

Instruction Manual and Safety Information

DMA 1002

DMA 502

Density Meter

Full Reference Guide E15IB011 available for download

Find out more



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Original instructions

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1 Safety instructions



Read the documentation

- Read the documentation before using the product.
- Follow all hints and instructions in the documentation to ensure the correct use and safe functioning of the product.

1.1 General safety instructions

General

- Refer to the Reference Guide for a comprehensive description of the instrument. Download Anton Paar documents for free from the Anton Paar website: <https://www.anton-paar.com>
- The documentation is a part of the product. Keep it for the complete working life of the product and make it easily accessible to all persons involved with the product. If you receive any additions or revisions from Anton Paar, these must be treated as part of the documentation.

Liability

- This document does not claim to address all safety issues associated with the use of the product and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.
- Anton Paar only warrants the safe and proper functioning of the product if no modifications are made to mechanics, electronics, or software.
- Use the product only for the purpose described in the documentation. Anton Paar is not liable for damages caused by incorrect use of the product.
- The results delivered by the product depend on the correct function of the product and various other factors. We recommend that you have experts check the results (i.e., perform plausibility testing) before taking consequential actions based on the results.

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.).
- Substances used must be labeled. The corresponding material safety data sheets must be observed and made available near the measuring setup.
- Samples and cleaning liquids that have been used in the measuring system are not suited for human consumption after use.
- Check the wetted parts of the product for chemical resistance to all samples and cleaning liquids.

- Take care that samples, cleaning liquids and gases are chemically compatible when they come into contact with each other. They must not react exothermally or produce hazardous substances.

For products directly connected to electrical supply

- Install the product so that you can easily separate it from the electrical supply (pull the power plug) at any time.

Installation

- The installation procedure shall only be carried out by authorized personnel who are familiar with the installation instructions.
- Never use the product outside the specified ambient conditions and specifications.
- Use only accessories, consumables, or spare parts supplied or approved by Anton Paar.

Using the product

- Ensure that all operators have been trained beforehand to use the product safely and correctly.
- Before you start a measurement or cleaning procedure, take care that all parts of the measurement system are properly connected and in good condition.
- Before you start a measurement or cleaning procedure, check the injection adapters for leak tightness.
- Ensure that the product is sufficiently supervised during operation.
- In case of damage or malfunction, stop operating the product. Do not operate the product under conditions that could result in damage to goods or injuries or loss of life.
- If hazardous substances have been spilled on the product, immediately decontaminate it in an appropriate way.
- If you suspect that spilled substances got into the product, disconnect the product from the electrical supply and have it checked for electrical safety by a service technician authorized by Anton Paar.

Precautions for flammable samples and cleaning agents

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the product.
- 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 liquids, and other hazardous materials near the product.
- Do not spill sample/cleaning liquids or leave their containers uncovered. Immediately remove spilled sample/cleaning liquids.

- Ensure that the setup location is sufficiently ventilated. The environment of the product must be kept free from flammable gases and vapors.
- Provide fire-extinguishing equipment.

Operation with explosive samples

- The product must not be used for the measurement of samples of explosion group IIC (such as carbon disulfide or acetylene).

Operation in areas with risk of explosion

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

Service and repairs

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


Disposal

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

1.2 Conventions of safety messages and typography


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.

TIP: *Tip gives extra information about the situation at hand.*

Typographical conventions

The following typographical conventions are used in this instruction manual:

| Convention | Description |
|---|--|
| <i>Names for physical buttons</i> <i>Labels for tabs, buttons etc. in the software</i> | The names and labels are written in <i>italic</i> . |
| <i>Menu Level 1 > Menu Level 2</i> | Menu paths are written in <i>italic</i> . The menu levels are connected using a closing angle bracket. |

2 Overview

The compact density meter DMA 502/1002 measures the density of liquid samples by use of the oscillating U-tube method, which was first introduced on the market by Anton Paar in 1967. It combines high precision with easy operation and robust design. The instrument will cope with almost any sample that you can fill and clean.

Accurate results in the shape required

The instrument corrects viscosity-related errors automatically. An integrated Pt 100 platinum thermometer together with Peltier elements provide an extremely precise thermostating of the sample.

The density value can be automatically converted into concentration values for numerous generic user products (already factory-programmed).

Precise sample filling

Accurate and repeatable results strongly depend on bubble-free filling ensured by the peristaltic pump optionally integrated in the instrument.

FillingCheck™ automatically detects gas bubbles in the measuring cell by an advanced analysis of its oscillation pattern, and will generate a warning message in that case. Additionally, you can visually inspect the measuring cell on the real-time camera image (U-View™).

Intuitive user interface

Operate the instrument via the touchscreen user interface with the same ease as your smartphone. If you prefer, you can optionally connect an external keyboard or mouse and a barcode reader.

Data export/printouts

You can export all measured data as a PDF or CSV file onto any connected storage device. Data can be printed via USB, network, or serial port.

Ready for AP Connect

The instrument is compatible with AP Connect, the lab execution software by Anton Paar.

2.1 Intended use of the instrument

Your instrument is capable of measuring nearly every liquid, independent of its composition and viscosity.

Typical samples include soft drinks, various types of oil, acids and bases, infusion solutions, pastes and creams from applications as diverse as petrochemicals, food & beverages, chemicals, pharmaceuticals and cosmetics.

Restrictions

- Do not leave bases longer than necessary in the density measuring cell because the glass of the measuring cell is susceptible to attack by alkaline liquids.

Exclusions

- The instrument cannot measure solids.
- Do not measure hydrofluoric acid as it attacks the glass of the density measuring cell.
- Do not fill substances that may harden inside the measuring cell.
- Do not mix substances inside the measuring cell if these substances may react chemically.
- Do not use mechanical action for cleaning the measuring cell.

IMPORTANT: Always check if recommendations of the instrument (e.g. from the instrument's intelligent condition monitoring) are reasonable.

2.2 Functional components

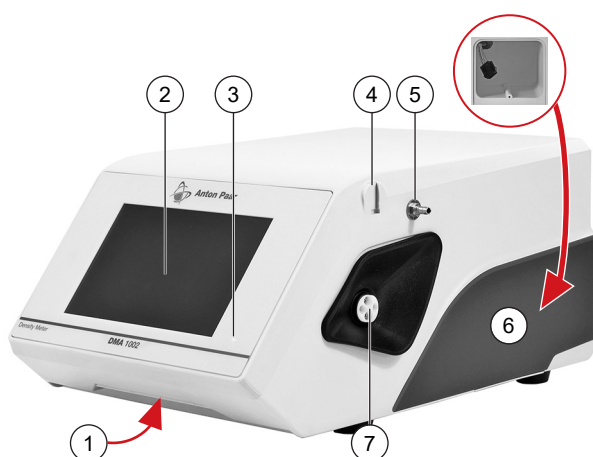


Fig. 1: Front and right side of the instrument

- 1 Recessed grip for transportation
- 2 Touchscreen
- 3 Power LED
- 4 Socket for syringe holder or funnel
- 5 Air pump outlet (5 mm barbed)
- 6 Slot for the optional peristaltic pump (to access, lift off cover held by magnets)
- 7 Sample inlet and outlet

