



Anton Paar

Measure
what is measurable
and make measurable
that which is not.

Galileo Galilei (1564-1642)

Reference Guide

Abbemat 350/550

Automatic Refractometer

Instrument Software Version: 5.30

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Further information

Published and printed by Anton Paar GmbH, Austria

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Date: 2021-08-25

Document number: D22IB013EN-D

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1 Safety Instructions

- Read the documentation before using the instrument.
- Follow all hints and instructions in the documentation to ensure the correct use and safe functioning of the instrument.
- The documentation is a part of the product. Keep it for the complete working life of the product and make sure it is easily accessible for all persons involved with the product. If you receive any additions or revisions to the documentation from Anton Paar GmbH, these must be treated as part of the documentation.
- Make sure all operators are trained to use the instrument safely and correctly before starting any applicable operations.
- In case of damage or malfunction, do not continue operating the instrument. Do not operate the instrument under conditions which could result in damage to goods or injuries or loss of life.
- If liquid has been spilled over the instrument, disconnect the instrument from the AC power supply. Clean and dry the housing of the instrument. If you have a suspicion that liquid got into the instrument, have the instrument cleaned and checked for electrical safety by a service technician.

1.1 General Safety Instructions

Liability

- This document does not claim to address all safety issues associated with the use of the instrument and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.
- Anton Paar GmbH warrants the proper functioning of the instrument only if no modifications have been made to mechanics, electronics, firmware or software.
- Only use the instrument for the purpose described in the documentation. Anton Paar GmbH is not liable for damages caused by the incorrect use of the instrument.
- The results delivered by the instrument depend not only on the correct functioning of the instrument, but also on various other factors. We therefore recommend you have the results checked (e.g. plausibility tested) by skilled personnel before consequential actions are taken based on the results.

Installation and use

- The instrument is **not** explosion-proof and therefore must not be operated in areas with risk of explosion.
- The installation procedure should only be carried out only by authorized personnel who are familiar with the installation instructions.
- Do not use any accessories or spare parts other than those supplied or approved by Anton Paar GmbH.

Maintenance and service

- Service and repair procedures may only be carried out by authorized personnel or by Anton Paar GmbH.

Disposal

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

Returns

- For repairs send the cleaned instrument to your Anton Paar representative. Only return the instrument together with the filled out RMA (Return Material Authorization) and the form "Safety Declaration for Instrument Repairs". Please download the Safety Declaration form from our website www.anton-paar.com.
- Do not return instruments which are contaminated by radioactive materials, infectious agents or other harmful substances that cause health hazards.

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.).
- Before a measurement, check the wetted parts of the instrument for chemical resistance to the samples and cleaning agents used.
- Take care that the liquids (samples and cleaning agents) or gases that you use are chemically

compatible when they come into contact with each other. They shall not react exothermically or produce solid particles which might stick to the sample interface.

- Before you start a measurement or cleaning procedure, take care that all parts, especially the measuring cells, the hoses, and the waste vessel, are properly connected and in good condition.
- Take measures that spilled liquids cannot get into plug connections or venting slots of electrical appliances.
- Connect the measuring system to the AC power supply via a safety switch located at a safe distance from the instruments. In an emergency, turn off the power using this switch instead of the power switch on the instruments.
- Ensure the sufficient supervision of the instrument during operation.

Precautions for highly inflammable samples and cleaning agents

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the instrument.
- Place the instrument on a laboratory bench made of fireproof material, preferably bricks, ceramics, or stoneware.
- Store only the minimum required amount of sample, cleaning agents and other inflammable materials near the instrument.
- Do not spill sample/cleaning agents or leave their containers uncovered. Immediately remove spilled sample/cleaning agents.
- Make sure that the setup location is sufficiently ventilated. The environment of the instrument must be kept free of inflammable gases and vapors.
- Provide a fire extinguisher.

1.2 Conventions for Safety Messages

The following conventions for safety messages are used in this document:



WARNING

Description of risk.

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



CAUTION

Description of risk.

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

NOTICE

Description of risk.

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

1.3 Safety Signs on the Instrument



CAUTION

Hot surface

The measuring prism, its surrounding steel surface or mounted accessories can be very hot. Do not touch these surfaces without adequate protective measures.

2 Abbemat - An Overview

The Abbemat is an automatic refractometer for measuring the refractive index of liquid and solid samples at high accuracy.



The Abbemat was developed to satisfy demanding quality control and research requirements with the utmost measuring precision and ease of use.

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, e.g. the freezing point of cooling liquid.

Refractive index data is usually related to a standard temperature, e.g. 20 °C or 25 °C, because the temperature dependence of the refractive index is specific to each sample. Therefore, an accurate temperature control of the refractometer prism and sample is essential. The refractive index of organic chemicals is particularly temperature-dependent. Small changes in temperature can cause considerable refractive index deviations.

Innovative features

- High accuracy over the entire measuring range
- Full compliance to international standards
- Fast measurements
- Low sample volume requirement
- Robust measuring principle
- Combination with Anton Paar DMA M density meter / MCP polarimeter
- Intuitive operating software
- Fulfills all data safety requirements of 21 CFR Part 11 regulation

Error detection

Two major sources of measuring errors are a dirty measuring prism and insufficient sample volume on the measuring prism. The Abbemat automatically recognizes such errors and will warn you accordingly.

User interface

The touchscreen user interface supports easy and intuitive operation in routine applications as well as in sophisticated scientific research work:

- For the most common applications, several measuring methods are predefined. Just select the method fitting your application or create your own methods.
- The refractive index values are automatically converted into concentration values for a large number of factory-programmed substances.
- You can operate the Abbemat via external keyboard, computer mouse or bar code reader.

Data management and safety

The Abbemat offers up-to-date data management and safety features to make your work easier and help you to comply with your quality management regulations:

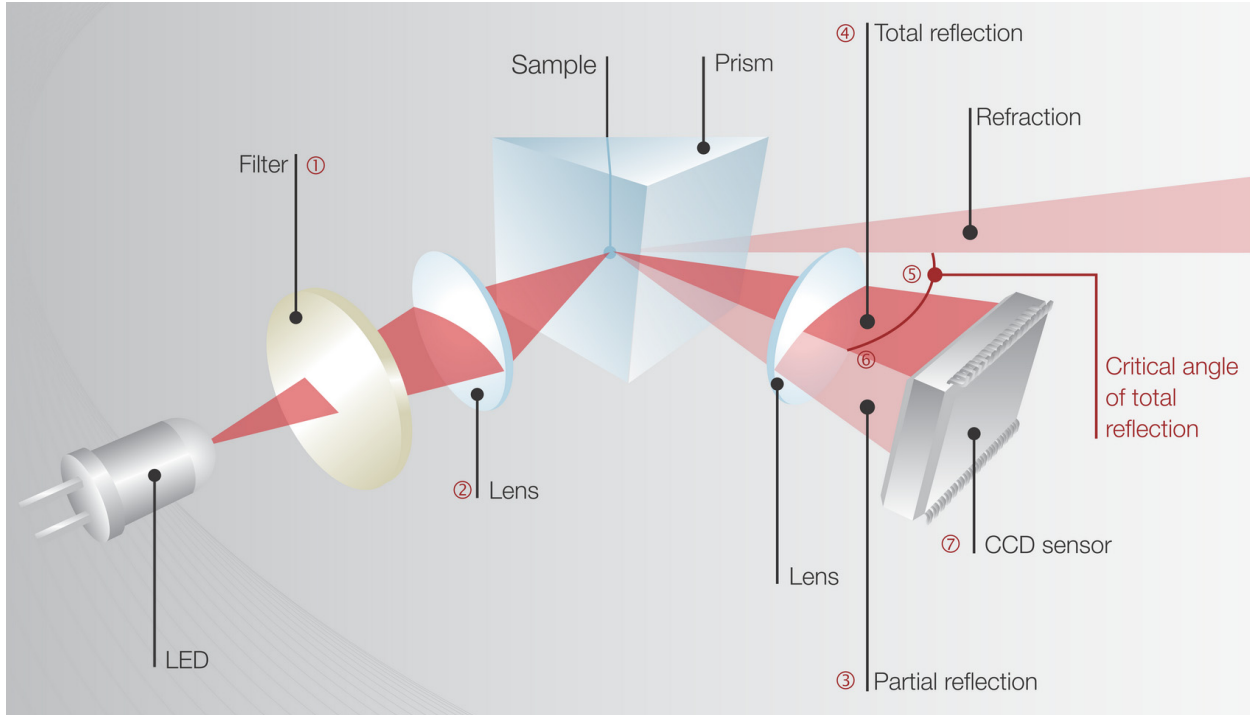
- Print out reports
- Export your data in the format of your choice (MS Excel, text or PDF)
- Choose between the interfaces: 3 x USB, Ethernet, RS-232 and CAN Bus
- Use the audit trail function with tamper-proof data export (checksum)
- Rely on compliance with international pharmacopoeias, OIML, 21 CFR Part 11 and GLP/GMP

The refractive index is a number without dimension. However, for daily work in the lab, a number of scales with units have proven useful. Abbemat refractometers cover many standard scales. Custom scales are available on request.

2.1 Measuring Principle

Anton Paar refractometers use reflected rather than transmitted light to measure the refractive index. In this approach the sample on top of the measuring

prism is irradiated from different angles by an LED. At the interface between sample and prism the incident beam is either refracted into the sample or reflected back into the prism. The reflected beam is detected by a sensor array.



1. The LED shines light through an interference filter. It defines the right wavelength for the measurement.
2. Lenses direct the light from different angles onto the interface between prism and sample.
3. Light hitting the prism-sample interface at **steep** angles is **partially reflected** onto the sensor and **partially refracted** into the sample.
4. Light hitting the prism-sample interface at **shallow** angles is **totally reflected** onto the sensor and no light is lost to the sample.
5. The boundary between partial and total reflection (critical angle), depends on the ratio of the refractive indices of prism and sample.
6. The critical angle shows as a transition between a darker region and a brighter region on the sensor (caused by partial reflection / total reflection).
7. The position of the dark-bright boundary on the sensor moves when applying samples with different refractive indices. From this position the critical angle of total reflection is calculated and used to determine the refractive index (RI) of the sample.

The refractive index is measured relative to air at 1013 hPa and 50 % relative humidity.

Three parameters determine a high-quality measurement of the refractive index:

- The critical angle of total reflection (α_{crit}).
- Temperature (T).
- Wavelength (λ).

With Abbemat refractometers, the critical angle of total reflection is measured with a high quality optical setup made of selected components. Minimal stray light, a high-resolution CCD sensor and Fresnel analysis result in a high resolution in refractive index. The optical bench is hermetically sealed to protect it from outside influences such as condensation - even in tropical conditions.

Temperature is the biggest influencing factor regarding the refractive index. For this reason Abbemat refractometers control the temperature at the prism/sample interface with utmost precision within seconds.

The wavelength is tuned to a small bandwidth by means of an interference filter. In contrast to simpler optical setups this technology ensures correct results for samples with different dispersions.

Your benefits of this technology are:

Economic use of sample

- Only a small sample volume is required.
- The sample can be recovered as the measurement is non-destructive.

Fast and easy measurements

- You do not have to prepare your sample
- Just apply sample and get a reading within seconds.
- A quick wipe cleans the prism after each run.

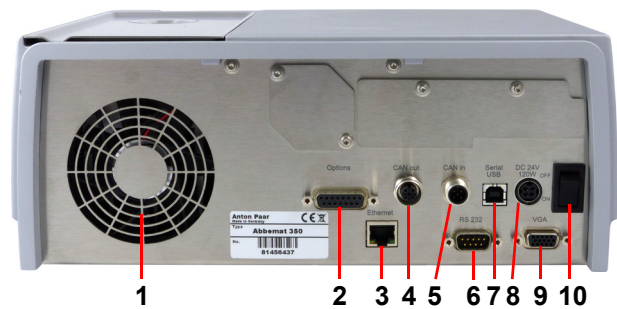
Highly tolerant

- No influence from vibrations and other environmental disturbances.
- Independent of sample properties you can measure:
 - all samples from liquids to pastes, polymers or solids.
 - turbid, colored or opaque samples.
 - liquids containing air bubbles or solid particles.

A durable instrument

- A long-life LED is used as light source.

Interfaces on the rear



- 1 Fan
- 2 Options
- 3 Ethernet
- 4 CAN out
- 5 CAN in
- 6 RS-232
- 7 Serial USB (for service)
- 8 Power inlet
- 9 VGA interface
- 10 Power switch

Interfaces on the left side



- 1 USB interfaces for printer, storage devices, mouse, keyboard or bar code reader

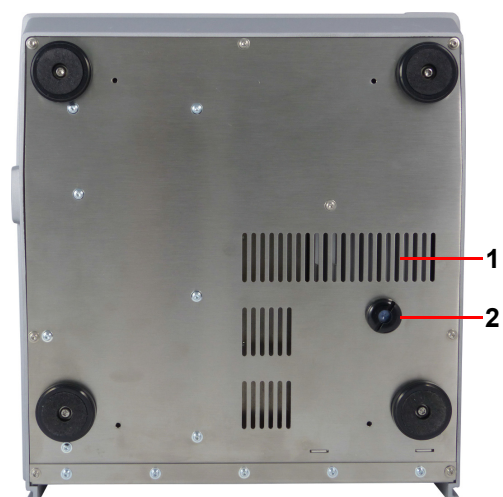
2.2 Functional Components

Front view



- 1 LCD color touchscreen
- 2 Magnetic sample cover
- 3 Power on LED

Bottom view



- 1 Ventilation openings
- 2 Drying cartridge (at the rear side in previous versions)

2.3 Abbemat Desktop

Abbemat Desktop is an optional PC software to control the refractometer series Abbemat 350, 450, 550 or 650. The software runs on a single workstation computer. Client-server operation is not provided. All data processing is performed on the computer, not on the instrument.

Because the data is stored on the PC, the program gives access to already acquired data, even if the instrument is not available. The measurement database can be backed up and restored on demand or automatically.

Your benefits of the Abbemat Desktop software are:

- The time to qualify the instrument is decreased.
- One software for all data processing of your instrument
- Automatic data storage in the Abbemat Desktop software data base
- No direct instrument connection to network or server necessary
- Log on with Windows Active Directory credentials possible
- Access to your data even in case the instrument is not available

- No risk of manipulation of original data
- Raw data accessibility for long retention periods
- Availability of data in machine-readable and human-readable form

For more information please see section 17 or ask your Anton Paar representative.

2.4 AP Connect

AP Connect is a software for the digital lab guaranteeing straightforward data flow from instruments to your existing data management system. AP Connect stores data from all connected instruments in a central database and offers features to visualize, check and transfer data automatically or on demand.

AP Connect comes in two editions, with one paying special attention on the requirements from regulated environments (such as the pharmaceutical industry).

For more information please visit www.anton-paar.com/apc or see the AP Connect reference guide.

3 Checking the Supplied Parts







The instrument was tested and packed carefully before shipment.

1. Keep the packaging material (box, foam piece, transport protection) for possible returns.
2. Check the delivery for completeness by comparing the supplied parts to those noted in table 1.
3. If a part is missing, contact your Anton Paar representative.

4. If a part is damaged, contact the transport company and your Anton Paar representative.

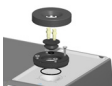
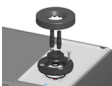


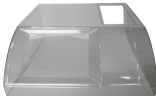

TIP: An instrument stored at low temperatures can cause condensation of moisture on sensitive parts. To prevent malfunctions allow the transport package and its contents to come to thermal equilibrium prior to opening. Therefore the unopened package should first be stored in a dry room at normal temperature for a few hours.

Table 1: Supplied Parts

Symbol	Pcs.	Article Description	Mat. No.
	1	Abbemat 350 or Abbemat 550	97789 97787
	1	Instruction manual (English)	99376
	1	External Power Supply	99780
	1	Power cord USA or Power cord UK or Power cord Europe	52656 61865 65146
	1	Magnetic sample cover	101659
	1	Drying cartridge	107786
	5	Pasteur pipette (3 mL)	47447

3 Checking the Supplied Parts

Table 2: Optional Parts and Accessories

Symbol	Pcs.	Article Description	Mat. No.
	1	Micro flow cell, Polypropylene PPSGF40 Micro flow cell, stainless steel, 1.4404 Micro flow cell, PFA	101384 101385 154808
	1	Flow cell	101383
	1	Flow cell with filling funnel	101396
	1	Sample presser for solid samples	110284
	1	Protective Cover	105468
	1	Peristaltic Pump	102989
	1	Roller cassette with fluran tubing	99306
	1	Roller cassette with novoprene tubing	99284
	1	Tubing Fluran 2.5 mm x 4.5 mm, 1 m	100302
	1	Tubing Novoprene 2.5 mm x 4.5 mm, 1 m	100297

3.1 Certified Reference Liquids

Certified reference liquids are available for checks and calibration of your refractometer. Please contact your Anton Paar representative for details.

3.2 Pharma Qualification

Anton Paar understands your need for completely traceable results and supports you with a qualification package following the 4Q model that fulfills the requirements of the pharmaceutical industry: GMP, 21 CFR Part 11, GAMP 5, USP<1058>. With the Pharma Qualification Package (PQP) your new Abbemat refractometer is ready for immediate start-up after purchase.

The Pharma Qualification Package (PQP) includes:

- Qualification Instruction (QI)
- Design Qualification (DQ) including Qualification Plan, As-built Specification and Risk Analysis, DQ Report
- Installation Qualification (IQ) including all installation relevant test points, IQ Report
- Operational Qualification (OQ) including Temperature Check, Calibration, Adjustment, Customer Reference Sample, Check List 21 CFR Part 11, User Training, OQ Report
- Performance Qualification (PQ) including Customer Sample Protocol, PQ Report
- Final Qualification (FQ) including Traceability Matrix, Deviation List, Final Qualification Report
- Standard Operating Procedure (SOP) as Word file for customer's use
- Qualified support on-site

The Pharma Qualification Package SMART (PQP-S) includes:

- Qualification Instruction (QI)
- Design Qualification (DQ) including Qualification Plan and Risk Analysis
- Installation Qualification (IQ) including all installation relevant test points
- Operational Qualification (OQ) including Temperature Check, Calibration, Adjustment, Customer Reference Sample, User Training
- Performance Qualification (PQ) including Customer Sample Protocol,
- Final Qualification (FQ) including Deviation List, Final Qualification Report
- Standard Operating Procedure (SOP) as Word file for customer's use
- Qualified support on-site

Table 3: Pharma Qualification

Article Description	Mat. No.
Abbemat 300/350/450/500/550/650 Pharma Qualification Package	101434
Abbemat 300/350/450/500/550/650 Pharma Qualification Package "Smart"	145922
Abbemat 300/350/450/500/550/650 Pharma Requalification Package	156605

4 Installing the Instrument

4.1 Installation Requirements

Allow the equipment to reach ambient temperature before installation. This is important if the equipment has been stored or transported at lower temperatures.

The setup location and surroundings should meet the requirements of a laboratory. Place the instrument on a stable, flat lab desk which is free of vibrations. To reach the highest possible precision for your measurements, do not place the instrument:

- next to a heating facility
- near an air conditioning, ventilation system or an open window
- in direct sunlight

Keep the instrument away from magnetic fields.

Read the safety instructions in section 1.

Find all technical data in appendix A.



WARNING

- Ensure that the power plug is always easily accessible so that the instrument can easily be disconnected from the mains at any time.
- Ensure that the ventilation through the rear and bottom of the instrument is not blocked by any obstacles.

4.2 Switching On the Instrument



WARNING

- Before switching on the instrument, make sure that the line voltage is 100 V AC to 240 V AC, 50/60 Hz. If large voltage fluctuations are to be expected, a constant voltage source (UPS) is recommended.
- The non-fused earth conductor of the power cord (or power inlet) has to be connected to earth.

1. Connect the power inlet of the Abbemat with the plug of the external power supply.
2. Connect the external power supply to the mains using the power cord.

To switch the instrument on or off, use the power switch at the rear of the instrument. The green LED on the front side indicates that the power is on.

After turning on the power, the instrument needs approximately 15 minutes for temperature equilibration and internal temperature adjustments.

5 Operating the Instrument

To operate the instrument you can use the touchscreen. You can also connect an external keyboard, bar code reader, or mouse (not supplied by Anton Paar) to one of the USB interfaces.

5.1 Main Screen

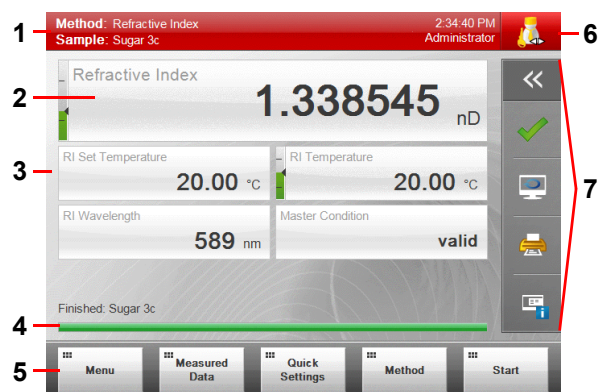


Fig. 1: Main Screen Example

- 1 Header
- 2 Output field (with limits displayed)
- 3 Content area
- 4 Progress bar
- 5 Buttons area
- 6 User indicator
- 7 Quick access area

NOTICE

- Operate the touchscreen with clean and dry fingers only.
- Never use any sharp objects.

The left part of the **header** displays the name of the currently active method and the sample name. While navigating in menus you can see the menu path here. The right side of the **header** displays the current time, the user name and a button with the **user indicator**. Tap on it to change users.

The **content area** displays measuring values, instrument status or limits in small, medium or large **output fields**.

The layout of the content area is defined in the settings of the current method and can be adapted according to your needs. The displayed output quantity of a single output field can easily be changed: Tap on it to select a new quantity.

The **output fields** display the measuring values and the actual temperature of the sample. A red **progress bar** indicates if the instrument is currently mea-

suring. It turns green when a measurement is finished.

Important functions and messages are easily accessible using the buttons in the **quick access area**. The status button changes its appearance depending on the current condition of the instrument.

