



Anton Paar

SmartRef

Instruction Manual and
Safety Information

(Original)

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Further information

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ABOUT THIS MANUAL

This instruction manual informs you about the installation and the safe handling and use of the product. Pay special attention to the safety instructions and warnings in the manual and on the product.

The instruction manual is a part of the product. Keep this instruction manual for the complete working life of the product and ensure that it is easily accessible for all people involved with the product. If you receive any additions to or revisions of this instruction manual from Anton Paar, these must be treated as part of the instruction manual.

Download the current version of the instruction manual from: www.my-smartref.com

CONVENTIONS FOR SAFETY MESSAGES

The following conventions for safety messages are used throughout this instruction manual:



WARNING!

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION!

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Notice indicates a situation which, if not avoided, could result in damage to property.

TIP

Tip gives extra information about the situation at hand

SAFETY INSTRUCTIONS

Read this instruction manual before using the device.

Make this instruction manual easily accessible to all persons working with the device.

Follow all tips and instructions in this instruction manual to ensure the correct use and safe functioning of the device.

LIABILITY

This instruction manual does not claim to address all safety issues associated with the use of the device and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.

Anton Paar warrants the proper functioning of the device only if no modifications are made to mechanics, electronics, or device software.

Use the device only for the purpose described in the instruction manual. Anton Paar is not liable for damages caused by incorrect use of the device.

The results delivered by the device depend not only on the correct functioning of the device, but also on various other factors.

Do not base any decisions concerning safety or commercial issues on data measured by a SmartRef.

INSTALLATION AND USE



WARNING!

Do not use the device in medical areas.

Use the device as a stand-alone unit (the SmartRef cannot be operated without a smartphone or tablet). Do not combine the device with other instruments or devices for automation purposes!

Use only accessories and consumables supplied or approved by Anton Paar.

Ensure that all operators are familiar with the safety instructions for the device.

Keep the device away from children.

Ensure that the device is sufficiently supervised during operation.



WARNING!

In case of damage or malfunction, do not continue operating the device. Do not operate the device under conditions which could result in damage to goods or injuries or loss of life.

Do not expose the device to temperatures below 0 °C (32 °F) if the sample well contains water. Freezing water can cause damage to the sample well.

OPERATION IN AREAS WITH RISK OF EXPLOSION



WARNING!

The device is not explosion-proof and therefore must not be operated in areas with risk of explosion.

PERSONAL SAFETY



WARNING!

Always keep a distance of at least 15 cm (6 in) between the device and an implanted cardiac pacemaker or defibrillator.

**CAUTION!**

During operation of the device, the operator must be equipped with appropriate personal protective equipment (safety goggles, gloves).

GENERAL PRECAUTIONS

Observe and adhere to your national safety regulations regarding the handling of all substances associated with your measurements (e.g. use safety goggles, gloves, respiratory protection, etc.).

For the handling of substances, abide by the corresponding material safety data sheets.

**WARNING!**

Fill only substances which will not pose a risk if they leak from the device in case of damage or malfunction.

**WARNING!**

Before a measurement, check the wetted parts of the device for chemical resistance to the samples and cleaning agents used.

Fill only liquids which will not attack the wetted parts of the device.

**WARNING!**

Take care that the liquids (samples and cleaning agents) that you use are chemically compatible when they come into contact with each other. They must not react exothermally or produce harmful substances.

Take measures that spilled liquids cannot get into plug connections or venting slots of electrical appliances.

Do not leave the device in a location exposed to direct sunlight or near a heat source for any extended period of time.

Do not change the ambient temperature of the device abruptly.

**CAUTION!**

Be careful with hot samples. Handling samples with temperatures of more than 50 °C (122 °F) bears the risk of burns.

Observe the maximum sample temperature.

**CAUTION!**

Do not drop the device and protect it against strong impacts as this may lead to a malfunction.

PRECAUTIONS FOR FLAMMABLE SAMPLES AND CLEANING AGENTS



CAUTION!

Keep potential sources of ignition, like sparks or open flames, at a safe distance from the device.

Store only the minimum required amount of sample, cleaning agents, and other flammable materials near the device.

Do not spill sample/cleaning agents or leave their containers uncovered. Immediately remove spilled sample/cleaning agents.

Ensure that the setup location is sufficiently ventilated. The environment of the device must be kept free from flammable gases and vapors.

Provide fire-extinguishing equipment.

BATTERY HANDLING

Make sure you insert the batteries with the correct polarity.

Keep batteries away from children.