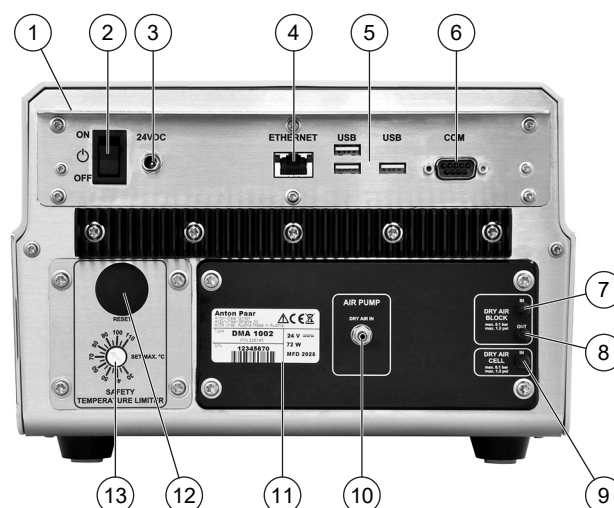


Fig. 2: Rear of the instrument

- 1 Ledge handle for transportation
- 2 On/off switch
- 3 DC power jack
- 4 Ethernet terminal (RJ45 connector)
- 5 USB 2.0 sockets (type A), 3x
- 6 COM / RS-232 serial port (DE-9M connector)
- 7 DRY AIR BLOCK IN connector (3.5 mm barbed) – drying of cell block inlet / max. 0.1 bar (1.5 psi) rel.
- 8 DRY AIR BLOCK OUT connector (3.5 mm barbed) – drying of cell block outlet
- 9 DRY AIR CELL IN connector (3.5 mm barbed) – drying of measuring cell inlet / max. 0.1 bar (1.5 psi) rel.
- 10 AIR PUMP / DRY AIR IN connector (3.5 mm barbed) – air pump inlet
- 11 Type plate with serial number S/N (P/N = mat. no.)
- 12 Reset button of safety temperature limiter
- 13 Safety temperature limiter

3 Installation

3.1 Installation requirements

Read the Safety Instructions in Section 1 [► 5].

Find all Technical Data in Appendix A [► 24].

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

IMPORTANT: *High humidity or a measuring temperature that is significantly below the ambient temperature may lead to condensation in the density measuring cell. In this case take measures to avoid condensation – consider using a drying cartridge.*

The right place

To achieve best measurement results, operate the instrument under typical laboratory conditions:

- 23 ±2 °C (73.4 ±3.6 °F) ambient temperature
- <60 % relative humidity
- no direct sunlight

The setup location and surroundings must meet the minimum requirements specified under “Operating conditions” in the Technical Data (Appendix A [► 24]).

NOTICE

No spray water protection at the rear

Consider that the rear of the instrument is not protected against spray water, whereas the front, top, and sides are.

Place the instrument on a stable, flat bench which is free of vibrations and away from vibrating equipment.

To ensure temperature stability and trouble-free measurement, do **not** position your instrument:

- next to a heating facility
- in a drafty place (e.g., near an air conditioning, ventilation system, or an open window)
- in direct sunlight

NOTICE

Do not inhibit heat dissipation

Leave a minimal distance of 10 cm (4 in) between the cooling fins on the rear of the instrument and any wall. Also ensure that the heat can freely dissipate. Do not install the instrument in a cabinet.

The instrument requires an electrical outlet nearby:

- 100–240 V~, 47-63 Hz, 1.5 A

3.2 Mounting the filling equipment

Samples may be filled by syringe, through an optional funnel (only DMA 502), or automatically by an optional Xsample 200 peristaltic pump.

- To mount the syringe holder and the filling hoses, refer to Section 3.2.1 [► 8].
- To mount the funnel and the filling hoses, refer to Section 3.2.2 [► 9].
- To install Xsample 200, refer to the documentation coming with Xsample 200.

3.2.1 Mounting syringe holder, all hoses, and waste vessel

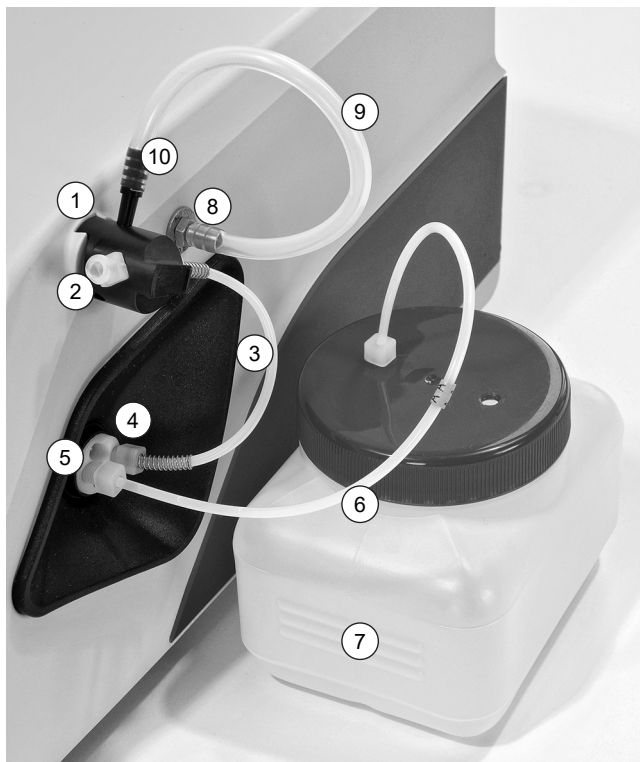


Fig. 3: Mounting the syringe holder, all hoses, and the waste vessel

- 1 Syringe holder mounted in the socket
- 2 Adapter Luer ¼" UNF, mat. no. 64792
- 3 Hose 145x3x2 PTFE 2x¼"–28 UNF, mat. no. 386159
- 4 Sample inlet
- 5 Sample outlet
- 6 Hose 300x3x2 PTFE "AA", mat. no. 3443
- 7 Waste vessel
- 8 Air pump outlet
- 9 Air pump hose
- 10 Adapter Luer cone PTFE black, mat. no. 384626

Depending on which side of the syringe holder you slide into the socket, you can switch between two filling positions of the syringe (refer to Fig. 4 [► 9]):

- **45° position (a):** The filling position of the syringe is at an angle of 45°. The hole of the fixing screw points downwards.
- **90° position (b):** The filling position of the syringe is upright. The hole of the fixing screw points towards the back of the instrument.

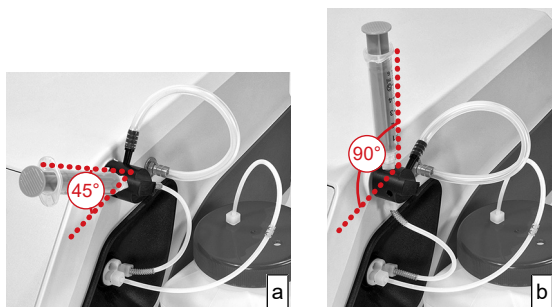


Fig. 4: Filling positions with the syringe holder

To mount the syringe holder and the filling hose

Refer to Fig. 3 [▶ 8].

1. Take the syringe holder (1) from the accessory kit.
2. Screw an adapter Luer ¼" UNF (2) into the screw hole at the broader end of the tapered dovetail.
3. Screw one end of the hose 145x3x2 PTFE (3) into the opposite screw hole.
4. Tighten the fixing screw in the syringe holder to secure the adapters in place.
5. Insert the appropriate tail of the syringe holder (depending on the desired filling position) into the socket on the instrument (1).

Push the syringe holder in firmly until you hear a clicking sound to ensure it is securely in place.

The position can be changed at any time without the need to unscrew the adapters.

6. Screw the free end of the hose (3) into the sample inlet (4).

Choose any of the two hose connections on the instrument (4 or 5), whichever suits your needs better. The other one will be the sample outlet.

Leak tightness test



CAUTION

Possible leakage of dangerous liquids

Dangerous liquids leaking from the instrument may cause injuries or risk of fire.

- Check the connections for leak tightness before you fill dangerous liquids.

Refer to Fig. 3 [▶ 8].

1. Close the sample outlet (5) tightly with a male Luer plug, mat. no. 63865.
2. Draw up air into a plastic syringe from the accessory kit and connect the syringe to the adapter (2) on the syringe holder.
3. Inject, with moderate pressure, the air in the syringe into the instrument.
4. Wait a few seconds, then release the plunger of the syringe.

If the connections are tight, the plunger of the syringe will be slowly pushed back by the pressure in the measuring cell.

If the connections are leaky, the plunger of the syringe will not move.

- In this case tighten all adapters and hose connectors firmly and repeat the leak tightness test.
- If the leak tightness test still fails after that, contact your local Anton Paar representative.

