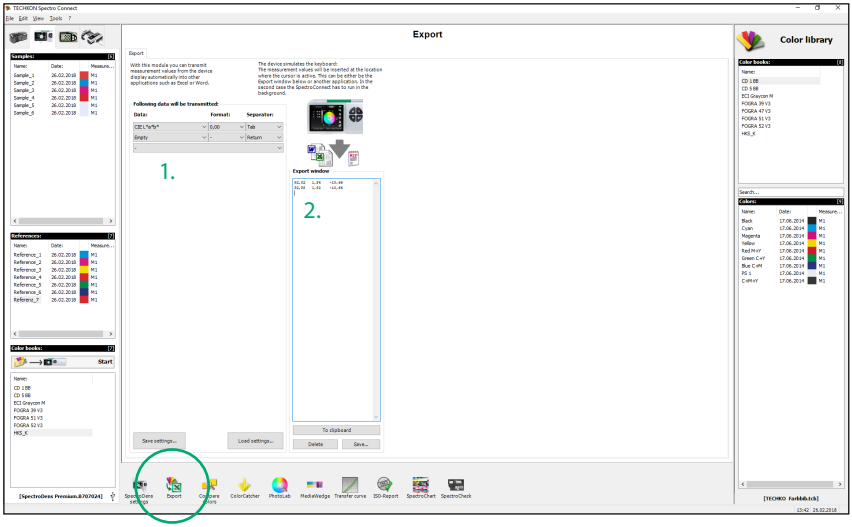
The procedure is explained in the program window:



3.6 Software module: Export

Measurement data can be exported in any other Windows application e.g. Microsoft Excel™, Word™ or other programs which can handle color data, e.g. a RIP calibration software.

SpectroDens works like the keyboard: Pressing the measurement button will place the measurement value automatically at the location where the cursor is.



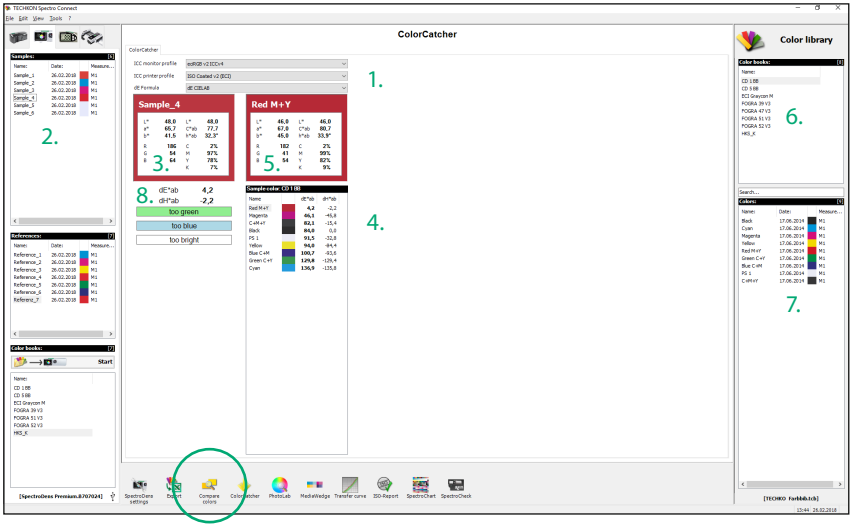
1. Here is defined, which data will be transmitted, how it will be formatted and what type of spacing between the measurement data will be. All the settings can be saved and recalled later.

2. The Export window can also be used for testing data transmissions.

This example shows the transfer of CMYK density values.

3.7 Software module: ColorCatcher

The program module **ColorCatcher** is available in the models SpectroDens Advanced and Premium. Based on a L*a*b*-measurement and referring to selected ICC profiles this program module displays the conversion into the color models L*C*h*, RGB and CMYK. Furthermore an automatic search for the closest matching color of a pre-set or self created color book is carried out. The lower part of the module window informs you about the exact color deviations between the sample and the recommended color of the color book.