Buttons Area

Use the buttons on the screen by directly tapping on them. If an external keyboard is connected, you can also use the function keys F1 to F5 to operate the five buttons within the buttons area:

Table 4: Buttons and function keys

Menu, F1	Open the main menu.
Measured Data, F2	View the measured data.
Quick Settings, F3	Opens the quick settings list. Only available in the "No Sample List" mode.
or Sample List, F3	Opens current sample list.
Method, F4	Choose and configure the measurement method.
Start/Stop, F5	Start/abort a measurement.

To start a measurement or to save changes, simply press <Enter> on your external keyboard. Pressing <Esc> exits without saving changes.

Quick access area

Table 5: Buttons in the quick access area










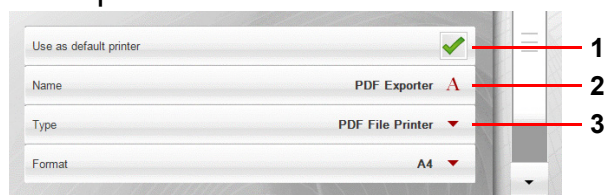
Button	Function
	Open the message list This button changes its appearance depending on the current instrument and measurement status:
	Red error sign The instrument has a major problem that needs to be fixed.
	Yellow warning sign The instrument has a minor problem, for instance a printer problem.
	Green OK sign Instrument status and error status of all measured samples are OK.

Table 5: Buttons in the quick access area

Button	Function
	The optional peristaltic pump is off. Use this button to switch it on.
	The optional peristaltic pump is on. Use this button to switch it off.
	Monitor mode is active. Until a measurement is started (or after a measurement is terminated by tapping <Stop>), the instrument is in the monitor mode and shows current measuring values.
	Activate the monitor mode . If you have started a measurement by tapping <Start>, the instrument continuously displays measuring values until the measurement is finished. The final values are frozen until the next measurement is started. Use this button to switch back to monitor mode.
	Instant print button for immediate printout of measurement results. Not available in Abbemat Desktop.
	This button is used to display information about favorites .

To reset the message list button to the green OK sign, confirm each message by tapping on the <X> button. To confirm all messages in the list in one step, tap <Remove deletable messages>.

5.2 Input Control Elements



- 1 Check box
- 2 Input Box
- 3 Drop-Down box









Check boxes

Tap on a check box to activate or deactivate the required function.

Input boxes

Tap on an input box to open the on-screen keyboard. Enter characters, numbers or special characters by tapping the buttons and then tap <OK>. You can also use the special keyboard buttons:

Table 6: Keyboard functions

	Deletes the character on the left side of the cursor position.
 	Moves the cursor position to the left or right.
	Changes to upper case or to special characters.
	Changes to the numeric character mode.
	Changes to alphabetic character mode.
	Changes to additional special characters.
	To display exponential numbers, e.g. to enter 0.025 as $2.5 \cdot 10^{-2}$ (only in number mode).

Drop-down or pop up menus

Tap on the menu and select an item from the list.

Context menus

To select an item in a table or list, directly tap on it. If you hold your finger on a data item for a prolonged time, a context menu will pop up. Select an item or tap outside to exit the context menu:

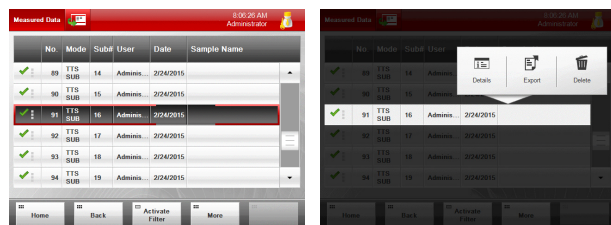


Fig. 2: A long tap (left) invokes a context menu (right)

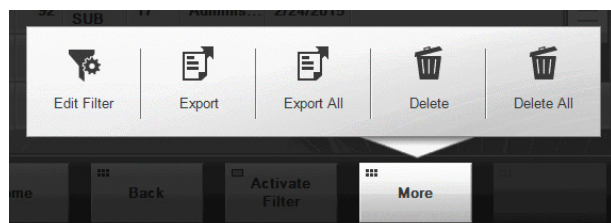



Fig. 3: Context menu of the <More> button


5.3 Using Favorites

The favorites function enables you to access your favorite menu dialogs directly from the main screen. The favorites list is the same for all users.



To add a dialog window to the favorites list

1. Open the dialog window to be set as favorite.
2. Tap  (add to favorites).
3. Confirm the proposed name or enter another.



To use the favorites list

1. In the main screen, tap  to open the quick access window.
2. Tap on a favorite in the list to open the required menu. If necessary, use the page navigation in the header of the window to navigate the list.



To change the sequence of the favorites list

1. Tap  then tap .
2. Use the up/down arrows in the right column to change the position of the list item in the favorites list.
3. Proceed so with all other list items whose position you want to change and tap <OK>.

To rename a favorite

1. Tap  then tap .
2. Select an item with a long tap, then tap <Rename>.
3. Enter the new favorite name.

To delete a favorite

1. Tap  then tap .
2. Select an item with a long tap, then tap <Delete>.

TIP: Standard favorites like "Message List" and "Monitor Mode" cannot be deleted or renamed.

5.4 Setting Date and Time

Tap **Menu > Setup > Control Panel > Date and Time** and enter the current date and time. This setting is not available with Abbemat Desktop.

5.5 Regional Settings

1. Tap **Menu > Setup > Control Panel > Regional Settings**.
2. Enter the "Language", "Data Format" (for numbers, date and time format), and the "Keyboard Layout".
3. Tap <OK> and then <YES> to confirm the new settings. The instrument reboots.

If the instrument is operating in a language you do not understand, you can reset the user interface to English. Connect an external USB keyboard, press <Ctrl>, <Alt> and <E> simultaneously and switch the instrument off and on again.

Abbemat Desktop: The language of the user interface is selected according to the language set in Windows. If this language is not available in Abbemat Desktop, the software switches to English per default.

5.6 Input Unit for Temperatures

In this menu, you can define the unit for every temperature value which you enter during operation.

1. Tap **Menu > Setup > Control Panel > Input Units**.
2. Select the "Input unit for temperatures".

5.7 Time Server

The instrument can automatically synchronize its clock with an Internet time server using the Network Time Protocol (NTP). This setting is not available in Abbemat Desktop.

To activate the synchronization, establish a network connection (see section 5.8). Your firewall must allow outbound connections to the specified servers.

To synchronize with a time server

1. Tap **Menu > Setup > Control Panel > Time Server Settings**.
2. Activate the check box "Use Time Server".
3. If required, you can change the time server address. Multiple addresses are separated by semicolon.
4. Select the "Time Zone" of your location.
5. Tap <OK> and then <YES> to confirm the new settings. The instrument reboots.

5.8 Network

If you connect the instrument to your local network, you can use a network printer for printouts and request the instrument system information and instruction manual via any PC in the network.

For network settings in Abbemat Desktop see the respective information in the section "Abbemat Desktop" (in the reference guide only).

1. Tap **Menu > Setup > Control Panel > Network**.
2. If your network server has DHCP functionality, activate "Obtain an IP address automatically (DHCP)", then tap <OK>.
3. If your network server has no DHCP functionality, enter IP Address, Subnet Mask, Default Gateway, primary and secondary DNS manually, then tap <OK>.

5.9 Instrument Name and Location

If you have more than one Anton Paar instrument and want to easily differentiate between them in printouts, data exports or within your local network (LIMS), you can define instrument names and locations.

1. Tap **Menu > Setup > Control Panel > Instrument Name and Location**.
2. Enter the "Instrument Name" and "Instrument Location".

5.10 Setting the Screen Saver

This setting is not available in Abbemat Desktop. Use a Windows screen saver instead.

1. Tap **Menu Setup > Control Panel > Screen Saver**.
2. Activate the check box "Automatically switch off display..." and enter a value between 1 and 300 minutes to set the time after which the screen saver starts.

To stop the screen saver

- Tap on the screen.
- Use another input device like mouse or keyboard.
- Start a measurement via Ethernet or RS-232.

5.11 Setting the Feedback Beep

The instrument can signal every touchscreen action, mouse click or bar code reader input as well as after the completion of a measurement.

1. Tap **Menu > Setup > Control Panel > Sound Settings**.
2. Activate/deactivate the feedback sound.
3. Activate/deactivate the sound at the end of a measurement.

5.12 Calibrating the Touchscreen

If you have difficulties in hitting the touchscreen user elements (buttons, sub-menus, etc.), calibrate the touchscreen (not available in Abbemat Desktop).

1. Tap **Menu > Setup > Control Panel > Calibrate Touchscreen**.
2. Follow the instructions on the screen.

5.13 Select Methods with Bar Code Reader

Connect a bar code reader (not supplied by Anton Paar) to enter sample names and to select methods in the sample list (see appendix D). The bar code reader has to be activated in the menu when used to edit sample lists.

1. Tap **Menu > Setup > Control Panel > Keyboard and Bar Code Settings**.
2. Activate the option "Use a bar code scanner to edit the sample list".

5.14 Adjusting the Display Brightness

Tap **Menu > Setup > Control Panel > Display Brightness** and enter the preferred setting (not available in Abbemat Desktop).

5.15 USB Storage Device

Insert a USB storage device into one of the ports (not available in Abbemat Desktop).

TIP: Format the storage devices using FAT, FAT32 or exFAT.

6 Measuring System Settings

6.1 Sample List

The sample list is a tool that helps you managing samples that you want to measure. It is especially helpful to measure multiple samples. In this mode the button <Sample List> is displayed on the main screen. Quick Settings (see section 11.4) can be found within the sample list.

No results are stored in the sample list itself, but the <Details> button in the sample list links you to the data memory and you can view the results of already measured samples in the sample list.

The sample list can contain up to 200 entries. The 201st entry overwrites the oldest entry. Entries older than 24 hours are automatically removed. The sample list will be automatically cleared if you switch off the instrument.

To activate the sample list mode

1. Tap **Menu > Setup > Measuring System Settings > Sample List / Sample Settings > Sample List / Sample Naming**.
2. Select the "Sample List Mode".
3. If required, activate "Use Automatic Sample Naming" and define the sample name settings (see section 6.3).
4. Tap <OK> to save the changes.

TIP: *The maximum data storage volume of 1000 data sets is calculated from the already measured samples (data memory) plus the samples in the sample list. Therefore it is recommended to regularly clear the sample list and the data memory.*

No Sample List Mode

With "No Sample List" mode active (set by default), just tap <Start> to initiate measurements. The "No Sample List" mode features the button <Quick Settings> on the main screen (see section 11.4). Tap this button to:

- enter a sample name.
- define measuring parameters.

The following measurements are executed accordingly without affecting the underlying method. Changed quick settings are maintained until further changes are made.

6.2 Managing the Sample List

To create a sample list

1. Tap <Sample List> (on main screen) to open the sample list window.
2. To enter a sample name, tap on a cell in the column "Sample Name".
3. Tap on a cell in the column "Method" and select a method from the sub-menu.
4. Tap <... > in the column "Quick Settings" and select measurement mode and settings as required.
5. Tap <OK>.
6. To exit the sample list and to save the changes, tap <OK>.

TIP: *You cannot edit or delete samples in the sample list that have already been measured.*

To copy, insert or delete samples

1. Select a sample with a long tap.
2. Tap <Copy>, <Insert> or <Delete>.

To copy multiple samples

1. Tap <Sample List> and then <More> and <Copy>.
2. Select samples to be copied and tap <Copy>.

To rearrange the sample list

1. Tap <Sample List>, <More> and <Reorder>.
2. Use the up or down arrows to change the position of the samples and tap <OK>.

To save a sample list

1. Tap <Sample List> and then tap <More> and "Save Sample List".
2. Choose one of the 10 available sample list templates.
3. Tap <Sample List Name> to enter a name for your sample list.
4. Tap <OK> and then tap <Yes>.

To load a sample list

1. Tap <Sample List> and then tap <More> and "Load Sample List".
2. Choose one of the ten sample lists in the sub-menu "Sample list templates:" and tap <Yes>.

To clear the current sample list

1. Tap <Sample List> and then tap <More>.
2. Tap <Clear Sample List> and <Yes>.

6.3 Automatic Sample Naming

To create descriptive sample names use the automatic sample naming. A prefix and a postfix can be added to each sample name after the measurement is finished. You can compose the additions out of a fixed part and an additional data field (date and time, user name, sample number, etc.). The complete sample name, including automatic sample name parts, may consist of up to 50 characters.

1. Tap **Menu > Setup > Measuring System Settings > Sample List / Sample Settings > Sample List / Sample Naming**.
2. Activate "Use Automatic Sample Naming" and define the sample name settings.

6.4 User-defined Data Fields

Activate up to three user-defined data fields and give these fields names to assign additional information to your samples. Typical examples are filling line number, tank number or batch identification. For each data field that you define, an extra column will be added to the sample list.

1. Tap **Menu > Setup > Measuring System Settings > Sample List / Sample Settings > User-defined Data Fields**.
2. Activate/deactivate the three "User-defined Data Fields", enter their names and tap <OK> to save the changes.

6.5 Sample List Warnings

Sample list warnings are generated only if you prepare a sample list prior to the measurement.

1. Tap **Menu > Setup > Measuring System Settings > Sample List / Sample Settings > Sample List Warnings**.
2. Use the check boxes to activate/deactivate the "Sample List Warnings":
 - Warn if sample list contains a sample without a name.
 - Warn if sample list contains methods with different measurement temperatures.
 - Only with sample changer: Stop processing the sample list if a check failed.

6.6 Mandatory Data Fields

If you define mandatory data fields, measurements can only be started after completing these fields. If they are not completed in the sample list, the instrument prompts again for completion after the start of the measurement.

1. Tap **Menu > Setup > Measuring System Settings > Sample List / Sample Settings > Mandatory Data Fields**.
2. Use the check box(es) to define whether it is mandatory to enter a sample name (or content for user-defined data fields) before starting a measurement.

6.7 Display of Current Values

By default the instrument displays current values during measurements as well as the final values after measurements. If required, you can prevent the display of values at certain times.

1. Tap **Menu > Setup > Measuring System Settings > Value Visibility**.
2. Choose when values should be shown: "Always", "During measurement" or "Only when measurement is finished".
3. If you select "During measurement" or "Only when measurement is finished", you can also choose to "Show temperature values".

6.8 Display of Errors

If air in a warm and humid environment contacts the surface of the eventually colder measuring prism, then water might be condensing on the surface of the prism. By default the instrument will report a bad air reference error. If required, you can disable the display of this type of error.

If you applied very small amounts of sample on the prism, the instrument might display a warning, that there is not enough sample volume on the prism. If you can accept a lower precision of the measuring results, the display of this type of error can also be disabled.

To configure the display of errors

1. Tap **Menu > Setup > Measuring System Settings > Error Visibility**.
2. Remove the check mark from the check box "Enable Bad Air Reference Error" to deactivate the display of bad air reference errors.
3. Remove the check mark from the check box "Enable Not Enough Sample Error" to deactivate the display of low sample volume errors.
4. Tap <OK> to save the changes.

From now on these errors will not be displayed in the quick access area of the main screen anymore but will still be visible in the stored measurement data.

6.9 Export Instrument Settings

In order to get a detailed overview on specific method settings, different users of the instrument and configured user functions you can export a file containing this information:

Tap **Menu > Service > Instrument Settings Management > Export Instrument Settings** and follow the instructions.

7 Printing and Exporting Data

To print the measuring results you can use RS-232 printers via RS-232 interface or PCL compatible office printers via USB or local network. Besides these hardware printers you can configure a virtual printer named "PDF File Printer". This printer is used to export PDF files to USB storage devices.

When using Abbat Desktop, manage the printers within the Windows operating system.

NOTICE

If a sample name contains characters which are incompatible with the file system such as \ / : . * ? " ' < > | [] ° € \$ §, they will be automatically replaced by the character underscore (_) to ensure a functioning data export.

7.1 Connecting a Printer

This section describes how to connect the different printer types to your instrument.

To connect an RS-232 printer

Connect the printer to the RS-232 interface (COM) of the instrument using the cable that is supplied together with the printer. If necessary, install a gender changer and/or a null-modem cable.

If you use an RS-232 printer which is not supplied by Anton Paar, configure the communication settings on the printer (9600,8,N,1).

To connect an office printer via USB interface

Connect the printer to the USB interface on the rear side of the instrument.

To connect an office printer via local network

You can connect your instrument and a PCL compatible printer via Ethernet to your local network.

1. Connect the instrument via Ethernet interface to your local network.
2. Configure the network settings (see section 5.8).
3. Connect the printer to your local network. For details, see the printer instruction manual.

7.2 Setting up a Printer

After connecting a printer to the instrument, perform the configuration:

1. Tap **Menu > Setup > Printout Settings > Printer Management** to open the printer list.
2. Tap <More> and <New> to install a new printer or tap on an existing printer to edit.
3. For RS-232 printers:
 - Select the printer "Type" RS-232 Printer.
 - Activate/deactivate the check box "Use as default printer".
 - Enter a "Name" for the printer.
4. For USB and network printers:
 - Select the required printer "Type".
 - Activate/deactivate the check box "Use as default printer".
 - Enter a "Name" for the printer.
 - Select the paper "Format".
 - Select the "Port" USB or network.
 - Activate/deactivate the check box "Color Print".
 - For network printers only: Enter the IP address and IP port.
5. For virtual PDF file printers:
 - Select the printer "Type" PDF file printer.
 - Activate/deactivate the check box "Use as default printer".
 - Enter a "Name" for the printer.
 - Select the paper "Format".
6. Tap <OK>.

To delete a printer

1. Tap **Menu > Setup > Printout Settings > Printer Management** to open the printer list.
2. Tap <More> and <Delete>.
3. Select the printer to delete.
4. Tap <Delete> and <Yes>.

TIP: The default printer cannot be deleted.

7.3 Printout and Report Settings

You can set up to 10 different report layouts for e.g. different methods, different sample types or for internal or external use. The layouts can be created, edited or deleted.

To create or edit a report

1. Tap **Menu > Setup > Printout Settings > Report Management** to open the report list.
2. Tap <More> and <New> to create a new report or tap on an existing report to edit it.
3. Perform the following settings:
 - Activate/deactivate the check box "Use as default report".
 - Enter a report "Name".
 - Select the report "Type", "List" or "Detail". List reports contain several measurement results in a table. Detail reports contain one detailed measurement result per page.
 - Define the paper orientation (portrait or landscape).
 - Activate/deactivate "GxP compliant".
 - Activate/deactivate signature caption 1 and 2 and use the input field to enter a name.
 - Activate/deactivate the "Print Signature Time" function.
4. Tap <OK>.

TIP: Signature caption 1 will be activated automatically if the report is set to be GxP compliant.

To delete a report

1. Tap **Menu > Setup > Printout Settings > Report Management** to open the report list.
2. Tap <More> and <Delete>.
3. Select the report to delete.
4. Tap <Delete> and <Yes>.

TIP: The default report cannot be deleted.

7.4 Report Header and Background

You can import logos via USB storage device and use them as header or background logo in the printer report. You can also define an address which will be printed in the header of the printer report.

Logo graphics files must meet the following conditions:

- JPEG or bitmap file (extension .jpg or .bmp)
- located in the root directory
- maximum size of 1536 x 1024 pixel

To import logos for the report

1. Tap **Menu > Setup > Printout Settings > Import Logos**.
2. Use the drop-down list "Storage Location" to select a connected USB storage device or an FTP server.
3. Use the drop-down list "File Name" to select the image file to be imported.
4. Use the sub-menu "Place" to define the position of the file in the internal logo list.
5. Tap <OK> to load the file into the logo list of the instrument.

To select logos for the report

1. Tap **Menu > Setup > Printout Settings > Select Logos**.
2. Use the drop-down lists to select the logos for the report header and/or the background.
3. Tap <OK>.

To enter a name and address for the header

1. Tap **Menu > Setup > Printout Settings > Name and Address**.
2. Enter the name and address
3. Tap <OK>.

7.5 Automatic Printout

The instrument can send measurement data to a file or a printer automatically. In Abbemat Desktop this function is replaced by the "Automatic Export", see the respective section in the chapter Abbemat Desktop (reference guide only).

1. Tap **Menu > Setup > Printout Settings > Automatic Printout**.
2. Activate "After each measurement".
3. Use the check box "Enable printing of subsamples" to print the results of subsamples.
4. Tap <Printer> to specify the target:
 - A printer that has been configured before
 - <PDF Export> to a file
5. Use the sub-menu "Report" to select the report layout. You can only select a report of the "Detail" type for automatic printout.
6. Set the "Export File Name" that will be used for exported data.
7. Tap <OK>.

7.6 Always Print Report in English

Reports are printed in the language selected in the regional settings. You can set the instrument to print reports on RS-232 printers in English language always regardless of the language setting:

Tap **Menu > Setup > Control Panel > RS-232 Settings** and activate "Always print report in English".

7.7 Export Settings

Data printed from the instrument or exported from the instrument to USB or FTP is usually marked as already exported. This prevents an additional export to the LIMS. If required, you can allow this additional export:

Tap **Menu > Setup > Printout Settings > Export Settings** and activate the check box "Only data exported via LIMS is set as exported".

From now on, only data exported via LIMS will be marked as exported. Local printouts or exports do not prevent an additional export to the LIMS anymore.

8 User Groups, Accounts and Passwords

8.1 Logging On/Off

When delivered, the instrument is freely accessible without password, because the auto logon function for the user "Administrator" is active by default.

There are three standard user groups with different levels of user rights (see appendix E):

Operator: This user group may perform measurements, select a method, edit the sample list and perform checks.

Manager: This user group has the rights of the "operator" user group and may additionally modify method settings and perform adjustments.

Administrator: This user group has the right to access the whole menu.

The **default passwords** are **operator**, **manager** and **administrator**. It is recommended to replace these passwords.

To log on

1. Tap the user indicator in the top right corner of the main screen.
2. Enter your "User Name" and "Password", then tap <OK>.

NOTICE

If the instrument is used in the increased security mode, your user account will be deactivated after three failed logon attempts.