To mount the waste hose and the waste vessel



CAUTION

Possible leakage of dangerous liquids

Dangerous liquids leaking from the instrument may cause injuries or risk of fire.

- Only use the supplied hoses and waste vessel if their materials are resistant to your samples and cleaning liquids.
- If the supplied parts are not suitable, use other parts made of an appropriate material.

Refer to Fig. 3 [▶ 8].

1. Screw one end of the hose 300x3x2 PTFE (6) into the threaded hole in the cap of the waste vessel (7).
2. Screw the other end of the hose (6) into the sample outlet of the instrument (5).

IMPORTANT: Always keep the waste vessel closed with the lid during operation.

To mount the air pump hose

Refer to Fig. 3 [▶ 8].

1. Cut a piece of approx. 20 cm (8 in) length from the supplied silicone hose, mat. no. 57024.
2. Attach an adapter Luer cone (10) to one end of the air pump hose (9).
3. Connect the other end of the air pump hose to the air pump outlet (8).

3.2.2 Mounting funnel, all hoses, and waste vessel

(Only DMA 502)

With DMA 502, low-viscosity samples (up to 50 mPa·s dynamic viscosity) can be filled using a funnel, mat. no. 386784, as an alternative to syringe filling.

For all instructions refer to Fig. 5 [▶ 10].



Fig. 5: Mounting the funnel, all hoses, and the waste vessel

- 1 Funnel mounted in the socket
- 2 Sample inlet adapter
- 3 Sample outlet adapter
- 4 Sample outlet of the funnel
- 5 Waste vessel
- 6 Air pump outlet
- 7 Air pump hose
- 8 Adapter Luer cone PTFE black, mat. no. 384626
- 9 PTFE Luer extension 80 mm, mat. no. 175611 (in parking position)

To mount the funnel, the filling hose, and the waste hose

1. Insert the tapered dovetail of the funnel fixture into the socket on the instrument (1).
2. Screw the adapters on the free ends of the hoses into the sample inlet (2) and the sample outlet (3).

Choose any of the two hose connections on the instrument as the sample inlet, the other one will be the sample outlet.

Use the tool, mat. no. 11153, coming with the funnel, to tighten the adapters.



Fig. 6: Tool, mat. no. 11153, to tighten the adapters

Leak tightness test



CAUTION

Possible leakage of dangerous liquids

Dangerous liquids leaking from the instrument may cause injuries or risk of fire.

- Check the connections for leak tightness before you fill dangerous liquids.

1. Close the sample outlet of the funnel (4) tightly with a male Luer plug, mat. no. 63865.
2. Connect a PTFE Luer extension 80 mm to the tip of a plastic syringe from the accessory kit.
3. Draw up air into the syringe and stick it (with the Luer extension at the tip) into the funnel.
4. Inject, with moderate pressure, the air in the syringe into the instrument.
5. Wait a few seconds, then release the plunger of the syringe.

If the connections are tight, the plunger of the syringe will be slowly pushed back by the pressure in the measuring cell.

If the connections are leaky, the plunger of the syringe will not move.

- In this case tighten all adapters and hose connectors firmly and repeat the leak tightness test.
- If the leak tightness test still fails after that, contact your local Anton Paar representative.

Positioning the waste vessel

The funnel comes with a specific waste vessel featuring a center hole in the lid.

- Position the waste vessel so that the sample outlet of the funnel (4) aligns with the center hole in the lid. Lifting the funnel slightly, may help positioning the waste vessel.

IMPORTANT: Always keep the waste vessel closed with the lid during operation.

To mount the air pump hose

1. Cut a piece of approx. 30 cm (12 in) length from the supplied silicone hose, mat. no. 57024.
2. Attach an adapter Luer cone (8) to one end of the air pump hose (7).
3. Attach a Luer extension (9) to the Luer cone.
4. Put the tip of the Luer extension in the parking position of the funnel.
5. Connect the other end of the air pump hose to the air pump outlet (6).

3.3 Installation of optional parts

For the installation of optional parts, refer to the particular instructions coming with the part or to the corresponding section in the Reference Guide.

3.4 Power connection



WARNING

Risk of electric shock or fire

- Use only a power supply that has come with your instrument or that is explicitly provided for your instrument (DC 24 V complying with PELV [protective extra-low voltage] according to EN 61140).
- Connect the power supply only to an electrical outlet with protective earthing.

NOTICE

Possible damage due to wrong voltage

Before you switch on the instrument, make sure that the correct line voltage and line frequency are available (AC 100–240 V, 47–63 Hz).

1. Connect the power supply to the DC power jack on the rear of the instrument and fix the cable with the knurled sleeve.
2. Use the supplied power cable to connect the power supply with a suitable electrical outlet.

3.5 Switching the instrument on/off


Use the on/off switch on the rear of the instrument to switch the instrument on or off.

- The power LED indicates whether the instrument is running or not.
- After the instrument has been switched on, the home screen will come up on the display.

Verification of software integrity

During the startup of the instrument, the integrity of the instrument's program code is verified by the calculation and comparison of a hash value.

The hash value of your software version can be found in the system information:

- Select  *System information* in the menu, then find *Software hash*.

3.6 Basic instrument settings and first checks

1. After installation, set the instrument settings (refer to Section 5 [▶ 11]).
2. If you don't want to use the predefined products, you may define your own products (refer to Section 6 [▶ 12]).
3. If you want to use settings (including product settings) already defined on another instrument (same model), you can import them by using the restore function for a backup from the other instrument.

4. Conclude initial setup with an air check and a water check (refer to Section 8.1 [▶ 19]) to verify that your instrument is in perfect condition. Your instrument has been factory adjusted, but during transport the density adjustment may have been compromised.
 - If both checks succeed, your instrument is ready for routine measurements.
 - Else perform an air/water adjustment as described in Section 8.2 [▶ 20].

4 Operation

Refer to the Reference Guide for a comprehensive description of the instrument software and all available settings and functions.



TIP: *If you do not see all functions described in this manual, if you cannot access certain settings, or if you cannot perform some procedures, this may be due to restricted user permissions. Refer to the Reference Guide for a description of system security and user management.*

5 Instrument settings

Refer to the Reference Guide for a comprehensive description of all instrument settings.

For the configuration of installed options, refer to the instructions that come with the option.

5.1 Language and regional settings

- Select  *Settings* in the menu, then under *System select*  *Time & language*.

First of all you will want to set the system **language** so that you feel comfortable on the instrument:

- Set *Language* to a language that you prefer.

On the occasion set the number format (decimal symbols etc.) and the date and time **formats**:



- Select *Format* according to your requirements.

Finally select the **keyboard layout** for the onscreen keyboard and the **keymap** for an optional USB keyboard:

- Set *Keyboard layout* and *HW keyboard keymap* appropriately.

5.2 Time settings

Set the system time correctly so that the time stamps of measurements and system events are correct and traceable:

1. Select  *Settings* in the menu, then under *System select*  *Time & language*.
2. Set *Region* and *City* to your time zone.

Daylight saving time will be calculated automatically.

TIP: The date and time formats are defined with the *Format setting* (refer to Section 5.1 [▶ 11]).



To set date and time **manually**:

- Set *Date* to the current date.
- Set *Time* to the current time.

Alternatively, set date and time via **time server**:



1. Configure a network connection first.
2. Switch *Use time server* to *Yes*.
The *Time servers* input field replaces the input fields *Date* and *Time*.
3. The *Time servers* setting depends on your network settings.
 - If you have set up an **automatic** network configuration, you can leave the *Time servers* input field empty.
 - If you have set up a **manual** network configuration, or if you want to specify a time server anyway:
Specify the address(es) of your time server(s) in the *Time servers* input field.
Put each time server in a new line. Do not separate addresses by commas or semicolons etc.
4. It depends on your time server when the system time will be synchronized. It may also be necessary to restart the instrument.



5.3 Display brightness

1. Select  *Settings* in the menu, then under *Hardware* select  *Instrument settings*.
2. To set the *Display brightness*, drag the slider to a convenient position.