1. Selected ICC profiles

2. Measured sample color

3. Calculation of L*a*b*-, RGB-, L*C*h*- and CMYK-values based on selected ICC profiles for the current sample.

4. Shows the closest match to the current sample out of the selected color book.

5. Calculation of L*a*b*-, RGB-, L*C*h*- and CMYK-values based on selected ICC profiles.

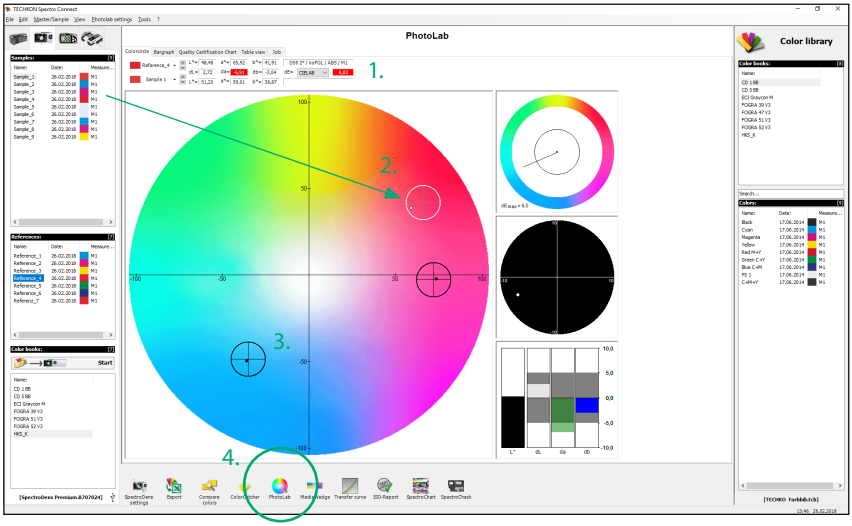
6. Self created color book

7. Colors from a color book

8. Variations and visible differences

3.8 Software module: PhotoLab

TECHKON **PhotoLab** is an optionally available program module for evaluating and displaying L*a*b* color data graphically. Color differences between sample and reference colors can be analyzed. PhotoLab is only available in the SpectroDens Premium version.



1. In the upper section of the module window, the color differences between sample and reference are shown numerically.

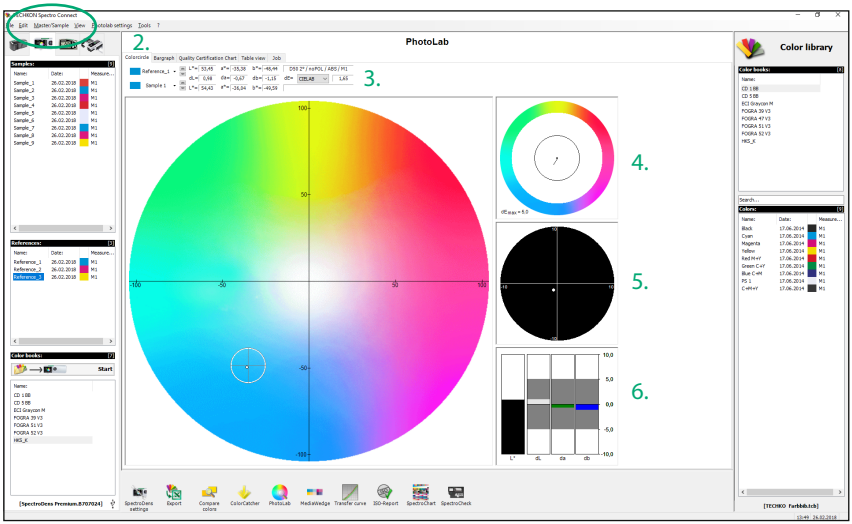
2. Reference: viewfinder with tolerance circle
   Sample: bold point
The current selected value is marked in white.

3. Color samples and references are directly imported into PhotoLab by making measurements with SpectroDens having it connected to the PC via the USB-cable.

Furthermore, color values and complete color books from the device memory or out of the PC color library can be selected and be moved by drag-and-drop with the mouse pointer directly to the center of the display where the L*a*b* color circle is.

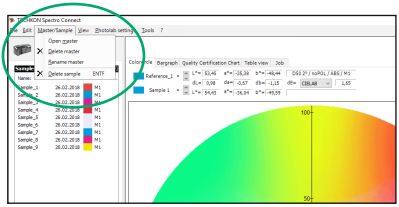
A pop-up window will ask, if the values should be used as sample or as reference values.

4. A mouse click on the program symbol will start the plug-in PhotoLab within the SpectroConnect environment.



1. Samples and references can be selected directly with a mouse click or by choosing from the “pull-down” menu.

Delete and renaming is done via the menu.



2. Different modes of the L*a*b*-display can be selected:

- The modes **Bargraph** and **Quality Certification Chart** show the trend of ΔL*-, Δa*- and Δb*-values of a measurement series.
- The **Table View** shows all values numerically.
- In the **Job** window job relevant text data can be edited.

