

TECHKON
Erfolg ist messbar

Color-Densitometer
DENS



Manual

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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 DENS.

The manual is divided into two chapters:

CHAPTER 1: How to use TECHKON DENS

CHAPTER 2: Description of the measurement functions

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

You will be fascinated that after only a few minutes you will know how to work with DENS. The second chapter will show you detailed insight into the measurement functions.

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 a glossary.

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 DENS

1.1 Product description

DENS is an all-purpose, modern measurement device and the result of 30 years of experience we have as a long-established company in the development and manufacture of high-quality spectral measurement technology.

DENS was designed by applying our four powerful principles for perfect measurement devices:

- Easy and fast to use
- High measurement accuracy
- Solid and reliable
- Functional and attractive design

The new TECHKON DENS unifies three devices in one. It is a color reflection densitometer for CMYK color prints, a film transmission densitometer and a high-precision illuminated magnifying glass for the visual control of printing results.

This cost effective entry-level instrument allows everyone to perform a fundamental densitometric quality control on the basis of the reliable high accuracy well-known from all TECHKON instruments.

The DENS indicates densities, dot area and gray balance clearly legible on a large color display. Automatic color and gray balance detection speeds up the measuring. In addition the device is easily operated by only three buttons. The whole measurement is provided in a split of a second.

LED technology, durable and energy-saving, is used as light source. A multi-channel color sensor evaluates the measuring signal guaranteeing inter-instrument agreement with high-class spectrophotometers.

The integrated Li-Ion battery can be recharged very fast via the Mini USB cable on any USB port and delivers energy for a few thousand measurements.

To meet the demands of a printing rooms harsh environment, the compact casing of the DENS is made of solid aluminum and is therefore very robust. Despite its solidity, the device weighs only 330 g and due to its ergonomic and elegant design it is easy to handle.

The advantages of TECHKON DENS at a glance

- High-quality multi-channel color sensor
- Patented measurement head for exact and direct positioning
- Fast measurement (approx. 0.5 sec.)
- LED technology
- Polarization filter (in version DENS Status ISO E / Pol)
- Rechargeable, high-capacity battery with quick recharge power management for up to 10.000 measurements per battery charge
- Mini USB port for easy battery charging
- Large color display
- Self-explanatory operation
- Automatic measurement function displays always the relevant values
- Ergonomically positioned, user-friendly measurement button
- Durable precision
- Handy and compact, low weight
- Well-designed

Two different versions

We supply TECHKON DENS in two device versions:

DENS Status ISO E / Pol

Density filter according ISO Status E with polarization filter (European standard)

Polarization filters compensate for measurement differences between freshly printed and dried sheets. The technical standards in Europe recommend the use of such a filter for densitometric measurements.

DENS Status ISO T / no Pol

Density filter according ISO Status T without polarization filter (North American standard)

Special device configurations on request.

Functions

- Automatic density measurement in reflection and transmission
- Gray balance
- Dot area in reflection and transmission
- High-precision, lit magnifier with 4 x magnification.

1.2 Packing list

Contents of delivery

- Measurement device DENS
- Mini USB cable for battery charging
- Short manual
- Package with foam insert
- This DENS manual can be downloaded under:
<https://www.techkon.com/support-en.html#dens>

Optional accessories

- Print Control Strip TECHKON TCS
(the Digital Print Control Strips TECHKON TCS can be downloaded free of charge at www.techkon.com)

