KRÜSS

DIGITAL REFRACTOMETERS | DR7000-Series

Product information

SCAN ME

Content

1 Performance description

The devices from the DR7000 series are digital refractometers that were designed to measure the refractive index, %Brix or other concentrations in liquid samples. In order to carry out the measurement, the limiting angle of total reflection between a sample and a prism is determined. Measurements are carried out at a wavelength of 589 nm. With an optical sensor, temperature control, measuring electronics, evaluation electronics and a touch display, the devices contain all the components needed to carry out measurements reliably. All operations are possible on the device itself. A separate PC with software is not necessary.

The devices and their firmware meet all requirements for FDA-regulated areas (depending on model), as well as the European (Ph. Eur.) and American (USP) pharmacopoeias.

Overview of the properties:

- Determining the refractive index in the range up to nD 1.3000 – 1.72000 and 0.00 – 95.00 %Brix
- Resolution up to 0.00001 nD and 0.01 %Brix
- ⓘ The exact measurement range, measurement accuracy and resolution depend on the particular DR7000 model, see chapter 3.1 Technical data.
- Internal Peltier temperature control and integrated sensor for temperature monitoring
- Pre-installed scales for refractive index and %Brix (concentration of a sucrose solution)
- Pre-installed temperature compensation for %Brix (concentration of a sucrose solution)
- Functions allowing the customer to create and edit further measurands and temperature compensations
- Versatile method settings
- Up to three measurands can be measured simultaneously
- Internal memory for storing measurement results and an optional audit trail
- 1-point adjustment by the customer
- Activatable user management with three user levels
- Chemical-resistant stainless steel measuring tray
- Sample prism made from scratch-resistant, chemical-resistant sapphire
- A small sample volume of around 0.3 ml is required for the measurement
- Device connections: 2x USB connections (2.0; type A); 1x serial interface (RS-232); 1x LAN connection (RJ-45); 1x AUX (currently not supported)
- Firmware with user interface for measurement, configuration, adjustment and management on the device itself

1.1 Application areas

Refractometry with measurement of the refractive index, %Brix and other derived concentrations is a widely used analysis method in identity and purity testing of liquid samples. The refractometers in the DR7000 series are used as laboratory instruments.

Refractometers are used to determine concentrations and mixture ratios and for purity control, mainly in the following sectors/industries:

- Pharmacy
- Drinks
- Food
- Sugar/sweetener
- Chemistry
- Flavourings
- Petrochemicals
- Automotive
- Cosmetics/hygiene
- Water/sewage
- Education/research

ⓘ See also Website: Typical areas of application

2 Device description

2.1 Overview device models

The refractometers of the DR7000 series are available in one of four different models. The models differ in their measurement range, measurement accuracy, resolution, temperature control range and the functionality of data integrity..

Model	Measurement range	Measurement accuracy	Resolution at launch	Resolution in future	Temperature control range	Audit Trail
DR7100-P	1,3000 nD – 1,5800 nD	4 digits after the decimal point	4 digits after the decimal point	4 digits after the decimal point	10 °C – 60 °C	without
DR7200-P	1,3000 nD – 1,5800 nD	4 digits after the decimal point	4 digits after the decimal point	5 digits after the decimal point	10 °C – 60 °C	completely available

2.2 Overview DR7100-P and DR 72000-P

DR7100-P:

- **MEASUREMENT RANGE**:
  nD 1,3000 – 1,5800; 0-95 %Brix
- **MEASUREMENT ACCURACY**:
  nD ±0,0001; ±0,1 %Brix
- **RESOLUTION**: nD 0,0001; 0,1 %Brix
- **TEMPERATURE CONTROL RANGE**:
  10°-60°C
  None Audit trail

DR7200-P:

- **MEASUREMENT RANGE**:
  nD 1,3000 – 1,5800; 0-95 %Brix
- **MEASUREMENT ACCURACY**:
  nD ±0,0001; ±0,1 %Brix
- **RESOLUTION**: nD 0,0001; 0,1 %Brix
- **TEMPERATURE CONTROL RANGE**:
  10°-60°C
- **Audit trail completely available**

2.3 Overview DR7300-P and DR 74000-P

Model	Measurement range	Measurement accuracy	Resolution at launch	Resolution in future	Temperature control range	Audit Trail
DR7300-P	1,30000 nD – 1,72000 nD	5 digits after the decimal point	5 digits after the decimal point	5 digits after the decimal point	10 °C – 80 °C	without
DR7400-P	1,30000 nD – 1,72000 nD	5 digits after the decimal point	5 digits after the decimal point	6 digits after the decimal point	10 °C – 80 °C	Completely available

