Anton Paar

Instruction Manual and Safety Information

DMA 1002 Petro

Density Meter

Find out more

www.anton-paar.com

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Table of contents

1 Safety instructions

1.1 General safety instructions

General

- The present manual is termed "Instruction Manual and Safety Information" (IMSI). It is designed as a quick guide providing you with the most important information regarding the safe installation and use of the product. 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.
- The proper function of the instrument's protective devices is only guaranteed when operated correctly within the specified scope of applications.

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.

Installation

- Install the product so that you can easily separate it from the electrical supply (pull the power plug) at any time.
- Never use the product outside the specified ambient conditions and specifications.
- Use only accessories, consumables, or spare parts supplied or approved by Anton Paar.
- Do not expose the product to direct sunlight for extended periods of time.

Using the product

- Ensure that all operators have been trained beforehand to use the product safely and correctly.
- 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 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.

Operator's skills

- All personnel involved in the operation and/or maintenance of the product must be qualified or properly instructed in its use.
- Operators must be able to read and understand the instructions within the manual.
- It is the owner's responsibility that all operators are sufficiently trained in the correct and safe use of the product.
- Operators must be able to judge dangerous situations and take the right measures to prevent accidents, injury and damage.
- Operators must have knowledge of chemistry and its rules.

Precautions for flammable samples and cleaning agents

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the product.
- Store only the minimum required amount of sample, cleaning liquids, and other hazardous materials near the product.
- Place the product and all samples in a fume hood of adequate capacity.

- 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.

Battery handling

- The product is supplied without a battery. The product can be operated with a rechargeable battery of the types listed in Appendix A [▶ 35].
- Do not use any other battery than recommended by Anton Paar GmbH.
- If the product is not to be used for a longer period, remove the batteries from the battery compartment.
- Never short-circuit or open batteries.
- Do not expose batteries to heat or throw them into fire.
- Do not charge non-rechargeable batteries. There is a risk of explosion.

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. Contact your Anton Paar representative for further questions.

1.2 Special safety instructions

- Do not use the product to measure fluids of the IIC group according to EN 60079-14 such as e.g. carbon disulfide or acetylene.
- Do not use the product to measure fluids above temperature class T3 according to ATEX Directive 2014/34/EU such as e.g. diethyl ether.
- Compressed dry air for drying the measuring cell must be dry, free of oil and particles. The pressure must be limited to a maximum value of 200 kPa (=2 bar =29 psi).

1.3 Safety signs on the instrument

NOTICE

It is imperative that the warning signs remain clearly legible.

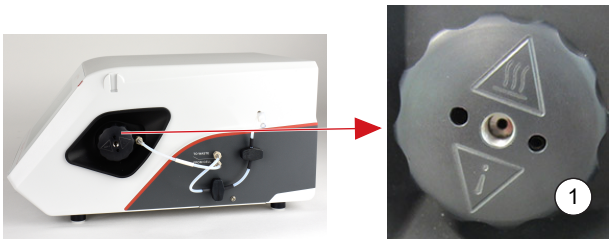

Fig. 1: *Warning signs on measuring cell lock*

1 Measuring cell lock

CAUTION

Hot surface, risk of injury

This sign calls attention to the fact that the measuring cell lock can get very hot.

a) Do not touch the measuring cell lock and the sample inlet/outlet without adequate protective measures (gloves) or make sure the measuring cell temperature is lower than 60 °C (140 °F) before touching these parts.

b) Do not remove the measuring rotor if the measuring cell temperature is not between 15 °C (59 °F) and 50 °C (122 °F).

CAUTION

Splashing of liquid, risk of injury

This sign refers to rinsing the measuring cell lock. It calls attention to the fact that liquid could suddenly splash out of the measuring cell lock if you apply force and pressure builds up during the rinsing procedure. The liquid could be hot.

a) Do not proceed with the rinsing when feeling resistance.

b) Always wear protective equipment.

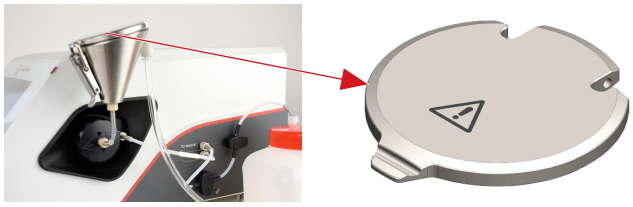

Fig. 2: *Warning sign on Simple Fill funnel*

CAUTION

Splashing of liquid, risk of injury
Risk of squeezing

This sign refers to the funnel cover of DMA 1002 Petro . It calls attention to the fact that liquid could suddenly splash out if you open the funnel cover while the air pump is running. The liquid could be hot.

a) Close the funnel after filling liquid.
b) Keep your fingers clear of the funnel when you close the cover.
c) Do not open the funnel during measurement or automatic cleaning.
d) Always wear protective equipment.

CAUTION

Wear safety gloves

CAUTION

Wear safety goggles

1.4 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.

CAUTION

Hot surface

This sign calls attention to the fact that the respective **surface can get very hot**. Do not touch this surface without adequate protective measures.

Wear safety gloves

Wear protective gloves when handling the product.

Wear safety goggles

Wear safety goggles when handling the product.

2 An overview

DMA 1002 Petro conforms to ASTM Standard D4052 and ISO 12185 .

Find all standards referencing the instrument listed on the Anton Paar home page.

– DMA 1002 Petro is designed for automatically filling single samples into the measuring cell and supports automatic cleaning. It does not support the use of a sample list or a sample carousel with vials.

Export measurement data as .csv file and .pdf report to a USB memory device, or print results to a label printer (Section 4.3.1 [▶ 13]).

The instrument supports the use of the digital lab execution software AP Connect. For more information, please refer to the AP Connect documentation.

Refer to Section 5.3 [▶ 16] for connecting the instrument to AP Connect.

Free download of documentation and software

Find useful documents (certificates, instruction manuals in other languages but English, ...) and the free data collecting software V-Collect (Section 4.3.2 [▶ 13]) in the free of charge webpack:

https://www.anton-paar.com/dma1002petro-webpack

Fig. 3: *QR code DMA 1002 Petro webpack*

2.1 Intended use of the instrument

DMA 1002 Petro is intended for determining density at a selectable measuring temperature.

Select the measuring temperature from a range of 15 °C to 100 °C (59 °F to 212 °F).

The instrument is intended to measure mainly oily samples within the specified measuring range (refer to Appendix A [▶ 35]).

The measuring principle is described in the *SVM Series Reference Guide*.

The below list names suitable sample types:

– standard and base oils

- fresh and used lubrication oils, e.g. engine crankcase oil, gear oil, ATF...
- other oils, e.g. mineral oil, white oil, conservating oil, heat transfer oil...
- hydraulic liquids, e.g. hydraulic oils, brake fluids
- edible oils, vegetable oils
- fuels (e.g. diesel fuel, biodiesel, marine/bunker fuels, ...)
- pure hydrocarbon solvents and mixtures (e.g. naphtha, toluene, hexane...)
- heavy heating oils, crude oils (treated), vacuum distillates with high viscosity at elevated temperatures.
- others: glycol (e.g. antifreeze), glycerin,...

2.2 Functional components

Right side

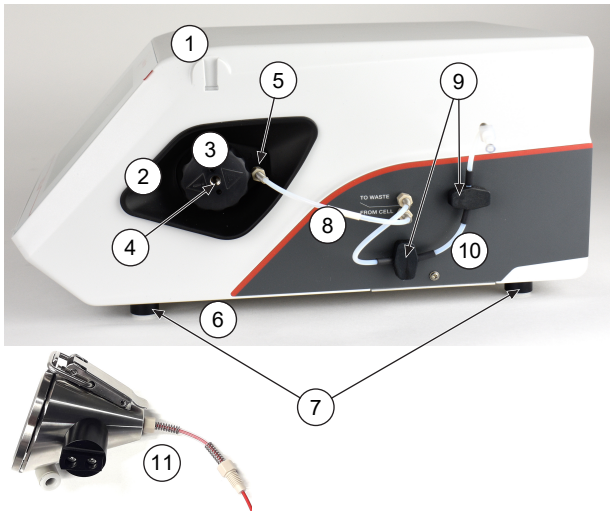

Fig. 4: *DMA 1002 Petro right side*

1 *Funnel lock*
2 *Splash guard*
3 *Measuring cell lock (turn counter-clockwise to open)*
4 *Sample inlet*
5 *Sample outlet*
6 *Venting openings in base plate*
7 *Anti-slip rubber feet*
8 *Hose from cell to valve*
9 *Caps covering optical liquid sensors*
10 *Sensor hose from valve to waste*
11 *Funnel with funnel hose and holder*

Front side

Fig. 5: *DMA 1002 Simple Fill front side*

1 *Home button (not active during measurement)*
2 *Touch screen (scroll content with your fingers)*
3 *Carrying ledge front*
4 *Protective foil (grip tab)*

Rear side

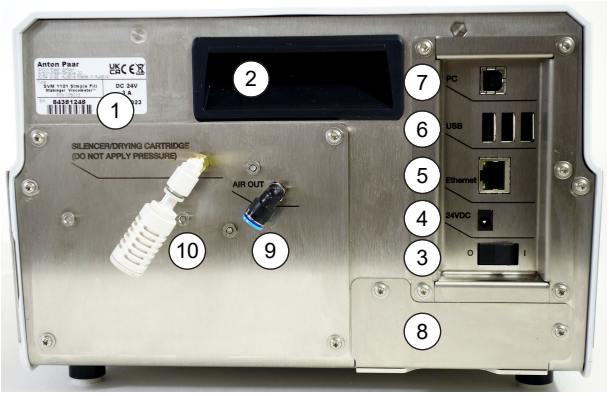

Fig. 6: *DMA 1002 Petro rear side*

1 *Type plate with serial number*
2 *Carrying ledge rear*
3 *Power switch*
4 *Power supply socket*
5 *Ethernet interface (RJ45 connector) - AP Connect*
6 *3x USB interface (type A) - USB memory device, label printer*
7 *PC interface (USB type B) - V-Collect*
8 *Cover plate of slot for optional rechargeable battery*
9 *Air hose connector "AIR OUT"*
10 *Silencer for air pump*

3 Supplied parts

The product was tested and packed carefully before shipment. However, damage may occur during transport.

- Keep the packaging material (box, foam piece, transport protection) for possible returns and further questions from the transport and insurance company.
- Check the delivery for completeness by comparing the supplied parts to those noted in the table(s) below.
- If a part is missing, contact your Anton Paar representative.
- If a part is damaged, contact the transport company and your Anton Paar representative.

Table 1: Supplied parts

	Qty.	Description	Mat. No.
	1	DMA 1002 Petro	105014
	1	Power supply unit with connection cable to instrument	186547
	1	Power cable (type depends on regional mains supply) – 2.5 m with EU plug – 2.5 m with UK plug – 2 m with US plug *Ask your Anton Paar representative for other power cables*	 52112 61865 52656
	1	USB 2.0 cable	94228
	1	Waste bottle SVM	17822
	1	Instruction Manual and Safety Information (English)	
	1	Funnel	
	1	Hose 81x3x2 PTFE 2x1.4”-28 UNF *This hose is delivered mounted on the funnel*	244404
	1	Hose 4x6 Polyurethane transparent L=0.48 m	15271
	1	Silencer for air pump *The silencer is supplied connected to the rear side of the instrument.*	244442

	Qty.	Description	Mat. No.
	1	**Accessory kit containing:**	244899
	2	Male Luer plug	63865
	8	Disposable syringe 5 mL Luer *To be ordered in packages of 100 pieces*	6772
	2	Disposable syringe 20 mL Luer *To be ordered in packages of 100 pieces*	21656
	1	Cleaning brush D=5 mm	5255
	1	Cleaning brush D=7 mm	5256
	1	Cleaning brush 175x25x2.7 *To be ordered in packages of 5 pieces*	98658
	20	Q-tips (extra-long) *To be ordered in packages of 100 pieces*	7445
	1	Puller for rotor bearings SVM	11153
	2	Adapter Luer Lock 1/4"-28 UNF PEEK	104768
	2	Hose 155x3x2 FEP 2x1/4"-28 UNF	164790
	2	Hose 250x3x2 FEP 2x1/4"-28 UNF "BB"	17814
	1	Hose 81x3x2 PTFE 2x1/4"-28 UNF *Spare hose for funnel of SVM 1001 Simple Fill*	244404
	1	Glass syringe 5 mL Luer Lock	14240
	5	Reducer Luer female / Record male *To be ordered in packages of 10 pieces*	180403

4 Installing the instrument

4.1 Environmental requirements

The setup location and surroundings should meet the requirements of a typical laboratory.