To log off

1. Tap the user indicator in the top right corner of the main screen.
2. Tap <Log off>.
 - If no user with auto logon right exists, the instrument finishes the current measurement or measurement series but does not accept any input until someone successfully logs on.
 - If a user with auto logon right exists, this user is logged on automatically.

Auto logon function

You can assign the auto logon function to a single user. If you switch off the instrument and restart, there is no logon procedure. All instrument functions according to user rights of the auto logon user are freely accessible.

NOTICE

- When activating 21 CFR Part 11 or increased security, the auto logon function will be disabled. Be sure to know your user name and password before switching off the instrument.
- With Active Directory as log on method (see section 17.7), the menu "User Management" is not available.

8.2 Managing User Accounts

Naming rules

If you operate the instrument in the increased security mode, user names must have at least six characters.

NOTICE

When activating 21 CFR Part 11 or increased security, user accounts that do not comply with the naming or password rules are deactivated.

Password rules

With low security levels, giving a password is not mandatory. If no password is set, users can log on by selecting their user name from the user list.

Passwords must be at least one character long. All ASCII characters are allowed, including letters, numbers and most special characters. Passwords are case-sensitive, meaning "Anton Paar" or "anton paar" are treated as different.

With high security levels (21 CFR Part 11 and "Increased Security"), giving a password is mandatory. Passwords must have at least six characters. When setting new passwords, the last five passwords must not be used.

TIP: A user without administrator rights can only change his/her own password.

You need administrator rights to create, edit or delete user accounts.

To create or edit a user account

1. Tap **Menu > Setup > User Management > User Management**.
2. Tap <More> and <New> to create a new user account or select a user name to edit an existing user account.

3. Perform the following settings:

- Enter or edit a "User Name".
- Activate/deactivate the user account with the check box. A user with a deactivated account cannot log on until activated again.
- Activate/deactivate the "Auto log on" using the second check box.
- Select the "User Group".
- Set or change the password of the user.
- Set an email notification for the status of sample lists and exceeded service intervals.
- Select the "Role for Electronic Signature". This is only possible if electronic signing is activated.

To delete a user account

1. Tap **Menu > Setup > User Management > User Management**.
2. Tap <More> and <Delete>.
3. Select the user to delete
4. Tap <Delete> and then <Yes>.

You cannot delete your own account or an account of a user group that has a higher level of user rights than your own account.

To change a password

1. Tap **Menu Setup > User Management > User Management** and select a user from the list.
2. Enter the old password followed by the new password twice and tap <OK>.

To retrieve a forgotten password

Tap the button <Forgot Password> in the "Logon" dialog and follow the instructions.

8.3 User Group Administration

If the standard user rights of the instrument do not fit your needs, you can create additional user groups. In these groups you can limit or grant access to the functions of the instrument. This allows you to assign individual rights to a user with the help of a custom-made menu. For example you can create a second administrator with special user rights for network administration only.

You may only modify the copy of a standard group. The menus of the original groups cannot be changed.

To create a new user group

1. Tap **Menu > Setup > User Management > User Group Administration**.
2. Tap <More> and <Copy>.
3. Select a user group to copy and tap <Copy>.

To choose an icon for the user group

A selection of seven different icons is available to represent the users of a new group. The icons of the standard groups Manager and Operator cannot be changed.

1. Tap **Menu > Setup > User Management > User Group Administration**.
2. Tap the drop-down box in the left column named "Icon"
3. Choose an icon from the list and tap <OK>.

To edit the name of the new group

1. Tap **Menu > Setup > User Management > User Group Administration**.
2. Tap the text box in the column "Name".
3. Change the name and tap <OK>.

To edit the rights of the new user group

1. Tap **Menu > Setup > User Management > User Group Administration**.
2. Tap < ... > in the right column.
3. Edit the rights as needed. A green check means this function is available in the menu. An empty check box makes the menu function unavailable for this user group.

To export a menu tree of a user group

You can export a menu tree of a user group in Excel format for documentation purposes. The spreadsheet generated contains the menu structure with the functions that are available for the selected user group.

1. Insert a USB storage device into a USB interface.
2. Tap **Menu > Setup > User Management > User Group Administration**.
3. Tap < ... > in the right column.
4. Tap the button <Export>.
5. Use the sub-menu to define the "Storage Location" and enter the "File Name", then tap <OK>.

9 System Security

You can enable different system security settings to ensure data security and protect your measuring system from unauthorized access.

9.1 Security Level

Depending on your needs you can set different security levels: "Low" or "21 CFR Part 11" compliant. The "Low" security level is set by default.

TIPS: Please note that you need to set an additional password for the service account to fulfill the security standards of 21 CFR Part 11.

If selecting the security level "21 CFR Part 11", user-defined values that correspond to a tighter security standard will not be changed.

If any changes are applied to one of the standard security level settings, the security level is switched to the user-defined security level.

Table 7: Security levels

Security Level	Low	21 CFR Part 11
Audit trail	Off	On
Audit trail backup reminder	Off	7 days
Electronic signature	Off	On/Off
E-Sign requires password	Off	On if activated
Auto logoff	Off	On
Auto logoff time	Off	60 min
Minimum password length required	Off	On
Minimum password length	Off	6 characters
Password expires	Off	On
Password expiry time	Off	60 days
Increased security	Off	On

To view or change the security level

1. Tap **Menu > Setup > System Security > Security Level**.
2. Tap <Details> to view your current settings.
3. Select a security level. The user-defined security level is only visible if the user has changed any default security settings.
4. Tap <Details> again to view the settings that will be affected by the new security level.
5. Tap <OK> to set the security level.

NOTICE

- Your current sample list will be reset by changing the security level.
- Increased security is activated automatically by switching to 21 CFR Part 11.

9.2 Increased Security

In addition to above security levels, you can further increase your security settings.

NOTICE

If the increased security is activated, all user accounts that do not comply with the naming rules or password rules will be deactivated. Auto login will be deactivated too.

1. Tap **Menu > Setup > System Security > Increased Security**.
2. Tap <Details> to view your current settings.
3. Activate the "Increased Security" check box.
4. Tap <Details> again to view the settings that will be affected by the increased security.
5. Tap <OK> to save the settings.

Table 8: Increased security settings

Off	On
Endless data storage allowed	No endless data storage allowed
All sample list types allowed	Only user-defined sample list mode allowed
Infinite logon attempts	User account locked after three failed attempts
Auto Logon allowed	Auto Logon is not allowed
User names shorter than 6 characters	User name length at least 6 characters
User name can be selected from list	User name must be entered manually
Same passwords can be used	Last 5 passwords must not be used
Data can be deleted without being exported	Only exported data can be deleted

9.3 Advanced Security

In addition to the increased security you can further improve your security settings:

1. Tap **Menu > Setup > System Security > Advanced Security**.
2. Use the "Disable USB memory devices" check box to deactivate the data transfer to or from USB storage devices (not available with Abbemat Desktop).
3. Use the "Service logon requires customer password" check box to activate an individual password for service personnel.
4. If activated, the instrument prompts you to enter and confirm a customer password.
5. To log on, service personnel have to enter the general service password first followed by the customer password.
6. Activate "Advanced Data Integrity" to replace the "Delete" function by the "Archive" function. If active, you can not delete measurements, checks or audit trail. Instead the "Archive" function ensures the data integrity by moving the data from the instrument to the target in one step. Additionally users can not be deleted from the user data base.
7. Tap <OK> to save the settings.

9.4 Auto Logoff

You can set the instrument to automatically log off the current user after a defined time of inactivity.

1. Tap **Menu > Setup > System Security > Logon Settings**.
2. Activate the auto logoff.
3. Set the auto logoff time (1 to 60 min).

9.5 Password Expiry

You can define how long passwords are valid. The setting applies to all passwords. If a password expires, the user account is deactivated.

1. Tap **Menu > Setup > System Security > Logon Settings**.
2. Activate the password expiry function.
3. Set the password expiry time (1 to 365 days).

9.6 Password Length

You can also define the required length of passwords. The setting applies to all new passwords. Existing passwords that are shorter than the new required password length remain unaffected.

1. Tap **Menu > Setup > System Security > Logon Settings**.
2. Activate the password length function.
3. Set the password length (6 to 30 characters).

9.7 Strong Passwords

A strong password rule may be enforced in order to protect passwords against guessing or brute-force attacks:

1. Tap **Menu > Setup > System Security > Logon Settings**.
2. Use the checkbox "Complex password" to enforce strong passwords.

From now on future passwords must contain one uppercase character, one lowercase character, one digit and a special character (.,_-<>?!/&%#+*).

Important: After activating strong passwords, the currently used passwords are still valid and the password complexity rule counts as soon as the password is changed.

9.8 Audit Trail

The audit trail function generates a log file containing all the operating steps which directly or indirectly lead to changes in measuring results. Additionally all changes which are relevant for data integrity, manipulation or access control are documented in the log file as well.

The following operations, including the respective warnings that appear in the diagnosis window, are documented in the audit trail:

- Successful or rejected adjustments and passed or failed checks
- Resetting of adjustments to factory adjustment
- Exceeding of adjustment intervals and check intervals
- Creation, deletion and archive of checks
- Measurements with results and quick settings
- Archiving of measurements (number of archived measuring data and corresponding unique sample ID)
- Changes in sample list entries
- Changes of methods or method settings
- Changes in quick settings
- Changes in customer functions
- Changes to date and time of instrument
- User logon/logoff
- Changes of user accounts (creating, editing, activating, deactivating, archiving, changing a password)
- Changes of user groups (creating, editing, deleting)
- Saving and restoring of parameter settings and configurations
- Changes in the instrument software, module firmware or operating system
- Changes in the setup of the measuring system (mounting or dismounting of modules)
- Changes for connections regarding VNC, LIMS Bridge or AP Connect
- Hardware failures and instrument errors
- Activation or deactivation of the audit trail function; export or archive of audit trail entries

TIP: *If working under QM regulations as GLP/GMP or 21 CFR part 11, set your security level to 21 CFR part 11 or a user-defined security level where the audit trail is active.*

TIP: *Export the audit trail data at regular intervals and store the data in a safe place.*

To activate/deactivate the audit trail

There are two ways to activate the audit trail:

- Set the security level to "21 CFR Part 11". The audit trail will be activated automatically.

- Activate the audit trail function within your user-defined security mode.

1. Tap **Menu > Setup > System Security > Audit Trail**.
2. Activate/deactivate the audit trail.
3. Activate the "Audit Trail Backup Reminder", set the time span and tap <OK>.

To view, print or export the audit trail

The audit trail list can store up to 2000 entries. A warning is issued at 1900 entries. After 1998 entries no more measurements can be started. Make sure to regularly archive audit trail data.

1. Tap **"Menu > Data Memory > Audit Trail"**.
2. Enter a search term to find entries quickly. The search covers the content of the column "Action". If you are looking for an entry with a specific date, time or user name, use the filter (see section 13.4).
3. Select a list item to see more detailed information or to enter a comment; for instance a reason for this change.
4. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or text file tap <More> and <Export>. Follow the instructions on the screen.

To export the audit trail automatically

The audit trail can be exported automatically to USB devices or FTP servers:

1. Tap **Menu > Setup > System Security > Automatic Audit Trail Export**.
2. Activate the automatic audit trail export.
3. Enter an interval for the repetition of the export.
4. Select the export device.
5. Use the check box to delete the audit trail entries after successful export.
6. Choose to export the audit trail in PDF or Excel file format and tap <OK>.

To delete/archive the audit trail entries

1. Tap **Menu > Data Memory > Audit Trail**.
2. Tap <More>, <Delete>/<Archive> and <OK>

For data safety reasons, it is not possible to delete audit trail entries that have not been exported.

Verifying the integrity of audit trail exports

Audit trail data exports are protected by an MD5 checksum file that is exported together with the data file to guarantee full traceability.

After successful export of the data file and the corresponding md5 file, a new audit trail entry including the MD5 checksum (hash) is generated. This checksum can be compared with the checksum of the exported file at any time to confirm that the exported file has not been manipulated.

TIP: *The Audit Trail entry for an export is written after a successful export. Therefore, the current MD5 checksum can be found only in the data memory of the instrument. The checksums in the exported data file are checksums from previous Audit Trail exports.*

To generate an MD5 checksum

Any MD5 checksum program can be used. For example the program "md5summer.exe" can freely be downloaded from the Anton Paar homepage via your web browser:

<http://download.anton-paar.com/softwareupdate/DownloadKey=md5summer.exe>

1. On your PC, start "md5summer.exe".
2. When asked "please select the root folder", select the directory where the log files (the md5 file and .pdf, .xls or .txt file) are saved and click <Verify sums>.
3. In the following dialog, select the .md5 file that you want to check and click <Open>.

If the checksum (hash) is the same as in the corresponding master instrument's audit trail entry, the export file has not been manipulated.

9.9 Securing Actions

Starting and stopping of measurements as well as security relevant settings can be further protected against unauthorized use.

When an action is secured, the user is forced to enter the logon password before. Additionally the user can be prompted to enter a comment, why this operation has to be performed. This comment (maximum 50 characters) will be stored together with the action in the audit trail.

The securing of actions can be set for:

- Start and stop of measurement
- Control Panel
- System security
- Electronic Signature
- User management
- Advanced security
- Increased security
- Methods
- Quick settings
- Menu

To set securing actions

1. Tap **Menu > Setup > System Security > Securing Actions**.
2. Activate the check box "Password Required" next to the action to be protected.
3. Activate the check box "Mandatory Audit Trail Comment" if a comment should be given for the reason of this operation.

9.10 Electronic Signature

Not available in non storage mode.

Electronic signatures can be classified as ordinary manual signatures helping to verify the authenticity of electronic data in regulated process environments.

TIP: *If electronic signature is activated, the measurement data has to be fully signed before an export via LIMS Bridge or AP Connect is possible.*

Roles for the electronic signature

Depending on importance or impact, different signing roles can be assigned to a user. According to common regulations, you can choose between three different roles: submitter, reviewer or approver.

Once the electronic signature function has been activated, a sample or a check can be signed as positive or negative by the submitter, followed by the reviewer and finally by the approver. If required, this three role signing can be reduced to a two role signing mode including only a submitter and an approver.

Signing states

With the electronic signature activated, three boxes appear in the first column in the data memory next to the error state icon. The boxes illustrate the signing states of submitter (bottom box), reviewer (middle box) and approver (top box):

- gray box: not signed yet
- green box: signed as positive
- red box: signed as negative

Substitute signing

If a user of a higher level signs first, the signing states of the lower levels are set according to the evaluation of this higher level user.

Example: If a sample is signed as positive by the approver prior to a submitter or reviewer, the signing states of submitter and reviewer are also set as positive, consequently.

To enforce a two-man rule (or "three-man rule"), this substitute signing by a higher level user in place of the lower level user can be disabled.

TIP: *If the substitute signing is disabled, a submitter has to start the measurements. If a reviewer or approver starts a measurement, it can be finished, but it can not be signed.*

To set up the electronic signature

1. Tap **Menu > Setup > System Security > Electronic Signature**.
2. Use the check box "Electronic Signature" to activate or deactivate the electronic signature.
3. If a password is required during the signing process, use the check box to activate a password inquiry.
4. To change the number of signing steps select your choice in the drop box "Signing Steps". Available options are:
 - Submitter
 - Submitter, Approver
 - Submitter, Reviewer, Approver.
5. To allow the substitute signing by a higher level user for measurements of lower level users check the box "Allow substitute signing".
6. The instrument can remind you periodically after a series of measurements to sign the results. To create a periodic reminder in the message list activate the check box "Reminder active" and set the number of samples to remind after.
7. Tap <OK>.

To assign the role for the electronic signature

1. Tap **Menu > Setup > User Management > User Management**.
2. Select the user to whom an electronic signature role shall be assigned.
3. Use the sub-menu to specify the "Role for Electronic Signature".
4. If required enter a name for the user who executes the electronic signature.
5. Tap <OK>.

To execute an electronic signature for a sample

Only the user who carried out the measurement is allowed to sign the corresponding sample as the submitter.

TIP: *Once you have executed an electronic signature, you can no longer change the signing state of the respective sample.*

1. Tap **Menu > Data Memory > Measurement Data > Measured Data**.
2. Select the sample to be signed.
3. Tap on the corresponding signing role button.
4. If needed, add a comment using the input field.

5. Enter your password if requested.
6. Assess the sample by tapping <Sign negative> or <Sign positive>.

If you want to print or export your results including signing state and respective comments, tap <Print or Export>.

9.11 Non Storage Mode

To reduce efforts for instrument validation and qualification in lab environments your instrument offers a "Non Storage Mode" (not available in Abbemat Desktop), that conforms to the United States Pharmacopoeia 1058 CAT-B. In this mode the data memory is not available. The instrument does not store any measurements, checks or adjustments.

As consequence the results have to be either written down manually or exported directly after every single measurement, check or adjustment. The export of results can be automatized (see section 7.5).

After restart in Non Storage Mode, a message in the quick access bar reminds you to confirm an export method. To avoid measurement data loss, the error message only disappears after confirmation of the export method.

Non Storage Mode features

- Operation without data memory.
- Simplified system security.
- Reduced menu tree (see appendix E).

NOTICE

- Perform a full system backup before activating non storage mode. Otherwise all measured data, check data, and adjustment data will be lost.
- By activating the non storage mode, the security level will be set to low. Desired security settings (e.g. Audit Trail or logon settings) have to be set again
- In the non storage mode you can print or export a result only directly after the measurement.

To activate or deactivate the Non Storage Mode

1. Tap **Menu > Setup > System Security > Non Storage Mode**.
2. Activate/deactivate the Non Storage Mode.
3. Follow the instructions on the screen.
4. The instrument reboots.

10 Checking, Adjusting and Calibrating

10.1 Definitions

Checks: Testing the correct state of operation of an instrument by measuring a sample of exactly known measurement properties and comparing the result with the expected values.

Adjustments: Enabling correct measurements in the future by measuring a sample of exactly known measurement properties (standard) and adjusting the instrument's constants in a way that the known correct results are found by the instrument.

Calibrations: Checking procedures which are carried out using certified standards. By comparing the measured result with the standard reference value, you can validate the quality of your measurements.

10.2 Checks

Creating or Editing Checks

Two different types of checks can be performed:

- A **custom check**, where you can select the method and define the limits of any available quantity.
- A **reference standard check** to measure certified reference liquids.

You can edit the name, method (custom check only), time interval as well as upper and lower limits for the checks.

1. Tap **Menu > Checks / Adjustments > Check Management / Execution**.
2. Select an existing check to edit or tap <More> and <New> to create a new check.
3. Enter the **Name** of the check.
4. Select the type **Custom Check** or **Reference Standard Check**.

Custom Check :

- Select the **method** for the check.
- Use the check box to define whether the check is **GxP relevant**.
- Use the check box **Check execution reminder** to define whether the check is obligatory and enter a time interval in days.
- Open the **Quantities** menu to define the check tolerances by entering the lower and upper value. Define additional quantities if required.

Reference Standard Check:

- **Select a reference standard**.
- Use the check box to define whether the check is **GxP relevant**.
- Use the check box **Check execution reminder** to define whether the check is obligatory and enter a time interval in days.
- Define the **reference standard settings**.

5. Tap <OK>.

Performing Checks

With checks carried out at regular intervals you can ensure a high and stable accuracy of your measurements.

1. Tap **Menu > Checks / Adjustments > Check Management / Execution**.
2. Tap the play button on the right side of the check name.
3. Follow the instructions on the screen.

When the check is finished, the following information is displayed:

- Check name and type
- Date and time
- Method
- Check result
- User name
- Reference value (reference standard check only)
- Measured value
- Lower and upper limit (custom check only)

4. Tap <Print or Export> if you want to print or export the check results.
5. Tap <OK> or <Home> to exit the check.

If the check failed, it is recommended to perform a water adjustment.

Archiving Checks

If advanced data integrity is activated, you have to archive the check results in order to remove checks from the check result data base permanently:

1. Tap **Menu > Data Memory > Check Data > Check Result Data**.
2. Tap <More> and <Archive> to archive checks. Follow the instructions on the screen.

10.3 Water Adjustments

A water adjustment has to be performed if the water check failed and using fresh water and cleaning of the measuring prism did not help.

For a water check preferably use ultra pure water (alternatively deionized or double distilled water).

The adjustment has to be done at measuring temperature, e.g. 20.00 °C, prior to the measurement of samples at this temperature.

TIP: *If the measuring temperature changes by more than 3 °K, perform a water check. If the check fails, perform a water adjustment.*

To perform a water adjustment

1. Tap **Menu > Checks / Adjustments > Refractometer Adjustments > One Point Adjustment**.
2. Select **Water (deionized)** as reference substance and tap <OK>. If you want to perform a water adjustment at current method temperature, select **Water (method temp.)**.
3. Follow the instructions on the screen. When the adjustment is finished, the following information is displayed:
 - Adjustment type
 - Reference substance
 - Old refractive index value
 - New refractive index value
 - Temperature
 - Deviation rel.
 - Deviation abs.

Before the adjustment is finished, it can be aborted by tapping <Cancel>.

4. Check the recommendation on the screen and select one of the options <Reject> or <Apply>.

10.4 One Point Adjustments

If all results across the entire measuring range are systematically too high or too low, this deviation can be corrected by performing a one point adjustment.

TIPS: *A one point adjustment modifies the offset of the internal calibration curve, not its slope.*

Choose a substance with a refractive index close to the samples to be measured subsequently.

The adjustment should be performed at the certified reference temperature of the standard, e.g. 20.00° C.

To perform a one point adjustment

1. Tap **Menu > Checks / Adjustments > Refractometer Adjustments > One Point Adjustment**.
2. Several reference substances are already in the database. You can select one of them, e.g. water, or select <other> in the sub-menu. In the latter case enter a name, temperature and refractive index, then tap <OK>.
3. Follow the instructions on the screen. When the adjustment is finished, the following information is displayed:
 - Adjustment type
 - Reference Substance
 - Old refractive index value
 - New refractive index value
 - Temperature
 - Deviation rel.
 - Deviation abs.

Before the adjustment is finished, it can be aborted by tapping <Cancel>.