DR7300-P:

- **MEASUREMENT RANGE:**
  nD 1,30000 – 1,72000; 0-95 %Brix
- **MEASUREMENT ACCURACY:**
  nD ±0,00002; ±0,02 %Brix
- **RESOLUTION:** nD 0,00001; 0,01 %Brix
- **TEMPERATURE CONTROL RANGE:**
  10°-80°C
- **None Audit trail**

DR7400-P:

- **MEASUREMENT RANGE:**
  nD 1,30000 – 1,72000; 0-95 %Brix
- **MEASUREMENT ACCURACY:**
  nD ±0,00002; ±0,02 %Brix
- **RESOLUTION:** nD 0,00001; 0,01 %Brix
- **TEMPERATURE CONTROL RANGE:**
  10°-80°C
- **Audit trail completely available**

3 Technical data all models DR7000 series

3.1 Basic device data

DESIGNATION	KEY DATA
MEASUREMENT RANGE	■ DR7100-P: nD 1.3000 – 1.5800; 0-95 %Brix ■ DR7200-P: nD 1.3000 – 1.5800; 0-95 %Brix ■ DR7300-P: nD 1.30000 – 1.72000; 0-95 %Brix ■ DR7400-P: nD 1.30000 – 1.72000; 0-95 %Brix
MEASUREMENT ACCURACY[1]	■ DR7100-P: nD ±0.0001; ±0.1 %Brix ■ DR7200-P: nD ±0.0001; ±0.1 %Brix ■ DR7300-P: nD ±0.00002; ±0.02 %Brix ■ DR7400-P: nD ±0.00002; ±0.02 %Brix
RESOLUTION	■ DR7100-P: nD 0.0001; 0.1 %Brix ■ DR7200-P: nD 0.0001; 0.1 %Brix ■ DR7300-P: nD 0.00001; 0.01 %Brix ■ DR7400-P: nD 0.00001; 0.01 %Brix
TEMPERATURE COMPENSATION	■ Automatic temperature compensation for %Brix according to ICUMSA Temperature compensation can be created by the customer
MEASUREMENT PERIOD[2]	■ Approx. 2 s
MEASUREMENT PRISM	■ Sapphire
FILLING QUANTITY	■ ≈0.3 ml
LIGHT SOURCE	■ LED 589 nm
OPERATION	■ 7.0 inch capacitive touchscreen, 800 x 480 pixels
AUDIT TRAIL FUNCTIONALITY	■ DR7100-P: none ■ DR7200-P: fully available ■ DR7300-P: none ■ DR7400-P: fully available
INTERFACES	■ 2x USB (2.0; type A); 1x RS-232; 1x LAN; 1x AUX (currently not used)
IP CODE	■ IP20
DIMENSIONS (W X H X D)	■ 230 mm x 170 mm x 360 mm
HOUSING	■ Aluminium, powder coated
COMPONENTS IN CONTACT WITH THE SAMPLE	■ Sapphire, PTFE and stainless steel 1.4404 (X2CrNiMo17-12-2)
DEVICE WEIGHT	■ 5 kg

[1] Under normal conditions for measurement of the refractive index (λ = 589 nm, 20 °C, 1013 hPa, 50 % rel. humidity)

[2] After temperature equalisation

3.2 Temperature data

DESIGNATION	KEY DATA
TEMPERATURE MEASUREMENT	Integrated Peltier temperature control
TEMPERATURE MEASUREMENT RANGE[3]	■ DR7100-P: 10 – 60 °C ■ DR7200-P: 10 – 60 °C ■ DR7300-P: 10 – 80 °C ■ DR7400-P: 10 – 80 °C
TEMPERATURE MEASUREMENT ACCURACY	■ DR7100-P: ±0.1 °C ■ DR7200-P: ±0.1 °C ■ DR7300-P: ±0.03 °C ■ DR7400-P: ±0.03 °C
TEMPERATURE MEASUREMENT	Integrated Pt100 temperature sensor
TEMPERATURE MEASUREMENT RANGE	10 – 80 °C
TEMPERATURE MEASUREMENT ACCURACY	■ DR7100-P: ±0.1 °C ■ DR7200-P: ±0.1 °C ■ DR7300-P: ±0.1 °C ■ DR7400-P: ±0.1 °C
TEMPERATURE MEASUREMENT RESOLUTION	■ DR7100-P: 0.1 °C ■ DR7200-P: 0.1 °C ■ DR7300-P: 0.01 °C ■ DR7400-P: 0.01 °C
AMBIENT TEMPERATURE	10 – 40 °C
AMBIENT HUMIDITY	10 – 90 % (non-condensing)