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

Place the instrument on a stable, flat lab desk.

To ensure temperature stability and trouble-free measurement never locate your 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 1.1 [▶ 5].

Find all technical data required for installation in Appendix A [▶ 35].

WARNING

Risk of injury or death

Using hazardous or flammable chemicals as samples or cleaning liquids could lead to damage of the instrument and cause serious injuries unless special precautions are taken.

a) Observe the safety instructions in the section "Precautions for highly inflammable samples and cleaning agents" in the safety instructions.

NOTICE

Risk of erroneous results

High humidity or a measuring temperature that is significantly below the ambient temperature may lead to condensation within the measuring cell. To avoid condensation:

a) Use a drying cartridge for DMA 1002 Petro .

b) Use dry air or technical nitrogen for drying if not using *Simple Fill* mode.

4.2 Installation

	Description	Refer to
1	**Place** the instrument on a bench in an appropriate environment.	Section 4.1 [▶ 11]
2	*DMA 1002 Petro*: Mount the **funnel**, the **hoses** and connect the **waste vessel**.	Section 4.2.1 [▶ 11]
3	Connect **optional equipment** (e. g. PC with V-Collect) to the corresponding interfaces.	Section 4.3 [▶ 13]
4	Connect the instrument to the **power supply** and **switch** it **on**.	Section 4.2.2 [▶ 12] Section 4.2.3 [▶ 12]
5	Define basic **instrument settings**.	Section 5.2 [▶ 15]

Required supplies

- If not operating DMA 1002 Petro in the *Simple Fill* mode, provide compressed air for drying the measuring cell.
- The air should be free of oil and dust. To avoid condensation at measuring temperatures below ambient, the air should also be dry.

4.2.1 Connecting funnel and hoses – DMA 1002 Petro

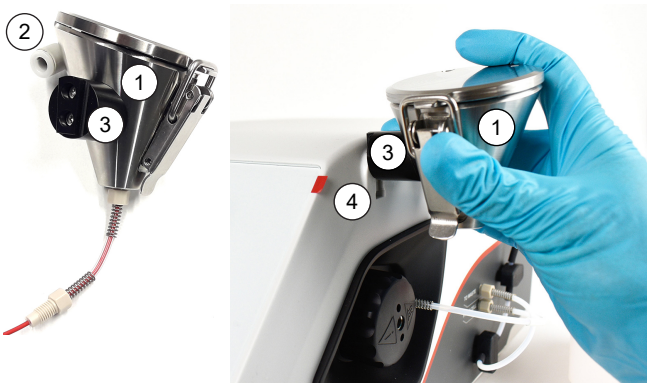

Fig. 7: *Connecting the Simple Fill funnel*

1 Funnel
2 Connector for air hose 4x6 mm
3 Funnel holder
4 Funnel lock

1. Take the funnel plus funnel hose out of its box.
2. Plug one end of the air hose (4x6 mm) into the connector on the funnel.
3. Slide the funnel holder from above into the funnel lock. Push the funnel downwards and make sure that it engages properly with the lock.
4. Guide the free end of the air hose under the instrument to the rear.

5. Plug the air hose into the connector “AIR OUT” on the rear (Fig. 6 [▶ 8]).

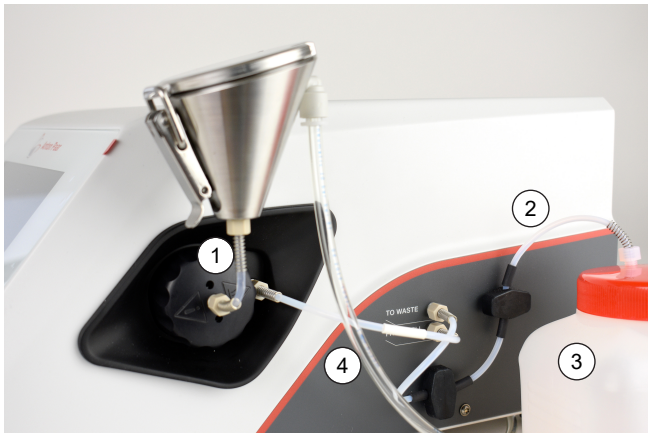

Fig. 8: *Simple Fill hose connections*

1 Funnel hose 81x3x2 mm
2 Sensor hose
3 Waste bottle
4 Air hose 4x6 mm

6. Connect the funnel hose to the sample inlet:
   a. Pre-bend the hose with your fingers. The red bend protection inside the hose helps to shape the hose without kinking it.

TIP: *Do not kink or sharply bend the hose. Such damages to the hose lead to the formation of bubbles and to unstable measuring results.*

   a. Screw the free end of the hose into the sample inlet.
   b. Tighten the hose connectors with your fingers.
7. Open the funnel cover and pull the red bend protection out of the funnel hose.

Fig. 9: *Removing the bend protection of the funnel hose*

1 Funnel
2 Bend protection of funnel hose

The hose from the sample outlet and the sensor hose are already connected to the instrument.

8. Fix the free end of the sensor hose to the waste bottle. Attach the hose connector to one of the three holes in the lid.

4.2.2 Connecting the power supply

WARNING

Risk of electric shock or fire

– Connect the device only to an electric outlet with protective earthing.
– Never connect the device to the AC power supply with protective separation or protective insulation.
– Ensure that the non-fused earth conductor of the power cable is connected to earth.
– Ensure that the current rating of the power cable is at least 10 A.

1. Plug the cable of the power supply into the power socket of the instrument.
2. Connect the power supply to the mains supply by the supplied power cable. The LED on the power supply lights up.

4.2.3 Switching on/off

NOTICE

Risk of damage to the instrument

Before switching the instrument on, make sure that the correct line voltage and line frequency are available (AC 100 V to 240 V, 50/60 Hz). If large voltage fluctuations are to be expected, we recommend using a constant voltage source (UPS).

1. Switch the instrument on using the power switch on the rear of the instrument. The touch screen lights up.
2. Wait for the temperature to stabilize.

TIP: *Switch the instrument off over night or if not in use for several days. This saves energy and avoids premature wear of the bearings.*

NOTICE

Risk of premature wear or corrosion

Do not let the instrument stand for long periods of time while the measuring cell temperature is:

– very high (approx. 100 °C / 212 °F)
– below ambient (< 20 °C / 68 °F).

Constantly high temperatures cause premature wear of the peltier elements and motor parts.

Constantly low temperatures cause condensation and corrosion of parts.

– Switch the instrument off with the power switch.
– Disconnect the power supply from the mains if deactivating the instrument for more than a few days.

4.3 Installing additional components

4.3.1 Printer

For printout of measurement results, Anton Paar offers a label printer with the following label size:
90 mm x 29 mm

1. Connect the printer cable to the printer.
2. Plug the printer cable into the USB interface of the instrument.
3. Connect the printer to the mains. Follow the safety and operating instructions of the printer's documentation.

The instrument prints automatically when a measurement is finished. Printout of measurements is also possible from the *data explorer*.

4.3.2 V-Collect software

It is possible to connect the instrument to a PC with USB interface and export the measurement results directly to MS Excel via V-Collect Software.

1. Plug the supplied USB cable into the PC interface of the instrument and connect it to the PC.
2. Install V-Collect Software (macro-based MS Excel Add-in). You need administrator rights on the PC in question.

Always use the latest version of V-Collect.

Download V-Collect Software here:

https://www.anton-paar.com/dma1002petro-webpack

Find a QR code to the webpack in Section 2 [▸ 7].

PC Software Requirements:

- Windows 7 or newer
- Microsoft Excel 2010 or newer

Find instructions how to install and operate V-Collect Software in the download package.

4.3.3 Drying cartridge (Simple Fill only)

Use the drying cartridge (Mat. No. 65085) for measurements at temperatures below the dew point. The drying cartridge is for use in Simple Fill mode only.

- The dew point depends on ambient temperature and air humidity.
- Below the dew point condensation occurs in the measuring cell.
- Condensation causes unstable and unreliable measuring values.
- The drying cartridge ensures that the air for the internal air pump is dry.

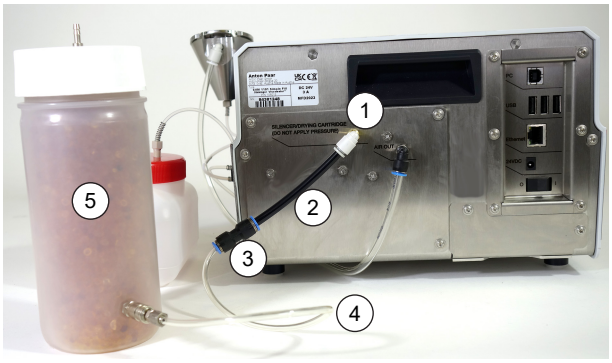

***Fig. 10:** Connecting the optional drying cartridge*

1 Connector for drying cartridge
2 Hose 4x6 black (Mat. No. 26936)
3 Hose connector (Mat. No. 17862)
4 Hose 2.5x4 PUR transparent (Mat. No. 15272)
5 Drying cartridge

1. Unplug the silencer from connector (1).
2. Connect the hose 2.5x4 to the drying cartridge.
3. Connect the hose connector with hose 4x6 to the hose 2.5x4.
4. Plug the hose 4x6 into connector (1).
5. Remove the black protection cap from the nozzle on the cover of the drying cartridge.

NOTICE

Risk of malfunction of the air pump

- Do not apply pressure to the air pump!
- Do not connect a direct dry air feed instead of the drying cartridge! The internal air pump does not work under pressure!

Drying agent

The drying cartridge contains a beaded indicator gel (silica gel).

- When active, the indicator gel is orange.
- If it has absorbed liquid, the color turns green.

Moist indicator gel can be regenerated:

CAUTION

Health risk in case of exposure

- Use personal protection (protective gloves, safety glasses) when handling silica gel.
- Do not inhale!
- Do not dispose of via sewage system or as domestic waste! Store the gel in a cool, dry place in tightly closed containers.

- Pour the gel into a glass bowl and blow hot, dry air through it for approx. 5 hours.
- Alternatively, place the gel in a laboratory oven for a few hours (or overnight).

NOTICE

Risk of damaging the indicator gel

Do not use higher drying temperatures than130 °C / 266 °F. Higher temperatures destruct the indicator function of the gel.

If dry air is available:

- Blow dry air continuously through the drying cartridge to keep the indicator gel active. Connect the dry air feed via a T-plug connector.
- Max. input pressure: 0.5 bar / 7 psi
- Do not connect the dry air feed to the nozzle on the cover of the drying cartridge!

Setup A in the following figure is correct. The pump is put under pressure in the incorrect setups B and C.