Replacement parts

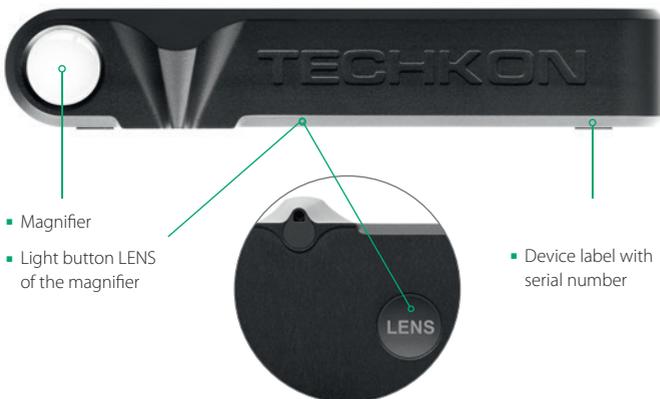
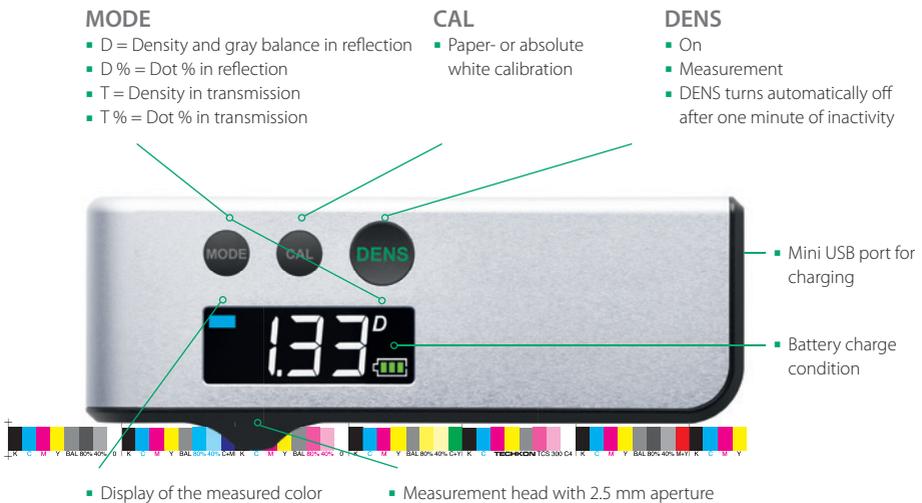
- Rechargeable battery

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

1.3 Design of DENS

DENS 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 index finger when the device is held. The display is clearly legible and a great advantage of DENS is, that it can be easily positioned on the measurement sample.

The USB connector is for battery charging. The Mini USB plug, which fits into the connector at the side of the device, is part of the package.



1.4 Working with DENS

Switching on and off

The device is switched on by pressing the DENS button and is immediately ready to measure. DENS will display the last measurement done before turning-off.

If no button is pressed within one minute, the device will switch off automatically. Switching it on again is easily done with the DENS button. There is no button to turn the device off.

The precision magnifier is used by placing it on the spot to be checked and pressing the LENS button to activate the light. As long as the LENS button is pressed the magnifier will be lit. This functionality is independent from the DENS being turned on or off.

Charging

The **battery status** is displayed as a battery symbol with three segments in the lower right corner of the display, when the device is turned on.

When the battery turns empty, the last remaining segment of the battery symbol starts to flash. In this state several measurements still can be obtained, but it is time to recharge the battery.

Charging starts automatically by connecting the DENS to a PC or another USB power source. When the three segments of the battery symbol are indicated statically, 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. DENS 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.

How to measure

After switching DENS on, 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 DENS button. Within less than 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.

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.

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 according to Status ISO E / Pol 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.

When a calibration according to Status ISO T / no Pol is carried out an absolute white standard is used (see enclosed reference card).

For dot % measurements in transmission a calibration is done on a unexposed spot of the film to be sure, that no "veil" on the film will falsify the dot % value.

A calibration is as easy to carry out as a measurement: Place the measurement head on top of a blank area of the paper sheet or the absolute white standard. The calibration can be started now by pressing the CAL button. A successful calibration will be indicated by three horizontal lines. The device is now ready for measurements.

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

DENS 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.

Cleaning

The measurement head with the optical system is sealed against dust and dirt. Take nevertheless 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.

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.

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

Warranty

The warranty for TECHKON products is 24 months starting with the date of purchase. 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 DENS 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 original packing. For a flat fee the device will be cleaned, checked and recalibrated. In case a repair or exchange of components should be necessary we will inform you in advance.

Replacement of the rechargeable battery

The rechargeable Li-Ion battery has a high lifespan. However, after a certain time it will lose its capacity and it will make sense to replace it.

Only use original TECHKON DENS replacement batteries. The use of other batteries is hazardous.

For opening the battery case you will need a TORX™ screwdriver type 6.

Place the instrument upside down and put a soft cloth underneath the display to avoid any scratches.