3. A measurement value highlighted in red indicates an out-of-tolerance sample.

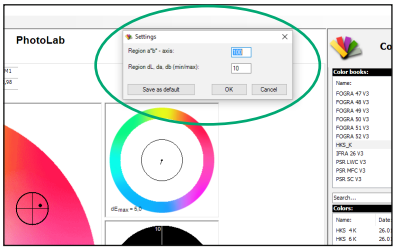
4. The black circle line indicates the tolerance limit of the ΔE*-region. If the black pointer reaches into the outer segment of the circle, the tolerance has been exceeded.

5. Enlarged view of the tolerance circle

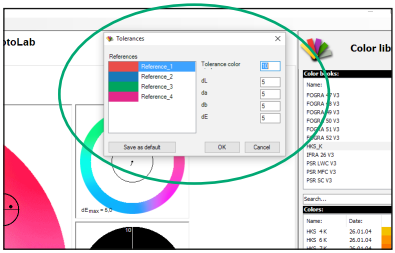
6. Display of the color components ΔL*, Δa* and Δb*.

PhotoLab settings

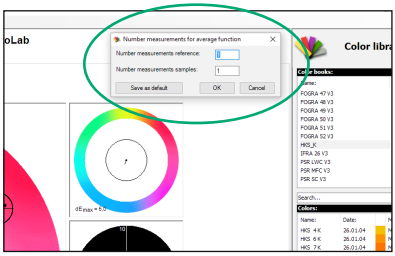
When you open the pop-up window **PhotoLab settings** in the menu bar of the program module PhotoLab, you can select and edit three areas.



1. General settings:
This is the window for setting the dimensions of the L*a*b* color circle and the ΔL*a*b* color deviation.



2. Tolerances:
In this window the tolerances for the color deviations are defined and the size of the tolerance circle is set.



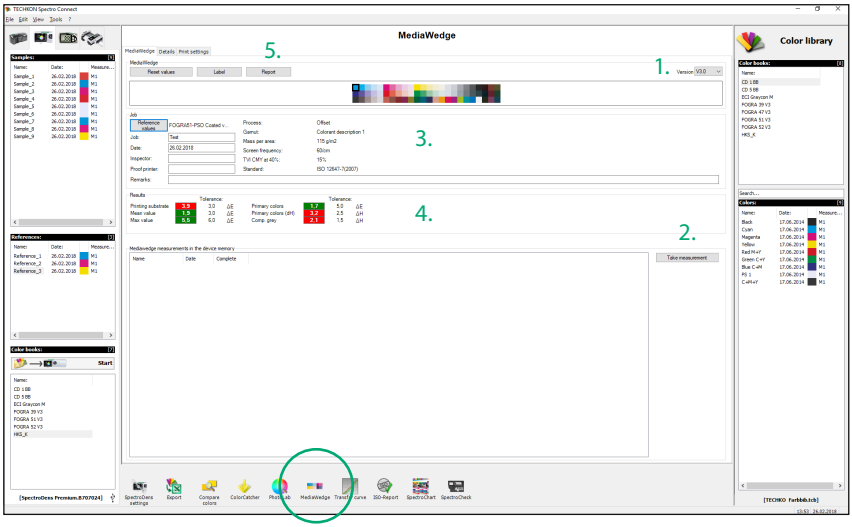
3. Mean values:
It can be appropriate to take several single measurements on one sample which then are averaged to an average value. The number of measurements which result in the calculation of the average value is defined in this window.

3.9 Software module: Media Wedge

The program module **Media Wedge** serves the fast, colorimetric analysis of the Ugra / Fogra Media Wedge. This digital control element is available from Fogra, the German "Graphic Technology Research Association" (www.fogra.org). The test element is placed at the border of a proof. The software evaluates the color quality printed in colorimetric terms.

Color differences between the Fogra target values and the measured samples will be clearly represented in this program module.

The software module **Media Wedge** is only available in the SpectroDens Premium version.



1. Manual selection of the media wedge version. (You will find the version number on the printed test element.) The software supports the Ugra / Fogra Media Wedge in version 3.0 as well.

2. With SpectroDens Premium there is a media wedge feature within the device as well.

Measurements can be made remotely without a connection to the PC. When the device gets connected later, the measured data will be uploaded.

3. Selection of reference values

4. Overview of measurement results

5. A short protocol can be printed with a Dymo label printer on a self-adhesive label which can be stuck on the proof. Alternatively a detailed report of the measurement values can be printed (see p. 90).