4. Check the recommendation on the screen and select one of the options <Reject> or <Apply>.

10.5 Two Point Adjustments

In case a one-point adjustment is not sufficient, a two-point adjustment may be carried out. A two point adjustment affects the offset as well as the slope of the internal calibration curve.

TIPS: *If measuring results are not plausible, it is often a good choice to restore the factory adjustment, see section 10.8.*

The refractive index values of the two reference liquids used for this adjustment should be close below and above the RI range of the samples to be measured.

In order to avoid adjustments with reference liquids with refractive index values that are too close together, the values should differ by at least 30 % of the measuring range of the Abbat refractometer.

Use one of the two substances in all subsequent one-point adjustments.

Perform the adjustment at the certified reference temperature of the standard, e.g. 20.00 °C.

To perform a two point adjustment

1. Tap **Menu > Checks / Adjustments > Refractometer Adjustments > Two Point Adjustment**.
2. Select the reference substance for the lower refractive index and tap <OK>. Several reference substances are already in the database. You can select one of them, e.g. "Water", or select <other> in the sub-menu. In the latter case enter name, temperature and refractive index.
3. Tap <OK>. If you tap <Skip> only the upper point will be adjusted.
4. Select the reference substance for the upper refractive index and tap <OK>. Several reference substances are already in the database. You can select one of them, e.g. water, or select <other> in the sub-menu. In the latter case enter name, temperature and refractive index.
5. Follow the instructions on the screen. When each adjustment is finished, the following information is displayed:
 - Adjustment type
 - Reference Substance
 - Old refractive index value
 - New refractive index value
 - Temperature
 - Deviation rel.
 - Deviation abs.

Before the adjustment is finished, it can be aborted by tapping <Cancel>.

6. Check the recommendation on the screen and select one of the options <Reject> or <Apply>.

10.6 Setting the Air Reference

A setting of the air reference has to be performed if the water adjustment is not satisfactory and readings are not stable. This adjustment does not measure the refractive index of air but adjusts the sensitivity of the internal sensor. Note that a subsequent measurement with an empty prism will result in a display of "---", since the refractive index of air is beyond the measuring range of the instrument.

TIP: *If the ambient temperature is close to the dew point (high relative humidity), the setting of the air reference should be performed at a higher set temperature, e.g. 30 °C in order to avoid dew on the measuring prism.*

To set the air reference

1. Clean the measuring prism thoroughly and let it dry (see section 18.2).
2. Tap **Menu > Checks / Adjustments > Refractometer Adjustments > Set Air Reference**.
3. Cover the measuring prism to prevent ambient light entering the optical system.
4. Follow the instructions on the screen and tap <OK>.

10.7 Viewing, Printing or Exporting Adjustment Data

You can view, print and export detailed data of the last 50 adjustments.

To view, print or export a single adjustment data set

1. Tap **Menu > Data Memory > Adjustment Data > Refractometer Module**.
2. Tap on an item to see the detailed adjustment data.
3. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or text file tap <Print or Export> and follow the instructions on the screen.

To print or export all adjustment data

1. Tap **Menu > Data Memory > Adjustment Data > Print or Export Adjustment Data**.
2. Select the module from which you want to print or export the adjustment data.
3. Tap <OK>.
4. Select "Print Report (Paper/PDF File)" or "Export Data (Excel File / Text File)".
5. Depending on your selection choose printer, USB device, enter a required file name, etc.
6. Confirm with <OK>.

10.8 Restoring the Factory Adjustment

If measuring results are not plausible, it is often a good choice to restore the factory adjustment.

1. Tap **Menu > Checks / Adjustments > Refractometer Adjustments > Reset to Factory Adjustment**.
2. Use the check box and tap <OK>.

10.9 Calibrating

The goal of a calibration is to validate the accuracy of the refractive index measurement. To calibrate the refractometer measure a certified standard liquid and compare the result to the reference value indicated in the calibration certificate of the standard.

The frequency of calibrations with certified liquid refractive index standards depends on your requirements and judgment. One calibration per month is recommended.

NOTICE

- Always check the expiration date of the calibration liquids.
- Store the calibration liquids in a cool and dark place.
- Use the calibration liquids immediately and use only once after the container has been opened.

To perform a calibration

1. Perform a refractive index check with water at the temperature for which the standard liquid is certified, usually 20.00 °C.
2. If necessary, carry out a water adjustment at the temperature for which the standard liquid is certified, usually 20.00 °C.
3. Thoroughly clean and dry the measuring prism.
4. Select the method "Refractive Index". Make sure that the temperature is set to the certified temperature of the reference liquid, typically 20.00 °C.
5. Open the bottle with the liquid refractive index standard and apply a few drops of sample on the measuring prism.
6. Immediately attach the sample cover.
7. Perform a measurement or check.

TIPs: *If you have sufficient standard liquid, we recommend making a series of three measurements and taking the arithmetic average of the results.*

For calibration measurements you can also use the check function of the Abbemat (see above).

It is recommended to document the calibration procedure in a calibration protocol which contains the operator's name, date, place, description of the calibration procedure, (printed) results and the calibration certificate of the standard.

10.10 Reference Standard Management

The reference standard substances can be administered in a database to ease operation and to avoid input errors.

NOTICE

- Different batches of the same substance can differ in their refractive index. Although this difference is small, checks and adjustments have to be performed with the exact value of the reference standard. Especially when receiving new substances, pay attention to the refractive index and change the values in the reference standard database accordingly.
- If a check or an adjustment is to be carried out at set temperatures other than 20 °C, create a suitable entry in the reference standard database.

To edit or to add a substance

1. Tap **Menu > Checks / Adjustments > Settings > RI Reference Standard Management**.
2. Select a substance from the list to edit or tap <More> and <New> to add a new substance.
3. Enter the name of the substance.
4. Enter the "Temperature" for which the refractive index is certified.
5. Enter the reference value of the refractive index substance.
6. If required enable the expiration check box and enter an expiration date of the substance.
7. If required enter a "Lot number" and/or a "Reference number" of the substance.
8. Tap <OK>.

To delete a substance

1. Tap **Menu > Checks / Adjustments > Settings > RI Reference Standard Management**.
2. Tap <More> and <Delete>.
3. Select the substances you want to remove from the database.
4. Tap <Delete>.

11 Measuring Methods

The Abbemat refractometers are used in all industries, from pharmaceuticals, chemicals, flavors and fragrances to beverages and food. The instrument is delivered with a set of predefined methods covering the most common applications.

In close cooperation with our customers Anton Paar collects and develops continuously new methods and applications. Benefit from the constant growing method know-how and contact Anton Paar for an

updated list of available methods.

You can use the factory preset methods as they are or change them to suit your needs. You can also create new methods.

Most measurements are performed at the standard temperature of 20 °C, if not stated otherwise. The standard wavelength λ of the Abbemat series is 589 nm.

11.1 Measurement Mode

The instrument can perform different types of measurements:

Table 9: Measurement modes

Measurement mode	Parameters
S Standard	Performs a standard measurement.
C Check	Performs one of the predefined checks. It is only possible to select a check which has been defined for the selected method before.
MM Multiple Measurements	Performs 2 to 10 consecutive measurements of a single sample automatically. The readings will be taken several times without changing the sample.
MF Multiple Filling	Performs 2 to 5 measurements of a single sample automatically. The sample is replaced after each sub-measurement. With an optional peristaltic pump or sampler this can be automated. Use the mode "Continuous Measurement" to perform as many measurements per sample as required. In this mode the user is asked after each sub-measurement to continue or to finish this measurement.
TS Temperature Scan	Measures samples over a temperature range with fixed intervals. Requires a "Start", "Step" and "End" temperature. Divide the difference between end and start temperature by an integer to calculate a valid step interval.
TTS Temperature Table Scan	Performs a temperature scan according to a user defined temperature table.
TiS Time Scan	For multiple measurements over a period of time by taking subsamples in fixed time intervals. Requires a "Duration" of the measurement and a time "Interval".

11.2 Measurement Accuracy

The instrument determines the validity of a measurement based on various criteria.

If temperature control is enabled, the instrument adapts the sample to the set temperature. After temperature equilibration a "Hold Time" period starts. This additional time (default 1 s) for the adaption of the sample temperature improves the stability of the measurement.

When the hold time has passed and the sample temperature remains stable (with temperature control enabled), the selected "Measurement Accuracy" determines the outcome of the measurement depending on the three different accuracy settings "Most Precise", "Precise", or "Fast Measuring".

If the measurement is not finished within the "Time-out interval" (default 200 s), it will be aborted.

Table 10: Accuracy settings for the validation of measurements

Measurement Accuracy	Max. temperature deviation ^a	Stable time ^b	Max. refractive index deviation ^c
Most Precise Abbemat 350 Abbemat 550	0.005 °C	15 s	0.00005 nD 0.00001 nD
Precise Abbemat 350 Abbemat 550	0.01 °C	10 s	0.0001 nD 0.00002 nD
Fast Measuring Abbemat 350 Abbemat 550	0.03 °C	5 s	0.0003 nD 0.00006 nD
Adjustments Abbemat 350 Abbemat 550	0.005 °C	15 s	0.000025 nD 0.000005 nD

a The maximum allowable deviation of the sample temperature to give a valid measurement. Active during the whole measurement process if temperature control is enabled.

b During this period the refractive index must be stable to give a valid measurement.

c The maximum allowable deviation of the refractive index within the stable time interval to give a valid measurement.

11.3 Defining Methods

A method contains the following settings:

- Measurement Mode.
- Constants.
- Refractometer Module Settings, i.e. temperature, accuracy, etc.
- Layout of measuring data on the main screen.
- Result Output for printout and data export.
- Limits.
- Quick Settings Management.
- Xsample settings and measuring module settings (if any module is installed), refer to the instrument-specific manual.

To define the measurement mode

1. Tap **Menu > Method Management** and select a method.
2. Tap <Measurement Mode>.

3. Select a measurement mode and enter the required values.

4. Tap <OK>.

To activate a module

If you have connected optional modules to your Abbemat, e.g. a peristaltic pump, these modules can be set separately for each method.

1. Tap **Menu > Method Management** and select a method.
2. Enable or disable the required modules and tap <OK>.

Depending on the activated modules, additional settings may appear.

To define the refractometer module settings

1. Tap **Menu > Method Management** and select a method.
2. Tap <Refractometer Module>.
3. Enable/Disable the temperature control and enter the set temperature.
4. Select the "Measurement Accuracy".
5. Enter the "Hold time" (default 1 s).
6. Enter the "Timeout" (default 200 s).
7. Tap <OK>.

To define the displayed output fields

For each method, you can select the number and content of output fields on the display:

1. Tap **Menu > Method Management** and select a method.
2. Tap <Layout Type> and choose a layout.

When switching to another display layout, the contents of the output fields of the previous layout are transferred to the new one (if possible).

To define the content of output fields

Users with manager or administrator rights can change the content of output fields in the main screen. The changes are saved automatically within the current method.

1. Tap on an output field within the main screen.
2. Select "Group", "Quantity", "Unit" and number of "Digits".

TIP: We recommend always having the output field "Master Condition" in addition to the measurement values on the screen.

To define the result output

You can define the list of output quantities for printouts and data exports. Change the settings any time and repeat the printout of saved results, if required.

If no output quantities are selected, the data browser settings are used instead.

1. Tap **Menu > Method Management**.
2. Select a method and tap <Result Output>.
3. Tap on the list item that you want to change or on the empty field at the bottom of the list if you want to add an item.
4. Use the sub-menus to define the "Group", "Quantity", "Unit" and the number of "Digits".

5. Use the up/down arrows in the right column to change the position of the list items.

To define method limits

In quality control, the measuring results should be within defined limits. Limits can be set for each method and for any parameter separately. When activated, a small triangle in the bar graph left to the output field displays if actual readings are within their limits.

If a quantity exceeds the defined limits, the background of the respective output field turns yellow. When the measurement is finished the instrument issues a limit warning message in the quick access area.

1. Tap **Menu > Method Management**.
2. Select a method and tap <Limits>.
3. Select the quantity to be monitored in the column "Quantity" (or add a new quantity by tapping on the empty line).
4. Select group, quantity and unit (if available).
5. Define upper and lower limit.

11.4 Quick Settings

The quick settings function allows you to easily access different parameters concerning your measurement without changing the current method.

The quick settings comprise several measuring settings or functions and are available in all sample list modes. User-defined data fields and user functions of the "Constant" type will be automatically added to your quick settings.

If the "No Sample List" mode is used, sample name and measurement type S (Standard) are preset by default. If the "Sample List" mode is used, the quick settings parameters are not preset. See section 6.1.

Quick settings parameters can be added for each method. User-defined data fields and user functions of the "Constant" type will be automatically added to your quick settings.

If you have connected one or more Anton Paar measuring modules to your master instrument, the range of parameters that can be added to your quick settings will be extended. See the instruction manual of your measuring module for information on the available parameters.

To change or add a quick setting parameter

1. Tap **Menu > Method Management**.
2. Select a method and tap <Quick Settings Management>.
3. Select a parameter to change it or tap on the empty line to add a new parameter.
4. Use the sub-menu "Quantity" to select a parameter.
5. Use the up or down arrows to change the position of the parameters.

To delete a quick setting parameter

1. Tap **Menu > Method Management**.
2. Select a method and tap <Quick Settings Management>.
3. Tap <More> and <Delete>.
4. Select the parameter you want to delete and tap <Delete>.

11.5 Editing Methods

You can copy, rename, hide, arrange delete and archive methods. You need manager or administrator rights to create, edit, delete or archive methods. Up to 200 methods can be created.

TIPS: *To create a new method, make a copy of an existing method with similar settings. Then rename the new method and change its method settings to your needs.*

Creating, archiving, hiding and arranging methods affects the position numbers in the method list. If you use bar codes for assigning methods, check the position numbers of your methods after these actions.

To copy a method

1. Tap **Menu > Method Management**.
2. Select a method with a long tap and tap <Copy>. A new method is created with the same method name as the original one and an additional number in brackets. The new method is saved in the last position of the method list.

To rename a method

1. Tap **Menu > Method Management**.
2. Select a method with a long tap and tap <Rename>.
3. Enter a new method name (up to 50 characters long).

To archive a method

1. Tap **Menu > Method Management**.
2. Select a method with a long tap and tap <Delete> or <Archive> (if advanced data integrity is active).

TIP: *You cannot delete, archive or rename the currently used method. Change to another method before deleting or renaming.*

To change the order and to set the visibility of methods

If a method is made invisible, you cannot select this method any longer in the method list and the method settings.

1. Tap **Menu > Method Management**.
2. Tap <More> and tap <Visibility and Order>.
3. Enable the check box to set the method visible or disable the check box to make the method invisible.
4. Use the up and down arrows to change the position of a method in the list.

11.6 Selecting a Method

You can select the method using the <Method> button on the main screen or using the respective column in the sample list (if in sample list mode):

1. Tap <Method> to open the methods list.
2. Select a method.

12 Measuring

12.1 General Sample Settings

If the "No Sample List" mode is active, you only need to tap <Start> to initiate a measurement.

In "Sample List" mode (see section 6.1) enter the required data into the sample list before starting a measurement. Tap the button <Sample List> and fill in the sample data.

Sample name

If you have configured the automatic sample naming, a prefix, a postfix or a counter will be added to each sample name after a measurement has been finished (see section 6.3).

Quick settings


You can use the quick settings function (see section 11.4) to:

- enter a sample name and select a measurement type.
- change the measurement settings of the following measurement(s) without affecting the settings of the active method.

TIP: *The new settings are maintained for the following measurements until other changes are made.*

12.2 Monitor Mode

If you have not started a measurement yet or if you have terminated a measurement by tapping <Cancel>, the instrument is in the monitor mode and shows a continuous reading of the current measuring values.

If you have started a measurement by tapping <Start>, the continuous measuring values are shown until the measurement is finished. The final values are frozen until the next measurement is started. To unfreeze the screen and to return to the monitor mode, tap  in the quick access area.

If required, the instrument can restart the monitor mode after a measurement automatically:

1. Tap **Menu > Setup > Measuring System Settings > Monitor Mode Settings**.
2. Check the box "Automatically enter monitor mode after a measurement was finished".

12.3 Applying a Sample



WARNING

Hazardous substances

Before applying any sample or cleaning liquid make sure that:

- All safety instructions concerning the use of chemicals and the use of inflammable chemicals are met (see section 1).
- The fire point of the liquid in use is higher than 169 °C (25 °C above the maximum temperature of the Peltier module which is 144 °C).
- No source of ignition exists close to the instrument.
- Sufficient ventilation is guaranteed.
- All wetted parts of the instrument are resistant (see appendix A.3).
- All wetted parts of the installed accessories are resistant. See the instruction manual of the accessory (e.g. the sample changer) for information about the materials.



CAUTION

Hot surface

The measuring prism, its surrounding steel surface or mounted accessories can be very hot. Do not touch these surfaces without adequate protective measures.

To achieve highly accurate measuring results, it is important that the sample is applied to the refractometer prism properly. The refractometer prism has a circular, polished measuring surface on which the sample has to be placed. For convenient dosage of liquid samples, polyethylene pipettes are recommended.

Samples of sufficiently high surface tension as well as pasty samples can be conveniently measured. Three or four drops of these samples (approximately 1 ml) is sufficient. The filling height should be at least 1 mm above the prism surface. Make sure that no air bubbles are formed on the prism surface.

Special Cases

- If samples of medium or high viscosity are measured, e.g. sugar syrups, reproducible results can only be obtained when sample liquid covering the outer surface of the pipette is wiped off.
- Pasty samples, e.g. mustard, should be applied on the prism with a spatula. The stainless steel surface surrounding the prism may remain uncovered.
- Samples of low surface tension such as alcoholic solutions cover the prism and the surrounding steel surface. Therefore a higher volume is necessary to reach the required filling height of 1 mm.
- Some emulsions or suspensions such as juices with pulp or sugarcane crusher juice contain suspended matter. Particles settling on the prism surface can cause unstable measurement values. Centrifuging or filtering the sample for separating juice and soil before measurements solves this problem.

12.4 Performing a Measurement

Perform an adjustment at measuring temperature prior to the measurement.

To speed up measurements


- Use automatic sample naming (see section 6.3).
- Reduce the accuracy (see section 11.2).

To perform a measurement

1. Before starting a measurement, check if:
 - the measuring prism is clean
 - the method settings are set correctly
 - suitable cleaning liquids are available
2. Apply the sample on the prism so that the whole measuring surface is covered by sample. The required sample volume is approximately 1 mL.

3. After applying the sample, it is recommended to place the magnetic sample cover over the prism. The cover helps to reduce evaporation. It can also prevent possible interference from excessive stray light.
4. After the sample has been applied on the prism, some time is required until the sample has attained the prism temperature and a constant result is displayed.

TIP: *The smaller the sample volume, the shorter the stabilization time. Samples with good thermal conductivity yield stable readings faster, while samples with poor thermal conductivity such as syrups or other highly viscous solutions may require up to one minute or more.*

5. Enter a sample name if required.
6. Tap <Start> and wait until the measurement is finished.
 - The progress bar shows the progress of the measurement with a red bar and the message "Measuring".
 - When the measurement is finished, the progress bar turns green, the message "Finished" is displayed. An acoustic signal is given, if the feedback beep function is activated. The master condition output field shows the message "valid".
 - Possible sample warnings and errors are saved in the data memory including a text to further describe what went wrong.
 - The results are frozen (if the automatic monitor mode is deactivated, see section 12.2). The display can be unfrozen by tapping .
 - The result values are saved in the data memory (if non storage mode is inactive) and can be viewed, printed, deleted or archived.
7. Clean the measuring prism (see section 18.2) and measure the next sample.

13 Handling the Measurement Data

TIP: *Some of the settings in this chapter are not available in the non storage mode.*

13.1 Data Memory Settings

Your instrument can store 1000 result data files and 110 check results. After 900 measurements or 99 checks, the instrument issues a reminder for clearing the memory. If the memory is full, no measurements or checks are possible. Make sure to free memory space in time (see section 13.7).

To avoid reminders and the necessity of deleting data manually, you can set the data memory to behave as a circular buffer (if you use the instrument in low security mode).

1. Tap **Menu > Data Memory > Measurement Data > Settings > Data Memory Settings**.
2. Activate the check boxes "Automatically delete old measurement data" and "Automatically delete old check data".

The oldest 100 measurement results or 10 check data will be deleted automatically when the number of 1000 measuring results or 110 check data has been exceeded.

3. Displaying samples that contain a huge number of subsamples can slow down the performance of the hierarchical view. Deactivate the check box "Use hierarchical view for sample results" to speed up the display of data.
4. The instrument can remind you periodically after a series of measurements to export or delete/archive measurement data. To create a periodic reminder in the message list activate the check box "Reminder active" and set the number of samples to remind after.

13.2 Data Columns in Data Browser

TIP: *This setting is independent of the selected method and identical for all data.*

TIP: You can define the kind of data which is displayed in the data browser. You can change these settings any time and add further sample parameters to the result data files.

1. Tap **Menu > Data Memory > Measurement Data > Settings > Data Browser Settings**.

2. Tap on the list item that you want to change or on the empty field if you want to add an item.
3. Set "Group", "Quantity", "Unit" and number of "Digits".
4. Use the up and down arrows to change the sequence of the columns in the data browser.

13.3 Viewing Results

The instrument supports two forms of result display:

- **Multiple sample view** displays a number of results listed in a table. The output quantities are displayed according to the data browser settings.
- **Single sample view** displays a more detailed view of one result at a time. The output quantities are displayed as defined in the result output settings.

Multiple sample view

1. Tap **Menu > Data Memory > Measurement Data > Measured Data** to open the multiple sample view. Alternatively use the button <Measured Data> on the main screen.
2. Use the scrollbars to scroll vertically and horizontally.

Single sample view

1. In the multiple sample view, select the sample that you want to see in detail.
2. Use the up arrow to see the previous result or use the down arrow to see the next result.

13.4 Filtering Results

The filter tool can reduce the number of displayed measuring results. Filter settings can be defined separately:

- for printing, exporting and viewing of measured data
- for deleting and archiving measured data

Subsequent actions such as printing, exporting, deleting and archiving only apply to the data corresponding with the filter criteria.