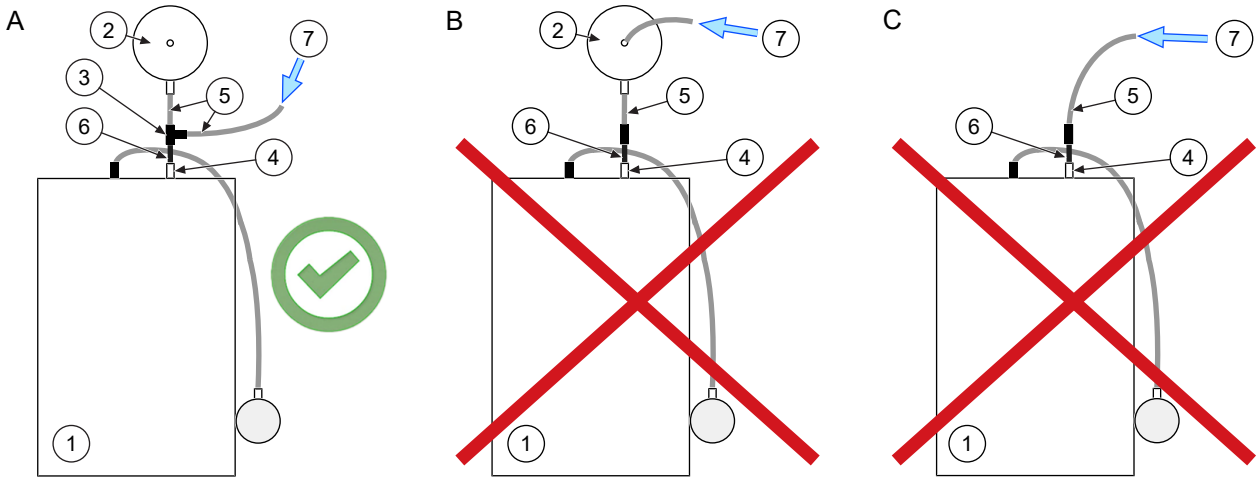

Fig. 11: *How to use external dry air with the drying cartridge*

1 *Instrument*
2 *Drying cartridge*
3 *T-plug connector (Mat. No, 17756)*
4 *Connector for silencer/drying cartridge*
5 *Hose 2.5x4 PUR*
6 *Hose 4x6 black*
7 *Dry air feed (0.5 bar / 7 psi)*

5 Operation

5.1 Operating the instrument

The home screen

After switching on and initializing, the home screen comes up.

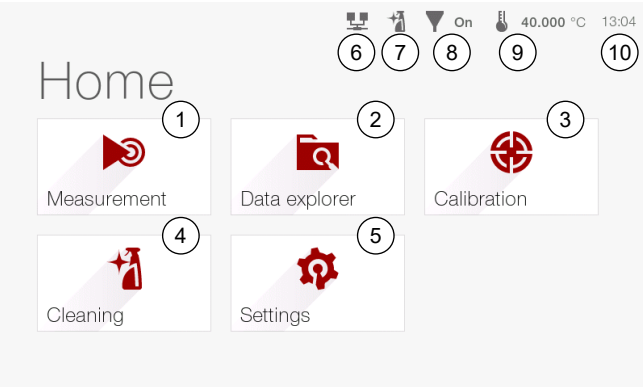

Fig. 12: *Home screen*

1 *Start measurement*
2 *Measured and calibration data*
3 *Calibrate the instrument*
4 *Cleaning wizard*
5 *Instrument settings (Section 5.2 [▸ 15])*
6 *Ethernet connection – the icon is displayed only if Ethernet is active (Section 5.3 [▸ 16])*
7 *Cleaning indicator*
8 *Filling mode (Simple Fill only – refer to Section 5.4 [▸ 16])*
9 *Cell temperature*
10 *Time display*

With the *Home* button, you always return to the home screen, except during measurements.

Tap on the icons on top to view the respective information as overlay on the screen. Tap on any other screen area to close the overlay.

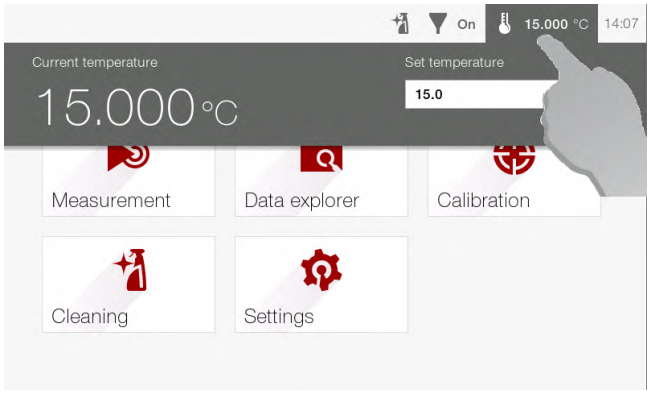

Fig. 13: *Overlay view: temperature*

The operating screen

The operating screen depends on the action you perform on the instrument. Example:

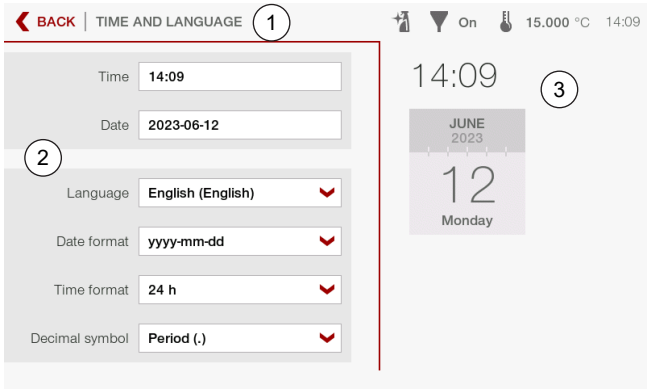

Fig. 14: *Example operating screen: Time and language*

1 Header: go BACK | current view
2 Input area
3 Information area

The **header** displays the currently open view and a field which takes you ❮*BACK* to the previous level.

The **input area** contains input fields which either use drop-down lists or a virtual keyboard.

Virtual keyboard:

Confirm entries with the ✔ key.

Discard entries with the ☒ key.

The **information area** optionally shows information or instructions relevant for the current view.

If content in windows, wizards or pop-up messages is not fully visible, scroll the area up- or downwards.

5.2 First steps

1. Perform the following settings:
   – Time and language
   – Global units
   – Ethernet connection (if applicable)
2. Rinse and dry the measuring cell before performing measurements for the first time. Refer to Section 9.2 [▸ 23].

The instrument is factory-adjusted for the entire temperature and measuring range.

3. If you need to check the validity of the factory adjustment, perform a calibration with a certified reference material.
   Refer to Section 6 [▸ 16].

Time and language

1. Tap ⚙ *Settings* on the home screen.
2. Select *Time and language*.
3. Perform the following settings:
   – Time and date
   – Language (English is default)
   – Date format and time format
   – Decimal symbol (period or comma)
4. To change an entry, tap on the field.

Global units

1. Tap ⚙ *Settings* on the home screen.
2. Select *Global units*.
3. Set units for the following quantities and select the reported quantity:
   – Temperature (°C, °F)
   – Density (g/cm³, kg/m³)
   – Alternative density (refer to Section 5.2.1 [▸ 15])
4. To change an entry, tap on the field. Select an item from the drop-down list.

5.2.1 API parameters (Alternative density)

One calculated API (American Petroleum Institute) parameter can be shown on the measurement result screen. If a label printer is connected, the alternative density is also printed.

Select this parameter in the *Alternative density* field of the *Global units* settings.

Available parameters:

– Specific gravity (T/60 °F), no unit - specific gravity calculated by dividing the density at the measuring temperature T by the density of water at 60 °F
– Specific Gravity (T/T), no unit - specific gravity calculated by dividing the density at the measuring temperature T by the density of water at temperature T (*refer to the below formula*).
– API Density 15 °C / 20 °C / 29.5 °C / 60 °F, unit same as measured density
– API Specific Gravity 15 °C / 20 °C / 29.5 °C / 60 °F, no unit
– API Gravity 15 °C / 20 °C / 29.5 °C / 60 °F, no unit

Depending on the sample type, select the correct API product group for the calculation in the measurement settings (Section 7.1.3 [▸ 18]).

Formula for the calculation of the density of water by Spieweck/Bettin (valid for an ambient pressure of 1013.25 hPa; covers temperature range from 0 °C to 100 °C):

$$\rho(t) = \frac{\sum_{n=0}^{5} a_n \cdot t^n}{1 + b \cdot t}$$

ρ	*density*
t	*temperature*
a_0 =	*9.998 395 2 x 10² kg/m³*
a_1 =	*1.695 257 7 x 10¹ °C⁻¹kg/m³*
a_2 =	*–7.990 512 7 x 10⁻³ °C⁻²kg/m³*
a_3 =	*–4.624 175 7 x 10⁻⁵ °C⁻³kg/m³*
a_4 =	*1.058 460 1 x 10⁻⁷ °C⁻⁴kg/m³*
a_5 =	*–2.810 300 6 x 10⁻¹⁰ °C⁻⁵kg/m³*
b =	*1.688 723 6 x 10⁻² °C⁻¹*

Find more information on API calculations in the *SVM Series Reference Guide*.

5.3 Ethernet - Optional laboratory software AP Connect

Ethernet – Optional laboratory software AP Connect

Refer also to the AP Connect Reference Guide. You need administrator rights in your network to install AP Connect and establish communication. The listening port is TCP 50553.

1. Connect a crossover Ethernet cable (Mat. No. 18597) to the Ethernet interface on the rear side of the instrument. Connect the free end of the cable to your network.
2. Tap *Settings* on the home screen.
3. Select *Ethernet*.
4. Activate *Ethernet* and *Automatic configuration*.
5. The instrument informs you when it is connected and displays the IP and the MAC-address on the right hand side.
6. Start AP Connect and add the instrument by entering the IP address.

AP Connect shows all calibration and measured data of the instrument. Data include the used settings. If calibration corrections are active during a measurement, this can be traced via a unique calibration ID.

5.4 Simple Fill settings

By default, the Simple Fill mode (automated filling using the funnel) is activated on DMA 1002 Petro . Alternatively, it is possible to deactivate the Simple Fill mode: in this case, connect the hoses for filling and cleaning using a syringe.

Setting the filling mode

1. Tap *Settings* on the home screen.
2. Select *Simple Fill settings*.
3. Tap on the switch to change the filling mode:
   – Simple Fill **On** / icon:
   – Simple Fill **Off** / icon:

A note on the right and instructions remind you to modify the hose connections accordingly.

Setup for syringe filling

1. Disconnect the funnel hose from the measuring cell lock. Use the puller for rotor bearings if you do not succeed with your fingers.
2. Lift the funnel out of its holder.
3. Screw an adapter UNF (1) into the sample inlet.
4. Disconnect the hose (2) from the connector marked “FROM CELL”. Connect the free hose end to the waste bottle (3), creating a direct connection from sample outlet to waste bottle.

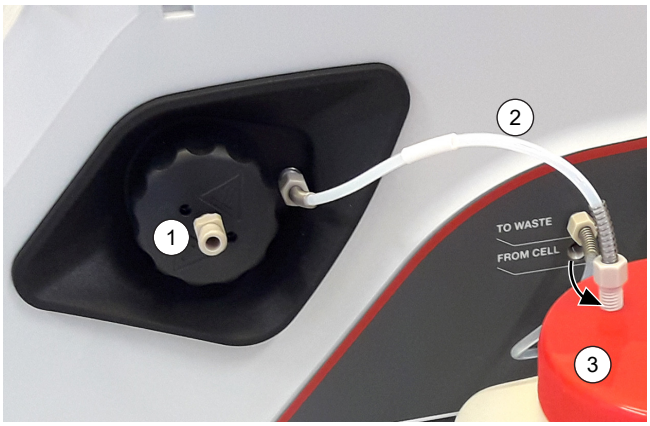

Fig. 15: *Simple Fill - setup for syringe filling*

1	*Adapter UNF in sample inlet*
2	*Hose from sample outlet to waste*
3	*Waste bottle*

6 Checking, adjusting and calibrating

By definition, a calibration is a check measurement that does not change the instrument’s constants. However, the instrument allows the correction of potential density deviations at the end of a calibration. This is called "calibration correction".