Do not leave batteries lying around unattended. They can be dangerous for children or pets if they use them as toys.

If a battery has been swallowed, seek medical advice immediately.

Leaking or damaged batteries can cause burns if they come into contact with skin. Use gloves for their handling.

Never short-circuit or open batteries.

Do not expose batteries to heat or throw them into fire.

Do not charge non-rechargeable batteries. There is a risk of explosion.



WARNING!

Do not insert damaged batteries in the battery compartment. They can cause permanent damage to the device and fire.



WARNING!

Do not use lithium ion rechargeable batteries or lithium ion batteries with the device.

Use only batteries type AAA LR03 (alkaline) or rechargeable batteries type AAA HR03 (NiMH).

Do not replace the batteries in an environment with high humidity. Vapor could be trapped inside the unit, which could cause condensation, permanently damaging your device.

**WARNING!**

In case you are not using the device for a long time, remove the batteries. Batteries could leak or be damaged.

DEVICE RETURNS

For returns, contact the vendor of the device. The device must be cleaned before return.

You must not return devices which are contaminated by radioactive materials, infectious agents, or other harmful substances that can pose health hazards.

DISPOSAL

Concerning the disposal of the device, observe the legal requirements in your country.

PACKAGE CONTENTS

SmartRef has been tested and packed carefully before shipment. However, damage may occur during transport.

Keep the packaging material for possible returns and for further questions from the transport or insurance company.

To check the delivery for completeness, compare the supplied parts to those listed in the supplied parts list below.

If a part is missing or damaged, contact the vendor of the device.

NOTICE

A device stored at low temperatures can cause condensation of moisture on sensitive parts. To prevent malfunctions, allow the transport package and its contents to come to thermal equilibrium prior to opening.

SUPPLIED PARTS

Picture	Quantity	Description	Mat. no.
	1	SmartRef digital refractometer (incl. 2 AAA batteries)	251846
	4	Pipette	253411

SMARTREF OVERVIEW

ABOUT THE DEVICE

The digital refractometer SmartRef measures the refractive index of liquids. In addition, a temperature sensor measures the sample temperature directly at the sample area. The refractive index of a pure material is a physical property and can be used to identify and characterize materials. The refractive index of a dissolved substance in a solvent correlates with its concentration and can therefore, be used for concentration measurements. Many other scales can be derived from the refractive index.

You operate and control the device via the mobile app running on your smartphone. For the communication between the device and your smartphone, Bluetooth Low Energy is used. Via the app various measurement units based on the refractive index can be calculated (e.g. %Brix).