Filter criteria

- Time
- Date
- Date Range
- Sample Name
- Method (only available if previously used)
- User-defined data fields
- Print/Export Status
- Sample Error State
- User (only those who performed measurements are available)
- Magazine Position (optional)
- Measuring Value
- Master Condition
- Measurement Mode

Comparators

- equals
- not equal
- larger than
- smaller than
- containing
- not containing
- printed/exported
- not printed/exported

Different filter criteria are linked to each other using the logical AND relation.

To define a filter

1. In the multiple sample view, tap <More> and <Edit Filter>.
2. Select a list item to change it or tap on the empty line to add a new filter.
3. Define a "Filter criterion", select an available "Comparator" and assign a "Value".
4. Tap <OK> and add more filters if required.

The multiple sample view and the single sample view now only show those results that meet your filter criteria.

Tap <Deactivate Filter> to disable the filter and see all results. Tap <Activate Filter> to enable the filter again.

Examples:

- If you only want to see the samples that were measured with the method "Refractive Index", choose the following settings:
 - Filter criterion: "Method"
 - Comparator: "equals"
 - Value: "Refractive Index"

- If you only want to see the samples that have not been exported yet, choose the following settings:
 - Filter criterion: "Print/Export Status"
 - Comparator: "Not printed/exported"
- If you only want to see the samples that have been measured during the last week, choose the following settings:
 - Filter criterion: "Date range"
 - Comparator: "equals"
 - Value: "Last Week"

To delete a filter

1. In the multiple sample view, tap <More> and <Edit Filter>.
2. To delete a single filter select it with a long tap and tap <Delete>.
3. To delete multiple filters, tap <More> and <Delete>. Then select the filters to delete and tap <Delete>.

13.5 Viewing Statistics

Statistical numbers are always calculated according to the filter settings of the measured data in the data browser.

Statistical details will only be calculated for those quantities which are activated for the result output of the respective measuring method, see section 11.3.

Results from checks and/or temperature scans are not included in any statistical analysis.

1. Tap **Menu > Data Memory > Measurement Data > Statistic** to open the statistics overview.

A table of methods and their respective number of result output quantities is displayed.

2. Select a row to view the details. Statistics are displayed for each output quantity.

Table 11: Statistics for output quantities

No. of values	Number of measurements
Minimum	Lowest value
Maximum	Highest value
Average	Arithmetic mean value
StdDev	Standard deviation

13.6 Printing and Exporting

NOTICE

In the non storage mode you can print or export your measured results only immediately after the measurement.

Following data types are available for printout and export

- Measurement data
- Check data
- Adjustment data
- Statistics
- Audit trails

Your instrument supports three kinds of printouts:

- Simple continuous printouts using an RS-232 printer with paper roll
- Report printouts using an office printer (USB or local network printer)
- Report printouts to PDF files (USB storage device, FTP File Server, LIMS)

Your instrument supports the export of data in the data formats:

- MS Excel spreadsheet (.xls)
- Text (tabulator separated values)
- PDF (portable document format)

To print measured data

1. Tap **Menu > Data Memory > Measurement Data > Measured Data** to open the multiple sample view.
2. Tap <More> and <Export>.
3. Select the data to print and tap <Export>.
4. Select "Print Report (Paper / PDF File)".
5. Define "Target", "Report", "Storage Location" and "File Name" and tap <OK>.

TIP: To create an empty line in your printed report, add the output quantity "Line break" from the group "System" to your result output list and position it at your convenience (see section 11.3).

To export measured data

1. Tap **Menu > Data Memory > Measurement Data > Measured Data** to open the multiple sample view.
2. Tap <More> and <Export>.
3. Select the data to export and tap <Export>.
4. Select "Export Data (Excel File / Text File)".
5. Use the sub-menu "File Format" to select "Excel" or "Text", define the "Storage Location" and enter the "File Name", then tap <OK>.

The measuring results are exported according to your current filter settings (see section 13.4). For each method, the data defined in the result output (see section 11.3) is exported.

13.7 Deleting Results

We recommend deleting your result data regularly after a successful data export or printout (see section 13.6).

Measured samples that are still in the sample list cannot be deleted. Clear the sample list first.

1. Tap **Menu > Data Memory > Measurement Data > Measured Data** to open the multiple sample view.
2. Tap <More> and <Delete>.
3. Select the data to delete, then tap <Delete> and <Yes>.

TIP: If you want to delete specific data apply a filter to select the data to be deleted (see section 13.4).

14 User Functions

With user functions, you can automatically calculate quantities of your interest from the output values of your instrument. For example, calculate the concentration of binary mixtures from the refractive index of the mixture.

For the calculated quantities, you have the same options for display, printout and export as for standard measurement results.

There are six types of user functions: constants, formulas, linear functions, polynomials with one input value (1 D), polynomials with two input values (2 D) and user tables. You can program up to 80 user functions.

Cascading user functions

You can freely use the output value of one user function as the input variable for another user function independently of the types of user functions involved. The instrument software automatically checks for circularity of the formula system.

Displaying user functions in output fields

To display an output quantity from the group "User Functions" on the main screen, see section 11.3.

Output fields displaying custom functions show the user symbol in the upper right corner of the output field. A maximum of 20 characters of the user function's name can be displayed.

14.1 Constants

The "Constant" user function is used to integrate a user-defined value to the result output.

The constant can describe every quantity needed and does not need to be directly measured with your measuring system. The constant can also be integrated in other user functions or changed if needed.

The constant has to be activated in the method settings of the desired methods. Then a value for the constant can be set in the method settings of the respective methods or in the sample settings via the quick settings function.

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. Tap <More> and <New> to program a new constant or select a list item to edit an existing constant.
3. Perform the following settings:
 - Enter a name for the constant.
 - Use the menu "Function Type" to select "Constant".
 - Use the menu "Physical Quantity" to select the type of quantity you want to use.
 - Use the menu "Unit" to select the output unit.
 - Enter a comment to describe this user function. This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.
 - Activate/deactivate the check box "Protect function against changes and copies by other users".
4. Tap <OK> to save the constant. A message is displayed to inform you that the constant and the value for the constant can be set in the method settings of the respective method.
5. To activate the constant in a method, tap **Menu > Method Management** and select a method.
6. Tap <Activate Modules / Constants>, enable the check box and tap <OK>. The constant is automatically added to the quick settings parameters.
7. To enter a value for the constant, use the quick settings function in the sample list or the menu **"Formula Parameters"** in the method settings.

14.2 Formulas

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. Tap <More> and <New> to program a new formula or select a list item to edit an existing formula.

3. Perform the following settings:
 - Enter a name for the formula.
 - Use the menu "Function Type" to select the "Formula".
 - Use the menu "Physical Quantity" to select the type of quantity you want to calculate.
 - Use the menu "Unit" to select the output unit.
 - Use the menu "Inputs" to define variables and input quantities.
 - Use the menu "Outputs" to enter your formula. The following formula elements are allowed:
 - Parentheses: ()
 - Operators: + - / * ^
 - Functions: log(), ln(), sqrt(), sin(), cos(), tan(), asin(), acos(), atan()
 - Constants
 - Enter a comment to describe this user function. This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.
 - Activate/deactivate the check box "Protect function against changes and copies by other users".

14.3 Linear Functions

The general formula for a linear function is:

$$f(x) = \text{factor} \cdot x + \text{offset}$$

x selected input quantity
f(x) calculated output quantity

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. Tap <More> and <New> to program a new linear function or select a list item to edit an existing linear function.
3. Perform the following settings:
 - Enter a name for the linear function (up to 50 characters long).
 - Use the menu "Function Type" to select "Linear Function".
 - Use the menu "Physical Quantity" to select the type of quantity you want to calculate.
 - Use the menu "Unit" to select the output unit.
 - Use the menu "Inputs" to define the input quantity.
 - Use the menu "Outputs" to enter "Offset" and "Factor" of your linear function.
 - Enter a comment to describe this user function. This comment will not be printed, exported or displayed anywhere but is only

an internal description of your user function.

- Activate/deactivate the check box "Protect function against changes and copies by other users".

14.4 Polynomials

The general formula for a one-dimensional polynomial is:

$$f(x) = \text{Coeff.0} + \text{Coeff.1} \cdot x + \text{Coeff.2} \cdot x^2 + \text{Coeff.3} \cdot x^3 + \text{Coeff.4} \cdot x^4 + \text{Coeff.5} \cdot x^5 + \text{Coeff.6} \cdot x^6$$

x selected input quantity
f(x) calculated output quantity

The general formula for a two-dimensional polynomial is:

$$f(x,y) = \text{Coeff.00} + \text{Coeff.01} \cdot y + \text{Coeff.02} \cdot y^2 + \text{Coeff.03} \cdot y^3 + \text{Coeff.10} \cdot x + \text{Coeff.11} \cdot x \cdot y + \text{Coeff.12} \cdot x \cdot y^2 + \text{Coeff.20} \cdot x^2 + \text{Coeff.21} \cdot x^2 \cdot y + \text{Coeff.30} \cdot x^3$$

x selected first input quantity
y selected second input quantity
f(x,y) calculated output quantity

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. Tap <More> and <New> to program a new polynomial or select an existing polynomial.
3. Perform the following settings:
 - Enter a name for the polynomial (up to 50 characters long).
 - Use the menu "Function Type" to select the polynomial type.
 - Use the menu "Physical Quantity" to select the type of quantity you want to calculate.
 - Use the menu "Unit" to select the output unit.
 - Use the menu "Inputs" to define the input quantity/quantities.
 - Use the menu "Outputs" to enter the polynomial coefficients. If you do not enter a value for a coefficient, the coefficient will be set to zero.
 - Enter a comment to describe this user function. This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.
 - Activate/deactivate the check box "Protect function against changes and copies by other users".

14.5 User Table

A literature table or individual experimental data can be programmed into a user table. Up to 1000 data pairs can be entered. You can also use every input quantity available to build a user table.

TIP: *The larger the number of data pairs and the higher the accuracy of the data pairs, the higher the accuracy that you can obtain with your user table.*

TIP: *The instrument will interpolate, but not extrapolate. This means, that the data pairs that you enter into the instrument should cover the whole range of values that you want to measure.*

You can enter the data pairs manually or import data from a USB storage device or an FTP server. The data files must fulfill the following requirements:

- File extension: .csv
 - Content: only data pairs; data separator: semi-colon; decimal mark: decimal point; no thousands separators or blanks
 - Location: root directory of the USB storage device or FTP server
1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
 2. Tap <More> and <New> to program a new user table or select an existing user table.
 3. Perform the following settings:
 - Enter a name for the user table (up to 50 characters long).
 - Use the menu "Function Type" to select "Table".
 - Use the menu "Physical Quantity" to select the type of quantity you want to calculate.
 - Use the menu "Unit" to select the output unit.
 - Use the menu "Inputs" to define the input quantity.
 - Use the menu "Outputs" to enter the values of the table or tap <More> and <Import> to import data.
 - Enter a comment to describe this user function. This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.
 - Activate/deactivate the check box "Protect function against changes and copies by other users".

14.6 Calculator

Using the calculator you can check the output of your user function. With the calculator, you can simulate any factory predefined function or any of your own user functions. You can enter an input value and check which output value the function will generate. You can also generate a graph within a defined range for the selected function.

To perform a calculation

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > Calculator**.
2. Select the "Function" and the output "Unit" and tap <OK>.
3. Select "Manual Value Input (Calculator)" and tap <OK>.
4. Enter the "Value" for the input parameter(s) and tap <Next>.
5. Read out the result of the function.
6. To calculate further results with other values, tap <Previous> and repeat steps 4 and 5. To exit the calculator tap <OK>.

To generate a plot

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > Calculator**.
2. Select the "Function" and the output "Unit" and tap <OK>.
3. Select "Data Diagram" and tap <OK>.
4. Enter the required values. The graph is displayed and can be printed out or exported by tapping <Print or Export>.

Graphs cannot be printed by RS-232 printers with paper roll.

5. Tap on the graph to activate the zoom function.
 - Use the magnifiers below the graph to zoom in and out.
 - Use the arrows to move from one data point to the previous or next.
 - Use the data point bar to scroll within the graph.
 - To close the zoom function, tap <X> in the upper right corner.
6. To calculate further results with other values, tap <Previous> and repeat steps 4 and 5. To exit the calculator tap <OK>.

14.7 Group Calculator

With the group calculator, you can simulate all calculations belonging to a certain group in one step. Enter the corresponding input values to get all output values belonging to the group.

To perform a calculation

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > Group Calculator**.
2. Use the menu "Group" to select the type and tap <OK>.
3. Enter the "Values" for the Input Quantities and tap <Calculate>.
4. Read out the calculated results.
5. To calculate further results with other values, tap <Back> and repeat steps 3 and 4.
6. To exit the calculator tap <OK>.

14.8 Printing or Exporting User Functions

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or text file, tap <More> and <Export> and follow the instructions on the screen.

14.9 Deleting User Functions

1. Tap **Menu > Setup > Measuring System Settings > User Functions / Calculator > User Function Management**.
2. Tap long on a user function to select it and tap <Delete>.

TIP: *User functions that are used to define limits in methods cannot be deleted.*

15 System Utilities

This chapter informs you about doing a backup/restore of your instrument settings, performing a firmware upgrade, getting details about the system and viewing the live raw data. The backup and restore procedures described in this chapter do not apply to Abbat Desktop.

15.1 Backup the Instrument Settings

You can use this utility to save the current instrument status for a later restore:

- Save the current settings before you perform a firmware upgrade.
- Copy the instrument settings to one or more other instrument.

A backup file contains the following instrument settings and instrument information:

- Global settings in the control panel (regional settings, keyboard settings, network settings, instrument settings, global module settings, sample list settings, audit trail settings, printout settings)
- Method settings (display layout and content, result output settings, limit settings, module settings, check definitions)
- User functions
- Users
- System settings (instrument settings, global module settings, sample list settings, audit trail settings, printout settings)
- Adjustments (special adjustments, adjustment data)

To backup the instrument settings

1. Tap **Menu > Service > Instrument Settings Management > Backup Instrument Settings**.
2. Select the content for your backup file and tap <Next>.
3. Select the data storage location (USB storage device) and enter a "File name" or accept the automatic file name.
4. Tap <Backup> and <Yes> to create your backup file. The backup file is stored into the root directory of your USB storage device.

15.2 Restore the Instrument Settings

NOTICE

- When restoring the instrument settings, make sure that the backup file corresponds with the instrument type.
- The audit trail is not restored.
- Any backup file restored in the "Non Storage Mode" (see section 9.11) recovers all instrument settings, but no measurement data or check data.

1. Tap **Menu > Service > Instrument Settings Management > Restore Instrument Settings**.
2. Select the location of your backup file (USB storage device) and the "File name" using the two drop-down boxes. The backup file must be stored in the root directory of your USB storage device.
3. Tap <Details> for information on the selected backup file.
4. Tap <Next>.
5. Select the settings to be restored to your instrument and tap <OK>.
6. Tap <Yes> to restore the settings.

15.3 Export the Instrument Settings

Use this utility to export or print the current instrument status for documentation purposes. The export file basically includes the same information as a backup file but it can not be restored.

To export the instrument settings

1. Tap **Menu > Service > Instrument Settings Management > Export Instrument Settings** to open the "Backup" dialog.
2. Select the content of your backup file and tap <Next>.
3. Select the data storage location (USB storage device) and enter a "File name" or accept the automatic file name.
4. Tap <OK>.
5. Tap <Yes> to create your export file. The export file is stored into the root directory of your USB storage device.

15.4 Full System Backup and Restore

A full system backup file can be used to restore a measuring system to the state of the backup. If restoring the full system, the entire file is restored to an instrument or system. In contrast for restoring the instrument settings, the content can be selected from the available instrument settings backup file (e.g. only one of the stored methods).

The data can be stored to or read from a USB storage device. At least 300 MB free memory are required.

Conditions for a successful full system backup

- The serial number of the master instrument and each measuring module of the system has been set correctly
- The software/firmware version of the master instrument and each measuring module of the system has been set correctly
- The entire system works correctly and is fully functional.

TIP: A full system backup should always be generated after a system has been installed.

In case one of the above conditions is not fulfilled, no Full System Backup will be performed. The master instrument displays the corresponding error messages.

To perform a full system backup

1. Connect a USB storage device to a USB port of your instrument.
2. Tap **Menu > Service > Instrument Settings Management > Full System Backup**.
3. Select the location for the backup file.
4. Activate or deactivate "Device-independent backup"

TIP: Device-independent backup generates a file that can be transferred to another measuring system that consists of the same measuring modules but with different serial numbers. If not activated, the backup file can only be restored to exactly the same measuring system the backup file was generated from.

5. Select the storage location on your USB device.
6. Tap <Backup>. The instrument will display a message and reboot if you confirm.

TIP: The backup package is a folder with an automatically generated name (containing the instrument name, serial no., date and time). It is stored in an automatically created folder named "BackupArchives".

Conditions for a successful full system restore

- Existing full system backup for the measuring system
- The measuring system is identical to the one the backup was done for.

NOTICE

For some instruments, the adjustment data and settings are also restored to the state of the full system backup. Perform a backup of the instrument settings before a full system restore, if the current instrument settings and adjustment data shall be applied afterwards, see section 15.1 and section 15.2.

To perform a full system restore

1. Connect a USB storage device to a USB port of your instrument.
2. Tap **Menu > Service > Instrument Settings Management > Full System Restore**.
3. Select the location of the backup file.
4. Activate or deactivate "Force module firmware restore".

TIP: If activated, the module firmware is restored for all modules even if adjustment data or instrument settings cannot be restored.

5. Select the storage location and folder on your USB device.

NOTICE

- On the USB storage device the folder with the backup package must be located in a folder named "Backup Archives". This folder is automatically created when doing a Full System Backup. If the folder "Backup Archives" contains more than one backup package folder, you can select the one to be used. Otherwise, the most recent package will be used for restoring the system.

6. Tap <Restore>. The instrument will display a message and reboot if you confirm.

15.5 Updating the Instrument Software.

A system update can be performed to provide the instrument with new features.

NOTICE

- Contact your local Anton Paar representative for updates of the instrument software. Updates can possibly affect settings concerning data transfer and interfaces.
- To update the system, you need administrator rights with activated auto logon function, see section 8.1, or the administrator must log on and perform the update. It is not possible to revert the system to an older version.

TIP: Before starting the system update, export or print relevant measurement data, see section 13.6, and create a backup file of the instrument settings, see section 15.1.

To update the software

1. Load the latest software package into the root directory of your USB storage device or to the FTP server.
2. Connect a USB storage device to a USB interface of your instrument or connect the instrument to the FTP server.
3. Tap **Menu > Service > Update > System Update**.
4. Select the storage location (USB storage device or FTP server) and the "File name" of the new software package.
5. Tap <OK> and follow the instructions on the screen.

To update the module firmware

TIP: A message is shown if outdated firmware is installed on one of your modules. If the auto logon for a user with administrator rights is activated, the firmware update of the module can be started. Otherwise, the administrator must log on and then start the firmware update.

1. Load the latest firmware into the root directory of your USB storage device or FTP server.
2. Connect the USB storage device to a USB interface of your instrument or connect the instrument to the FTP server.
3. Tap **Menu > Service > Update > Module Firmware Update**.

Select the storage location and file name of the new firmware or select "Internal" and tap <Next>.

If you select "Internal", the instrument automatically checks the system. In case any modules run an older firmware version, the instrument will update it to the version supported by the user interface software. No USB storage device or FTP server connection is required in that case.

4. Follow the instructions on the screen.

To install a language pack

To receive a language pack, contact your Anton Paar representative.

1. Load the language pack into the root directory of your USB storage device or FTP server.
2. Connect the USB storage device to a USB interface of your instrument or connect the instrument to the FTP server.
3. Tap **Menu > Service > Update > Install Language Pack**.
4. Select the storage location and file name of the language pack, tap <OK> and follow the instructions on the screen.

15.6 Viewing the System Information

In this menu, you find information about the configuration of the hardware, software and firmware. The instrument type, serial number and firmware versions are shown in a table.

In this menu, you can also save an instrument log file to a USB storage device. This file contains the last operating steps and may help during troubleshooting.

To view hardware and firmware configuration

1. Tap **Menu > Service > System Information**.
2. Use the vertical scrollbar to scroll through the configuration overview table.

To save the instrument log file

1. Tap **Menu > Service > System Information**.
2. Insert a USB storage device into a USB interface and tap <Save Logfile>.
3. Accept the automatically generated file name or enter a new one and tap <OK>.

The instrument log file is now saved to the root directory of the USB storage device.


To change the log file configuration

In special cases your Anton Paar representative will ask you to change the configuration of your log file in order to get more specific information about your instrument.

1. Tap **Menu > Service > Update > Logging Configuration**.
2. Insert a USB storage device with the special configuration file delivered by your Anton Paar representative into a USB interface.
3. Tap <OK>.
4. To save the changed instrument log file see above.

15.7 Viewing and Printing Live Raw Data

If the monitor mode is active, you can get a live view of sensor signals including raw data. You can also print the live raw data.

After a measurement is finished, the live raw data of the measuring unit are frozen as well as the quantities on the main screen. To unfreeze the values, tap .

1. Tap **Menu > Service > Live Raw Data > Abbe-mat**.
2. To perform a printout on paper or to a PDF file, tap <Print or Export> and follow the instructions on the screen.

16 Instrument Connectivity


16.1 Virtual Network Computing

The instrument can be operated via LAN by an external PC running the virtual network client software named AP Instrument Viewer. It is recommended to place your PC close to the instrument, because normally an interaction with the instrument is required. Contact your local Anton Paar representative for further information about installation and setup of the AP Instrument Viewer.

TIP: For security reasons a connection with VNC is possible only, if no user is logged into the instrument. Before a VNC connection is allowed, the user indicator has to show the symbol "locked". Therefore the auto login feature has to be disabled (see section 8.1). Activating the check box "Enable VNC" will disable the auto logon function for one time only. If you activate auto logon later, you would have to disable it again in order to establish a VNC connection.