Media Wedge evaluation: Label and details

Mediawedge Analysis

Job: Test
Date: 26.02.2018
Inspector:
Proof printer:
Remarks:

	dE/dH	Max. Tolerance	Remarks	
Print. Substr.:	**0,6**	**3,0**	**OK**	✓
Mean:	**2,1**	**2,5**	**OK**	✓
Max:	**6,1**	**5,0**	**Not OK**	✗
Primary colors:	**3,6**	**3,0**	**Not OK**	✗
Primary col. (dH):	**2,9**	**2,5**	**Not OK**	✗
Comp. grey (dH):	**2,5**	**2,0**	**Not OK**	✗
Comp. grey max (dH)	**4,3**	**3,5**	**Not OK**	✗

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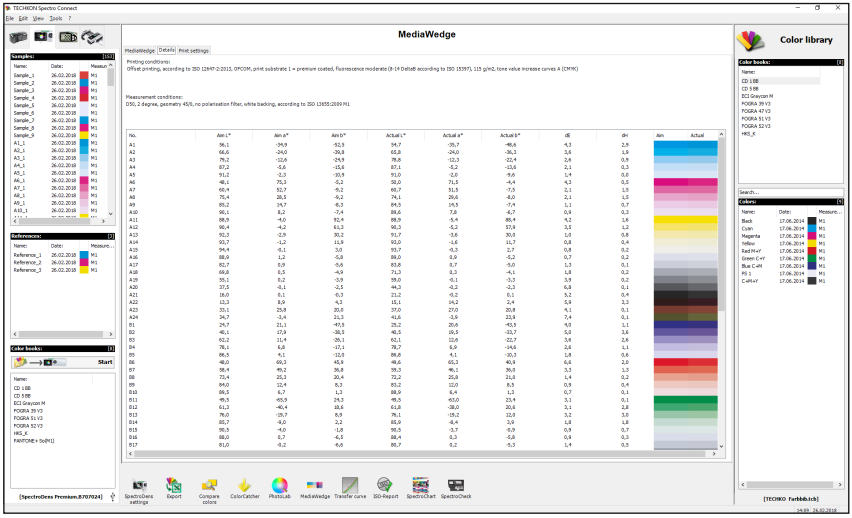
Printing and measurement conditions:
Offset printing, according to ISO 12647-2:2013, OFCOM, print substrate 1 = premium coated, fluorescence moderate (8-14 DeltaB according to ISO 15397), 115 g/m2, tone value increase curves A (CMYK)
D50, 2 degree, geometry 45/0, no polarisation filter, white backing, according to ISO 13655:2009 M1

After the import of the media wedge a short protocol will be generated and can be printed on a self-adhesive label with a Dymo label printer.

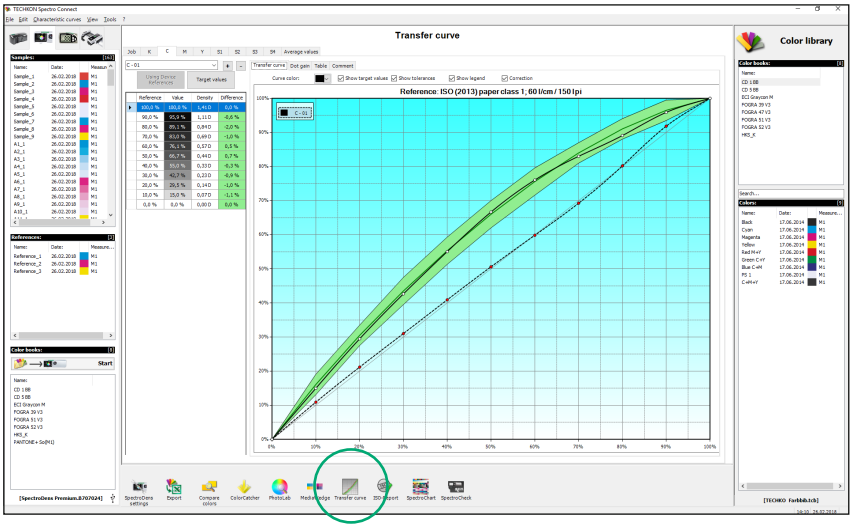


The software supports the Ugra / Fogra Media Wedge in version 3.0 as well.
The picture shows the section **Details**.