– Only one correction can be active.
– If a newer calibration correction is applied, it replaces (overwrites) the existing calibration correction point.
– Replaced calibration correction points are stored in the calibration data, but do no longer influence future measurements.

TIP: *Calibration corrections are only valid for measurements and do not affect calibrations. A calibration always checks the state of the instrument without calibration corrections.To verify corrections, measure the reference substance used for calibration at the same temperature and compare the result to the reference value.*

6.1 Density calibration

TIP: *ASTM D4052 recommends to perform a density calibration at least once a week, when results are suspicious, and after the initial installation of the instrument.*

Validity of calibration correction

A density calibration correction is effective for the entire temperature and density measuring range. The calibration is always performed with air and a density reference standard. The calibration data show the density correction factor and density correction offset.

Required equipment

- Reference standard liquid with density values at the required temperature and in the required density range.
- If not using Simple Fill mode: 5 mL syringe

Density calibration procedure

Tap *Calibration*.

- In the column *Density calibration*, tap *CALIBRATE*. A wizard guides you through the calibration.
- Confirm completed steps with *CONTINUE*.

The cell temperature and density are visible on the right.

1. Step 1: Enter the reference standard settings.
   - Calibration temperature
   - Relative air humidity at site
   - Reference standard name
   - Density reference value
   - Reference standard batch number
   - Expiration date of reference standard
2. Step 2: Enter the calibration settings.
   - Maximally allowed deviation of the measured density value to the reference value.

   This value is entered in the set density unit. The deviation is based on the reference standard's uncertainty (stated on the certificate), the measuring uncertainty of the instrument (reproducibility), and the user influence.
   - Temperature equilibration time (refer to Section 7.1.2 [▶ 18])
3. Step 3: Fill the cell and tap *MEASURE* to start the calibration measurement.
4. Step 4: Ongoing measurement.
   - A progress bar and messages provide information.
   - When the measurement is completed, the instrument prompts you to start the cleaning procedure.

Calibration completed

The screen displays the following parameters in the calibration result window.

- Calibration status
- Reference values of air and liquid
- Deviations to reference values

A red button recommends the next action.

- *Apply:* The deviation to the reference value exceeds the maximally allowed deviation. *Apply* corrects the deviation. The correction is used for future measurements.
- *Save*: The deviation to the reference value is smaller than the maximally allowed deviation. There is no need for a correction.
- *Reject*: Calibration failed, the measurement did not become valid or the deviation exceeds ±0.01 g/cm³ (±10 kg/m³). Check whether you entered the correct reference value.

View the calibration data in Section 6.2 [▶ 17].

6.2 Calibration data

1. Tap *Data explorer*.
2. Select *Density calibration*.

All stored calibrations of the selected type are listed.

- A calibration with applied correction appears at the top of the list and is marked by a check.
- Calibrations saved without correction show the *Save* icon.

Tap on a calibration to view it in detail. Scroll down to view all data.

Options:

- *Export* data (as .csv file). Connect a USB memory device before starting export.
- *Delete* data.

7 Measurement settings

Tap *Measurement*. The measurement screen comes up.

Measurement settings

Use the toggle buttons to define which measurement settings you access directly on the measurement screen and which you access in the *Measurement settings*.

7.1 Available measurement settings

Temperature settings

Enter the measuring temperature.

Mode settings

- D4052 compliant – measure conforming to ASTM D4052 (default setting)
- Quick mode – for fast measurement not conforming to standards

To obtain valid results, the stability criteria defined for each mode must be fulfilled. Refer to Appendix A [▸ 35].

D4052 density measurement settings

- *Prewetting* (Section 7.1.1 [▸ 18])
- *Equilibration time* (Section 7.1.2 [▸ 18])
- *API product group* (Section 7.1.3 [▸ 18])
- *FillingCheck threshold* (Section 7.1.4 [▸ 18])

Funnel settings

Funnel settings are available only if the Simple Fill mode is active.

- Activate (or deactivate) cleaning after measurement: DMA 1002 Petro drains the sample from the measuring cell, cleans and dries.
- Set a *soak time*.

  For the duration, the solvent remains in the measuring cell to dissolve sample residues. The soak time depends on the type of sample. Clean, low viscosity samples (e. g. diesel fuel) do not need any soak time. The more highly viscous and the dirtier a sample is, the longer the soak time should be. Determine the suitable soak time for a sample experimentally.

  If the soak time exceeds 10 s, the measuring tube turns at measuring speed for a better cleaning effect.
- Set a *drying time*. The built-in air pump blows the measuring cell dry.

  Recommended: at least 120 s.
- Set the number of cleaning cycles.

  The instrument performs draining and soaking for every cycle. Fill fresh solvent into the funnel when prompted. The built-in air pump dries the cell after the last cleaning cycle.

Refer to Section 9.2.4 [▸ 25] if the cleaning indicator is still yellow after drying.

7.1.1 *Prewetting*

- Activate or deactivate *prewetting* with the toggle switch.

Reproducibility and precision of results are better if the sample liquid is in good contact with the surface of the viscosity measuring cell.

If prewetting is on, the instrument starts the motor of the viscosity cell before starting the actual measurement. The sample moves around in the measuring tube. The movement also dissolves potential residues of the last sample.

After prewetting,

- DMA 1002 Petro automatically refills sample. If the *Simple Fill* mode is deactivated, the instrument prompts you to refill 1 mL of sample.

7.1.2 *Equilibration time*

This is an optional, additional time which allows the sample to achieve better temperature equilibration. It should be used for samples which are **not sufficiently homogeneous** or have a **higher viscosity**.

Its countdown begins when the cell temperature has become stable and is within ±0.05 °C (±0.1 °F) of the set temperature. The motor runs at measuring speed during the equilibration time. Measurement starts when the equilibration time has passed.

You can use *equilibration time* for samples of a viscosity from approx. 300 mPa·s on.

If measurements do not become valid (error "bad filling value"), *equilibration time* can solve the issue.

TIP: *Samples where an equilibration time can improve the results are highly formulated oils (with polymeric additives) or plant-based oils.*

7.1.3 API Settings

The API (American Petroleum Institute) specifies three *API product groups* for calculating API density parameters:

- *Crude oil* – e.g. light crudes to heavy crudes
- *Refined products* – e.g. heavy fuel oils, diesel fuel, jet fuel
- *Lubricating oil* – e.g. engine oils, gear oils

Alternatively, you can select product group *Special*, where you need to enter a customized *API alpha factor*. Determine this alpha factor for the special sample group according to the API Manual of Petroleum Measurement Standards.

If no group is selected, only the Specific Gravity can be calculated. This calculation is not group-specific.

Show API parameters

One API parameter can be can be shown on the measurement result screen. Refer to Section 5.2.1 [▸ 15]. This section lists all API parameters available in the instrument.

You can display all the API parameters you want in the *data explorer* (refer to Section 8.4 [▸ 21]).

7.1.4 *FillingCheck threshold*

The filling check monitors the filling quality of the density cell. It gives no data of the viscosity cell.

- Measurement does not become valid if a calculated check value exceeds this threshold.
- The lower the threshold is, the less the check value may deviate from an expected ideal value.
- The threshold can be a value between 1 and 9.9. The default value is 3. This value is recommended for measurements according to ASTM D4052, as it suits most sample types.

Find more information on the FillingCheck™ in the *SVM Series Reference Guide*.

8 Performing a measurement

To perform a measurement according to D4052 , refer to the below table. The listed sub-sections give more information on each step (sample preparation, filling, measuring, ...).

Table 2: Steps of a typical measurement – Standard Operating Procedure

	Description		Refer to
1	Check that the **measurement system** is properly installed and in good working order, and that all conditions for a good measurement are met. **Simple Fill:** Make sure the selected filling mode corresponds to the hose connections.		Section 4.2 [▶ 11] Section 5.4 [▶ 16]
2	Select *Measurement*.		
3	Enter a sample name. Define the **measurement settings**. (default: mode D4052 compliant, prewetting off, equilibration time 0 s, no API group, FillingCheck threshold 3).		Section 7.1 [▶ 17]
4	**Prepare** your **sample** if required (homogenize, filter, preheat, degas).		Section 8.1 [▶ 19]
5	**Fill** the **sample**. Tap on *MEASURE*.		Section 8.2 [▶ 19] Section 8.3 [▶ 21]
	Prewetting is **on**.	**Prewetting** is **off**.	
6	**Refill** approx. 1 mL **sample**.[a]	↓	
7	The determination is valid.		
8	**Clean and dry** the measuring cell.[a] Check the cleaning indicator: Cell is clean | Repeat the cleaning and/or increase the drying time.		Section 9.2 [▶ 23] Section 7.1 [▶ 17], *Funnel settings*

[a] *Simple Fill mode: The instrument refills and cleans automatically.*

8.1 Sample preparation

Most samples need no special preparation for filling them. Find special sample preparation procedures in the *SVM Series Reference Guide*.

8.2 Sample filling

Requirements

1. Always use clean laboratory equipment and new single-use injection equipment.
2. Take your test specimen preferably from the middle of the sample vessel.
3. Before you fill the measuring cell, check if:
   – the hoses are correctly connected and the hose connections are tight.
   – the measuring cell is clean.
   – the content of the waste container does not react with the sample or cleaning liquid you plan to use.
   – the waste container is not full.
   – suitable cleaning liquids are available (refer to Section 9.2.1 [▶ 24]).

Possible filling procedures

– Filling with cleaning and drying in-between

  This filling routine is suitable for most samples within the instrument's works adjustment range. Between measurements, the cell must be properly cleaned and dried (refer to Section 9.2 [▶ 23]).

– Filling by sample displacement

  This filling routine is only suitable for measuring similar, fully miscible samples of low viscosity. For example, you can fill different batches of diesel fuel by displacement. One sample can be replaced by the next. Use sufficient sample quantities to ensure that no residues of the previous sample remain in the measuring cell. Clean the instrument after each batch of samples or at least at the end of a working shift.

Sample replacement is not possible in *Simple Fill* mode!

NOTICE

Risk of damage and erroneous results

Filling unsuitable samples can cause erroneous measuring results or even damage the instrument or associated equipment.

a) Before filling, check whether the wetted parts are resistant to the sample and cleaning liquids (refer to section “Wetted parts”).

b) Make sure that the sample will not solidify inside the measuring cell and can be removed from it after measurement.

c) Check whether the waste container is resistant to the cleaning liquids used.

TIP: *How to fill critical samples, e.g. volatile, ultra-low or highly viscous samples is described in the SVM Series Reference Guide.*

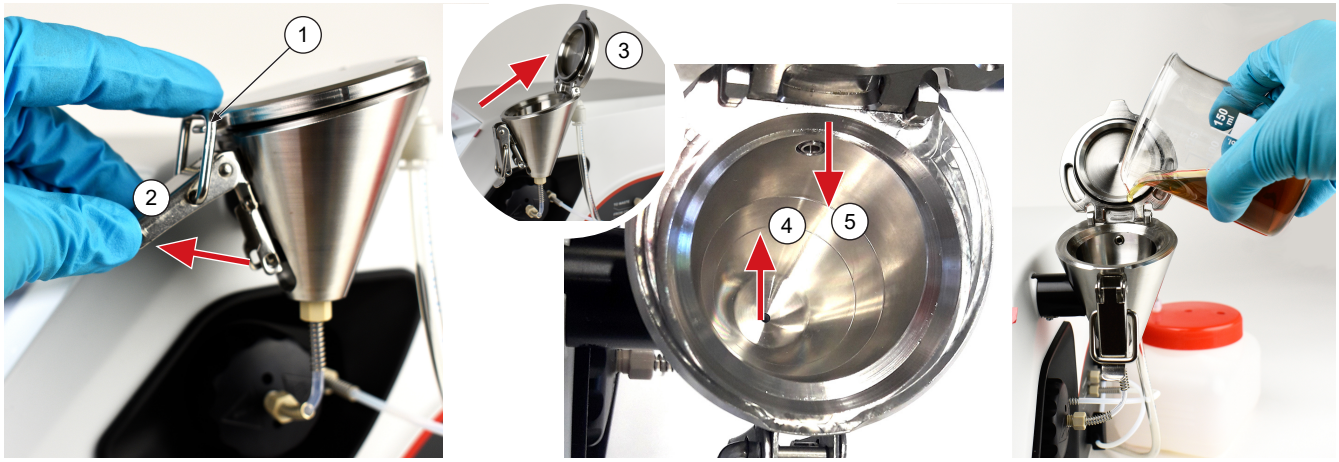

Fig. 16: *Filling the Simple Fill funnel*

1 Bracket
2 Latch
3 Funnel cover
4 Filling mark 5 mL
5 Filling mark 10 mL

4. Proceed with Section 8.3 [▸ 21].

8.2.2 Filling with a syringe

Filling with a syringe is an option for e.g. very low-viscosity samples or if you want to work with sample replacement.