[3] normal conditions for measurement of the refractive index (λ = 589 nm, 20 °C, 1013 hPa, 50 % rel. humidity)

3.3 Electrical data

DESIGNATION	KEY DATA
OPERATING VOLTAGE	90 – 240 V_{AC}
POWER CONSUMPTION	40 W in measurement mode[4]; 75 W maximum value
RATED FREQUENCY	50/60 Hz

[4] Under normal conditions for measurement of the refractive index (λ = 589 nm, 20 °C, 1013 hPa, 50 % rel. humidity)

3.4 Instruction Manual

■ For CSP partners, available in German and English with log-in on the website download page

4 Advantages of the DR7000 series

4.1 Operation and measurement

OPERATION

- Lightweight – Fast – User-friendly
- Capacitive 7.0-inch touch display
- Interactive user interface in several languages
- Easy-to-understand, menu-guided adjustment
- Any number of user profiles possible
- Export as print via network/printer or to USB stick
- Export also to several password protected network folders
- Operation also via keyboard and/or PC mouse
- Help and explanations "On Board" for Operation without a manual

MEASUREMENT

- Almost all samples are measurable
- Highly accurate, fast concentration measurement of liquid samples and pastes
- Consistently high accuracy across the entire measurement range
- Precise Peltier temperature control and a measured value preview which is updated every second
- Automated conversion to any measurement variables/scales
- Pre-installed scales: refractive index, %Brix sucrose, many more scales available on request as well as individually adjustable scales
- Up to three scales visible at the same time
- Single, interval or continuous measurement
- Low sample volume from < 0.3ml
- Easy cleaning due to flat measuring recess
- Scratch-resistant sapphire prism

4.2   Design & Features

DESIGN

- Advanced technology for precise measurements
- New ventilation concept: ventilation unit is hermetically separated from optics and electronics
- Electronics are protected from dust and other environmental influences, making the device low-maintenance
- Intelligent waste heat control and ventilation control
- Improved sample temperature control for even greater accuracy and measurement consistency
- High-tech display with state-of-the-art user management
- Option for modular replacement of the flow-through cell
- Robust metal housing
- Low noise during operation

FEATURES

- Model diversity for adaptive use
- Large temperature control range: 10°-80°C
- Large measurement range: 1.3000nD-1.72000nD
- User accounts: >10000
- Methods: >1000
- Measured data storage > 1 000 000
- Device volume <10 dB (temperature control range 15°C-30°C)

4.3   Assistance systems and compliance

KRÜSS - ASSISTANCE SYSTEMS

- KRÜSS – TempGate

  The set sample temperature control is continuously monitored by the TempGate functionality. An LED ring around the sample well indicates that the DR7000 is ready to measure.

- KRÜSS – MEASUREMENT STABILITY CHECK (MSC)

  This function can be used to check the stability of the measured value during an ongoing measurement. This means that only measured values that meet the set stability criteria are saved in the results memory.

- KRÜSS – DYNAMIC TEMPERATURE CONTROL (DTC)
  The DR7000 temperature controls samples fully automatically and homogeneously. With the Dynamic Temperature Control – DTC – function, the desired accuracy of temperature control can be selected. This allows the required temperature control and measurement period to be adapted to individual samples and thus reduced to a minimum.


CONFORMITY WITH STANDARDS & DIRECTIVES

- CFR 21 Part 11
- Pharmakopöen (EU / USP / JP / BP)
- ASTM / DIM / ICUMSA / NIST / OIML
- GAMP / GMP