DEVICE VIEWS

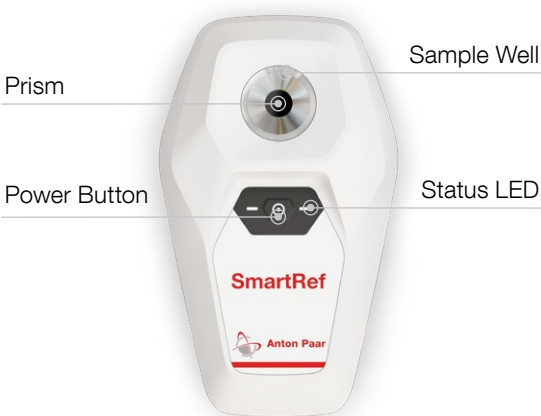


Figure 1: Top View

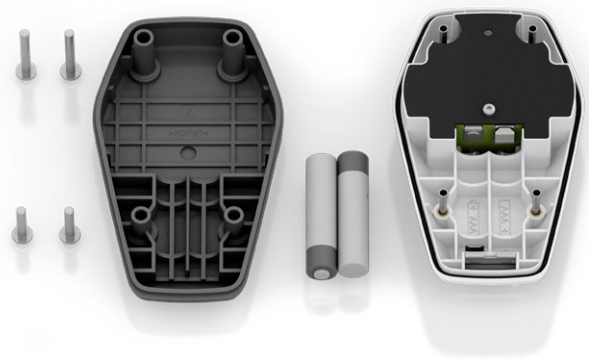


Figure 4: Disassembled View



Figure 2: Sample Area

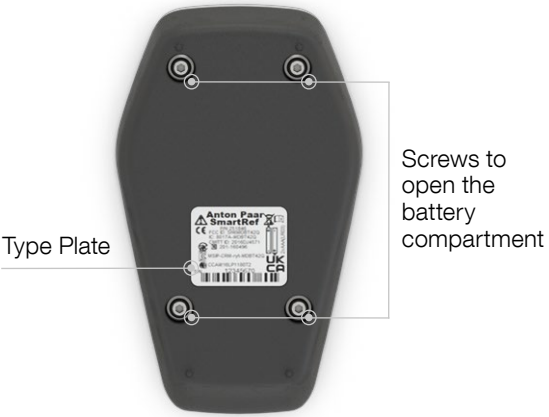


Figure 3: Bottom View

STARTING UP SMARTREF

SWITCHING THE DEVICE ON/OFF

To switch the device on, press the power button (see Figure 1). The status LEDs will start blinking (visible next to the power button), indicating that your SmartRef is switched on. To switch the device off, press the button again.

NOTICE

Never use any sharp objects to press the power button.

CONNECTING TO YOUR IOS OR ANDROID DEVICE

The SmartRef works with the corresponding app for iOS or Android, installed on a supported device. Data is transmitted via Bluetooth Low Energy wireless technology.

For a list of available apps and supported devices, go to: www.my-smartref.com

The app can be downloaded from the Apple App Store or on Google Play Store.

Start the app on your smartphone. It will guide you through the steps required to connect to your SmartRef. After a successful connection has been established, the status LEDs are permanently on. The device is then ready to perform measurements. The app will guide you through the measurement steps and provide relevant information.

MEASUREMENT

GENERAL INSTRUCTIONS FOR MEASURING

Fill the sample area to the indicated line in the sample well. A minimum sample volume of 0.4 mL is required for proper operation.

For best measurement performance, ensure that the sample temperature does not deviate significantly from the ambient temperature. When measuring hot/cold samples, allow the measurement area temperature to equilibrate. Depending on the temperature difference between the sample liquid and the device, this may take only a few seconds or up to a minute.

Prior to each measurement ensure that the prism and sample well are clean and dry.

Carefully clean the device after each measurement series to avoid deposits in the sample area. Have suitable solvents for cleaning at hand.

The measurement performance can be deteriorated by excessive ambient light (sunlight, artificial light). Make sure the sample area is not exposed to direct irradiation. If you are using the device in a bright environment, it might be necessary to shield the sample area from direct light.

Use plastic syringes or pipettes to apply the samples. Metal devices or other hard subjects (e.g. spoons, tweezers) may scratch the glass prism, causing permanent damage to your device.

Sample containing dissolved CO₂ will cause bubbles, which can lead to invalid measurement results. Degas your sample carefully before measurement. For samples containing suspended solids it is recommended to filtrate the sample.



CAUTION!

Handling samples with temperatures of more than 50 °C (122 °F) bears the risk of burns. Wear appropriate protective clothing or take other protective measures when you handle hot samples.

PERFORMING A MEASUREMENT

- Properly clean the prism surface and the surrounding sample well.
- Apply the sample on the measuring surface using a plastic pipette or plastic syringe until the sample well is filled up to the marked height.
- Start measurement via the app.
- The app displays the result of the measurement.

TIP

If errors occur during the measurement process the app will provide respective information.

It is recommended to perform a zero-adjustment daily before measuring (see 9.2) and if changes in ambient conditions have occurred.

If the sample has a significant different temperature compared to the device or the device temperature differs significantly from the ambient temperature allow the sample temperature to equilibrate for a short time (approximately 1 minute).

In between measurements of different samples make sure to clean the prism surface and the sample well properly and dry it prior to the subsequent measurement to avoid cross contamination.

After a certain time of inactivity (duration selectable via the app) the device will shut of automatically.

CLEANING AND STORING THE DEVICE

CLEANING ROUTINE AND CLEANING AGENTS

After each sample measurement with the device always clean the prism surface and the sample well using ultra-pure water or ethanol.

You may need to clean it more often when you are going to measure a sample that could chemically react with the previous sample or when you are going to measure a sample that is not miscible with the previous sample.

Remove the sample via rinsing the sample area with a suitable liquid, e.g. ultra-pure water or via absorbing the sample using a soft tissue. If you did not use ultra-pure water as cleaning liquid, additionally rinse the prism surface and the sample well with ultra-pure water to remove any other cleaning liquid. Finally, empty the sample well and use a clean, soft cloth (cotton or microfiber) to dry off any remaining droplets.

Clean the housing and the sample area with a soft cloth dipped in ethanol or warm water. If necessary, you can use a mild solvent (pH < 10).

**CAUTION!**

Do not use dirty or rough cloths for cleaning/drying the sample area, since this could cause scratches on the prism surface and permanently damage your device.