TIP: The display brightness is reduced when no user interaction has been detected for 20 minutes. As soon as you touch the screen, the display brightness is back to its previous value.



5.4 Camera settings

To set the properties of the camera image, select  *Settings* in the menu, then under *Hardware* select  *Camera*.

- Use the arrow buttons to browse through the camera settings.
- Tap  to align the camera image with the density measuring cell:
 - a. Drag the red frame representing the camera view and position it over the measuring cell.
 - b. Tap  to confirm the position.

5.5 Global units




Global units will be used as default units on the instrument:

1. Select  *Settings* in the menu, then under *System* select  *Global units*.
2. Set the global units that you prefer.

6 Measurement settings – products

6.1 Products


You can individually define the measurement settings for each of your products or sample varieties and save them for repeated use:

1. Select  *Products* in the menu.
2. Tap  *Create product*.
3. Specify a name and a description for the product.
4. Define measurement settings and optionally configure limits.
5. Tap  to select an image for the representation of the product.
6. Tap *Save* to save the collection of measurement settings for the product.

TIP: The instrument comes with several predefined product settings, which you can use as a template.

6.2 Measurement settings

Measurement settings comprise the measurement parameters, the assignment of a dashboard, and a report configuration for the results.


- For measurements without predefined product, assign dashboard and report configuration under *Setup*  on the *Measurement* spot.

6.2.1 Dashboards / measuring quantities

Dashboards serve to monitor your measurements.

The instrument already comes with dashboards predefined for various generic products. You can adapt them to your needs or define new dashboards according to your requirements.

You can place the following widgets onto a dashboard of the instrument:

- the live camera image of the density measuring cell (U-View™)
- measurement information (giving information about the current status of the measurement)
- display boxes for any measuring quantity
(Select  *Quantities* in the menu for a complete reference of available quantities. Tap on any of the quantities to see a comprehensive description.)

6.2.2 Reports

Measurement results are presented as reports, which you can access in the data explorer.

TIP: *The report configuration can also be changed after the measurement. It is independent of the dashboard configuration.*

6.3 Measurement parameters

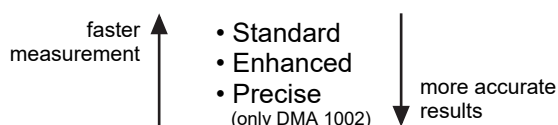
6.3.1 Set temperature

Set the measuring temperature here.

TIP: *Mind that some measuring quantities may be only valid at a specific temperature.*

6.3.2 Measurement performance

Select a measurement performance class for the measurement:



We recommend the performance class with the highest possible accuracy as the standard setting (*Precise* for DMA 1002, *Enhanced* for DMA 502).

The *Density* widget includes a **precision indicator** showing the measurement performance class set and the currently reached measurement performance class (according to the stability criteria met). Read the precision indicator as follows (example for DMA 1002):

| Indicator | Measurement performance class |
|---|---|
| | Standard |
| | Enhanced |
| | Precise |
| White squares indicate the measurement performance class set. Green squares indicate the measurement performance class currently reached. | |
| | Example: The measurement performance class <i>Precise</i> has been set (white squares). Currently the measurement reaches measurement performance class <i>Enhanced</i> (green squares). |

6.3.3 Check density stability

(Only available for the highest measurement performance class)

| | |
|-----|---|
| Yes | The measurement result is determined when the temperature value as well as the density value are stable within a defined deviation range. |
| No | The measurement result is determined when the temperature value is stable. |

Generally, temperature stability is reached faster than density stability.

TIP: *Yes is the recommended standard setting for most precise measurements. Select No if the characteristics of your sample prevent achieving stability (inhomogeneous or unstable samples).*

6.3.4 Hold time

The instrument will wait this time span after all specified stability conditions are met, and then determines the measurement result. This gives the sample time for temperature conditioning.

TIP: *A hold time of 4 minutes for DMA 502 and 5 minutes for DMA 1002 is recommended when you measure without checking density stability. When you check density stability, the standard hold time is 0 minutes.*

6.3.5 Timeout

If a stable measurement result cannot be achieved, the instrument will abort the measurement process after the specified timeout (for example 10 minutes).

The time span begins with measurement start.

TIP: *A timeout may be caused by a filling error: In this case repeat the measurement. Or your sample is inhomogeneous or unstable: In this case deactivate checking for density stability (and set a hold time).*

6.3.6 FillingCheck™

| | |
|-----|-------------------------------|
| Yes | FillingCheck™ is active. |
| No | FillingCheck™ is deactivated. |

FillingCheck™ is an automatic bubble detection based on an advanced analysis of the U-tube's oscillation pattern.

If applicable, a filling warning will be shown in the measurement information widget on the dashboard.

TIP: *Additionally check the filling visually by means of the built-in live camera (U-View™).*

TIP: *Yes is the standard setting. Select No if the detection of filling errors by FillingCheck™ obviously contradicts what you see in the live camera image.*

TIP: *FillingCheck™ provides excellent support to the operator for samples of low and medium viscosity ranges.*

The sensitivity of this feature depends on a combination of density, viscosity, and temperature, and is not constant. For example, certain samples with high den-

sity (approx. 1.5 g/cm^3) and medium viscosity (approx. $550 \text{ mPa}\cdot\text{s}$) might generate a filling warning also for correctly filled samples. In all such cases, changing the measuring temperature may influence this combination so that FillingCheck™ continues working as expected.

Some samples may generate a filling warning even when filled without bubbles, for example highly viscous samples or samples containing inhomogeneities. In these cases, we recommend to disable Filling-Check™ and perform repeated measurements to validate the quality of filling.

7 Performing a measurement

Table 1: Steps of a typical measurement cycle

| Step | | refer to |
|------|---|--|
| A | Check that the measurement system is properly installed and in good working order and that all conditions for a good measurement are met. | Section 3.1 [▶ 8] and below |
| B | Perform a water check to verify the instrument's accuracy before you start your daily routine measurements. After the check, dry the measuring cell. | Section 8.1 [▶ 19] |
| C | 1 Choose a way to start your measurement: Use pre-defined product settings or define the measurement settings on the fly. | Section 7.1 [▶ 15] Section 6 [▶ 12] |
| | 2 Prepare your sample if required. | Section 7.2 [▶ 15] |
| | 3 Fill the sample . | Section 7.3 [▶ 16] |
| | 4 Start the measurement . | Section 7.4 [▶ 17] |
| | 5 Clean and dry the measuring cell. | Section 9.1 [▶ 21] |
| D | Perform an air check to verify the efficiency of your cleaning and drying procedure after you have finished your daily routine measurements and the measuring cell has been cleaned and dried. | Section 8.1 [▶ 19] |

Refer to Section 8.2 [▶ 20] for recommendations when to perform an adjustment before a measurement.



WARNING

Risk of fire and injuries

In the very rare case of a malfunction of the temperature control, the measuring cell could heat up to 150 °C (302 °F).

- Set the safety temperature limiter on the rear of the instrument (13, Fig. 2 [▶ 7]) to a temperature that is safe for your sample (use a screwdriver).

Preparatory steps

Before you start a measurement, check that:

- the measuring cell is clean and dry
- hoses are connected correctly
- hose connections are tight
- the waste hose leads into the waste container
- the volume of the waste container is large enough for the number of samples
- suitable cleaning liquids are at hand

6.3.7 Thermal expansion factor

(Only available in product settings)

The parameter is used for the calculation of API Custom quantities. It does not affect other measurements or calculations. API Group C (Custom) relates to petroleum samples not belonging to any pre-defined API classes.

The thermal expansion factor [$^{\circ}\text{C}^{-1}$] relates density changes of a liquid to temperature changes and is used to convert the measured density to reference conditions.

To speed up measurements

- Set the measuring temperature on the instrument in advance using the header control.
- Bring the sample to measuring temperature in advance.
- Select a faster measurement performance class and set measurement parameters so that the time for temperature conditioning of the sample becomes shorter (Section 6.3 [▶ 13]).

Consider, however, that your measurement results will become less accurate by proceeding so.