TIP: *Applicable to sample replacement only – if a sufficient quantity of sample is available, use one syringe filled with sample to rinse the measuring cell and another syringe to fill the cell for measurement.*

1. Deactivate the *Simple Fill* mode and modify the hose connections (refer to Section 5.4 [▸ 16]).

TIP: *If you do not deactivate the Simple Fill mode, the pump will cause a timeout message.*

8.2.1 Filling in Simple Fill mode

By default, you fill DMA 1002 Petro via the funnel.

1. To open the clamp lock, push the latch forwards until the bracket comes loose.
2. Open the cover and pour sample into the funnel:
   – Filling volume: Lower filling mark, approx. 5 mL

NOTE: *Do not overfill the funnel. It the sample exceeds the upper (10 mL) mark, the funnel may not be fully drained directly after measurement. How to solve this problem is described in Section 9.2 [▸ 23].*

3. Close the cover. The bracket must engage with the cover.

NOTICE

Risk of erroneous measurement results

Unsuitable syringe materials can dissolve into the sample and lead to a systematic measurement error.

a) Do not use syringes that contain lubricants or rubber seals.

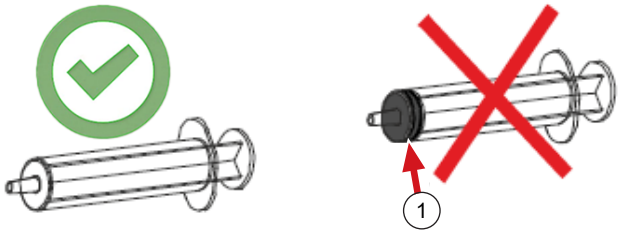

Fig. 17: *Suitable / unsuitable syringe*

1 Rubber sealing

Filling procedure

1. Take a clean new plastic syringe. Recommended volume – not using sample displacement: 5 mL
2. Fill the syringe bubble-free with sample. Pull out the plunger slowly and smoothly. Quick and jerky movement leads to bubble formation.
3. Remove bubbles – if any – from the syringe:

- Turn the syringe around so that the tip points upwards. Bubbles rise to the top. Remove them by carefully pushing the plunger upwards.
- For very small bubbles put the syringe into a vessel.The tip should point downwards. Wait until the bubbles have moved upwards to the plunger and will not be filled into the cell.

NOTICE

Risk of damage to the measuring cell or leakage

The pressure when filling or pressing sample out of the cell must not exceed 500 kPa = 5 bar (72 psi), otherwise sample may leak out at the bearings. This pressure corresponds to a force of approx. 65 N on the plunger of a 5 mL syringe. A too high pressure may also cause damage to the measuring cell. In this case Anton Paar is not liable for damage.

a) Do not exceed 5 bar when filling or draining the cell.

b) Take care especially with highly viscous samples.

c) Do not use special syringes or devices (e.g. screw-driven) to apply extra force.

4. Plug the syringe firmly into the adapter UNF on the measuring cell lock.
5. Push the plunger of the syringe slowly and continuously down.
   - Fill at least 1.5 mL of sample (3 mL for sample displacement).
   - Leave the syringe connected.

Fig. 18: *Filling sideways with a 5 mL syringe*

6. The cell is now filled. Proceed with Section 8.3 [▸ 21].

8.3 Actual measurement procedure

Refer to Section 8 [▸ 19] for the steps of a measurement procedure. After defining the measurement settings fill the sample. Tap on *MEASURE*. The instrument guides you through the procedure.

Depending on the measurement settings,

- the instrument performs a prewetting or not.

The measurement screen shows you the current state of the measurement procedure.

- A red bar at the bottom indicates the progress of the measurement. A text line informs on the current step.
- A picture also informs on the current step.
- The screen shows the sample name, the current temperature, density, and class (refer to the below description).

Stability (class) and mode

- A measurement is valid if the fluctuations of temperature, viscosity, and density over time fulfill predefined stability criteria.

NOTE: *The viscosity stability is verified because viscosity is required for viscosity correction of the density.*

- The stability criteria depend on the selected measurement mode. Refer to Appendix A [▸ 35].
- Viscosity and density stability can reach stability only if also the required stability criterion for temperature is fulfilled.
- At the start of a measurement, no criteria are fulfilled. The instrument's state is *unsteady*.
- The density stability is shown as *class*. The lowest class is *ultrafast*.

DMA 1002 Petro in Simple Fill mode

- The instrument cleans the measuring cell automatically as part of the measurement procedure (*Funnel settings*, refer to Section 7.1 [▸ 17]).
- Messages prompt you when to open or close the funnel and fill cleaning liquid.

Measurement completed

When finished, the screen reads *Measurement completed*.

- The screen shows the final results for temperature, density, and alternative density (if applicable, refer to Section 5.2.1 [▸ 15]).
- View more information by tapping on the button *Show details*.
- Scroll up and down to view all data (sample information, measurement setup, results).
- If a suitable label printer is connected or if using V-Collect, the instrument prints the data as soon as the measurement is finished.
- Tap on *DONE* to return to the home screen.

If using a syringe (Simple Fill deactivated):

Clean the measuring cell (Section 9.2.3 [▸ 25]) or fill the next sample if operating with sample replacement.

Sample replacement is not possible in *Simple Fill* mode!

8.4 Measured data

Find all data in the *data explorer*.

1. Tap *Data explorer* on the home screen.

2. Browse through the measured data.
   – Tap on the desired measurement. The instrument displays all details of the selected measurement.
   – Scroll up and down to view all data (sample information, measurement setup, results).

Options

– *Export* - to USB (as *.csv file* and *.pdf report*). Connect a USB memory device before you start the export.
– *Print* - to optional label printer
– *Delete* - delete data. If you select *Delete*, a message prompts you to confirm your action.
– To export or delete **all stored data**, tap on the respective icon on the right side of the data explorer.
– To export, print (via label printer), or delete **only one measurement**, select this measurement and tap on the respective icon on the left side.

***Report settings*: API parameters**

Refer also to Section 5.2.1 [▶ 15] and Section 7.1.3 [▶ 18].

1. Tap on *Report settings* on the right side of the measured data in the *data explorer*.
2. Select all API parameters to be reported using the toggle switches (On/Off).
3. Close the report settings.
   – Your settings are applied to all measurement data stored in the instrument.
   – The settings are valid for all measurements until you reconfigure them.

Data export via V-Collect includes all available API parameters independent of the report settings.

9 Upkeep and cleaning

9.1 Upkeep and cleaning schedule

Operation	Frequency of (preventive) maintenance work
Rinse and dry the measuring cell (Section 9.2 [▶ 23])	– immediately after each measurement – if the cleaning indicator is yellow – if the instrument was not used for a long period of time
Disassemble the viscosity cell and perform manual cleaning (Section 9.5 [▶ 29])	– once a day to once a month depending on the number of samples and sample type – after measuring hard-to-remove samples – if measuring results are suspicious (e.g. unaccountably increasing or decreasing)
Clean the measuring cell lock (refer to the *SVM Series Reference Guide*)	– if the sample inlet does not move (smoothly) or you cannot feel the resistance of the spring (refer to Section 9.5 [▶ 29]) – after measuring hard-to-remove samples
Visual inspection of O-rings and rotor bearings (Section 9.5 [▶ 29])	– when manually cleaning the viscosity cell
Check and if necessary, tighten the hose connections	– if leakage occurs – when manually cleaning the viscosity cell
Check for leak tightness (Section 9.4 [▶ 27])	– once a month – after the cell was disassembled for cleaning – when leakage is suspected – if measuring results are not stable
Replace the O-rings (Section 9.7 [▶ 33])	– once a year – if a damage is visible – if leakage occurs
Check measurement with a sample of known reference value	– regularly, preferably daily or at least before starting a measurement series
Calibration measurement with a certified reference standard (Section 6 [▶ 16])	– once a week to once a month – if measuring results are suspicious – before starting important measurements (e.g. ASTM ILCP)
Clean the housing and touch screen (Section 9.6 [▶ 32])	– wipe spills immediately – once a week to once a month, depending on the ambient conditions and tested samples
Regular maintenance and check by authorized Anton Paar service personnel (Section 10 [▶ 34])	– once a year (recommendation)

9.2 Cleaning and drying the measuring cell

Clean the measuring cell immediately after each measurement.

TIP: *If measuring similar, fully miscible samples, one sample can be replaced by the next. This requires more sample liquid, as the first sample batch must be flushed completely from the measuring cell by the following one. In this case always clean the system at the end of a work shift, but at least once every 24 hours.*

Sample replacement is not possible in Simple Fill mode!

Wipe sample spills on the instrument immediately with a soft tissue or dry cloth.

Refer to Section 9.6 [▶ 32].

Cleaning indicator

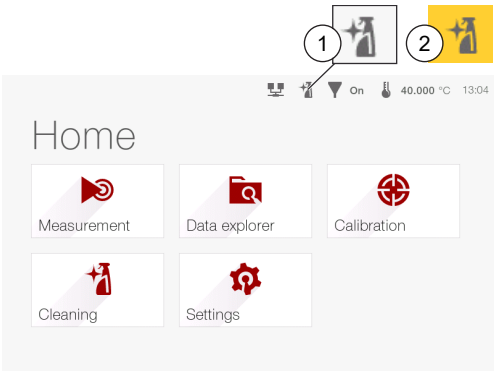

Fig. 19: *Cleaning indicator*

1 *Measuring cell is sufficiently clean and dry*
2 *Measuring cell requires another cleaning cycle or longer drying time*

The cleaning indicator is highlighted yellow, if the measuring cell is not sufficiently clean. A message tells you the cell cleaning status if you tap the indicator.

9.2.1 Cleaning liquids

The selection of the cleaning liquid(s) depends on the samples. All wetted parts must be chemically resistant to the cleaning liquid(s). Section “Wetted parts” lists all wetted parts and materials.

Find additional information on chemical resistance to selected liquids in the reference guide of the instrument.

This guide also contains information on selecting suitable solvents, on solubility tests, on sample-solvent combinations and on solvent properties (boiling point).

Cleaning liquid 1 must dissolve and remove sample residues in the measuring system.

The chemical quality must be high enough so that the cleaning liquid evaporates without leaving residues (e.g. particles). If cleaning liquid 1 does not dissolve the sample completely or does not dry up fast and/or without leaving residues, a second cleaning liquid is required.

Cleaning liquid 2 removes cleaning liquid 1 and evaporates easily with a stream of dry air.

TIP: *Do not use a cleaning liquid with a boiling point close to or lower than the measuring temperature selected for cleaning. If the cleaning liquid boils, it evaporates and cannot dissolve the substance in the instrument.*

If you are not sure if a cleaning liquid is suitable for your sample, perform a preliminary test in a test vessel. This shows if any phase separation, precipitate or opalescence occurs.

Find sample-dependent and special cleaning routines in the *SVM Series Reference Guide*.