Do not submerge the device in water or any cleaning agents or other liquids.

Particulate material suspended in sample liquid or the use of an abrasive cleaning agent may lead to scratches during the cleaning process. This can damage the device permanently.

**CAUTION!**

Do not use aggressive solvents (e.g. Acetone) to clean the device. Only use approved and compatible cleaning agents, otherwise your device could suffer permanent damage.

NOTICE

The inside of the device does not require cleaning. Only clean the exterior housing and the sample area.

NOTICE

It is recommended to use ultra-pure water instead of tap water because tap water can cause limescale buildup in the sample area, leading to a deterioration of the measurement quality.

NOTICE

Dispose samples and cleaning agents according to legal regulations.

STORING

Before you store away the device, clean it as described above. If you are going to store your device for a longer period of time, remove the batteries.

**CAUTION!**

Store the device in a dry environment. Do not store device in direct sunlight, low or high temperatures.

CHECKS AND ADJUSTMENTS

It is recommended to check the measurement performance of the device prior to a new series of measurements. If you get a result that deviates from the target value of your sample by more than the given tolerances, you need to adjust the device by performing a zero adjustment.

CHECK MEASUREMENT

Fill the sample well with ultra-pure water up to the sample height indication and perform a measurement via the app. Depending on the selected unit of measurement, the result should be e.g. 0.0 °Brix, 0 ppt, etc. within the respective accuracy. A water check should be performed before starting measurements. Perform additional water checks on demand, depending on your judgement, e.g. when you get a series of unexpected results. If the check fails, take corrective actions until the check is valid again:

- Check the reference liquid (ultra-pure water) quality.
- Clean the measuring prism thoroughly. Alcohol or a solvent suitable for the samples measured before could be useful.
- If above actions do not help to perform a valid check, perform a zero adjustment.

TIP

For best measurement performance use a new and clean pipette for every measurement.

ZERO ADJUSTMENT

Before measuring, performing a zero adjustment using ultrapure water is recommended.

- Properly clean and dry the prism surface and the sample well.
- Apply ultrapure water on the measuring surface until the sample well is filled up to the marked height.
- If the sample temperature differs strongly from the device temperature allow the sample to equilibrate for approximately 1 minute.
- Perform zero adjustment via the app.
- The app will indicate if the zero adjustment process was successful or provide further information otherwise.

TIP

Perform the zero adjustment under the same conditions as the sample measurement. Changes in ambient conditions between the zero adjustment and the sample measurement could lead to deviations in the measurement result.

If the zero adjustment is performed under strong light (e.g. sunlight) ensure a proper shading of the sample well during the adjustment process.

EXCHANGING THE BATTERIES

For proper battery handling, observe the safety instructions. The battery status of the device is indicated in the app. When the batteries are depleted, the device switches off by itself. If the app indicates a low battery or the device does not switch on it is advised to replace the batteries. Use only batteries type AAA LR03 (alkaline) or rechargeable batteries type AAA HR03 (NiMH).



CAUTION!

Turn the device off prior to exchanging the batteries.

Make sure the sample area is empty and dry before exchanging the batteries to avoid spillage of liquids.

Only open the device in a clean and dry environment.

The inside of the device does not require any cleaning. Do not use liquid cleaning agents on interior parts of the device.

Do not open the compartment containing the optical and electronical components of the device as this will void the warranty.

STEPS TO EXCHANGE THE BATTERIES

- Unscrew the bottom cover of the device using an Allen key (2 mm; 5/64 in).
- Remove the empty batteries.
- Insert the fresh batteries with the correct orientation!
- Reattach the bottom cover and tighten the screws firmly.

NOTICE

Ensure that the screws are tightened properly so that no liquid can get inside. Do not overtighten the screws. Using excessive force may permanently damage your device. After replacing the batteries, be sure to only use the original screws to fix the battery compartment cover. Consider the polarity of the batteries when you insert them in the battery compartment. Insert only equally charged batteries of the same type.

NOTICE

When replacing the batteries, check if the O-ring between the bottom and the top cover is not damaged and in place. Make sure to use the original screws that include an O-ring.