TIP: Do not activate the LIMS Service and the VNC mode (Virtual Network Computing) simultaneously.

To start the AP Instrument Viewer

1. Set up a network connection for your PC and the instrument (see section 5.8).
2. Log into your instrument as administrator, see section 8.1.
3. Tap **Menu > Setup > Control Panel > VNC Settings**.
4. Activate the check box "Enable VNC".
5. Set a password for the VNC connection.
6. If you want the display of the instrument to stay dark during a VNC connection, activate the check box "Enable Dark Mode".
7. Tap <OK> and <Home>.
8. Tap the login button in the upper right corner of the instrument and press the button <Log Off>. The user indicator should show the locked symbol now: .
9. Tap the user indicator to display the login screen.
10. Start the AP Instrument Viewer on your PC.

11. Enter the IP address of your instrument, port 5900 and the password defined in the instrument before.
12. Click the button <Open>.
13. Within the VNC client: Select your "User name", enter your "Password", and click <OK>.

Now you can operate the instrument via your PC exactly as you would do via touchscreen. When VNC is not in use, it should be disabled in the VNC menu of the instrument.

When the VNC feature is active

- The characters "VNC" are displayed in the user logo to indicate an active VNC connection.
- The touchscreen of the instrument is disabled.
- The display is dimmed if dark mode is enabled.
- In case of a disconnect a reconnection to the AP Instrument Viewer is possible within 60 seconds. Afterwards the instrument will attempt an automatic logoff.

16.2 FTP Settings

The instrument allows you to export your measuring data directly to a connected PC or server via file transfer protocol FTP (not available with Abbemat Desktop). Also an automatic printout to the FTP server is possible.

To configure an FTP connection

1. Install an FTP server of your choice (for example FileZilla) on your PC or your server.
2. Tap **Menu > Setup > Control Panel > FTP Settings**.
3. Select an existing FTP connection or tap <More> and <New> to create a new one.
4. Enter a name of your choice in the field "Name".
5. Enter the IP address of the server in the Field "FTP Server Path".
6. Enter the user name you created earlier on the FTP server into the Field "Username" (case-sensitive).
7. Enter the password of the FTP user, if one was defined on the FTP server.
8. Tap <OK> and reboot the instrument.

To export measured data to FTP server

1. While on the main screen tap <Measured Data>.
2. Tap <More>, then tap <Export>.
3. Select the data you would like to export and tap <Export>.
4. Tap <Print Report (Paper / PDF File)> to export a PDF file or tap <Export Data (Excel File / Text File)> to export an Excel file or text file, then tap <OK>.
5. Set the "Storage Location" to your FTP server.
6. Tap <OK>. A file is transferred to the directory specified on your FTP server.

Automatic printout to FTP server

In order to export files, your FTP server has to be defined as a printer.

1. Tap **Menu > Setup > Printout Settings > Printer Management**.
2. Tap <More> and <New>.
3. Enter the name of your FTP connection in the field "Name". Choose "PDF File Printer" as Type.
4. Select your FTP connection in the drop-down box "USB Printer" and tap <OK>.
5. Tap **Menu > Setup > Printout Settings > Automatic Printout**.
6. Select check box "After each measurement".
7. Select your FTP printer in the field "Printer".

After each measurement a file with the measurement data will be sent to the FTP server.

16.3 Automatic Email Notifications

An email can be sent upon the following events:

- when a sample list was measured successfully (only if an Xsample is used)
- when one or more errors occurred during measuring the sample list (only if an Xsample is used)
- when a service interval, check interval or audit trail interval is due (for administrator users only)

The email is sent to the currently logged on user if the email function is activated for this account, see section 8.2.

To set the SMTP server settings

1. Establish a network connection as described in section 5.8.
2. If necessary, contact your local IT administrator for information on the SMTP host name, port, user name, password and instrument address.
3. Tap **Menu > Setup > Control Panel > SMTP Server Settings** and perform the following settings:
 - Enter the "Host" name.
 - Activate "Enable SSL" if required.
 - Enter the "Port".
 - Enter the "User Name" and "Password".
 - Enter the instrument address ("From address").
4. To test the settings, tap <Test Settings>, enter your email address in the "Recipient" input box and tap <OK>.
5. If the settings are correct, a test email will be sent to the defined recipient.
6. Tap <OK>.

16.4 Connecting to a LIMS

The instrument can be connected to your Laboratory Information Management System (LIMS) using the Anton Paar software AP Connect (also via Abbemat Desktop) or LIMS Bridge (not available with Abbemat Desktop). These can be used to send remote measurement commands to the instrument and to forward result files from the instrument.

TIP: *If electronic signature is activated (see section 9.10), the measurement data has to be fully signed before an export via LIMS Bridge is possible.*

For more details, see the LIMS Bridge or LIMS Service instruction manuals.

16.5 Web Interface, Reference Guide

You can transfer system informations and the full reference guide from your instrument to any PC within your local network.

1. Set up a network connection for your PC and the instrument (see section 5.8).
2. Open an internet browser on your PC.
3. Enter the IP address of your instrument in the address field of the browser and press <Enter>.

Now the system information of your instrument is displayed together with a download link for reference guide and release notes.

16.6 Connecting via RS-232

To connect the instrument to a PC you have to use a terminal software and a suitable RS-232 serial interface cable. RS-232 functionality is not available with Abbemat Desktop.

Table 12: Pin assignment of RS-232 cable

Connector D-sub, 9 pins, female	Connector D-sub, 9 pins, female
2	3
3	2
5	5

If necessary, install a gender changer and/or a null-modem cable. If you have no RS-232 connector at your PC, it is also possible to use a USB/RS-232 converter.

TIP: *If you have defined an RS-232 printer, make sure that you do not print anything (manually or automatically) while using the RS-232 interface for data transfer to a PC.*

Table 13: RS-232 settings

Baud rate	9600
Data bits	8
Parity	none
Stop bits	1
Handshaking	none

To configure the RS-232 interface

1. Tap **Menu > Setup > Control Panel > RS-232 Settings**.
2. Activate/deactivate the check box "Accept input without carriage return".
3. Reports are printed in the language selected in the regional settings. By activating the check box "Always print report in English" reports on RS-232 printers are printed in English language always regardless of the language setting.

RS-232 interface commands

Commands can be written with or without blanks between the words, for example both "getdata" and "get data" are valid commands.

The encoding is according to the 8-bit ANSI code page 850. This means that strings with special characters can only be converted with a loss of information. A question mark will be used for characters which cannot be encoded.

Table 14: Output format

Language	always English
Decimal separator	. (dot)
Column separator	; (semicolon)
Line end	CR

Table 15: RS-232 commands to operate the instrument

start or start method_number	Creates a new sample in the sample list and starts a measurement with the active method.
abort	Aborts the measurement.
get data head	Gets meta data of the last measured sample. The answer contains the names of the output quantities of the last measured sample. The output quantities depend on the method and are set in the "Result Output" settings.
get data unit	Gets unit data of the output quantities of the last measured sample. For each output quantity the unit is returned.
get data	Returns the result values of the last measurement only once.
finished	Returns the status of the measurement.
get raw data	Returns the current raw data values for "Refractive Index", "RI Temperature", "Set Temperature" and the "Unique Sample ID". The unique sample ID is "NaN" if no sample was measured yet.
get method name	Returns the name and number of the method.
get id	Returns the serial number, instrument type, firmware and protocol version.
set temperature xx.xxx	Sets the set temperature of the current method to the given value (xx.xxx in [°C]). This command is only allowed, if no measurement is in progress.
help	Returns a list of the available RS-232 interface commands.

Table 16: RS-232 commands and their specific responses

Command	Response	Description
start or start method_number	measurement started	The command was accepted and the measurement was started.
	measurement already started	The measurement was already started.
abort	measurement aborted	The measurement was aborted.
	measurement not started	No measurement was started.
	already aborting	The measurement is already being aborted.
get data head	Refractive Index, Temperature	Example response with the default settings.
	no data available	No measurement has yet been finished and so no data is available.
get data unit	nD;-;°C;-	Example response with the default settings.
	no data available	No measurement has yet been finished and so no data is available.
get data	1.332987;20.00;valid	Example response with the default settings.
	no new data available	No new measurement has yet been finished and so no new data is available.
finished	Measurement not started	No measurement has yet been started.
	Measurement not finished	The measurement is in progress now.
	Measurement finished	The measurement was finished.
get raw data	1.333689;19.999;20.000:8	Example response.
get method name	method name: Refractive Index, 0	Example response.
get id	serial number: 80000000 Abbemat x50 V1.10.6534.57 protocol version: 2.00	Example response.
set temperature xx.xxx	accepted	The command was accepted and the refractive index temperature was set to the given value.
	wrong parameter value	The given value was not accepted (e.g. value is out of specifications).
help	commands: abort ...	List of all available commands.

17 Abbemat Desktop

Abbemat Desktop is an optional PC software to control the Abbemat series 350, 450, 550, and 650. The software runs on a single workstation computer. Client-server operation is not provided. All data processing is performed on the computer, not on the instrument.

Because the database resides on the PC, Abbemat Desktop can be operated with a disconnected instrument or even if the instrument is unavailable. The program gives access to already acquired data and allows settings.

17.1 Abbemat and Abbemat Desktop compared

Basically the operation of Abbemat Desktop and a standalone Abbemat instrument is identical. Due to differences in the two systems, some functions and settings are obsolete. For instance the setting of date and time is done via the Windows operating system. Therefore the obsolete menu items are not available in Abbemat Desktop.

Settings not available in Abbemat Desktop

- Date and time
- Time server settings
- Screen saver
- VNC setting
- Calibrate touch screen
- Calibrate external Touch Screen
- Display brightness
- FTP settings
- RS232 settings
- Disable USB memory device
- Printer management

Functions not available in Abbemat Desktop

- LIMS bridge support
- Module support (i.e. for sample changers)
- Non storage mode
- Instant print button
- Automatic printout (this function is replaced by automatic export)

Further details about the differences between Abbemat and Abbemat Desktop are explained in the respective sections of this manual. For an overview see the menu tree in appendix E.

17.2 System Requirements

- Operating System:
 - Windows 8
 - Windows 8.1
 - Windows 10
- RAM:
 - At least 4 GB
- Suitable instruments for Abbemat Desktop:
 - Abbemat 350, 450, 550, and 650 with software version 5.2 or above

The operation of a refractometer usually requires a close contact of the operator to the instrument, i.e. to apply the sample or to clean the measuring prism. Therefore it is recommended to place the PC with Abbemat Desktop close to the instrument.

TIP: *Due to the fact that the desktop software and the instrument software are separate software types, version numbers might differ. E.g. desktop software 5.20 and instrument software 5.30 are interoperable and thus a valid configuration.*

17.3 Installing Abbemat Desktop

Abbemat Desktop can be installed in two different modes: Pharma and non-pharma. In pharma mode the audit trail and the pairing of PC and instrument (see section 17.8) are active by default and cannot be deactivated.

NOTICE

- Choose the required mode (pharma or non-pharma) carefully. The chosen mode cannot be changed later on. In pharma mode the pairing of instruments is mandatory. Any Abbemat connected to Abbemat Desktop is paired permanently to this installation.
- Other required security features must be set manually (see section 9).
- Every user of the desktop software should have write access to all folders used. For example, when using the electronic signature, an approver should have write access to the export folder so that the data can be written after signing.

To install the Abbemat Desktop software on a PC

1. Store the installation program on the PC.
2. Exit any other programs that may be running.
3. Start the installation program.
4. Follow the instructions of the installation program.

After successful installation, an Abbemat Desktop desktop icon is created. The installed software can also be found in the Windows start menu (e.g. Start > Programs > Anton Paar > Abbemat Desktop).

17.4 Switch Abbemat into Desktop Mode

Before an Abbemat can be connected to Abbemat Desktop, it has to be switched into desktop mode once. If the instrument was acquired as an Abbemat Desktop system, the following steps might have been already done by Anton Paar. Check if your Abbemat displays a start screen similar to Fig. 17-2. If so, skip to section 17.5, Network Settings.

NOTICE

Loss of data

Switching to desktop mode deletes all data that may be stored on the device. If necessary, archive any existing data (measurements, audit trail, checks and adjustments).

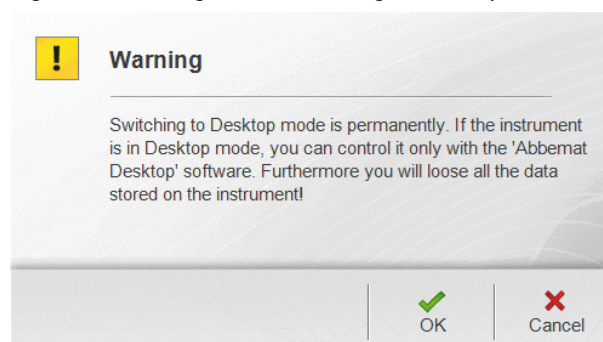
NOTICE

Risk of irreversible misconfiguration

Never switch a device to desktop mode for testing purposes only. The conversion is permanent and cannot be reversed. A device in desktop mode can only be controlled by the desktop software. If the device needs to be switched back to standalone mode, contact your Anton Paar service representative.

1. Tap **Menu > Service > Switch to Desktop Mode**. If this menu item is not available, the device has not yet been unlocked for operation in desktop mode. Please contact your Anton Paar sales representative.
2. Activate the check box <Switch to Desktop Mode> and tap <OK>. A warning message appears:

Fig. 17-1: Warning before switching to desktop mode.



3. Tap <OK> to confirm the switch to desktop mode. The instrument reboots:

Fig. 17-2: The instrument displays its serial number in desktop mode.



17.5 Network Settings

The instrument can be connected to a network or to a server. It can also be connected directly to a PC (peer to peer) via a hub or an Ethernet cable.

To change the network settings

1. Tap the button <Network Settings>. If this button is not available, the instrument is already connected to Abbemat Desktop. To change the network settings, close the Abbemat Desktop program first.
2. If your network server has DHCP functionality, activate <Obtain an IP address automatically (DHCP)>, then tap <OK>.
3. If your network server has no DHCP functionality, enter IP Address, Subnet Mask, Default Gateway, primary and secondary DNS.

If the instrument is connected directly to the PC via hub or Ethernet cable, enter an arbitrary static IP address i.e. 192.168.1.2., subnet mask 255.255.255.0

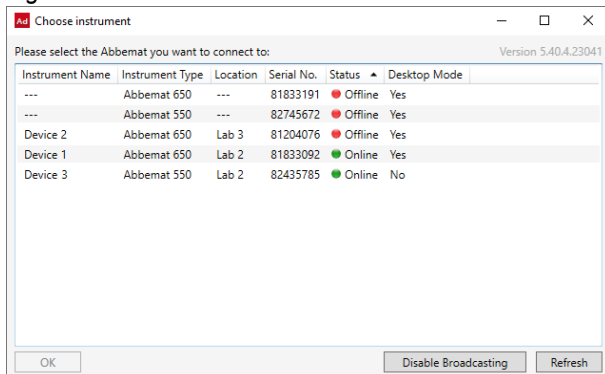
and default gateway 192.168.1.1. Primary and secondary DNS do not have to be entered.

Set the PC to the static IP 192.168.1.1., same subnet mask and default gateway. Now a direct connection is possible.

17.6 Connecting to the Instrument

1. Start the desktop software. The program scans automatically for available instruments:

Fig. 17-3: Start window with list of available instruments.



2. If an instrument is not on the list, check all network connections and the settings of the missing instrument. Scan the network again by clicking <Refresh>. If the problem persists, ask the administrator of the network.
3. To disable the automatic search for instruments on the network, click <Disable Broadcasting>. When you restart the desktop software (after a successful connection with an instrument), the program will no longer search for available instruments on the network. This feature reduces the startup time and avoids unnecessary network traffic.

With broadcasting disabled, you can still add instruments to the list. Click <Add instrument> and enter the IP address of the instrument manually. Or switch back to the automatic search of instruments with the <Enable Broadcasting> button.

4. To connect to an instrument from the list, select it and click <OK>. When the desktop software and the instrument are connected, the user interface at the instrument is inactive. It displays its serial number and software version. The <Network Settings> button disappears (see Fig. 17-4). Now the instrument can be operated remotely.

Fig. 17-4: Instrument screen, when Abbemat Desktop and instrument are connected.



17.7 Log on with Active Directory

With the Windows Active Directory feature, the desktop software accepts Windows credentials for the logon procedure.

NOTICE

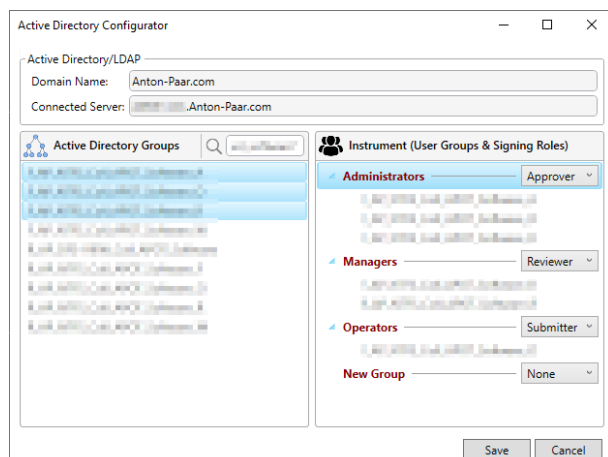
Risk of blocking the access to the instrument

- With Active Directory, local instrument users (Administrator, Manager, Operator or custom group) can not log on. Make sure that you are registered in the "Administrator" user group with your Active Directory account in order to retain full access to the instrument.
- With Active Directory, the password rules of the network apply. The password rules that were set on the instrument (length, expiration, etc.) are irrelevant. For example, if Active Directory is set to block an account after three unsuccessful logon attempts, access to the instrument will also be blocked.
- If the Active Directory service in your network has a malfunction, you will not be able to log on to the instrument.

Active Directory itself has no information to which user group of the instrument (administrator, manager, operator or custom group) a user belongs. Therefore, this information has to be provided to the desktop software before. To set up the Active Directory function:

1. Start the desktop software and go to **Menu > Setup > User Management > Active Directory**.
2. Activate the check box <Active Directory Service>.
3. Click <Active Directory Configurator>. A configuration window appears:

Fig. 17-5: Active Directory groups (left pane) and user groups of the instrument (right pane).



4. In this Window you can map Active Directory groups (left pane) to the user groups of the instrument (right pane):
 - To add a mapping, first select a user group in the right pane as target and then double click on an Active Directory group in the left pane.
 - To remove a mapping, double-click on an already mapped Active Directory group in the right pane.
 - Alternatively, you can simply drag and drop list entries or right-click and select the desired action from the context menu.
 - Usually, the list of all Active Directory users is quite long. To find a specific entry, type an appropriate search term in the field next to the magnifying glass. Then press the Enter key on the keyboard to filter the list.
 - Multiple Active Directory groups can be mapped to a single user group.
 - An Active Directory group can be assigned to only one of the user groups.
 - When a user tries to log on with Windows credentials, the software scans the list of user groups from top to bottom. The first user group in the list that matches one of the Active Directory groups to which the user belongs is used for logon. This ensures a logon with the highest privileges of a user.

Tip. Active Directory groups can only be fully assigned to a user group on the instrument. If you need to assign individual users to a group on the instrument, ask your network administrator to set up dedicated Active Directory groups for those users.

5. If electronic signature (see section 9.10) is active, you can specify signing roles (submitter, reviewer or approver) for instrument user groups (Administrator, Manager, Operator or custom group). Use the drop down menu on the right of

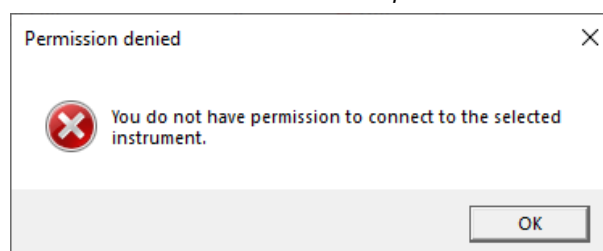
a user group to select a signing role for the whole group.

6. Click <OK> in the configuration window to confirm the mapping.
7. Click <OK> in the Abbemat menu.
8. Enter your Windows credentials. The configuration is only saved after a successful authentication. Then the user is logged off automatically.
9. The desktop software is now ready to accept a logon with Windows credentials.

17.8 Pairing of Instruments

Instruments can be paired with the desktop software. Once the pairing is performed, an instrument connects exclusively with the installation of the desktop software it was paired with. Connections to other installations are refused by the instrument:

Fig. 17-6: Trying to connect to an instrument paired with another installation of the desktop software.



An installation of the desktop software however can connect (sequentially) to more than one instrument.

If the desktop software was installed in pharma mode, it is set to automatic pairing permanently. In non-pharma mode the automatic pairing is disabled by default and can be activated later on if required.

NOTICE

Risk of irreversible misconfiguration

If the desktop software is installed in pharma mode, it is set to automatic pairing permanently. Never connect to an instrument which should not be paired. If you connect to such an instrument anyways, only Anton Paar service can unpair the instrument.

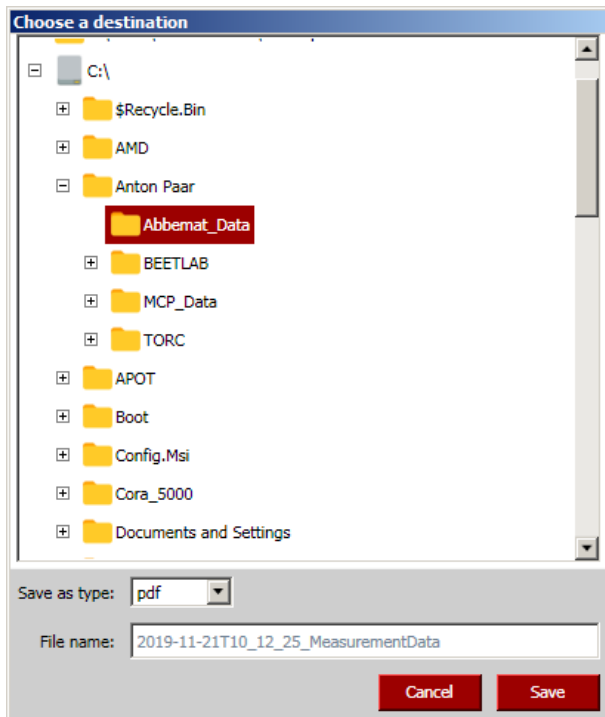
To pair an instrument with the desktop software

1. Tap **Menu > Setup > System Security > Pairing**
2. Activate the check box "Allow only current desktop to connect" and press <OK>.