CAUTION

Potentially hazardous liquids

Cleaning liquids may involve health risks.

a) Always read the material safety data sheet of a liquid before using it.
b) Apply protective measures according to the safety data sheet.

Table 3: Recommended cleaning liquids

Sample, condition	Cleaning liquid
Fresh base and lube oils, fuels (e.g. diesel, ...), max. cell temperature: 100 °C	Petroleum benzine (boiling range 100/140 °C) or white spirit or toluene – only one cleaning liquid
Heavy (fuel) oils, crude oils and other "heavy" substances, max. cell temperature: 100 °C	Two cleaning liquids: Liquid 1: aromatic solvent (e.g. toluene) Liquid 2: e.g. petroleum benzine (refer to the above row)
In-service oils, max. cell temperature: 100 °C	Two cleaning liquids: Liquid 1: a viscous liquid like kerosene or diesel fuel Liquid 2: e.g. petroleum benzine
Samples which are not soluble in petroleum benzine (e.g. some kinds of lube oils, some heavy oils and crude oils), max. cell temperature: 100 °C	Two cleaning liquids: Liquid 1: aromatic solvent e.g. toluene/xylene Liquid 2: e.g. petroleum benzine or a second rinsing with toluene

9.2.2 Cleaning in Simple Fill mode

For measurements in the *Simple Fill* mode, the instrument automatically prompts you to fill cleaning liquid when a measurement is finished or was aborted.

NOTE: *If more sample than up to the 10 mL mark was filled, the funnel may not be fully drained. If you fill cleaning liquid on top of remaining sample, draining will fail. Proceed as follows:*

- *Tap Cancel to abort the cleaning procedure.*
- *Start a fresh cleaning procedure and set a suitable drain time. The funnel must be empty before you fill cleaning liquid.*

To start a cleaning procedure independently of measurements, proceed as follows. You require at least 5 mL of cleaning liquid.

1. Tap on *Cleaning*. A wizard guides you through the cleaning procedure.
2. Enter the following parameters in seconds:
   - *Drain time*: the pump removes the sample from the measuring cell with air.

  - *Soak time*: the solvent remains inside the measuring cell to dissolve sample residues. If the soak time exceeds 10 s, the measuring tube turns at measuring speed for a better cleaning effect.
  - *Drying time*: the pump blows the measuring cell dry with air. Recommended: 120 s.
3. Close the funnel cover with the clamp lock.
4. The pump drains the sample from the cell.
5. Open the funnel and pour 5 mL to 10 mL of cleaning liquid into the funnel. Do not exceed the upper filling mark!
6. The *Simple Fill* system fills the measuring cell, drains the solvent, and dries the measuring cell.

9.2.3 Cleaning with a syringe

You clean with a syringe if you filled with a syringe. Alternatively, you can clean with a syringe to improve the cleaning effect: Moving the syringe plunger increases the efficiency.

1. Deactivate the *Simple Fill* mode and modify the hose connections (refer to Section 5.4 [▶ 16]).

TIP: *If you do not deactivate the Simple Fill mode, the pump will cause a timeout message.*

2. Tap on *Cleaning*. The instrument displays the required cleaning steps.
3. Remove the sample from the measuring cell:
   a. Suck low viscosity oils back into the syringe. Empty the syringe into the waste container.
   b. Fill the syringe with air. Connect it to the syringe holder. Push down the plunger to remove the sample from the measuring cell.

NOTICE

Risk of damage to the measuring cell or leakage

The pressure when filling or pressing sample out of the cell must not exceed 500 kPa = 5 bar (72 psi), otherwise sample may leak out at the bearings. This pressure corresponds to a force of approx. 65 N on the plunger of a 5 mL syringe. A too high pressure may also cause damage to the measuring cell. In this case Anton Paar is not liable for damage.

a) Do not exceed 5 bar when filling or draining the cell.

b) Take care especially with highly viscous samples.

c) Do not use special syringes or devices (e.g. screw-driven) to apply extra force.

4. Fill a clean 5 mL syringe with cleaning liquid. Do not use syringes that contain lubricants or rubber sealings.
5. Plug the tip of the syringe firmly into the adapter UNF on the syringe holder.
6. Fill approx. 2 mL of cleaning liquid into the measuring cell to remove sample residues.
7. Leave the syringe connected.
8. Fill approx. 3 mL of cleaning liquid. Move the syringe's plunger up and down repeatedly to improve the cleaning effect.
9. If required (e.g. for hard to remove samples), repeat the above steps a few times.
10. Drain all cleaning liquid from the cell with air.
11. To dry the cell, use oil-free compressed air. Maximum allowed pressure: 1 bar.

If using two cleaning liquids, remove the residues of liquid 1 by blowing or pushing air through the cell for some seconds. Then proceed with cleaning liquid 2 as described above.

9.2.4 Potential reasons for bad cleaning values

- The cell is not dry. Use a longer drying time. If cleaning with a syringe, use dry air or technical nitrogen.
- Insufficient cleaning routine. Repeat the cleaning steps more often. Clean with a syringe for additional cleaning effect due to plunger movement. If required, perform a special cleaning.
- Wrong cleaning liquid. Use a different cleaning liquid or an additional second cleaning liquid that dries up better.
- If cleaning at high temperatures: The cleaning liquid boils at the cleaning temperature. Therefore, the cleaning effect is insufficient. Use a cleaning liquid with a higher boiling point.
- Condensation in the cell (especially for measuring temperatures below ambient and with high ambient humidity). Use a drying cartridge for DMA 1002 Petro (refer to Section 4.3.3 [▶ 13]). Use dry air or technical nitrogen (not possible in Simple Fill mode).

Find more information on cleaning liquids, special cleaning routines, and drying equipment in the *SVM Series Reference Guide*.

9.3 Wetted parts

Table 4: Sample wetted parts

Material	Part
Copper	– Measuring cell block – Measuring tube
Titanium grade 2	– Inner conical rotor
Stainless steel 1.4404 (AISI 316L)	– Rotor bearing sleeves short and long – Yoke of density oscillator – Measuring cell lock – Sample inlet in measuring cell lock – Sample outlet – Funnel incl. cover (DMA 1002 Petro)
Stainless steel 1.4571 (AISI 316 Ti)	– Redirection of density oscillator
Inconel® 600	– Density oscillator tubes – Sample outlet tube
Ceramics (Zirconium oxide ZrO_2, Aluminum oxide Al_2O_3)	– Measuring rotor bearings
Balinit® C WCC	– Anti-friction coating on rotor bearing sleeve on motor side
FEP (Fluorinated Ethylene Propylene)	– Waste hose (from valve to waste)
PEEK (Poly Ether Ether Ketone)	– Hose connectors UNF – Adapter Luer Lock 1/4"-28 UNF – Valve body (DMA 1002 Petro)
PTFE (Poly Tetra Fluoro Ethylene)	– Hose between funnel and sample inlet (DMA 1002 Petro) – Hose between sample outlet and valve (DMA 1002 Petro) – Sealing cone inside measuring cell lock – Valve diaphragm (DMA 1002 Petro)
DAI-EL™ Perfluor (=FFKM perfluoro elastomer, similar to Kalrez®)	– Seal and O-rings of valve (DMA 1002 Petro)
Viton® Extreme	– O-rings of rotor bearings – O-ring of measuring cell lock – O-ring sealing the oscillator side of the viscosity cell – O-ring sealing the drive side of the viscosity cell – O-ring sealing the connection between viscosity and density cell
PE (Poly Ethylene)	– Green plunger of Luer syringe
PP (Poly Propylene)	– Transparent part of Luer syringe
Durobax® glass	– Glass syringe 5 mL
HDPE (High Density Poly Ethylene)	– Waste bottle SVM
Goat hair, stainless steel wire	– Cleaning brushes
PA 6 - Akulon F223-D	– Reducer Luer female-Record male (for cleaning of measuring cell lock)

Potentially sample wetted parts

Table 5: Potentially sample wetted parts

Material	Part
Viton® 70 ShA black	– Splash Guard SVM
PPS GF 40 (polyphenylene sulphide polymer strengthened with 40 % glass fibers)	– Cover of measuring cell lock
Viton® Extreme	– O-Ring inside measuring cell lock
Viton® FKM 75 ±5 Sh	– O-Ring of funnel cover (DMA 1002 Petro)
POM-C black (polyoxymethylene copolymer)	– Funnel support (DMA 1002 Petro)
Stainless steel 1.4301 (AISI 304)	– Funnel lock (DMA 1002 Petro)

9.4 Leak test

A leak test checks whether the measuring cell is leak-tight. Leak-tightness is vital for correct function of the instrument and for stable and reliable measuring values. Perform a leak test once a month, always after cleaning the rotor, and if the instrument does not achieve stable measuring values.

The measuring cell must be clean and dry when you perform a leak test.

9.4.1 Leak test measuring cell

Required equipment

Refer to the supplied parts for the required equipment.

- 1 Glass syringe
- 2 Adapters Luer Lock 1/4"-28 UNF PEEK (= adapters UNF)
- 1 Male Luer plug

Procedure

NOTICE

Risk of glass breakage

The plunger of the glass syringe moves easily.

a) Always hold the plunger to prevent it from dropping out of the syringe.

b) Handle the glass syringe with care.

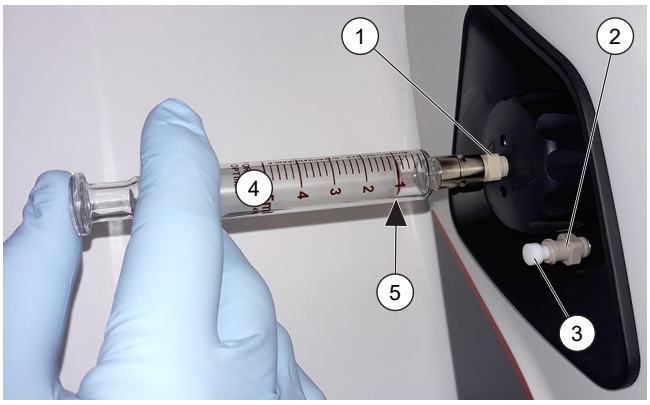

Fig. 20: *Leak test - pressing the plunger in to 1 mL mark*

1 Adapter UNF on sample inlet
2 Adapter UNF on sample outlet
3 Male Luer plug
4 Glass syringe
5 1 mL mark

1. Unscrew the hoses from the sample inlet and from the sample outlet.
2. Screw one adapter UNF each into the sample inlet and into the sample outlet.
3. Connect the glass syringe to the adapter UNF at the sample inlet. The syringe has got a Luer lock connector. Turn the syringe clockwise to fix it.
4. Pull the plunger out as far as the 4 mL mark. The syringe is filled with air.
5. Plug a male Luer plug firmly into the adapter UNF on the sample outlet.
6. Press the plunger in to the 1 mL mark. You should feel resistance.
7. When you release the plunger, it should move out at least to the 3 mL mark.

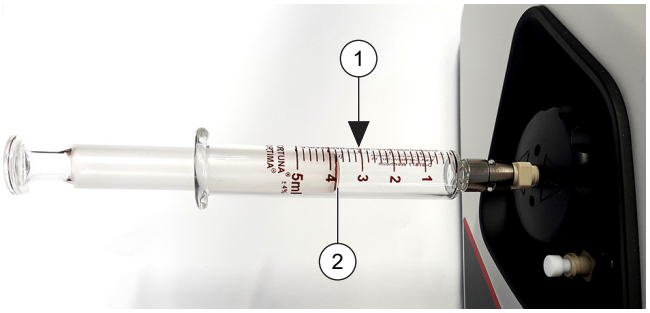

Fig. 21: *Leak test passed - plunger above 3 mL mark*

1 3 mL mark
2 End of plunger

8. Repeat the above step two or three times. The plunger should always return to the same position.
9. Disconnect the glass syringe. Remove the male Luer plug and unscrew both adapters UNF. Store all parts in the accessory bag or box.
10. Connect the respective hoses to the sample inlet and to the sample outlet.