1. Unscrew the three TORX™ screws on the device bottom and remove the upper device case.

2. Unscrew the two TORX™ screws of the battery holder and remove the holder.

3. When exchanging the battery take care of the correct position of the battery contacts. Refit the battery holder to the circuit board and finally fix the device case.

4. When reassembling do not tighten the screws too much otherwise they might break.

Device adjustment

Should DENS show deviations to other devices, first check, if the instrument settings are correct. Especially the settings of the **Density adjustment (SLOPE)** influence the measurement result.

Setting of the Density adjustment (SLOPE) / Reflection

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



1. Press the MODE button to choose the D mode.
2. Press the CAL button for 5 seconds. The device switches into the Slope calibration mode.
3. Place the measurement head on the white patch of the reference and press the CAL button.
4. Place the measurement head on the Cyan solid density patch of the reference and press the DENS button.
5. The desired value can be set respectively by pressing the DENS button = + or MODE button = - and be stored by pressing the CAL button.

The desired value cannot deviate more than $\pm 20\%$ from the measured value.

6. Repeat the steps 4 to 5 analog for the Magenta, Yellow and Black solid density patch.

When all colors are captured the device calculates the SLOPE correction values, quits the SLOPE calibration and switches automatically into the D-mode.

To reset the Slope-Calibration to factory default settings, the measured values will be memorized unchanged with the CAL-button during the calibration process.

Setting of the Density adjustment (SLOPE) / Transmissin

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



1. Press the MODE button to choose the T mode.

2. Press the CAL button for 5 seconds. The device switches into the Slope calibration mode.

3. Place the measurement head directly on the light plate and press the CAL button.

4. Place the measuring head on the film (layer side up) and press the DENS button. (Position the device on the same spot of the light plate to prevent fluctuations in brightness.)

5. The desired value can be set respectively by pressing the DENS button = + or MODE button = - and be stored by pressing the CAL button.

The desired value cannot deviate more than $\pm 20\%$ from the measured value.

When the value is saved the device calculates the SLOPE correction value, quits the SLOPE calibration and switches automatically into the T-mode.

The successful adjustment can be checked with a control measurement.

To reset the Slope-Calibration to factory default settings, the measured values will be memorized unchanged with the CAL-button during the calibration process.

Chapter 2

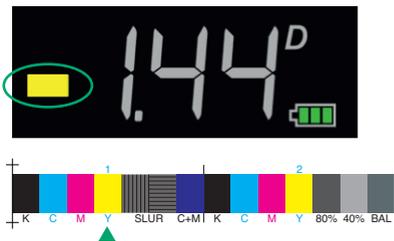
Description of the measurement functions

The current measurement function is indicated on the right side of the display. A switch to the next mode is done by pressing the MODE button. Thus the measurement functions **D**, **D %**, **T** and **T %** can be selected.

2.1 Measurement function D: Automatic density and gray balance measurement in reflection

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

- Solid density D with automatic color detection
- Gray balance

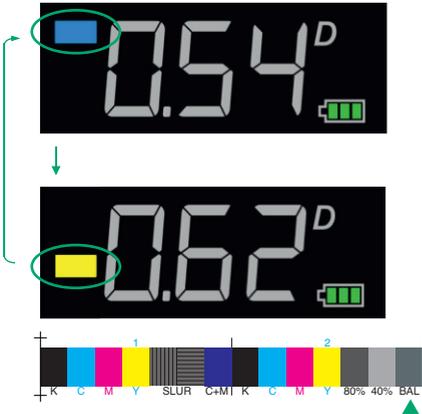


Measurement on solid density patches:
In this example the measurement has been taken on a Yellow **solid density** patch.

DENS recognizes the type of process color and displays it as a color patch symbol.

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.



Measurement on a gray balance patch:
Rolling display of the single CMYK values one step every second.