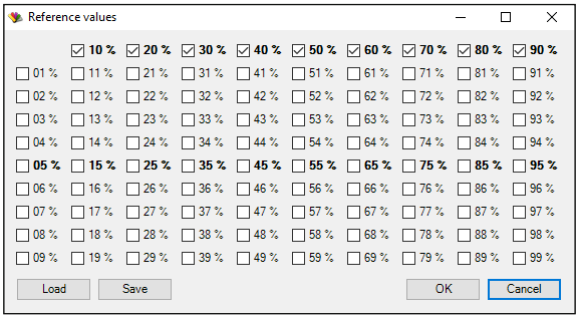
3.10 Software module: Transfer curve

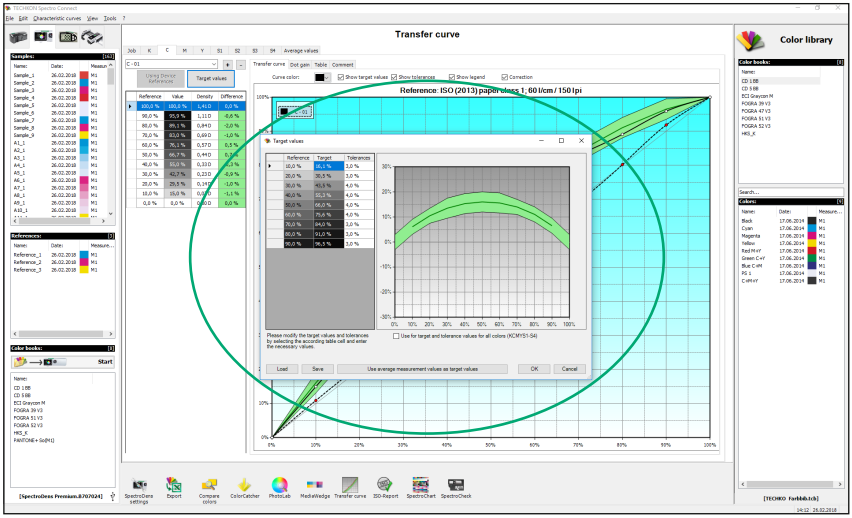
Using the software module **Transfer curve** you can fast and easily determine transfer characteristics on prints and check the compliance of the dot gain according to ISO 12647 targets or individual standards. The software calculates at the same time compensation values for the adjustment during plate exposure.

Values for CMYK as well as spot colors can be analyzed. Measurement results can be displayed as graphics or charts. Furthermore several curves can be compared and average values can be calculated.



Any step wedge can be evaluated. The design of the step wedge can be defined in 1 % steps by using the window **Reference values**.

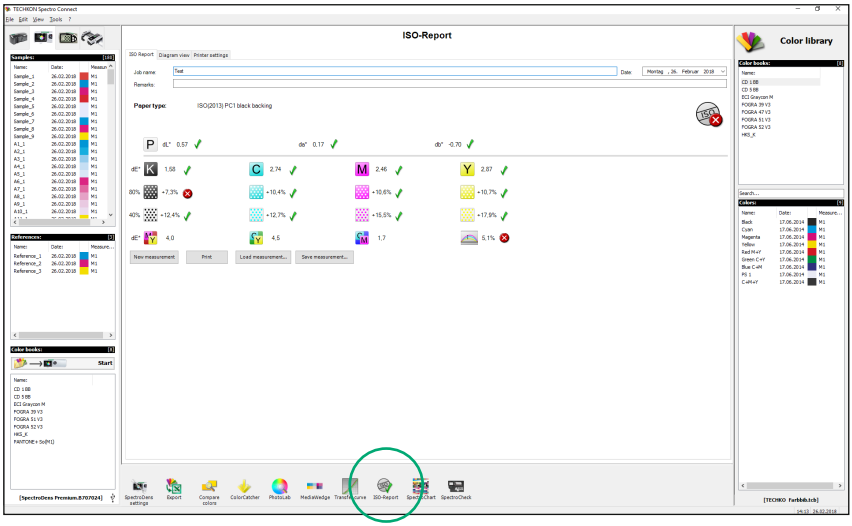


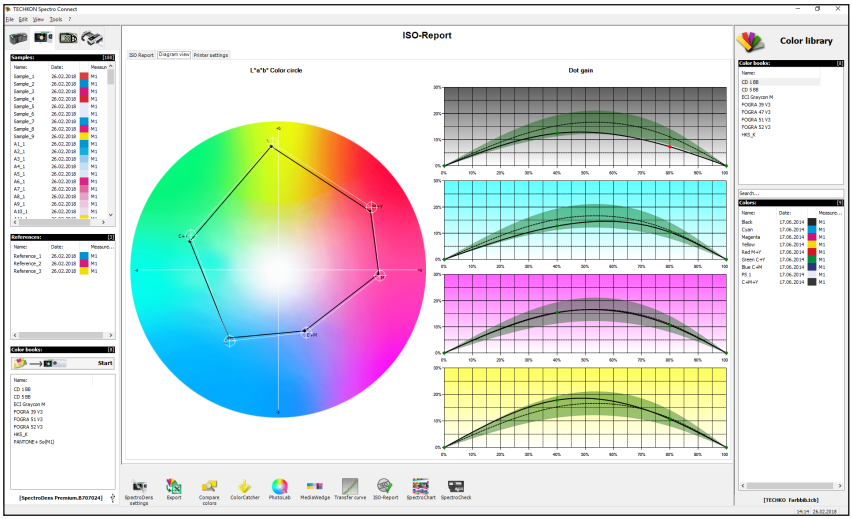


In the section **Target values** the target values can be edited. Furthermore settings for the assignments of the targets can be defined.