Potential reasons for failing the leak test

- The test setup is not tight: Check both adapters UNF and the Luer plug.
- The spring-loaded sample inlet is dirty or damaged. Clean and check the sample inlet on the measuring cell lock. Refer to Section 9.5 [▶ 29].
- The measuring cell lock may be leaky. Perform a leak test on the measuring cell lock. Refer to Section 9.4.2 [▶ 28].
- The measuring rotor is not correctly assembled. Take it apart and reassemble it. Refer to Section 9.5 [▶ 29].
- There are sample residues on the ceramic bearings or the ceramic bearings are damaged. Clean the viscosity measuring cell. Refer to Section 9.5 [▶ 29].
- The O-rings of the viscosity measuring cell are worn or damaged. Replace the O-rings. Refer to Section 9.7 [▶ 33].
- Some inaccessible part inside the measuring cell is damaged.

In case one or several parts other than the O-rings are damaged, contact your Anton Paar Service.

9.4.2 Leak test measuring cell lock

Required equipment

- 1 new 5 mL plastic syringe
- 1 Adapter Luer Lock 1/4"-28 UNF PEEK, Mat. No. 104768 (= adapter UNF, refer to the supplied parts)
- Single use protective gloves made of rubber material

Procedure

Fig. 22: *Leak test measuring cell lock*

1. Screw the adapter UNF into the measuring cell lock and ensure that it fits tightly.
2. Fill a 5 mL syringe up to the 4 mL mark with air and plug it into the adapter UNF.
3. Use a protective glove and close the ceramic bearing by pressing your thumb onto the spring-loaded part.
4. Press the plunger downwards to the 1 mL mark and release it. The plunger must move back at least to the 3 mL mark. Listen for any hissing noise.
5. Leave the syringe in its position and repeat the above step a few times. The plunger should always return to approximately the same position.
6. If the plunger moves back repeatedly, the PTFE sealing cone inside the measuring cell lock is leak tight. Otherwise, either the adapter UNF may not be tightened completely or the PTFE sealing cone is leaky.

Potential reason for failing the leak test

The sealing cone within the measuring cell lock may be leaky. For replacement contact your Anton Paar Service.

9.4.3 Leak test simple fill system

This test checks the entire system, including measuring cell, measuring cell lock and funnel.

Required equipment

Refer to the supplied parts for adapter, plug, and hose.

- 1 new 20 mL plastic syringe
- 1 Adapter Luer Lock 1/4"-28 UNF PEEK, Mat. No. 104768 (= adapter UNF)
- 1 Male Luer plug
- approx. 30 mm of air hose (PU 4x6)

Procedure

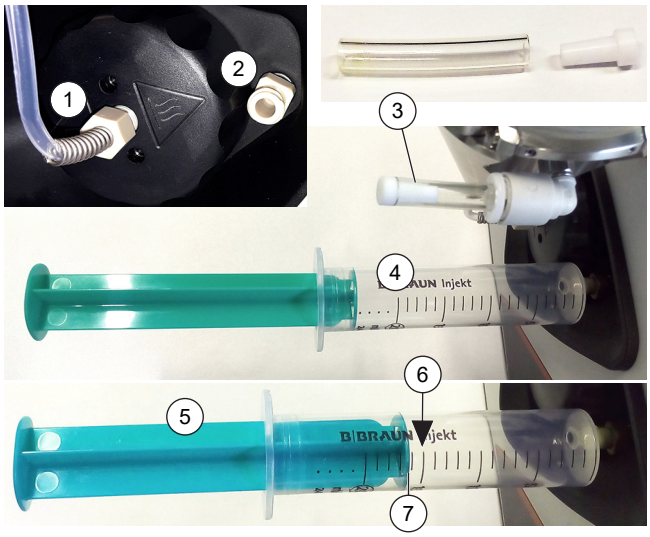

Fig. 23: *Leak test Simple Fill system*

1 Funnel hose (connected)
2 Adapter UNF on sample outlet
3 30 mm air hose with male Luer plug
4 Syringe filled with 24 mL air
5 Leak test passed – plunger above 15 mL mark
6 15 mL mark
7 End of plunger

1. Cut approx. 30 mm off the supplied PU hose.
2. Open the measuring cell lock for easy access to the sample outlet.
3. Screw the adapter UNF tightly into the sample outlet instead of the hose 171705.
4. Close the measuring cell lock.
5. Make sure that the funnel is correctly attached, the funnel hose is tightly connected, and the funnel cover is closed.
6. Plug the 30 mm of air hose into the air connector of the funnel instead of the regular air hose.
7. Plug the male Luer plug firmly into the short hose.
8. Fill a 20 mL syringe up to the 24 mL mark with air and plug it into the adapter UNF.
9. Press the plunger downwards to the 5 mL mark and release it.
10. The plunger must move back to the 14 mL or 15 mL mark. This takes a few seconds.
11. Disconnect the syringe and repeat the test. When disconnecting the syringe, you should hear a hissing noise.

Potential reasons for failing the leak test

– The test setup is not tight: Check the funnel hose, the adapter UNF, the short hose, and the Luer plug.
– The measuring cell is not leak tight (refer to Section 9.4.1 [▶ 27]).
– The O-ring of the funnel is not tight.

9.5 Cleaning the measuring rotor

Clean the measuring rotor at regular intervals (Section 9.1 [▶ 23]) for good function of the viscosity cell.

Required equipment

Refer to the supplied parts for the required equipment.

– Cleaning liquid(s) (refer to Section 9.2.1 [▶ 24])
– Cleaning brushes
– Puller for rotor bearings
– 1 adapter Luer Lock 1/4"-28 UNF (= adapter UNF)
– Lint-free tissue paper
– Q-tips (extra-long)
– Protective gloves

General instruction

– Always use fresh tissue paper and cleaning liquid.
– Always wipe the brushes after using them – also in-between cleaning steps.
– Place all parts on clean tissue paper.

Procedure

CAUTION

Hot surface, risk of injury

This sign calls attention to the fact that the measuring cell lock can get very hot.

a) Do not touch the measuring cell lock and the sample inlet/outlet without adequate protective measures (gloves) or make sure the measuring cell temperature is lower than 60 °C (140 °F) before touching these parts.
b) Do not remove the measuring rotor if the measuring cell temperature is not between 15 °C (59 °F) and 50 °C (122 °F).

1. Disconnect the hose from the sample inlet.

NOTE: *Otherwise, you might kink especially the short funnel hose of DMA 1002 Petro .*

2. Open the measuring cell lock by turning it counterclockwise.

Fig. 24: *Opening the measuring cell lock*

Check the measuring cell lock

1. Put on protective gloves.

2. Unscrew the hose from the sample outlet.
3. Wet some tissue paper with cleaning liquid and wipe the inside of the measuring cell lock. Brush the sample inlet with the smallest brush (2.7 mm).
4. Push the sample inlet repeatedly into the cell lock (arrow in the below figure). The built-in spring pushes the sample inlet out again. The sample inlet must move smoothly in both directions.

Fig. 25: *Measuring cell lock*

1 Sample inlet, spring-loaded

– In case the inlet moves jerkily, gets stuck or you do not feel the resistance of the spring, clean the measuring cell lock.
– Refer to the *SVM Series Reference Guide (Cleaning the Measuring Cell Lock)*.
– If the sample inlet moves smoothly, continue as follows.

Take apart the measuring rotor

1. Take the turning measuring rotor out by the drive disc. Use your fingertips. Pull the measuring rotor out sideways.

Fig. 26: *Taking out the measuring rotor*

1 Drive disc of measuring rotor

2. Wet some tissue paper with cleaning liquid and wipe the measuring rotor and drive disc.
3. Unscrew the rotor bearing long (carrying the drive disc) using your fingers. Turn it counter-clockwise. Pull the rotor bearing out of the measuring tube. You have to overcome the resistance of the O-ring.

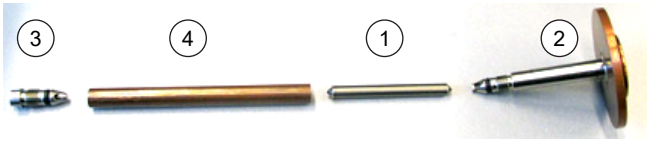

Fig. 27: *Measuring rotor*

1 Measuring tube
2 Rotor bearing long with drive disc
3 Rotor bearing short
4 Titanium rotor

NOTICE

Risk of damage to the instrument

The rotor consists of precision parts. Using force and/or unsuitable tools can bend or kink the parts.

a) Do not use force.
b) Use only tools recommended in this description.
c) Do not try to loosen the drive disc.

4. Tilt the measuring tube and let the titanium rotor drop onto a sheet of tissue paper.
   If the titanium rotor sticks to the measuring tube, you can remove it later using a Q-tip.
5. Unscrew the rotor bearing short using the puller for rotor bearings. Pull the rotor bearing out of the measuring tube. You have to overcome the resistance of the O-ring.

TIP: *If the measuring tube slips through your fingers, use a piece of rubber or comparable material to get a better grip on it.*

For example, wrap a thin rubber protection glove several times around the measuring tube.

6. In case the rotor is still inside the measuring tube, remove it using the soft cotton end of a Q-tip.
   – Slowly insert the Q-tip by turning it.
   – You may have to squeeze the cotton bud a bit in order to reduce its width. Refer to the below figure.

NOTICE

Risk of damage to the titanium rotor

The titanium rotor is a precision part with thin walls. Using force and/or unsuitable tools can damage it beyond repair.

a) Do not use force if the rotor is firmly stuck.
b) Only use the soft Q-tip to remove the rotor.
c) Soak the measuring tube with the stuck rotor in suitable solvent for some time. Then try removing the rotor again.

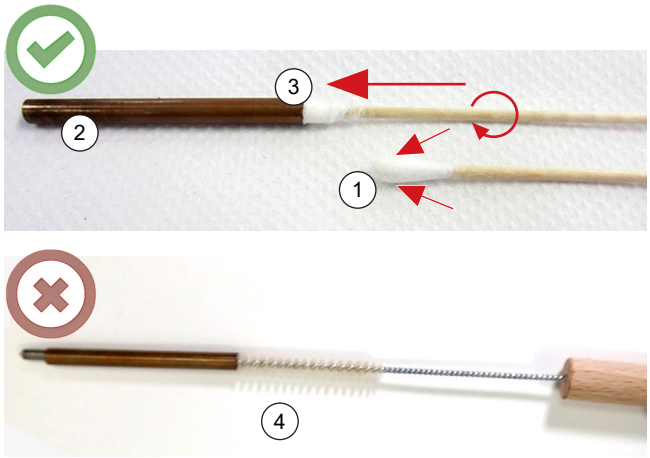

Fig. 28: *How to remove the titanium rotor*

1 Q-tip - squeeze the cotton bud to fit it into the measuring tube
2 Measuring tube with rotor inside
3 Inserting the Q-tip by turning - soft end first
4 Do NOT use the brush to push out the rotor

Clean the parts of the measuring rotor

1. Wet the smaller brush (5 mm) with cleaning liquid and insert it into the measuring tube. Brush the tube. Rotate the brush to clean the threads of the bearings.
2. Check the threads of the rotor bearings for sample residues. Brush them with cleaning liquid.
3. Wet sheets of tissue paper with cleaning liquid and wipe all parts.
4. Clean the ceramic bearings on the inner ends of the rotor bearings and on the inside of the measuring cell lock. Wet Q-tips with cleaning liquid and wipe the ceramic bearings.
5. In case of hard to remove residues, wet the tip of a brush and brush the ceramic bearings.
   Use the smallest brush (2.7 mm) to clean the inside of the rotor bearings.
   Then wipe the ceramic bearings again.
6. Check the ceramic bearings for damage (cracks) or permanent residues. In that case, you need to replace the ceramic bearings. Contact your Anton Paar Service.
7. Check the O-rings on the rotor bearings and the O-ring on the measuring cell lock for signs of wear. To replace the O-rings, refer to Section 9.7 [▸ 33].