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

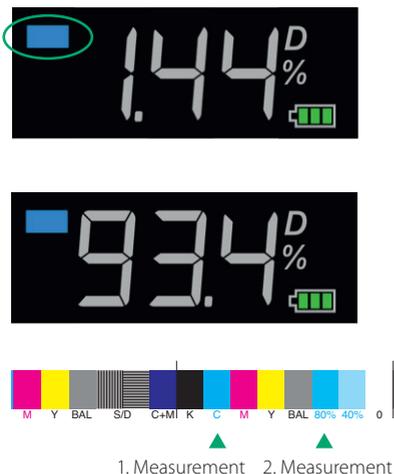
When making a measurement on a **gray balance** patch, the referring density values for all four process colors are shown. The values for Cyan, Magenta and Yellow should be in close range to each other to ensure a neutral gray balance without a color hue.

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.

2.2 Measurement function D %: Dot area measurement in reflection

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.



To capture the **dot area in %**, first the solid density patch of the color has to be measured.

1. Place the measurement head above a solid patch and start the measurement by pressing the DENS 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 solid density and a 80 %-patch of Cyan. The effective dot area is 93.4 %.

The resulting **dot gain** can be easily calculated: $93.4 \% - 80 \% = 13.4 \%$

2.3 Measurement function T: Density measurement in transmission

T mode measures the densities in transmission.



Density measurement in T mode:

1. Select the T mode with the MODE button.
2. If necessary do a calibration without film by pressing the CAL button.
3. Position the device on the measurement patch selected.
4. Start the measurement with the DENS button.

The measurable density in transmission depends on the luminosity of the light table. Average bright light tables allow you to measure densities up to $D = 4.00$ and over.

Please note: The emulsion side of the film has to be always on the upper side.

2.4 Measurement function T %: Dot % measurement in transmission

T % mode measures the screen densities in transmission.



Measurement of dot percentage values:

1. Select the T % mode with the MODE button.
2. If necessary do a calibration on film (0 %) with the CAL button.
3. Position the device on the measurement patch selected.
4. Start the measurement by pressing the DENS button.

Please note: The emulsion side of the film has to be always on the upper side.

Appendix



Specifications

Measurement technology	Multi-channel color sensor, color density determination to ISO 5-3
Measurement geometry	45°:0° optics
Measurement aperture	2.5 mm
Light source	LED
Polarization filter	Twice linear crossed (ISO E) optional no polarization filter (ISO T)
Measurement time	0.5 seconds per measurement
White reference	Relative (ISO E) or absolute (ISO T)
Density filter	ISO E (with polarization filter) optional ISO T (without polarization filter)
Density measurement range	0.00 – 2.50 D in reflection, 0.00 – 4.00 D in transmission
Repeatability	0.01 D
Inter-instrument agreement	0.01 D
Display	Backlight color display
Magnifier	4 x magnification, lit
Power supply	Rechargeable Li-Ion battery, regulated recharge via USB cable, up to 10.000 measurements per battery charge, battery level control
Weight	330 grams
Dimensions	32 x 68 x 175 mm (approx. 1.3 x 2.7 x 6.9 inches)

Versions DENS Status ISO E / Pol and DENS Status ISO T / no Pol: see page 6

Contents of delivery and spare parts: see page 7

Manufacturer certificate

applicable for ISO 9000 documentation

DEVICE: Densitometer TECHKON DENS

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 89/336/EWG concerning the electromagnetic compatibility EMC and is provided with the CE label. The device is RoHS compliant.

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 multi-channel color sensor is calibrated by a white calibration. After performing a white calibration the device is long term stable. We recommend to make a white calibration before every measurement series, to ensure the device is calibrated correctly.

STANDARDS:

The measurement device is manufactured according to the recommendations of the technical standards DIN 5033 part 1-9, CIE and ISO 5-3.

The accuracy of the device is checked during the manufacturing by spectral measurements on color samples which were measured and certified by the German Institute for Material Testing (Bundesanstalt für Materialprüfung, BAM).

The calculation of densitometric values is according to the formulas and tables of ISO 5-3 and the handbook of standardization of the German Printing and Media Industries Federation (Bundesverband Druck und Medien e. V.) and Fogra (Forschungsgemeinschaft Druck e. V.).

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

D-61462 Königstein

erklärt, dass die Produkte:

Declares that the products / déclare, que le produits / si dichiara che il prodotto

Typ:

Type / tipo

DENS

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: 200**

EN 55024

**Ausgabe: 2003-01
1998+A1:2001
+A2:2003**

Please send this registration card 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

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)

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

Erfolg ist messbar

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