Hints for accurate measurements – temperature equilibration

If you want to achieve most accurate measurement results, give the measuring cell and sample enough time for temperature conditioning:

- Keep the instrument continuously switched on or at least switch it on well before measurements (more than an hour before).
- Keep the instrument at a constant temperature over a long time (more than an hour).

- If you change the measuring temperature, wait 1 hour per 10 °C (18 °F) temperature difference at the new temperature before starting measurements.

Perform a check or calibration measurement at the new temperature in order to check the accuracy of the measurements at the new temperature.




If the check or calibration measurement fails, perform an adjustment at the new temperature and again a check.

- As a rule of thumb allow for a conditioning time of 1 minute per every 10 °C (18 °F) difference between the temperature of the filled sample and the set measuring temperature.
- If you do not check density stability in your measurement, set an additional hold time of 4 minutes (DMA 502) / 5 minutes (DMA 1002).
- If you measure density that is not viscosity-corrected, allow for a longer conditioning time: approx. 5 minutes if you check density stability or approx. 10 minutes if you don't.

7.1 Starting a measurement

Product measurements


For routine measurements, define your measurement settings as a product. You can add your routine product measurements to the home screen as favorites in order to start measurements directly from there.

- **Setting a product measurement as favorite**
 - a. Select  *Products* in the menu, then open the specific product.
 - b. Verify that the product settings are correct, then tap  *Create measurement*.
 - c. Add the spot with the measurement setup as favorite (tap ).

From here you can start a measurement by tapping *MEASURE*.

- **Starting a product measurement from the home screen**

The favorite on the home screen combines two links.


- Tap *Measure*  on the favorite to directly start a quick or routine product measurement that requires no sample details.
- Tap on the product name to start a measurement from the measurement setup.

There you can add a sample name or verify the product settings (tap *Details...*).

To start a measurement, tap *MEASURE*.

Measurements without predefined product

You can also perform a measurement without predefined product and define all measurement settings on the fly:

1. Select  *Measurement* in the menu.
2. Define the measurement settings.
3. To start a measurement, tap *MEASURE*.

7.2 Degassing samples

There are various methods to degas liquid samples. The preferable method for your application depends on the kind of sample and the amount of gas that is dissolved in the sample. Pay attention to always treat all samples the same way in order to get reproducible measuring results.

IMPORTANT: *Be aware of the fact that the composition of some samples may slightly change during the pretreatment due to the evaporation of volatile components.*

TIP: *Degassing efficiency also depends on the sample's temperature. Pre-condition cold samples to the measurement temperature before you begin the degassing procedure.*

Using a syringe

The syringe must be large enough to leave space for creating a vacuum.

1. Fill the syringe up to two thirds with sample and close its tip with your finger.
2. Pull the piston to create a vacuum.
3. Release your finger to let the gas out.
4. Repeat the procedure at least three times.

Boiling the sample



WARNING

Health risk with toxic components

Samples containing toxic volatile components can cause irritation and serious injuries to your eyes, skin, and mucous membranes as well as toxication.

- If your sample contains volatile components that are toxic, always handle it in an appropriate environment like under a fume hood, particularly when you boil your sample.



WARNING

Risk of fire and burns with flammable liquids

When you boil flammable liquids, there is a risk of fire. Serious injuries are possible.

- Do not boil flammable liquids.

1. Boil the liquid for several minutes to remove dissolved gas.
2. Fill the boiled liquid into a clean glass flask and cover it.
3. Wait until the liquid has cooled down approximately to measuring temperature.

Stirring the sample

Stir your sample vigorously for 5 to 15 minutes (depending on the stirring equipment) until bubbling ceases.

You can pour the sample through a paper filter after stirring to degas it even more efficiently.

Using an ultrasonic bath

Put your sample for approx. 5 to 10 minutes into an ultrasonic bath until bubbling ceases.

7.3 Filling sample



WARNING

Risk of injuries and fire by liquids leaking

Filling samples and cleaning liquids that the wetted parts are not resistant to will corrode the wetted parts. Sample leaking from corroded parts may cause serious injuries.

Before you fill any sample or cleaning liquid, in particular hazardous or flammable chemicals, into the instrument:

- Strictly follow all safety instructions concerning the use of chemicals and the use of flammable chemicals (refer to Section 1 [▶ 5]).
- Make sure that all wetted parts are resistant to the filled-in liquid. Consider also the wetted parts of installed options.
The chemical resistance depends on the temperature and concentration of the liquid.
- Make sure that you have suitable cleaning liquids at hand for cleaning the measuring cell.

NOTICE

Corrosive samples require special care

Samples with a moderate tendency to corrode borosilicate glass, such as strong alkali solutions (for example caustic soda), can be measured with the instrument. However:

- Remove corrosive samples immediately after measurement and rinse the measuring cell thoroughly.
- Check the validity of the adjustment more frequently than generally recommended. Perform a new adjustment if necessary.
- The measuring temperature for strong alkali solutions should not be higher than 20 °C (68 °F). Higher temperatures dramatically increase the speed of corrosion.

NOTICE

Proceeding in case of instrument leaks

If liquid leaks from the draining hole by the sample inlet:

- Perform a leak tightness test as described in the installation section.
- If the leak tightness test fails, contact your local Anton Paar representative.

You can fill the sample with a syringe, through an optional funnel, or with an optional peristaltic pump. Refer to the documentation of the peristaltic pump for instructions on its installation and use.

To achieve highly accurate measuring results, fill the sample into the measuring cell steadily and without bubbles.

TIP: *Sample containing dissolved CO₂ will cause bubbles in the measuring cell, which render the measurement results invalid. Degas your sample carefully as described in Section 7.2 [▶ 15].*

Sample amount




If the measuring cell is clean and dry, you need approx. 2 mL of sample.

If you measure without cleaning and drying between samples, you will need a higher amount of sample because you have to flush residues of the previous sample out of the measuring cell to avoid cross-contamination.

Bubble detection – FillingCheck™ and U-View™ (live camera image)

FillingCheck™ helps you detect bubbles during filling. Activate the function in the measurement settings.

Additionally, check the filling visually by means of the built-in live camera (**U-View™**):

- Place the camera widget on the dashboard assigned to your measurement.
- Watch the live camera image on the dashboard during filling:
 - Tap on the image to open the camera screen.
 - Tap  to zoom in, tap  to zoom back out.
 - You can drag the zoomed image left or right to examine all parts of the measuring cell.
 - Tap  to close the camera screen.

The camera image will be saved with the measurement results.

7.3.1 Filling with a syringe (Luer tip)



WARNING

Risk of injuries by dangerous liquids leaking or spurting out

If you push the plunger of the syringe too hard, or if, for example, the measuring cell breaks, dangerous liquids may leak or spurt out of ruptures causing injuries.

- Wear safety goggles and protective gloves when you fill dangerous liquids.

IMPORTANT: Do not use syringes that contain lubricants. The lubricants can dissolve into your sample and lead to a systematic measuring error.

Filling position

- To achieve best measurement results, fill with the syringe attached to the adapter Luer ¼" UNF on the syringe holder.
This is the standard filling position.
- Only in the case that the available amount of sample is very limited:
 - Remove the adapter Luer ¼" UNF from the syringe holder and screw it into the sample inlet of the instrument (instead of the inlet hose).
 - Fill through this adapter using a 2 mL syringe.

To fill with a syringe (Luer tip)

1. Connect the syringe (filled with sample) to the adapter Luer ¼" UNF on the syringe holder (or mounted directly on the sample inlet of the instrument).
2. Push the plunger of the syringe slowly and steadily until a drop emerges from the sample outlet adapter.
3. Leave the syringe in the filling position during the measurement.

7.3.2 Filling with the optional funnel

Pour approx. 10 mL liquid directly into the funnel. The circumferential mark inside the funnel indicates the 10 mL level.

7.3.3 Special filling techniques

Refer to the Reference Guide for a discussion of special filling techniques concerning the following kinds of samples:

- bubbling samples
- suspensions and emulsions
- highly viscous samples
- pastes
- liquids in aerosol cans

7.4 Actual measurement procedure

- When you have verified that all measurement settings are correct, and the sample has been filled, tap **MEASURE**.