TECHNICAL DATA

MEASUREMENT SPECIFICATIONS

Measuring Range

Refractive Index (RI) at 20°C	1.3330 – 1.5040
Brix	0° to 85°
Sample Temperature	10 °C – 100 °C (50 °F – 212 °F)
PSU (practical salinity units)	0 – 50
ppt (parts per thousand)	0 – 150
S.G. (20/20)	1.000 – 1.114

Accuracy

Refractive Index (RI)	±0.0003
Brix	±0.2°
Temperature	0.5 °C (0.9 °F)
PSU (practical salinity units)	±2
ppt (parts per thousand)	±2
S.G. (20/20)	±0.002

Resolution

Refractive Index (RI)	0.0001
Brix	0.1°
Temperature	0.1 °C (0.1 °F)
PSU (practical salinity units)	1
ppt (parts per thousand)	1
S.G. (20/20)	0.001

Further Specifications

Sample volume	0.4 mL
Measurement time	<2 s
Automatic Temperature Compensation 20°C (ATC) %Brix	10 °C – 100 °C (50 °F – 212 °F)
Automatic Temperature Compensation 20°C (ATC) PSU, ppt, S.G. (20/20)	10 °C – 40 °C (50 °F – 104 °F)
Mobile Operating System	Android & iOS

DEVICE SPECIFICATIONS

Data

Dimensions (L x W x H)	108 x 64 x 35 mm (4.3 in x 2.5 in x 1.4 in)
Weight (incl. batteries)	~135 g (0.31 lbs.)
Power supply	2x AAA 1.5V LR03 alkaline batteries (included) or AAA NiMH rechargeable batteries
Enclosure Rating	IP66 according IEC 60529

OPERATING CONDITIONS

Condition

Ambient temperature	10 °C – 40 °C (50 °F – 104 °F)
Air Humidity	5% – 95% RH, non-condensing
Battery lifetime	~10 000 measurements
Storage temperature	10 °C – 40 °C (50 °F – 104 °F)
Interface	Bluetooth™ Low Energy
Frequency band	2400 MHz – 2480 MHz
Transmitter power	7.5 dBm max. (5.6 mW max.)

WETTED PARTS

Part

Sample area
Enclosure housing

Material

Stainless steel and glass, FKM O-Ring
Flame retardant PBT/PC, UL94-V0

EU DECLARATION OF CONFORMITY

EU Declaration of Conformity

(translation of original)



The Manufacturer **Anton Paar ConsumerTec GmbH**, Anton-Paar-Str. 20, 8054 Graz, Austria – Europe hereby declares that the product listed below

Product designation	SmartRef Digital Refractometer
Model	SmartRef
Material number	251846

is in conformity with the relevant European Union harmonisation legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer.

Radio Equipment Directive (2014/53/EU, ABI. L153/62 of 22.5.2014)

Applied harmonised standard:

- EN 300 328 V2.2.2

Low Voltage Directive (2014/35/EU, OJ L 96/357 of 29.3.2014)

Applied harmonised standard:

- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

Electromagnetic Compatibility (2014/30/EU, OJ L 96/79 of 29.3.2014)

Applied harmonised standard:

- EN 61326-1:2013

RoHS Directive (2011/65/EU, OJ L 174/88 of 1.7.2011)

Place and date of issue: Graz, 14.01.2025

Signed by:

2C56977AF451446...

DI Dr. Christine Körner
General Manager
Anton Paar ConsumerTec GmbH

BLUETOOTH REGULATIONS

DocuSign Envelope ID: 6397E4D2-BD93-47A3-BAC3-8CD218113C47

Supplier's declaration of Conformity

47 CFR § 2.1077 Compliance Information



Unique Identifier: SmartRef, P/N 251846

Responsible Party – U.S. Contact Information

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Tel. +1 (804) 550-1051
info.us[at]anton-paar.com

Test report: Intertek 2244110KAU-012 (Issue Date 17.12.2021)

FCC Compliance Statement (e.g., products subject to Part 15)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

DocuSigned by:
A handwritten signature in black ink that reads 'Reinhard Eberl'.
4DB529F6453A446...

Mr. Reinhard Eberl
Executive Director The Americas
Anton Paar USA Inc.

USA

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Canada

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Taiwan

注意！依據 低功率電波輻射性電機管理辦法第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

Japan

TELEC Certificate: R 201-160496

South Korea

KC Certificate MSIP-CRM-ryt-MDBT42Q

China

SRRC Certificate: CMIIT ID: 2016DJ4571

WARRANTY AND RETURNS

The warranty covers electronical and mechanical defects and is valid for 1 year from the date of purchase. The warranty excludes user-caused damage to the device, such as a scratched prism. In case of a warranty claim, contact the vendor of your device who will take care of the necessary steps. The device must be cleaned before return. See also corresponding safety instructions.