3.11 Software module: ISO-Report

The software module **ISO-Report** allows a fast and comprehensive documentation according to the ISO standard. The ISO-Report can be printed out. **ISO-Report** is only available in the SpectroDens Premium version.





3.12 Software module: SpectroChart

The software module **SpectroChart** allows the fast and easy evaluation of test charts like for example ECI 2002, IT8.7/3, Fogra27L, Fogra39L and others.
Related target templates in .ttg-format are deposited in the folder **User → Public → Public Documents → TECHKON GmbH → TECHKON SpectroConnect**.

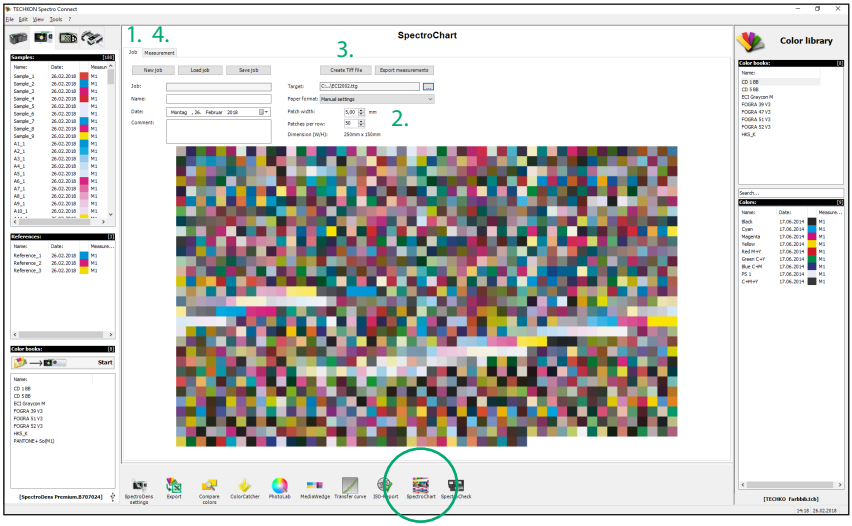
The measurement results are saved in ISO-format. This way they can be imported into common ICC profile generator software.

In the program section **Job** (1.) the job is specified. Here you also choose the target you wish to use. Additionally you can determine its patch width and the amount of patches per row (2.).

The resulting final size of the target will be calculated automatically and then displayed to you. Alternatively you can simply use the presets of a target template or else choose one of the pre-defined paper formats.

When the button **Create Tiff file** (3.) is used, the target can be saved as a tiff file on the PC, where you can initiate to get it printed. Additionally the "Job" section can be used to save the job and to start the export of the measurement values.

In the program section **Measurement** (4.) the current measurement result is displayed clearly. Furthermore here you can define and activate a ΔE value as tolerance.