The measurement will be performed according to your settings. The progress bar shows the progress of the measurement.

When the measurement is finished, the results are displayed.

The results together with the camera image and a time stamp are automatically saved in the data memory.

Saved data can be accessed in the data explorer.

- Tap
 - **DONE** to close the results and finish or
 - **REMEASURE** to perform another measurement with the same settings.

7.5 Measuring at low temperatures / under high humidity conditions

If the ambient air is humid, and the measuring temperature is lower than the ambient temperature, condensation may occur inside and on the measuring cell and in the measuring cell block.

Condensation inside and on the density measuring cell causes adjustment and measurement errors. Condensation in the measuring cell block damages the electronics and may lead to a failure of the U-view™ function.

The higher the difference between the set measuring temperature and ambient temperature, and the higher the air humidity, the easier condensation occurs. The instrument's condition monitoring will show a warning if the temperature lies below the dew point.

7.5.1 Condensation inside the measuring cell

If U-View™ shows condensed water inside the measuring cell, install a drying cartridge to dry the air from the air pump outlet. When you use the internal air pump for drying the measuring cell, its air will then be dry.

A drying cartridge must be used for a measuring temperature of 20 °C under the following ambient conditions:

| Ambient temperature | Relative air humidity |
|---------------------|-----------------------|
| 20 °C (68 °F) | >70 % |
| 25 °C (77 °F) | >50 % |
| 30 °C (86 °F) | >38 % |

To remove condensation inside the measuring cell

1. Install a drying cartridge, mat. no. 65085 (Section 7.5.2 [► 18]).

2. Dry the measuring cell with the internal air pump as usual until you can't see condensed water anymore in U-View™ (Section 9.1 [▶ 21]).

7.5.2 The optional drying cartridge

The drying cartridge, mat. no. 65085, can be used to dry the air from the air pump outlet.

Installing the drying cartridge

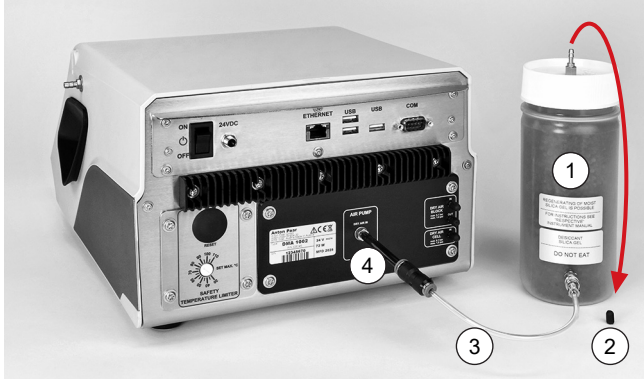


Fig. 7: Drying cartridge installed

- 1 Drying cartridge
 - 2 Remove cap from inlet of drying cartridge
 - 3 Transparent polyurethane hose
 - 4 Black hose, connected to air pump inlet connector
1. Push the fitting on the thin, transparent polyurethane hose (coming with the drying cartridge) into the outlet connector at the bottom of the drying cartridge (3).
 2. Push the open end of the transparent hose into the connector on the thicker, black hose (coming with the drying cartridge).
 3. Connect the open end of the black hose to the air pump inlet connector "AIR PUMP / DRY AIR IN" at the rear of the instrument (4).
 4. Remove the cap from the barbed fitting (inlet) on top of the drying cartridge (2).

NOTICE

- Never connect hoses containing liquids or moist gases to the air pump inlet connector "AIR PUMP / DRY AIR IN" as this may lead to condensation in the density measuring cell and subsequently to measurement and adjustment errors.
- Operate the air pump inlet only at ambient pressure.

To regenerate moist silica gel

The drying cartridge contains silica gel, a non-toxic drying agent. When active, the color of the drying agent is orange. Silica gel having absorbed liquid turns green.

Moist silica gel can be regenerated:

Pour the silica gel into a glass bowl and put it in a laboratory oven for a few hours (or overnight) until its color is orange again.

NOTICE

Do not use drying temperatures over 130 °C (266 °F). Otherwise the indicator function of the silica gel will be spoiled.

7.5.3 Preventing and removing condensation

If the measuring temperature is more than 5 °C (9 °F) lower than the ambient temperature, a dry air supply for the measuring cell and the measuring cell block must be used in addition to the drying cartridge.

The following specifications of the applied air are required:

- **0.03 bar** (0.435 psi) relative pressure
- max. volumetric flow rate: 80 L/h
- class 5 according to ISO 8573-1
- max. particle size: 40 µm
- max. pressure dew point: 10 °C below measuring temperature
- max. oil content: 25 mg/m³

Measuring cell

To prevent or remove condensation on the measuring cell:

1. Connect a dry air supply to the "DRY AIR CELL IN" connector. Use a 3x5 mm hose made of suitable material, for example silicone.
2. Continuously flush the measuring cell's surface with dry air.

Measuring cell block

To prevent or remove condensation in the measuring cell block:

1. Connect a dry air supply to the "DRY AIR BLOCK IN" connector. Use a 3x5 mm hose made of suitable material, for example silicone.
2. Remove the cap from the "DRY AIR BLOCK OUT" connector.
3. Continuously flush the measuring cell block with dry air.

NOTICE

Never connect hoses containing liquids or moist gases to the "DRY AIR BLOCK IN" connector as this may lead to damage of the electronics.

7.5.4 Removing condensation using the internal air pump

If no external dry air supply is available, you may use the internal air pump to remove condensation on the measuring cell and in the measuring cell block.



IMPORTANT: This is a solution for emergency cases and not intended for long-term use.



The procedure requires to install an optional drying cartridge, mat. no. 65085, and an optional filter set DMA 502/1002, mat. no. 387931.



Fig. 8: Example: Removing condensation from the measuring cell block with the internal air pump

- 1 Drying cartridge
- 2 Remove cap from inlet of drying cartridge
- 3 Hose connection from drying cartridge to air pump inlet connector
- 4 Filter
- 5 Long hose of the filter set
- 6 Air pump outlet
- 7 DRY AIR BLOCK IN connector / remove cap from OUT connector
- 8 DRY AIR CELL IN connector

1. Install the drying cartridge as described in Section 7.5.2 [▶ 18].
This ensures that the air from the air pump is dry.
2. Install the filter set:
 - The long hose (5) may be disconnected from the filter(4): In this case connect the end with the hose clamp to the filter with a clockwise turn.
 - Connect the open end of the long silicone hose 4x6 mm (5) to the air pump outlet (6).
3. Connect the open end of the short silicone hose 3x5 mm to the inlet where dry air is required:
 - “DRY AIR CELL IN” connector (8) if you want to dry the outside of the measuring cell
 - “DRY AIR BLOCK IN” connector (7) if you want to dry the measuring cell block
In this case remove the cap from the “DRY AIR BLOCK OUT” connector.
4. On the instrument, select  *Cleaning* in the menu.
5. Tap the temperature in the screen header and set it to the maximal temperature.
6. Disable air pump timeout:
 - Tap .
 - In the air pump settings, set the switch *Turn off after timeout* to *Off*.
 - Tap *Save*.

7. After maximal temperature has been reached, tap  to start the air pump.
8. When condensation has disappeared, tap  to stop the air pump.
9. Restore your standard settings for the temperature and air pump timeout.

Consider to prevent condensation as described in Section 7.5.3 [▶ 18].

8 Checking, adjusting and calibrating

8.1 Checks

By checks, carried out in regular intervals, you can ensure that your measurements consistently deliver results of high accuracy.

With a density check, you fill a medium of known density (air, water, or a standard liquid specific to your needs) into the measuring cell and compare the measured density with the target value.

- Use **water checks** or **custom checks** to verify that the instrument is measuring with satisfactory accuracy.

We recommend to perform a water check or a custom check every day before you start your measurements. Perform the check at the same temperature as your measurements.