17.9 Secure File Dialog

By default Abbemat Desktop uses the standard windows file select dialog. If required, you can change to a secure dialog which prevents the manipulation of files. This simple dialog does not allow to copy, move, delete or rename any files or folders:

Fig. 17-7: Secure File Dialog.



To activate the secure file dialog

1. Tap **Menu > Setup > System Security > Advanced Security**.
2. Activate the check box <Use safe dialogs> and press <OK>.

17.10 Backup of Abbemat Desktop

The complete data (measurements, audit trail, checks and adjustments) is stored in the Abbemat Desktop database.

To backup the database

1. Tap **Menu > Service > Instrument Settings Management > Backup the Database**.
2. To generate a backup file instantly:
 - Choose <Backup now>.
 - Select folder and filename.
 - Select to append the current date and time to the file name or alternatively to append a sequential number.

- Tap <Backup> and confirm the following information window with <Yes> to start the backup.

3. For an automatic backup, select the cases in which it shall be executed:

- At the startup of the software
- At the shutdown of the software
- At regular intervals ("Periodically")

For periodic backups enter a start date, a start time and an interval (30 minutes or more).

4. Tap <Next> and

- Select folder and filename.
- Select to append the current date and time to the file name or alternatively to append a sequential number.

5. Tap <Save>. The automatic backup is now set up.

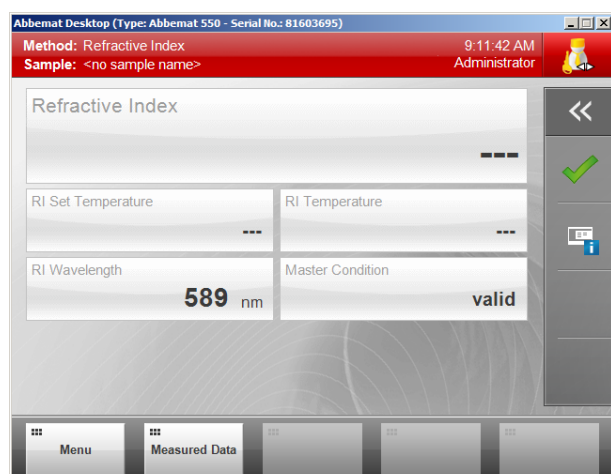
To restore the data base

1. Tap **Menu > Service > Instrument Settings Management > Restore the Database**.
2. Select a backup file and tap <Restore>.
3. Tap <Yes> to restore the database. The application restarts.

17.11 Using Abbemat Desktop Off-line

Because the data is stored on the PC, Abbemat Desktop can be operated with a disconnected instrument or even if the instrument is unavailable. If Abbemat Desktop connects at least once with an instrument, the program gives access to already acquired data and allows settings. Hardware related functions such as measurements or adjustments are not available.

Fig. 17-8: Abbemat Desktop without instrument connection.



18 Upkeep and Cleaning

To ensure a constant high accuracy of your measurements, employ a regular and effective cleaning routine and store the instrument under the recommended conditions.



WARNING

Hazardous substances

Before applying any sample or cleaning liquid make sure that:

- All safety instructions concerning the use of chemicals and the use of inflammable chemicals are met (see section 1).
- The fire point of the liquid in use is higher than 169 °C (25 °C above the maximum temperature of the Peltier module which is 144 °C).
- No source of ignition exists close to the instrument.
- Sufficient ventilation is guaranteed.
- All wetted parts of the instrument are resistant (see appendix A.3).
- All wetted parts of the installed accessories are resistant. See the instruction manual of the accessory (e.g. the sample changer) for information about the materials.



CAUTION

Hot surface

The measuring prism, its surrounding steel surface or mounted accessories can be very hot. Do not touch these surfaces without adequate protective measures.

NOTICE

To protect the surface of your instrument never use:

- highly nonpolar solvents (e.g. toluene, hexane, solvent naphtha)
- strong acids or bases (e.g. nitric acid, sulfuric acid, hydrochloric acid, caustic soda)
- strong mechanical action (e.g. steel brush).

18.1 Cleaning Instrument Housing and Touchscreen

To clean the instrument housing or the touch screen, use a soft tissue that can be wetted with an ethanol water mix or warm water, if necessary with some mild cleaning agent added (pH < 10).

Cleaning frequency for ventilation openings

All ventilation openings must be cleaned at least once a year with a vacuum cleaner. Reduce the vacuum power to avoid high fan speeds. Avoid touching the fan blades in order to protect the fan bearing and blades.

18.2 Cleaning the Measuring Prism

1. Tissue is best suited for wiping off the samples. Use a new tissue for each cleaning step. Avoid touching the prism with your fingers or cleaning the prism with a part of the tissue that was touched before.
2. The prism surface must be absolutely clean and dry before the sample is applied.
3. An occasional cleaning of the prism with water or another solvent such as ethanol or acetone may be necessary. A solvent that is suitable for the samples measured before is recommended.

TIP: You can check the cleaning result by measuring distilled or deionized water. If the Brix measurement value is 0.00 %mas, the prism is clean.

18.3 Cleaning a Flow Cell

Cleaning liquids

For cleaning two liquids may be required:

1. Cleaning liquid 1 dissolves and removes sample residues in a measuring cell. It has to be a good solvent for all sample components.
2. Cleaning liquid 2 removes cleaning liquid 1 and is easily evaporated by a stream of dry air in order to accelerate drying of the cell. Cleaning liquid 2 has to be a good solvent for cleaning liquid 1.

Table 18-1: Recommended cleaning liquids

Sample	Cleaning Liquids	
	1	2
Aqueous	Water	Ethanol
Chemical	Ethanol	Acetone

If you are not sure if a cleaning liquid is suitable for your sample, perform a preliminary test in a test tube to see if any phase separation, precipitate or opalescence can be observed.

Cleaning frequency

Clean and dry the flow cell at least after each working day or working shift. Cleaning more frequently can become necessary when:

- you perform adjustments.
- you measure a sample that is not miscible with the previous sample (e.g. an aqueous sample after a petrochemical sample).
- you measure a sample that could chemically react with the previous sample.

To perform a cleaning procedure

1. Flush the cell thoroughly by pumping distilled or deionized water through the cell several times with a syringe or a pump.
2. An occasional cleaning of the cell with another solvent such as ethanol may be necessary. A solvent that is suitable for the samples measured before is recommended.
3. Drain the flow cell completely.
4. Unscrew the screw cap of the flow cell. An O-ring seals the sample cell. Remove the O-ring carefully and clean it. Also clean the groove in which the O-ring sits.
5. Clean the measuring prism (see section 18.2.)
6. When flow cell and prism are clean and dry, mount the flow cell back onto the device. Don't forget to put the O-ring back in place.

18.4 Cleaning a Flow Cell with Filling Funnel

Cleaning liquids

See section 18.3.

Cleaning frequency

Clean and dry the flow cell at least after each working day or working shift. Cleaning more frequently can become necessary when:

- you perform adjustments.
- you measure a sample that is not miscible with the previous sample (e.g. an aqueous sample after a petrochemical sample).
- you measure a sample that could chemically react with the previous sample.

To perform a cleaning procedure

1. Flush the cell thoroughly by pouring distilled or deionized water into the filling funnel several times.
2. An occasional cleaning of the cell with another solvent such as ethanol may be necessary. Recommended is a solvent that is suitable for the samples measured before.
3. Drain the flow cell completely: Close the top of the riser tube with your fingertip and pour water into the filling funnel. The liquid will be sucked out of the cell due to the siphon effect.
4. Unscrew the screw cap of the flow cell. An O-ring seals the sample cell. Remove the O-ring carefully and clean it. Also clean the groove in which the O-ring sits.
5. Clean the measuring prism (see section 18.2.)
6. When flow cell and prism are clean and dry, mount the flow cell back onto the device. Don't forget to put the O-ring back in place.

18.5 Storing the Instrument

Always clean and dry the prism before storing the instrument for more than one day. For storage that lasts a day or less, the sample cell can be filled with distilled or deionized water.

18.6 Drying Cartridge

The drying cartridge protects the optical system from moisture. It is equipped with a humidity indicator behind the window in the center. This allows you to check the status of the cartridge without the need to remove it.

NOTICE

- Check the status of the drying cartridge at least once a year.
- Don't exchange the drying cartridge unless it needs exchanging.
- Always install a drying cartridge. An unsealed optical system might result in damage to the instrument.

When the desiccant in the cartridge saturates with moisture, the indicator changes its color from blue to pale pink. If the blue color disappears and the indicator begins to show a tinge of pink, the cartridge must be replaced:

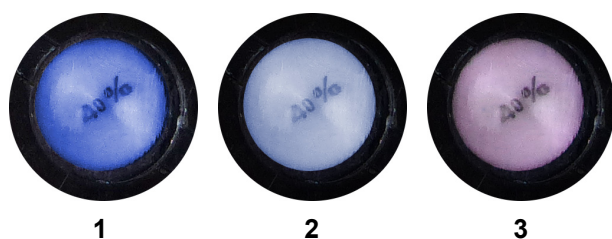


Fig. 4: Humidity indicator of drying cartridge

- 1 Dry, new cartridge
- 2 Replace
- 3 Saturated, replace immediately

To replace a drying cartridge

1. Unscrew the old cartridge counterclockwise using the transparent, protective cap of the new cartridge as a screwdriver.
2. Remove any residue around the threaded hole of the housing.
3. Check the correct position of the gasket of the fresh cartridge.
4. Screw the cartridge into the hole.

19 Maintenance and Repair

19.1 Warranty

To keep the warranty¹ on the instrument valid, observe the instructions given in section 18, "Upkeep and Cleaning".

The instrument does not require any periodic maintenance by Anton Paar service engineers to retain the warranty.

The following wear and tear parts are generally excluded from the warranty:

- Drying cartridge
- Fuses
- Hoses in direct contact with sample (if applicable, i.e. for flow cells or peristaltic pumps)
- O-rings in direct contact with sample (if applicable, i.e. for flow cells)
- Fluid connectors in direct contact with sample (if applicable, i.e. UNC connectors for flow cells)
- Button cell (real-time clock)

The real-time clock of the device is powered by an internal lithium button cell while the device is switched off. When the button cell is depleted, the real-time clock sets the date of the instrument to January 1, 2000 on start-up. If date and time are not set manually, incorrect time stamps will be written to reports.

To ensure continuous operation, it is recommended to replace the button cell every five years as a preventive measure. Contact your local Anton Paar representative for a replacement of the button cell.

19.2 Repair Performed by an Authorized Anton Paar Representative

In case your instrument needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your instrument needs to be returned, request an RMA (Return Material Authorization Number). It must not be sent without the RMA and the filled "Safety Declaration for Instrument Repairs". Please make sure it is cleaned before return.

TIP: Find the contact data of your local Anton Paar representative on the Anton Paar website (<http://www.anton-paar.com>) under "Contact".

¹ For detailed information please see the general terms of delivery (GTD) on the Anton Paar website (<http://www.anton-paar.com>).

20 Optional Accessories

Different flow cells are available for your Abbeemat. These can be used for the installation in automated systems or in bypass applications. Furthermore the flow cells can be installed for preventing volatile solvents from evaporation or for reducing the amount of sample volume required for a measurement. Finally, they can be used to increase the convenience and ease of handling of the samples.

20.1 Micro Flow Cell

This type of flow cell is used for continuous measurements of liquids. The micro flow cell offers advantages when combined with an automated system such as an auto sampler, e.g. for measuring fragrances and flavors or for quality analysis of beer.

The system can fill the cell automatically by flushing out the previous sample with the next one. No manual cleaning of the measuring prism is required between measurements. Only in cases where the sample cannot easily be flushed out by the next sample, e.g. samples which form films on the prism, a manual cleaning could be required.

Feeding the micro flow cell by a syringe is also possible: Connect a tube to the outlet of the cell that leads to a drain or a collecting vessel. Use a suitable adapter, which allows the connection of a syringe, in order to connect to the inlet of the cell, e.g. a Luer adapter. Now the cell can be conveniently filled with sample. Make sure that all air bubbles will be flushed out. Do not remove the syringe before the measurement is finished, otherwise the sample will flow out and air will enter the cell. If required, the sample can almost be fully recovered by using the syringe to draw out the sample again.

Table 17: Available micro flow cells

Part No.	Description
101384	Micro flow cell complete: PPSGF40 micro flow cell insert with adapter female Luer to 1/4"-28UNF, cell assembly ring, screw cap, drip plate and required installation materials
101385	Same as 101384, but with stainless steel (1.4404) micro flow cell insert
154808	Same as 101384, but with PFA micro flow cell insert

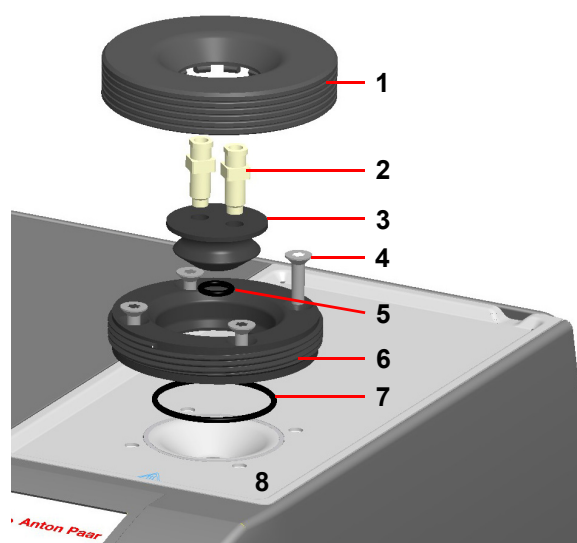


Fig. 5: Micro flow cell

- 1 **100803** Screw cap
- 2 **64792** Adapter female Luer to 1/4" UNF, PTFE/ETFE
- 3 **101381** Micro flow cell insert PPSGF40 incl. adapter 64792 and O-ring 46884
101382, Micro flow cell insert stainless steel (1.4404) incl. adapter 64792 and O-ring 46884
154787 Micro flow cell insert PFA incl. adapter 64792 and O-ring 10318
- 4 **25106** Flat head screw I-Torx, M4x16, stainless steel
- 5 **46884** O-ring 7.65 x 1.78 FKM or alternatively **10318** O-ring 7.65 x 1.78 FFKM (with improved chemical resistance)
- 6 **100805** Cell assembly ring
- 7 **96947** O-ring 42 x 2 FKM or alternatively **133815** O-ring 42 x 2 FFKM (with improved chemical resistance)
- 8 **96942** Drip plate with 4 holes for the attachment of the cell assembly ring

Installation of micro flow cell

1. Remove the drip plate from the instrument. The plate is fixed by internal magnets and can easily be lifted.
2. Four holes drilled for fastening the cell assembly ring are now accessible.
3. Place the drilled drip plate (8) on the instrument.
4. Press the O-ring (7) into the groove of the cell assembly ring (6).
5. Place the cell assembly ring onto the drip plate and screw in the four fixing screws (4) with a Torx 20 screwdriver.
6. Attach the micro flow cell (3) to the screw cap (1).

- Now the cell is ready to use.

- 1 **100803** Screw cap
- 2 **100809** Tube connector OD 7 mm
- 3 **62403** O-ring 5 x 1 FKM or alternatively
23713 O-ring 5 x 1 FFKM (with improved chemical resistance)
- 4 **25106** Flat head screw I-Torx, M4x16, stainless steel
- 5 **101380** Flow cell insert for Abbatemat, PPSGF40, ID 4.5 mm with tube connectors 100809, including O-rings (1 x 72505, 2 x 62403)
- 6 **72505** O-ring 10.82 x 1.78 FKM or alternatively
101407 O-ring 10.82 x 1.78 FFKM (with improved chemical resistance)
- 7 **100805** Cell assembly ring
- 8 **96947** O-ring 42 x 2 FKM or alternatively
133815 O-ring 42 x 2 FFKM (with improved chemical resistance)
- 9 **96942** Drip plate with 4 holes for the attachment of the cell assembly ring

This type of flow cell is used for measurements of liquids, e.g. in bypass installations in a laboratory. The flow cell can be automatically filled by a suitable pump. The following sample will replace the previous one, so that no manual cleaning of the measuring prism is required between measurements. Only in cases where the sample cannot easily be flushed out by the next sample, e.g. samples which form films on the prism, a manual cleaning could be required.

Diagram illustrating the components of the Anton Paar 3000 series force transducer assembly, numbered 1 through 9:

1. Top flange / mounting plate
2. Upper nut / spacer
3. Lower nut / spacer
4. Central pin / rod
5. Lower flange / mounting plate
6. O-ring / seal
7. Base flange / mounting plate
8. Base nut / spacer
9. Base plate / mounting surface

Fig. 6: Flow cell for Abbmater

1. Remove the drip plate from the instrument. The plate is fixed by internal magnets and can easily be lifted.
2. Four holes drilled for fastening the cell assembly ring are now accessible.
3. Place the drilled drip plate (9) on the instrument.
4. Press the O-ring (8) into the groove of the cell assembly ring (7).
5. Place the cell assembly ring onto the drip plate and screw in the four fixing screws (4) with a Torx 20 screwdriver.
6. Insert the two O-rings (3) into the flow cell (5) and screw in the two tube connectors (2).
7. Attach the flow cell (5) to the screw cap (1).
8. Insert the O-ring (6) into the groove of the flow cell.

Now the cell is ready to use.

20.3 Flow Cell with Filling Funnel

For routine analysis of low-viscosity liquids, e.g. beverages, this cell type is most convenient. The sample poured into the filling funnel completely replaces the previous one so that a quick and comfortable sample exchange is possible. The required sample volume depends on the viscosity of the liquid and has to be determined by experiment. Pouring in the sample in two or more portions is recommended.

Part No.	Description
101396	Flow cell complete with filling funnel with magnetic stand, flow cell insert PPSGF40, cell assembly ring, screw cap, screws, drip plate and required installation materials

TIP: This flow cell is not suitable for Abbemat Juice Station. For information about the suitable cell (No. 152169) please refer to the manual of Abbemat Juice Station.

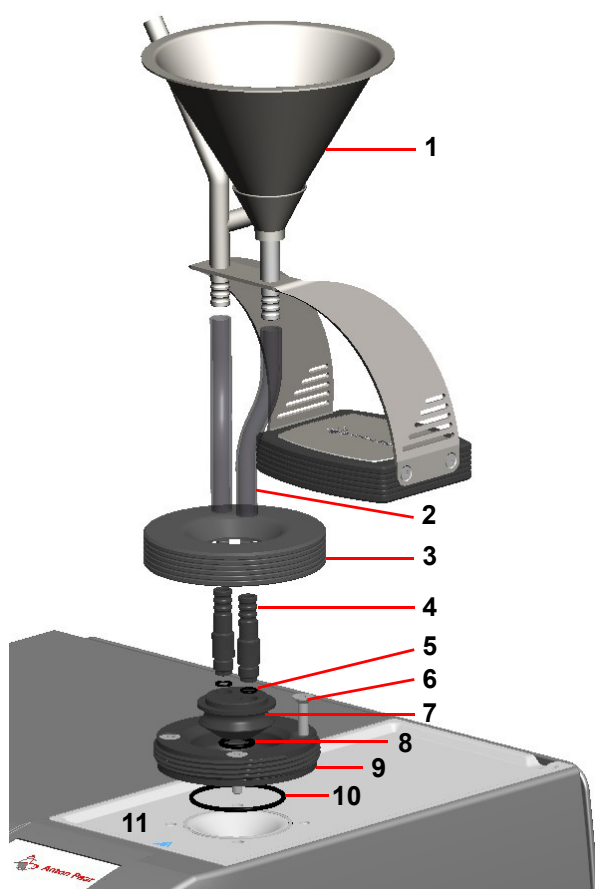


Fig. 7: Flow cell with filling funnel

- 1 **101256** Filling funnel with magnetic stand
- 2 **81065** Tubing 7 x 11, FKM black, connection funnel to flow cell

- 3 **100803** Screw cap
- 4 **100809** Tube connector OD 7 mm
- 5 **62403** O-ring 5 x 1 FKM or alternatively **23713** O-ring 5 x 1 FFKM (with improved chemical resistance)
- 6 **25106** Flat head screw I-Torx, M4x16, stainless steel
- 7 **101380** Flow cell insert for Abbemat, PPSGF40, ID 4.5 mm with tube connectors 100809, including O-rings (1 x 72505, 2 x 62403)
- 8 **72505** O-ring 10.82 x 1.78 FKM or alternatively **101407** O-ring 10.82 x 1.78 FFKM (with improved chemical resistance)
- 9 **100805** Cell assembly ring
- 10 **96947** O-ring 42 x 2 FKM or alternatively **133815** O-ring 42 x 2 FFKM (with improved chemical resistance)
- 11 **96942** Drip plate with 4 holes for the attachment of the cell assembly ring
- 12 Not depicted: **81078** Tubing 6 x 9, silicone transparent for drainage

Installation of flow cell with filling funnel

1. Remove the drip plate from the instrument. The plate is fixed by internal magnets and can easily be lifted.
 2. Four holes drilled for fastening the cell assembly ring are now accessible.
 3. Place the drilled drip plate (11) on the instrument.
 4. Press the O-ring (10) into the groove of the cell assembly ring (9).
 5. Place the cell assembly ring onto the drip plate and screw in the four fixing screws (6) with a Torx 20 screwdriver.
 6. Insert the two O-rings (5) into the flow cell (7) and screw in the two tube connectors (4).
 7. Attach the flow cell (7) to the screw cap (3).
 8. Insert the O-ring (8) into the groove of the flow cell.
- TIP:** When mounting the flow cell, take care to keep the O-ring between cell and prism in its groove. For the correct position of all O-rings, refer to the exploded view drawing of the flow cell in Fig. 7.
9. Clean the measuring prism surface carefully.
 10. Screw the screw cap (3) hand-tight onto the cell assembly ring (9).
 11. Connect the two tubes (2) to the filling funnel outlet and riser tube.
 12. Place the magnetic filling funnel assembly behind the flow cell on the drip plate.