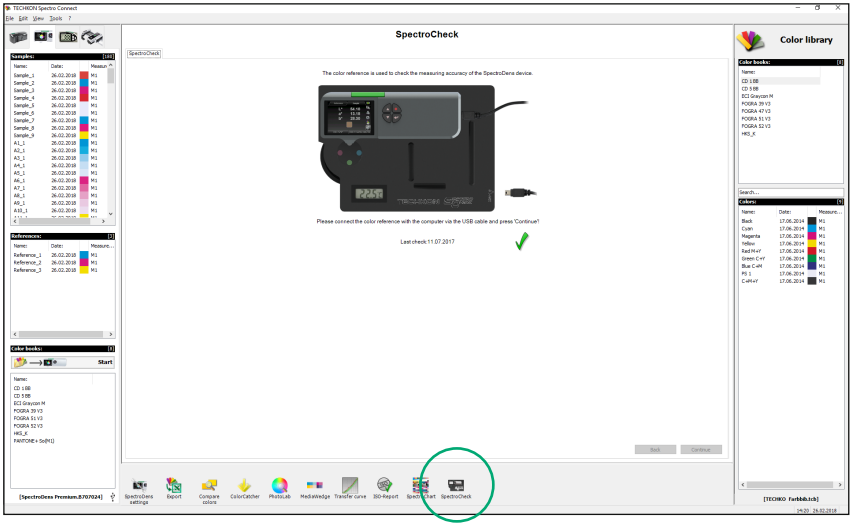


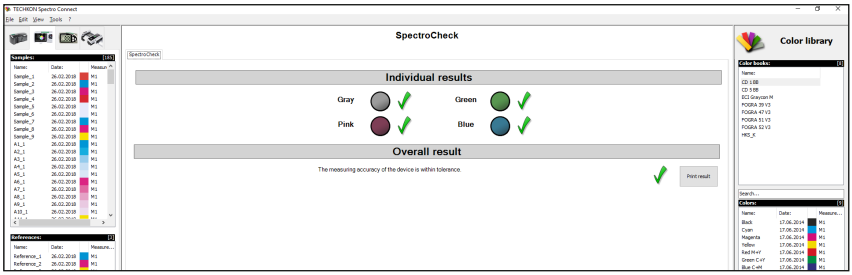
3.13 Software module: SpectroCheck

TECHKON **SpectroCheck** (optionally available) is a color reference used to check the measuring accuracy of the SpectroDens advice.

Connect SpectroDens and SpectroCheck via the USB cable with the computer. The program module SpectroCheck will now lead you step by step through the checking procedure of the measurement device. The information, whether the device corresponds to the technical specifications, can also be printed out.

NOTE: The checking of the TECHKON SpectroDens has to be made with 3.0 mm standard aperture.





Appendix

TECHKON
Erfolg ist messbar

Specifications

Measurement geometry	0°: 45° optics according to ISO 5-4
Spectral range	400 to 700 nm in 10 nm steps, spectral resolution 10 nm, pixel distance sensor < 3 nm
Measurement aperture	3 mm round standard; 1.5 mm round optional
Light source	LED, provides measurement conditions M0, M1, M2, M3 according to ISO 13655
Polarization filter	Twice linear crossed, switched on and off per button release
Measurement time	Approx. 1 sec. per measurement; max. 10 seconds in scan mode
White reference	Absolute and relative; absolute white standard integrated and protected in charging console
Illumination types	A, C, D50, D65, F 2/7/11
Standard observer	2°, 10°
Density filter	DIN 16536, DIN 16536 NB, ISO/ANSI T, ISO/ANSI I, ISO E; spectral density Dmax
Density measurement range	0.00 – 2.50 D
Repeatability	0.01 D; 0.03 CIE ΔE*a*b*
Inter-instrument agreement	0.01 D; 0.3 CIE ΔE*a*b*
Display	Color LC backlight display, anti-reflective, 320 x 240 pixels
Power supply	Rechargeable LiFePO4 battery, regulated recharge via charging console with AC adapter, 100 – 240 V, 47 – 63 Hz, approx. 10000 measurements per battery charge, battery level control
Communication port	USB; WLAN module optional
Weight	495 grams
Dimensions	62 x 50 x 185 mm (approx. 2.4 x 2.0 x 7.3 inches)

System requirements for TECHKON software:
Windows 7, 8 or 10; 32- and 64-bit, minimum: IBM-compatible PC with Intel Core Duo processor or comparable processor, 4 GB RAM, 2 USB ports

Performance packages SpectroDens Basic, Advanced and Premium: see page 7
Accessories, spare parts and contents of delivery: see page 8

Specifications can be subject to change without notice. Specifications valid for standard device with 3 mm aperture.
All mentioned trademarks and copyrights are recognized. SpectroPlate, SpectroDens, SpectroJet, SpectroDrive, DENS, SpectroCheck, InkCheck and TECHKON are registered trademarks of TECHKON GmbH.

Manufacturer certificate

applicable for ISO 9000 documentation

Device: Spectro-Densitometer TECHKON SpectroDens

Serial Number:

Manufacturer: TECHKON GmbH • Wiesbadener Str. 27 • D-61462 Königstein
Telephone: +49 (0)6174 9244 50 • Telefax: +49 (0)6174 9244 99
info@techkon.com • www.techkon.com

Certification: The device is compliant with EU directive 2014/53/EU concerning the electromagnetic compatibility EMC and is provided with the CE label. The device is RoHS compliant (class 9). Japanese Radio Law and Japanese Telecommunications Business Law Compliance. This device is granted pursuant to the Japanese Radio Law (**電波法**) and the Japanese Telecommunications Business Law (**電気通信事業法**). This device should not be modified (otherwise the granted designation number will become invalid).

The device complies with the Japanese Type Approval:

R 202-LSE115
T D 16-0031 202

Notice: The supplied AC adapter is according to regulations UL, IP 40, IEC 950 and VDE EN-EC10. The device is to be used only with the original TECHKON SpectroDens AC adapter.