Perform additional water checks or custom checks as required and at your own discretion, for example when you get unexpected results.

- Use **air checks** to verify the efficiency of your cleaning and drying procedure.

We recommend to perform an air check every day after the measurements have been finished and the measuring cell has been cleaned and dried.

Perform additional air checks as required and at your own discretion, for example after the measurement of critical samples that might stick to the measuring cell (e.g., samples containing adhesives, sticky particles, proteins).

8.1.1 Performing a check

1. Select  *Checks* in the menu, then select one of the available checks.
2. Observe all hints on the screen and fill the check medium.
 - For a water check, use freshly degassed ultra-pure water.
 - For an air check, clean and dry the measuring cell thoroughly.

Use the camera image to check that the density measuring cell is clean or that the check medium has been filled bubble-free.

3. Tap **START CHECK**.
4. The summary of the check will show the check results and a recommendation if the check has failed and an adjustment is necessary.
All results are also saved in the data memory.
5. Tap **DONE** to close the summary.

IMPORTANT: We advise you to follow the recommendations.

If the water check has failed

We recommend taking corrective actions until the check is valid again:

- Examine the camera image included in the results to check that the water has been filled bubble-free.
- Check the quality of the water.
- Clean the measuring cell thoroughly.
- If above actions do not help, perform an air/water density adjustment.

8.2 Adjustments

With an adjustment, a sample of exactly known measurement properties (standard) is measured, and the instrument constants are adjusted in a way that the instrument delivers the known correct results.

The instrument features a 2-point adjustment (air/water adjustment) and a wide range adjustment.

DMA 1002 also features a 1-point adjustment (water adjustment) as the standard adjustment. After ten 1-point adjustments you are prompted to perform a 2-point adjustment for accuracy reasons.

- Perform a density adjustment if a check has failed and corrective actions have not helped.
- We recommend to perform an air/water density adjustment if you relocate the instrument to a place where the ambient temperature differs by more than 10 °C (18 °F).
- *DMA 1002 only:* To achieve highest accuracy, we recommend to perform an air/water density adjustment after each temperature change. Wait at least one hour after the required temperature has been reached.
- You will likely never need a wide range adjustment. Be aware that it will last several hours. However, a wide range adjustment may be useful when you adjust your instrument at a temperature in the middle of the range, and if subsequent measurements are out of specifications at other temperatures.

8.2.1 Performing an adjustment

Adjustment media: dry air and freshly degassed ultra-pure water for the air/water adjustment

The 1-point water adjustment simply skips the air adjustment.


IMPORTANT: You cannot use the peristaltic pump for adjustments.

IMPORTANT: We strongly recommend to adjust the instrument at the temperature at which you will perform your measurements.

IMPORTANT: Start an adjustment only after the instrument has been running at the start temperature of the adjustment for more than 1 hour (the longer, the better).

IMPORTANT: Atmospheric pressure for adjustments

The atmospheric pressure that you get from a local weather station is usually not the absolute atmospheric pressure, but a calculated atmospheric pressure value referenced to sea level.



1. Select  **Adjustments** in the menu, then select one of the available density adjustments.
2. Rinse and clean the measuring cell.

TIP: If you use undenatured ethanol as the final rinsing liquid, only 3 to 4 minutes drying time are required.

3. Tap **Start Air Pump** to dry the measuring cell.
4. Tap **Stop Air Pump** when the measuring cell is dry.
5. Tap **DONE**.
6. **Air adjustment:**
 - Enter the air humidity and the atmospheric pressure.
The air humidity is set to 50 % per default.
The atmospheric pressure displayed is measured automatically by a built-in sensor.
 - Enter the adjustment temperature.
 - Tap **START**.
The air adjustment routine is carried out.
7. **Water adjustment:**
 - Fill freshly degassed ultra-pure water into the measuring cell.
Take care to fill the water without air bubbles.
 - Tap **START**.
The water adjustment routine is carried out.
8. The result of the adjustment is shown.
Check the recommendation on the screen and apply or reject the adjustment.
Applied results are also saved in the data memory.

8.2.2 Resetting adjustments to factory adjustment

You can reset the instrument's adjustments to the factory adjustment:

1. Select  **Adjustments** in the menu, then tap  in the action box.

2. Switch the required factory adjustment to **Yes**.
3. Tap **Reset**.

Adjustments will be reset.

After resetting to factory adjustment, perform an air/water adjustment before you continue with checks and measurements.

8.3 Calibrations

Refer to the Reference Guide for information on calibrations.

9 Upkeep and cleaning

9.1 Cleaning and drying the measuring cell

Employ a regular and effective cleaning routine and store the instrument under the recommended conditions.

Cleaning frequency

Clean and dry the measuring cell at least after each working day or working shift.

Cleaning more frequently can be necessary ...

- before you perform adjustments
- before you measure a sample that is not miscible with the previous sample
- before you want to measure using a minimum sample amount
- before you measure a sample that could chemically react with the previous sample
- immediately after you have measured a sample that could solidify or harden in the measuring cell

Cleaning liquids

Employ two cleaning liquids in a row:

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

Table 2: Recommended cleaning liquids

| Sample | Liquid 1 | Liquid 2 |
|----------------------------|-------------------|-----------------------|
| aqueous samples, beverages | water | non-denatured ethanol |
| petrochemical samples | petroleum naphtha | acetone |

If you are uncertain about a suitable cleaning liquid, perform preliminary tests on a glass plate (for example a microscopic slide):

- Put some drops of sample on the glass surface and try to remove it by rinsing with different liquids.
- Only if the sample can be removed completely by rinsing (**not wiping**) with a suitable cleaning liquid, it should be filled into the density measuring cell.

Cleaning procedure



WARNING

Risk of injuries and fire by liquids leaking

Before you fill any sample or cleaning liquid, in particular hazardous or flammable chemicals, into the instrument:

- Strictly follow all safety instructions concerning the use of chemicals and the use of flammable chemicals (refer to Section 1 [► 5]).
- Make sure that all wetted parts are resistant to the filled-in liquid (refer to the appendix). Consider also the wetted parts of installed options.


NOTICE

Risk of damaging the measuring cell

Do not use any mechanical action for cleaning the measuring cell.

IMPORTANT: *Observe all safety instructions for filling sample that are applicable for cleaning liquids.*

For a description of the cleaning and drying procedure with an optional Xsample, refer to the manual of the Xsample.

1. Select  **Cleaning** in the menu.
2. Rinse the measuring cell with cleaning liquid 1 (minimum 5 mL).
If your sample is viscous or contains particles, use more cleaning liquid.
3. Empty the measuring cell (by filling air).
4. Rinse the measuring cell with cleaning liquid 2 (minimum 5 mL).
5. Empty the measuring cell.
6. Continue with the drying procedure.

Drying procedure

IMPORTANT: *Consider to install a drying cartridge if the instrument's condition monitoring shows a warning.*



Fig. 9: Drying the measuring cell

1. Connect the adapter Luer cone of the air pump hose to the adapter Luer 1/4" UNF on the syringe holder (or mounted directly on the sample inlet adapter of the instrument).
2. On the *Cleaning* screen, tap ► to start the air pump.
3. Wait until the measuring cell is dry (stable density reading).

The time needed depends on the vapor pressure of your cleaning liquid 2 and the temperature of the measuring cell (ethanol at 20 °C: approx. 5 minutes, acetone at 20 °C: approx. 3 minutes).

4. Tap ■ to stop the air pump.
You can also set the air pump to turn off automatically:
 - Tap ⚙️ to open the air pump settings.
 - Switch *Turn off when density is stable* or *Turn off after timeout* on/off according to your requirements.
 - Tap Save.
5. Disconnect the air pump hose from the syringe holder (or from the sample inlet adapter).



WARNING

Risk of injuries and fire by liquids leaking

If liquids get into the air pump system, they may destroy the pump diaphragm and leak from the instrument.

- Disconnect the air pump hose before you start filling liquids.