4.4   Data integrity and customer care

DATA INTEGRITY / DEVICE SECURITY

- Firmware, data acquisition and storage are compliant with 21 CFR Part 11 & EU GMP Annex 11
- Secured audit trail (remains for the lifetime of the measuring device)
- Tamper-proof measured data and export data (PDF/A)
- Measured value preview during measured value stabilization
- Multi-level user management
- Extensive password settings
- Configurable device interfaces
- Simple integration into existing networks is possible with the DHCP client
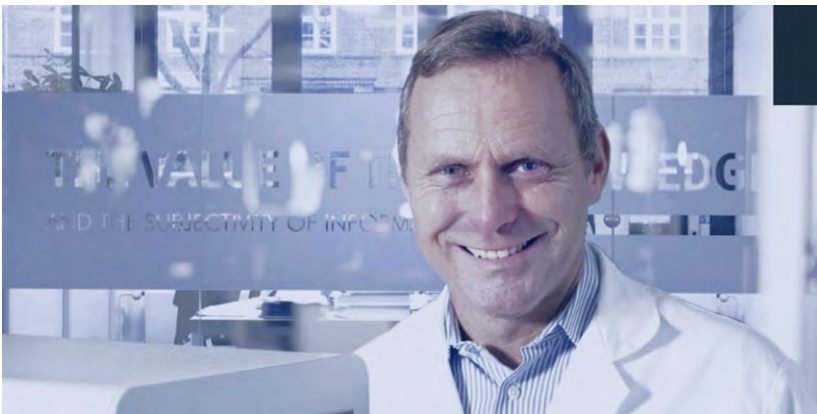
CUSTOMER CARE

- Low maintenance
- Up to 3 years warranty
- On-site calibration and maintenance service
- Maintenance contracts possible on request
- Certified installations (DQ/IQ/OQ/PQ) for compliance with regulatory and internal requirements

4.5 Overview Details: Data integrity and device security

AUDIT TRAIL FUNCTION	
RECORDING	▪ Secure electronic records of system activities (measurements, signatures, exports, setting changes) including comment option
DATA MANIPULATION	▪ Data cannot be deleted or manipulated The audit trail and measurement results cannot be deleted or manipulated for the entire service life of the device. ▪ Deleting user accounts is not possible. Unused user accounts are blocked for use

FUNCTIONS FOR DATA SECURITY	
DATA PRINTOUT	▪ GxP-compliant printout of data and device settings, fully traceable
TAMPER-PROOF	▪ Tamper-proof thanks to individual authorization of the time and date setting
DATA TRANSMISSIO	▪ Data transmission using standard protocols (LAN, network share protocol)

UNIQUE AND NON-CONFUSABLE ASSIGNMENT OF USER ACCOUNT	
USER ACCOUNTS	▪ Creation and identification of users at three predefined levels (User, Application Administrator, System Administrator)
USER ACCOUNT LOGIN	▪ Each user account has a unique combination of name and login information to correctly and uniquely identify the user account
PASSWORD SECURITY	▪ Enhanced security through complex passwords (letters, numbers, special characters) and individual, defined expiry periods

EXTENDED COMPLIANCE FUNCTIONS	
RAW DATA ACCESS	▪ Possibility to access raw data and save raw data

FUNCTIONS FOR COMPLETE TRACEABILITY OF MEASUREMENT RESULTS	
MEASURED VALUE STORAGE	▪ All measurement results are saved together with all method settings so that results are fully traceable

DATA IMPORT AND EXPORT	
SIGNED & PROTECTED IMPORT	▪ Only files that are signed and recognized as permissible by the system can be loaded and processed by the system
INTERFACES CONFIGURATION	▪ It is possible to define the interfaces for export and import system-wide. Note: If a interface is not selected, it is not possible to export and import to it.

5 Accessories and calibration standards

ⓘ Order direct on our WEBSITE:

⌐ **ACCESSORIES**

⌐ **CONSUMABLES**

ORDER NUMBER	ITEM
PC762	Protective cover
P7001	**Dessicant cartridge for DR7000 series** (National Stock Number 4440-12-158-5263)
RI34	**Certified calibration liquid** Refractive index nD: 1.3400; 30 ml
RI39	**Certified calibration liquid** Refractive index nD: 1.3900 (~34.8 %Brix); 30 ml
RI43	**Certified calibration liquid** Refractive index nD: 1.4300 (~54.6 %Brix); 30 ml
RI48	**Certified calibration liquid** Refractive index nD: 1.4800 (~75.8 %Brix); 30 ml
RI65	**Certified calibration liquid** Refractive index nD: 1.6500; 30 ml

6 Promotion Material

6.1 Website

➔ Product published (in the languages: [German](#)/[English](#)/[Spanish](#)/[French](#))

➔ Information about refractometry on the KRÜSS campus

(in the languages: [German](#)/[English](#)/[Spanish](#)/[French](#))

CONTENTS

1. What does the refractometer measure?
2. Standards and guidelines
3. Samples and measured values
4. Typical areas of application
5. Cleaning tips
6. How to Use
7. Refractometer measurement & adjustment
8. Documents

6.2 Video

➔ Watch the refractometer on KRÜSS-Channel [YouTube](#)

ⓘ Any questions ? Book a discovery call

[BOOK NOW](#)