Maintenance: The device is maintenance free. The measurement aperture has to be kept clean from dust. It can be cleaned with clean, compressed air and an optics brush.

We recommend a functionality check-up every 24 months at the TECHKON service center, which includes the issue of a new Manufacturer certificate.

Warranty: The warranty for TECHKON products is 24 months starting with the date of purchase. The warranty is invalid if the damage is caused by improper use of the device. Only original TECHKON spare parts and accessories are to be used.

Recycling: The device is according to §14 ElektroG registered under the EAP no.: DE 98280049. Devices for disposal can be sent directly to the manufacturer.

Calibration: The integrated spectral sensor is calibrated by a white calibration. After performing a white calibration with the supplied absolute white standard integrated in the charging console, the device is long term stable. We recommend to make a white calibration before every measurement series, to ensure the device is calibrated correctly.

The remission values documented on the back of the charging console are derived from a ceramic white standard, which is referenced to measurements taken and certified by the National Institute of Standard and Technology (NIST).

Standards: The calculation of colorimetric values is according to the formulas and tables of ISO 13655:2017 and publications of CIE.

The calculation of densitometric values is according to the formulas and tables of ISO 5-3.

ETSI EN301-489-1 EMC standard for radio equipment and services V2.1.1 (2017-02)
ETSI EN301-489-17 EMC standard for radio equipment: specific conditions for broadband data transmission systems V3.1.1 (2017-02)
ETSI EN 300 328 RF spectrum use V2.1.1/2016-11

Place	Date	Signature
D-61462 Königstein		

EU-Konformitätserklärung

EC-Declaration of Conformity
Déclaration de Conformité de la CE
Dichiarazione di conformità CE

Hersteller: Manufacturer / constructeur / costruttore	TECHKON GmbH
Adresse: Address / adresse / indirizzo	Wiesbadener Str. 27
erklärt, dass die Produkte: Declares that the products / déclare, que le produits / si dichiara che il prodotto	D-61462 Königstein
Typ: Type / tipo	SpectroDens
Verwendungszweck: Intended use / utilisation prévue / uso previsto	Farbmessungen Color measurements / mesure de la couleur / misurazione del colore

bei bestimmungsgemäßer Anwendung den grundlegenden Anforderungen gemäß EU-Richtlinie 2004/108/EC entspricht und dass die folgenden Normen angewandt wurden:
complies with the essential requirements of the 2004/108/EC Directive, if used for its intended use and that the following standards has been applied: / répond aux exigences essentielles de l'article 3 de la directive 2004/108/EC, prévu qu'il soit utilisé selon sa destination, et qu'il répond aux standards suivants: / soddisfa tutti i requisiti della direttiva 2004/108/EC qualora venga utilizzato per l'uso previsto e che le seguenti norme siano applicate:

angewendete Norm: Applied standard / standard appliqué / norma applicata issue / édition pubblicato	EN 55022:2006 Ausgabe: 2008-05 +A1: 2007 EN 55024 Ausgabe: 2003-01 1998+A1:2001+A2:2003

ETSI EN301-489-1	EMC standard for radio equipment and services V2.1.1 (2017-02)
ETSI EN301-489-17	EMC standard for radio equipment: specific conditions for broadband data transmission systems V3.1.1 (2017-02)
ETSI EN 300 328	RF spectrum use V2.1.1/2016-11

Please copy this registration card and send it by mail or via telefax to us. This way we can keep you informed in future about product news.
You can send your registration information by E-mail as well.
TECHKON GmbH ▪ Wiesbadener Str. 27 ▪ D-61462 Königstein/Germany ▪ Telefax: +49 (0)6174 9244 99 ▪ E-mail: info@techkon.com

TECHKON Registration card

☐ Please send me information about the entire TECHKON product range

☐ Please put my E-mail address on the mailing list for the TECHKON-Newsletter

TECHKON GmbH
Wiesbadener Str 27

D-61462 Königstein

Via telefax to: +49 (0)6174 9244 99

Name: _____

Company: _____

Department / Job title: _____

Address: _____

City / ZIP-Code: _____

Country: _____

Telephone: _____

Telefax: _____

E-mail: _____

Your TECHKON-Dealer: _____

Device Serial number: _____
(Label on the bottom of the device)

Erfolg ist messbar

TECHKON GmbH
Wiesbadener Str. 27 · D-61462 Königstein
T +49 (0) 6174/92 44 50 · F +49 (0) 6174/92 44 99
info@techkon.com · www.techkon.com