9.2 Cleaning the instrument housing and the touchscreen



WARNING

Before using any cleaning agents for the instrument's surface parts:

- Strictly follow all safety instructions concerning the use of chemicals and the use of flammable chemicals (refer to Section 1 [► 5]).
- Make sure that all surface parts are resistant (refer to section "Wetted parts" in the appendix). In case of uncertainties, contact Anton Paar GmbH.
- Decontaminate and remove aggressive sample residues on the instrument.

NOTICE

Corrosion due to unsuited means of cleaning

Using substances for cleaning that are not suitable causes corrosion of the instrument's surface parts. Never use:

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



WARNING

Possible shock current over wet skin

In case of moist cleaning unplug the power supply from the instrument.

To clean the instrument housing or the touchscreen, use a soft tissue which can be wetted with warm water, if necessary with a mild cleaning agent added (pH <10).

9.3 Storing the instrument

Clean and dry the measuring cell before you store the instrument for **more than one day**. Otherwise algae may grow on the glass surface, which are difficult to remove.

If you store the instrument for **less than one day**, the measuring cell can be filled with ultra-pure water or stay filled with the last cleaning liquid used. If you have filled by syringe, leave the syringe mounted in the filling position to keep the liquid from running out.

9.4 Transporting the instrument



CAUTION

Risk of squeezing your fingers

Do not hold the instrument by its bottom to avoid squeezing your fingers when you put down the instrument.

- Empty the measuring cell and all hoses before you move or lift the instrument.
- To carry the instrument, put one hand into the recessed grip below the front and grasp the metal ledge on the rear with the other hand.
- Carry the instrument in front of you and keep it close to your body.

10.2 Repair performed by an authorized Anton Paar representative

In case your product needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your product 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. Do not return products that are contaminated by radioactive materials, infectious agents or other substances that cause health hazards.

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

10 Maintenance and repair

10.1 Maintenance performed by an authorized Anton Paar representative

The product does not require a periodic maintenance by an authorized Anton Paar representative to retain warranty coverage.

To fulfill requirements of regulatory authorities e.g. FDA 21 CFR 211.67, PIC/S 023-2 (5.5), Anton Paar offers services for compliant preventive maintenance and requalification for qualified Anton Paar products in case of software update, repair, and location change.¹

Following parts are generally excluded from the warranty (wear and tear parts)

- Syringes
- Hoses
- Adapters, connectors, fittings
- Pump diaphragms
- Filters
- O-rings, seals, gaskets
- Cables
- Fuses
- Batteries
- Desiccants
- Protection foils and covers

All parts damaged in consequence of a fall of the instrument are generally excluded from the warranty as well.

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

Appendix A Technical data

Appendix A.1 Specifications

| | DMA 502 | DMA 1002 |
|--|---|----------------------------------|
| Density | | |
| Measuring range | 0 g/cm ³ to 3 g/cm ³ | |
| Repeatability s.d. ^a | 0.0002 g/cm ³ | 0.00005 g/cm ³ |
| Reproducibility s.d. ^a | 0.0004 g/cm ³ | 0.00007 g/cm ³ |
| Accuracy ^b | 0.001 g/cm ³ | 0.0001 g/cm ³ |
| Resolution | 0.0001 g/cm ³ | 0.00001 g/cm ³ |
| Temperature | | |
| Measuring range | 15 °C to 40 °C (59 °F to 104 °F) | 15 °C to 60 °C (59 °F to 140 °F) |
| Repeatability s.d. ^a | 0.1 °C (0.18 °F) | 0.02 °C (0.036 °F) |
| Accuracy | 0.3 °C (0.54 °F) | 0.03 °C (0.054 °F) ^c |
| Resolution | 0.01 °C (0.01 °F) | 0.01 °C (0.01 °F) |
| Sample volume | <2 mL (incl. filling adapter) | |
| Sample viscosity | 0 to 35,000 mPa·s | |
| Accuracy and convenience features | full range viscosity correction U-View™ FillingCheck™ | |

^a According to ISO 5725

^b Under ideal conditions and for low densities/viscosities

^c If room temperature does not deviate more than ± 2 °C from room temperature of the last temperature adjustment

Appendix A.2 Instrument data and operating conditions

| | |
|--|--|
| Data memory | <ul style="list-style-type: none"> – audit trail entries: up to 5,000 – measurement data: up to 5,000 (with camera image) – check definitions: up to 100 – check results: up to 500 – adjustment results: up to 100 – products: up to 400 – custom quantities: up to 50 – users and roles: not limited, tested with up to 1000 users and 100 roles |
| Display | 7" TFT WVGA (800x480 px); PCAP touchscreen |
| Controls | touchscreen, optional keyboard, mouse, and barcode reader |
| Interfaces | 3x USB ^a , 1x RS-232, 1x Ethernet |
| RS-232C printer settings | Baud rate: 9600; Parity: none; Stop bit: 1; Data bits: 8 |
| Environmental conditions (EN 61010) | indoor use only |
| Ambient temperature | 5 °C to 35 °C (41 °F to 95 °F) permissible operating temperature |
| Air humidity | 10 % to 90 % relative humidity, non-condensing ^b |
| Altitude | max. 3000 m (9800 ft) |

| | |
|----------------------------------|---|
| Operating pressure sample | max. 10 bar (145 psi) absolute pressure |
| Pressure drying air | max. 0.1 bar (1.45 psi) relative pressure |
| Pollution degree | 2 |
| Overvoltage category | II for the supplied AC adapter |
| Power supply | instrument: DC 24 V, 3 A via supplied power supply: 100 to 240 V~, 47 to 63 Hz, fluctuation $\pm 10\%$, 1.5 A |
| Power consumption | 72 W |
| Dimensions (L x W x H) | 375 mm x 265 mm x 180 mm (14.8 in x 10.4 in x 7.1 in) |
| Weight | 13.5 kg (29.8 lbs) |

^a USB memory devices have to be formatted with FAT32 or exFAT file system

^b Drying the measuring cell is mandatory when humidity is condensing

Appendix A.3 Wetted parts and housing surface materials

The following materials are in contact with samples and the cleaning liquids:

Instrument

| Material | Part |
|--------------------------------|----------------------------|
| Borosilicate glass | density measuring cell |
| PTFE (polytetrafluoroethylene) | filling adapter and O-ring |

Standard accessories

| Material | Part |
|----------------------------------|---|
| HDPE (high-density polyethylene) | waste vessel |
| Polypropylene / polyethylene | syringe |
| PTFE (polytetrafluoroethylene) | adapters, Luer plug, filling hose, waste hose |
| Tefzel | adapter Luer ¼" UNF |

Optional filling funnel

| Material | Part |
|--------------------------------|--------|
| PTFE (polytetrafluoroethylene) | hoses |
| Steel 1.4301 | funnel |

Instrument housing surface materials

| | |
|------------------|--|
| Housing | Crastin S600F40 NC010 (colored) |
| Touchscreen | glass, chemically hardened |
| Rubber cover | HNBR (hydrogenated nitrile butadiene rubber) |
| Protection plate | steel 1.4301 |

Appendix B Declaration of conformity

DocuSign Envelope ID: 3A5B6202-5948-421C-A0BB-17EB823B04F7

EU Declaration of Conformity (original)



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

Product designation: **DMA 502**
DMA 1002

Model: **DMA 502**
DMA 1002

Material number: 325846, 326145

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

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

Applied harmonised standard:

- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019
- EN IEC 61010-2-010:2020

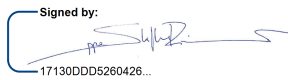
Electromagnetic Compatibility (2014/30/EU, OJ L 96/79 of 29.3.2014)

Applied harmonised standard:

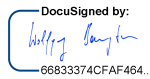
- EN 61326-1:2013

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

Place and date of issue: Graz, 28. May. 2025

Signed by:

17130DD05260426...

Steffen Riemer
Executive Director
Business Unit Measurement

DocuSigned by:

66833374CFAF464...

Dr. Wolfgang Baumgartner
Head of Lab Density and Concentration
Business Unit Measurement

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