13. Cut the tubes (2) in the required length and attach them to the tube connectors (4).
14. Connect a suitable tube (12, not depicted) to the horizontal outlet of the riser pipe. The other end should lead to a waste vessel or a drain.
15. Flush the cell thoroughly with distilled or deionized water and perform a water adjustment.

Now the cell is ready to use. One sample after another can be poured into the filling funnel for fast and convenient measurements.

To drain the cell completely, e.g. for cleaning, put a finger onto the riser pipe and flush the cell with deionized water. The water will be sucked out of the cell due to the siphon effect.

20.4 Sample Presser

The sample presser from Anton Paar can be used to measure the refractive index of solid samples, e.g. plastic films. It ensures a coplanar orientation of the sample on the prism, even if the sample is flexible.

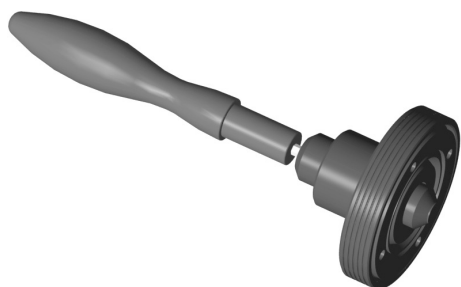


Fig. 8: **110284** Sample presser for solid samples

NOTICE

Please ensure that the prism temperature does not exceed 100 °C while using the sample presser.

Preparation of Test Specimens

The test sample's shape must fit on the measuring prism of the Abbemat. The ideal shape would be a disk of 8 mm diameter, having a thickness of at least 1 mm. The following dimensions are recommended in order to fit on the prism face:

- Diameter: 6 mm to 8 mm
- Thickness: 1 mm to 5 mm

A close contact of the solid sample with the prism is important. The preset torque for optimum contact between sample and prism is 0.4 Nm.

For maximum accuracy, the surface of the test specimen in contact with the prism must be optically

flat and well polished. A minimum of three specimens should be prepared and measured. For further information about the use of the sample presser see the Anton Paar application note D22IA006EN, "Refractive index measurements in polymers according to ASTM D 542-00 and ISO 489: 1999".

20.5 Protective Cover

The cover protects the housing from damage and dirt, extending the working life of the refractometer.

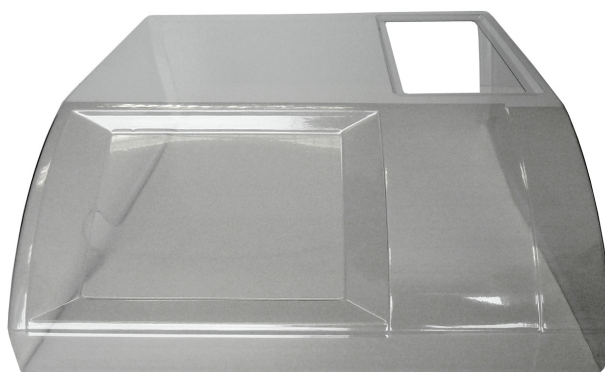


Fig. 9: **105468** Protective cover for Abbemat

With the protective cover in place, it is recommended to operate the instrument with a USB mouse (optional).

20.6 Built-in Peristaltic Pump

The Abbemat can be equipped with a peristaltic pump for the convenient filling of flow cells.



Fig. 10: Built-in peristaltic pump with hoses

16. Two types of pump cassettes with different hose material are available, either fluran or novoprene. The peristaltic pump comes with the tubings according to your order. Check the resistance of the tubings to your samples and the rinsing agents.

Part No.	Description
102989	Peristaltic pump
99306	Roller cassette with fluran tubing
99284	Roller cassette w/ novoprene tubing
100302	Tubing Fluran 2.5 mm x 4.5 mm, 1 m
100297	Tubing Novoprene 2.5 mm x 4.5 mm, 1 m

Connecting the Hoses

For filling a flow cell using the peristaltic pump, we recommend to draw the sample into the measuring cell to minimize the time to exchange a sample. A Luer type cone adapter is already pre-assembled on the sample hose of the peristaltic pump cassette.

Connect the pump inlet hose to the flow cell (see Fig. 10). The pump outlet hose should lead to a waste vessel or drain. Use an additional hose to connect the flow cell inlet with your sample vessel. A tubing as short as possible allows for a reduced carryover between samples.

If required, disconnect the peristaltic pump cassette and adjust the hose length according to your requirements.

Exchanging the Peristaltic Pump Cassette

If necessary, replace the supplied pump cassette with a new one:

1. Remove the pump cassette from the instrument by pressing on the right and left clip holder and pulling the pump cassette from the motor shaft.
2. When mounting the new pump cassette onto the motor shaft, make sure that the hoses face upwards.
3. Push the pump cassette in the direction of the motor shaft until you hear a clicking noise.

Configuration of Methods

When using the (optional) peristaltic pump, the pump parameters can be configured for each single method.

To start/stop the peristaltic pump manually

Tap on the pump icon on the main screen to start the peristaltic pump. Tap on the pump icon again to stop the pump.

To activate/deactivate the peristaltic pump within a method

1. Tap **Menu > Method Management > "Method Name" > Activate Modules /Constants**.
2. Enable/Disable the check box for peristaltic pump. and tap <OK>.

To define the pump settings

The filling time can be set for each method separately. It is recommended to check the filling time by measuring two different samples of known refractive indices alternately e.g. water and sugar solution, to make sure that the previous sample is completely replaced by the following sample.

1. Tap **Menu > Method Management > "Method Name" > Peristaltic Pump**.
2. Set the filling time (the sample will be pumped for this duration).
3. Set the pump speed.
4. Set the pump hold time - this is the time which is waited before a measurement will start.
5. Tap <OK>.

When a measurement is started by pressing the start button, the pump will pump according to the configured filling time with the entered pump speed. After the elapsed filling time the pump will stop. When the hold time is over the measurement will start.

TIP: When a peristaltic pump is connected and a check or adjustment is performed, the pump configuration (filling time, etc.) of the actual selected method is used.

If you want to perform a check or adjustment manually select a method not using the pump or deactivate the pump in the current method.

When performing an adjustment by using the pump, it is possible to flush the cell by pressing the "pump on" button.

20.7 pH Module

Please refer to the manual of the optional pH module.

20.8 Xsample Sample Changer

Please refer to the manual of the optional Xsample sample changer.

Appendix A: Technical Data

Appendix A.1: General Technical Data

Dimensions (W x H x D)	300 mm x 145 mm x 330 mm
Weight	6.5 kg
Mains Voltage	AC 100 V to 240 V, 50/60 Hz
Power consumption	Max.120 VA
Power inlet	According to IEC/EN 60320-1/C14, protection class I
Housing material	
Front, top & side cover	Styrene/Butadiene
Back, bottom, drip plate, surface surrounding the prism	Stainless Steel
Prism material	Synthetic sapphire
Environmental conditions (EN 61010)	Indoor use only
Ambient temperature	10 °C to 35 °C (50 °F to 95 °F)
Air humidity	10% to 90% relative humidity, non-condensing
Pollution degree	2
Overvoltage category	II
Light source	LED 589.3 nm, average lifetime 100 000 h
Touchscreen	163 mm (6.4"), 640 px x 480 px
Memory	1000 measuring values
Interfaces	<ul style="list-style-type: none"> • 3 x USB 2.0 Type A • 1 x USB 2.0 Type B • 1 x CAN Bus in • 1 x CAN Bus out • 1 x VGA • 1 x Ethernet • 1 x RS-232 • 1 x Options

NOTICE

- Only connect devices to the interfaces that comply with PELV (protective extra-low voltage) according to EN 61140 or with SELV (safety extra-low voltage) according to EN 60950.
- Only connect Anton Paar equipment or equipment with a maximum current load of 250 mA to the CAN interface.
- The length of the CAN cables should not exceed 30 m.
- Only connect USB devices with a maximum current load of 250 mA to the USB interfaces.

Appendix A.2: Specifications

	Abbemat 350	Abbemat 550
Measuring range of refractive index	1.26 nD to 1.72 nD	
Resolution of refractive index	0.00001	0.000001
Accuracy of refractive index ^a	+/-0.0001	+/-0.00002
Measuring range of °Brix scale	0 % to 100 %	
Resolution of °Brix scale	0.01 %	0.001 %
Accuracy of °Brix scale ^{a, b}	+/-0.05 %	+/-0.015 %
Sample/prism temperature control	4 °C ^c to 85 °C	
Resolution	0.01 °C	
Accuracy ^a	+/-0.05 °C	+/-0.03 °C
Stability	+/-0.002 °C	
Thermostating speed from ambient temperature to 20.00 °C	approx. 20 s	

a Valid at refractometric standard conditions ($T = 20\text{ °C}$, $\lambda = 589\text{ nm}$, ambient temperature = 23 °C)

b Brix values up to a measuring temperature of 40 °C are calculated according to ICUMSA SPS3. Above 40 °C the Brix values are calculated by extrapolation of the ICUMSA formula.

c Valid at an ambient temperature of max. 30 °C

Appendix A.3: Wetted Parts

Table 18: Parts in contact with samples and cleaning liquids during normal operation

Sample Area	Material
Prism	Synthetic sapphire
Surface surrounding the prism	Stainless steel
Seal between prism and surface	FFKM
Micro flow cell	Material
O-rings	FKM (FFKM optional)
Sample cell	PPS-GF40, PFA or stainless steel
Luer connector	ETFE
Flow cell	Material
O-rings	FKM (FFKM optional)
Sample cell	PPS-GF40
Tube connectors of flow cell	PPS-GF40
Flow cell with filling funnel	Material
O-rings	FKM (FFKM optional)
Sample cell	PPS-GF40
Tube connectors of sample cell	PPS-GF40
Filling funnel, riser tube	Stainless steel
Tubing funnel to flow cell, flow cell to riser tube	FKM
Tubing for drainage	Silicone

Appendix B: Output Quantities

Group: Temperature	
RI Set Temperature	Shows set temperature of the measuring prism/sample
RI Temperature Sensor State	Shows temperature of the measuring prism/sample
Group: System Settings	
Data Field 1	User-definable text
Data Field 2	User-definable text
Data Field 3	User-definable text
Date	e.g. 5/20/2018
Last RI Check Date	Date of last RI check
Last RI Check Name	Name of last RI check
Last RI Check State	State of last RI check
Last RI Check User	User name of last RI check
Master Condition	temp. equilibration / measuring / valid
Measurement Type	Standard
Method	Selected method, e.g. Refractive Index
Method ID	ID of the selected method
RI Last Adjustment Date	Last adjustment date, e.g. 7/19/2011
RI Last Adjustment User	Name of user who performed the last adjustment, e.g. Administrator
RI Serial Number	Serial number of the instrument
RI Wavelength	Measuring wavelength
Sample Error State	Error state: No Error / Error
Sample Name	Entered name of sample, e.g. Tetrachloroethylene
Time	Actual time, e.g. 1:08:29 PM
Unique Sample ID	A unique sample ID, which will be assigned to a sample
User	Logged on user
Group: User Functions	
The defined user function can be selected for display. User functions can be formulas, linear functions, polynomials (1D or 2D) or tables (see section 14).	
Group: Refractive Index	
RI Condition	The condition of the actual refractive index measurement, e.g. "busy" or "valid"
RI State	The state of the actual refractive index measurement, e.g. "single measurement" or "stopped"
RI Substate	The substate of the actual refractive index measurement, e.g. "finished"
Group: RI Basic Scales	
Refractive Index	The basic scale of refractometry

Appendix C: Quick Settings Parameters

Parameter Type	Parameter	Description
Sample name		Only in "No Sample List" mode.
Measurement Type	S (Standard)	To perform a standard measurement.
	C (Check)	To perform one of the predefined checks. It is only possible to select a check which has been defined for the selected method before.
	MM (Multiple Measurement)	To perform 2 to 10 consecutive measurements of a single sample automatically.
	MF (Multiple Filling)	To perform 2 to 5 measurements automatically. The sample is replaced after each submeasurement.
	TS (Temperature Scan)	To perform a temperature scan.
	TTS (Temperature Table Scan)	To perform a temperature scan using a table with temperatures.
	TiS (Time Scan)	Multiple measurements over a period of time by taking subsamples in fixed time intervals.
Temperature		To set the measuring temperature.
RI Hold Time		To set the hold time for the measurement (between 0 and 3600 s).
RI Timeout		To set the timeout for the measurement (between 0 and 3600 s).
RI Measurement Accuracy		<ul style="list-style-type: none"> - most precise - precise - fast measuring

Appendix D: Assigning Methods with Bar Codes

Connect a bar code reader (not supplied by Anton Paar) to enter sample names and to select methods in the sample list (see section 5.13).

To generate a bar code for a method, you can use any bar code generator, e.g.
<http://barcode.tec-it.com>.

Use the format "MethodX" with "X" standing for the position number of the method in the method list.

To view the position number, tap <Method> in the main screen.

TIP: Please check the position number of your method after any changes in the method sequence, after deleting or hiding methods and after creating new methods.

Table 19: Bar codes type "Code 128" (encoding all 128 standard ASCII characters))

	
Method1	Method6
	
Method2	Method6
	
Method3	Method7
	
Method4	Method9
	
Method5	Method10

Appendix E: Menu Tree

The menu tree shows which parts of the menu are accessible for users with administrator, manager or operator rights using the following colors:

Administrator, Manager, Operator
Administrator, Manager
Administrator

Table 20: Menu tree

Level 1	Level 2	Level 3	Level 4
Checks / Adjustments	Check Management / Execution		
	Refractometer Adjustments	One Point Adjustment	
		Two Point Adjustment	
		Set Air Reference	
		Reset To Factory Adjustment	
	Settings	RI Reference Standard Management	
Data Memory ^a	Measurement Data	Measured Data	
		Statistic	
		Settings	Data Browser Settings Data Memory Settings
	Check Data	Check Result Data ^b	
		Settings ^b	Data Memory Settings
		Export Check Data ^c	
	Audit Trail	Export Audit Trail Data	
		Delete / Archive Audit Trail Data	
	Adjustment Data	Refractometer Module	
		Print or Export Adjustment Data	
Method Management	Select a Method	Measurement Mode	
		Activate Modules / Constants	
		Refractometer Module	
		Peristaltic Pump ^{b, d}	
		Layout Type (Display)	
		Result Output	
		Xsample Module ^{b, d}	
		Limits	
		Quick Settings Management	
	More	Visibility and Order	

^a Not available in Non Storage Mode. "Audit Trail" displayed instead if audit trail is activated

^b Not available in Abbemat Desktop

^c Only available in Abbemat Desktop (optional)

^d With peristaltic pump (optional) installed and activated

^e With Xsample (optional) connected

Table 21: Menu Tree (continued)

Level 1	Level 2	Level 3	Level 4
Setup	Measuring System Settings	Sample List / Sample Settings	Sample List / Sample Naming
			User-defined Data Fields
			Sample List Warnings
			Mandatory Data Fields
		User Functions / Calculator	User Function Management
			Calculator
			Group Calculator
		Value Visibility	
		Error Visibility	
		Monitor Mode Settings	
	Control Panel	Date and Time ^a	
		Regional Settings	
		Input Units	
		Time Server Settings ^a	
		Network ^a	
		External Interface Settings	LIMS Bridge ^{a, b} , AP Connect
		Instrument Name and Location	
		Screen Saver ^a	
		Sound Settings	
		VNC Settings ^a	
		Calibrate Touch Screen ^a	
		Calibrate External Touch Screen ^a	
		Keyboard and Bar Code Settings	
		FTP Settings ^a	
		SMTP Server Settings	
		Display Brightness ^a	
		RS-232 LIMS Settings ^a	
	System Security	Security Level ^c	
		Audit Trail	
		Electronic Signature ^c	
		Logon Settings	
		Increased Security	
		Advanced Security	
		Securing Actions	
		Pairing ^d	
		Automatic Audit Trail Export ^a	
		Non Storage Mode ^a	
	User Management	User Management	
		User Group Administration	
	Printout Settings ^a or Export Settings ^d	Active Directory ^d	
		Printer Management ^a	
		Automatic Printout ^a	
		Report Management	
		Select Logos	
		Import Logos	
		Name and Address	
		Export Settings ^a	
	Automatic Report ^{d, e}	Measurement	
		Audit Trail	
		Check	
		Adjustment	

^a Not available in Abbemat Desktop^b For details see the LIMS Bridge manual^c Not available in Non Storage Mode^d Only available in Abbemat Desktop (optional)^e Menu not available with AP Connect (optional)

Table 22: Menu Tree (continued)

Level 1	Level 2	Level 3
Service	Instrument Settings Management	Backup Instrument Settings ^a
		Restore Instrument Settings ^a
		Export Instrument Settings ^a
		Full System Backup ^a
		Full System Restore ^a
		Backup the Database ^b
		Restore the Database ^b
	Update ^a	System Update
		Module Firmware Update
		Import Method Package
		Install Language Pack
		Logging Configuration
	System Information	Export (Instrument Data)
		Save Logfile
	Refractometer Device Information	
	Unlock Service	
	Live Raw Data	Abbemat
		Calculations
	Download Documents ^a	Download Manual
		Download Release Notes

^a Not available in Abbemat Desktop

^b Only available in Abbemat Desktop (optional)

Table 23: Main Screen Options

Level 1	Level 2	Level 3
Menu (see table 20)		
Measured Data ^a		
Quick Settings ^b or		
Sample List ^c		
	List Management	Load Sample List
		Save Sample List
		Clear Sample List
		Copy Sample List Entry
		Reorder Sample List
	Select Method	
	Quick Settings	
Select a Method		
Start/Stop a measurement		
Quick Access Bar	Message List	Open Message List
		Delete Messages
	Peristaltic Pump (optional)	
	Monitor Mode	
	Instant Print	
	Favorites Info	
Output Fields	Configure Output Fields	

^a Not available in Non Storage Mode

^b If "No Sample List Mode" is active (see section 6.1)

^c If "Sample List Mode" is active (see section 6.1)

Appendix F: Troubleshooting

Table 24: Main Power

Problem	Cause	Correction
Instrument is without power.	Mains power cable is not connected or defective.	Check connection of the mains power cable; if required, replace it with a new one.
	Mains power is switched off.	Switch on the mains power.

Table 25: Display of unstable results

Problem	Cause	Correction
Sedimentation on the prism	Sample contains particles, e.g. fibers	Filtrate the sample
Sample is hygroscopic or contains a solvent of low vapor pressure	The sample is taking up water from the air or solvent is evaporating	Use a sample cover with O-ring seal or a flow cell
Residue of previously measured sample has remained on prism	The samples will mix slowly	Clean the prism thoroughly before measuring

Table 26: Display of stable, but wrong measuring values

Problem	Cause	Correction
Ambient light is entering the optical system	Sample cover not used or not covering the sample well completely	Place the sample cover correctly
Wrong adjustment	A mistake was made during adjustment, e.g. by an impure or wrong standard or a dirty prism	Set the instrument back to factory adjustment. Afterwards perform an adjustment
Wrong air reference	Air reference was set with dirty prism or with sample on the prism	Set the air reference accurately
Bad air reference or dirty measuring prism	The measuring prism is contaminated with sample	Clean prism thoroughly with deionized water, acetone, or any other suitable solvent
Not enough sample on the prism	The volume of sample applied on prism is too low	Apply at least 1 ml of sample

Table 27: No measuring value

Problem	Cause	Correction
The instrument cannot get a measuring result	Refractive index of the sample is out of range	Measure sample with refractive index in range of instrument

Table 28: Temperature

Problem	Cause	Correction
The instrument is overheated	Insufficient air circulation	Ensure unhindered air circulation at the ventilation openings
	Defective cooling fan	Contact your local Anton Paar representative
	Ambient temperature too high	Lower the room temperature
	Frequent and fast changes between high and low prism temperatures	Extend the times between different prism temperatures
	Malfunction of internal temperature control	Contact your local Anton Paar representative
Prism temperature is not stable	Temperature control is switched off	Switch temperature control on or use a method with internal temperature control
	Internal Peltier temperature control is not reaching the set temperature	Ensure unhindered air circulation at the ventilation openings; if required, lower room temperature
	Malfunction of internal temperature control	Contact your local Anton Paar representative

Table 29: Other

Problem	Cause	Correction
The drying cartridge is used up	The cartridge was not screwed in properly or its lifetime is exceeded	The drying cartridge must be replaced, see section 18.6
	The internal housing of the optics is not air-tight	Contact your local Anton Paar representative
Internal optics are out of adjustment	The instrument was improperly transported or handled	Contact your local Anton Paar representative
The refractometer lamp is not operating	LED light source is defective	Contact your local Anton Paar representative
Measuring prism is defective	Prism was damaged due to mechanical or thermal stress	Contact your local Anton Paar representative
Wrong date and time	Internal button cell depleted, see section 19.1	Contact your local Anton Paar representative for a replacement of the button cell

Appendix G: CE Certificate

EU Declaration of Conformity

(original)



Anton Paar

The Manufacturer **Anton Paar OptoTec GmbH**, Lise-Meitner-Str. 6, 30926 Seelze-Letter, Germany – Europe hereby declares that the product listed below

Product designation: **Automatic Refractometer**
Model: **Abbemat 200/300/350/500/550**
Material number: **109980, 97790, 97789, 97788, 97787**

is in conformity with the relevant European Union harmonisation legislation.

This declaration of conformity is issued under the sole responsibility of the manufacturer

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

Applied standards:

EN 61326-1:2013

Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

The product is classified as a class B equipment and is intended for the use in industrial area.

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

Applied standards:

EN 61010-1:2010

Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements

EN 61010-2-010:2014

Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-010: Particular requirements for laboratory equipment for the heating of Materials

Place and date of issue: Seelze-Letter, 2016-04-15

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