Clean the measuring cell (thermostat tube)

1. Wet the larger brush (7 mm) with cleaning liquid and insert it into the measuring cell.

NOTICE

Risk of damage to ceramic rotor bearing

The ceramic rotor bearings are precision parts. Using force and/or unsuitable tools can damage them. Note that there is also a ceramic bearing inside the measuring cell.

a) Clean the inside of the measuring cell with care.
b) Do not use excessive force. Do not push the brush or Q-tip into the cell with great speed
c) Do not use any other tool than the recommended brush or Q-tips.

Fig. 29: *How to clean the viscosity measuring measuring cell*

1 Sample inlet
2 Insert brush 7 mm or Q-tip here
3 Sample outlet

2. Rotate the brush. Insert it slowly until you meet resistance. Rotate the brush in the end position to clean the ceramic bearing at the end of the viscosity cell.
3. Remove the brush and wipe it. Repeat the above step until the tissue paper remains clean when you wipe the brush.

TIP: *You can also use an extra-long Q-tip to clean the inner ceramic bearing with some cleaning liquid.*

4. Screw an adapter UNF into the sample outlet.
5. Fill a syringe with cleaning liquid and plug it into the Adapter UNF at the sample outlet. Hold a sheet of tissue paper in front of the measuring cell opening. Rinse the measuring cell from the outlet.

Fig. 30: Rinsing the measuring cell from the outlet

CAUTION

Risk of liquid spray getting into your eyes

When drying the cell, remaining liquid can spray out and get into your eyes.

a) Wear safety goggles.

b) Take care to cover the opening completely with the tissue paper.

6. Hold a sheet of tissue paper in front of the measuring cell opening and blow the cell dry with dry, oil-free air.
7. Check the tissue paper for sample residues. If the paper becomes dirty, brush and rinse the cell again. Blow it dry as described above.

TIP: *DMA 1002 Petro – If no external dry air is available, use the built-in air pump:*

- *Close the measuring cell lock (leave the measuring rotor outside).*
- *Fix the measuring cell lock and connect the hoses.*
- *Start cleaning with short drain time (e.g. 1 s) and 0 s soak time.*
- *Set 180 s drying time.*
- *Do not fill solvent when prompted.*

Assemble the viscosity measuring cell

1. Screw the rotor bearing long with drive disc onto the measuring tube. Tighten it with your fingers.

TIP: *The measuring tube is symmetric. It does not matter which bearing you fix to which end. You need not insert the titanium rotor in any defined direction.*

2. Insert the titanium rotor into the measuring tube.
3. Screw the rotor bearing short onto the open end of the measuring tube. Tighten it with your fingers. There must not be a gap between measuring tube and bearing.

***Fig. 31:** Assembling the measuring rotor*

1 Gap - tighten the bearing until that gap is closed

4. If you do not succeed with your fingers, use the puller for rotor bearings to close a potential gap. Do not tighten the rotor bearing any further.
5. Insert the measuring rotor into the thermostat tube. The measuring rotor starts turning when it is in place.
6. Fix the measuring cell lock. Turn it clockwise until you hear and feel a click.
7. Check whether the measuring cell is leak-tight (Section 9.4 [▶ 27]). If yes, connect all hoses.

9.6 Cleaning housing and touch screen

– Use a soft cloth dipped in ethanol, petroleum benzine, or warm water (optionally plus a mild solvent, pH <10) to wipe the housing and the base of the device.

WARNING

Risk of fire

Ethanol is a highly flammable liquid.

a) Strictly observe all safety instructions.

NOTICE

Risk of damage to the instrument

Materials listed below can damage the housing. Never use:

a) Highly non-polar solvents (e.g. toluene, hexane, solvent naphtha)

b) Strong acids or bases (e.g. nitric acid, sulfuric acid, hydrochloric acid, caustic soda)

c) Abrasive cleaning agents (containing particles) or strong mechanical action (steel brush).

NOTICE

Risk of damage to the housing

Wiping the housing with acetone can discolor the front foil. If using any other cleaning agents than named here, make sure they do not damage the materials of the device.

9.7 Replacing O-rings

Required equipment

- 2 pcs. O-ring 2x1 Viton® Extreme (mat. no. 12843)
- 1 pc. O-ring 28x1.5 Viton® Extreme (Mat. No. 158512)
- Cleaning liquid(s)
- Cleaning brushes
- Puller for rotor bearings
- 1 Adapter Luer Lock 1/4"-28 UNF PEEK (= adapter UNF)
- Lint-free tissue paper
- Q-tips (extra long)
- Small flat screw driver
- Lubricating grease
- Utility knife (Stanley knife) or small cutting pliers or tweezers
- Protective gloves

Procedure

1. Disassemble the measuring rotor and clean it. Check all parts for damages. Refer to Section 9.5 [▸ 29].

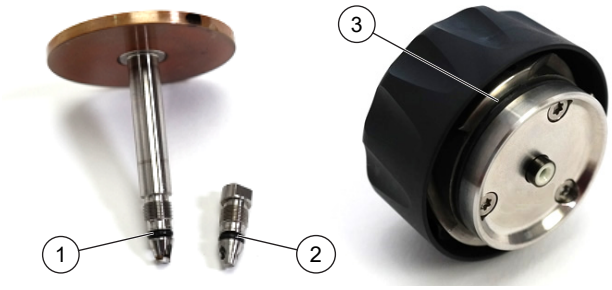

Fig. 32: *O-rings on bearings and measuring cell lock*

1 O-ring rotor bearing long
2 O-ring rotor bearing short
3 O-ring measuring cell lock

2. Remove the O-rings from the rotor bearings. Use a utility knife, small tweezers or small cutting pliers.
3. Remove the O-ring from the measuring cell lock. Use a small flat screwdriver as lever.
4. Make sure all parts are clean.
5. Mount a new O-ring onto each rotor bearing.
   - Slip the O-ring into its groove on the rotor bearing.
   - Use your fingers.

TIP: *If you lubricate the O-ring with a drop of grease or standard oil, it moves more easily.*

6. Slip the new O-ring into its groove on the measuring cell lock.
7. Assemble the measuring rotor as described in Section 9.5 [▸ 29].

9.8 Storage and transport

1. Empty the measuring cell and all hoses and disconnect the waste container before you move, lift or store the instrument.
2. Store the belonging equipment in a safe place (e.g. the supplied accessory bag or box).
3. Make sure no sample residues or spills remain on the instrument. Clean these parts as described in Section 9.6 [▸ 32].
4. Disconnect the instrument from the mains supply.
5. It is recommended to cover the instrument with a dust protection hood.
6. Store the instrument in a clean, dry place.

Transport

1. Grasp the carrying ledge on top of the instrument back side with one hand.
2. Place the other hand on the carrying ledge under the display on the front side.
3. Carry the instrument in front of you and keep it close to your body.

9.9 System update

To update the instrument to the latest software, proceed as follows:

1. Make sure to export or print all measurement data.
2. Store the latest software file in the root directory of a USB storage device.

TIP: *Make sure the file was properly unzipped in case you downloaded a zip package from the web.*

3. Connect the storage device to one of the three USB connectors on the rear of the instrument.
4. Tap *Settings* on the home screen.
5. Select *System update*.
   The information area shows the current software version.
6. Tap on button *Select package* and select the current software file (.apupx).
7. Tap *INSTALL*. The instrument asks you whether you want to update to the selected software package.
8. Confirm the message. The instrument installs the current software.
9. When the installation is completed, the instrument reboots.

10 Maintenance and repair

10.1 Maintenance performed by an authorized Anton Paar representative

A preventive maintenance service carried out by an Anton Paar Certified Service Representative will ensure stable and compliant operation, reliable and accurate measuring results, and ongoing warranty support for your product.[1]

Under certain conditions, if you miss a maintenance service, your warranty is invalidated.[2]

The mandatory and recommended services for your specific product can be found in the following table:

Table 6: Maintenance and repair

Component	Action	Interval	Classification
Calibration	Calibrate	12 months	Mandatory
O-Rings of the viscosity measuring cell	Replace	12 months	Mandatory
DMA 1002 Petro : – O-ring of the funnel cover – Funnel hose (81x3x2 mm) – Hose "171705" from cell to valve (180x3x2 mm) – Sensor hose (325x3x2 mm)	Replace	12 months	Mandatory
Magnetic ring with bearings	Replace	5 years or after 7800 single determinations	Mandatory
Battery on DCB board	Replace	10 years	Mandatory

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.

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

- Hoses
- O-Rings
- Parts of maintenance kits

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”.*

10.2.1 Instrument with battery

In case of return of the instrument, please **do NOT send an optional battery to Anton Paar GmbH**!

Anton Paar GmbH cannot return batteries because lithium-ion batteries are classified as dangerous goods!

[1] Please contact your Anton Paar representative to schedule preventive maintenance.

[2] 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

Table 7: Measuring ranges and precision

	Measuring range[a]	Repeatability (stability)	Reproducibility	Resolution
Density	0 g/cm³ to 3 g/cm³	±0.00005 g/cm³ [b]	±0.0001 g/cm³ [b]	5 significant digits
Measurement conforms to ASTM D4052 , ISO 12185				
Temperature	15 °C to 100 °C (59 °F to 212 °F)	±0.005 °C (±0.009 °F)	±0.03 °C (±0.05 °F)	±0.001 °C

[a] *The instrument comes with a works adjustment for temperature, viscosity and density. For more information on the works adjustment range, refer to the SVM Series Reference Guide, Appendix A. Repeatability and reproducibility are valid for ideal measuring and sample conditions within the works adjustment range by using petroleum based viscosity standards. Suitable standards are available from Anton Paar GmbH.*

[b] *Attested for the works adjustment range. Specified reproducibility does not include the uncertainty of the standard used for verification.*

Table 8: Temperature control

Peltier thermostatting, flexible temperature selection
Typical heating/cooling rates: at room temperature (approx. 23 °C/73 °F), mains operation
– 20 minutes from 15 °C to 100 °C – less than 40 minutes from 100 °C to 15 °C

Table 9: Modes and criteria

Modes	Stability temperature	Stability viscosity	Stability density	Timeout[a]
D4052 compliant	±0.005 °C for 120 s	0.07 % for 60 s	0.00002 g/cm³ for 60 s	1,800 s
Quick mode	±0.025 °C for 40 s	0.2 % for 10 s	0.00050 g/cm³ for 20 s	400 s

[a] *Timeout starts to run after motor startup, when the cell temperature has reached a value that is within ±0.05 °C (±0.1 °F) of the set temperature and the equilibration time — if any — has passed.*

Table 10: Filling volumes

Instrument	Sample minimum	Sample typical (ASTM D7042)	Solvent minimum	Solvent typical
DMA 1002 Petro	3.5 mL	5 mL	5 mL	10 mL

Table 11: General technical specifications

Maximum sample throughput (samples/hour)	
Simple Fill, Quick mode, no prewetting	– Diesel fuel at 60 °C: 21 – Lubricating oil at 50 °C: 18
Simple Fill, D4052 compliant, with prewetting	– Diesel fuel at 20 °C: 10
Maximum filling viscosity	1,000 mm²/s at filling temperature
Maximum pressure in cell	
Measuring	1 bar (14.5 psi) relative, no suction
Filling and cleaning, no suction	5 bar (72 psi) relative
Filling and cleaning, suction	1 bar (14.5 psi) relative
Drying	1 bar (14.5 psi) relative

Input/output

User interface	7" touch screen
Interfaces	1 x Ethernet (100 Mbit), 3 x USB type A, 1 x USB type B
Data memory	1,000 measurement values
Data transfer	– as table (.csv) to MS Excel using AP V-Collect software (included in delivery) – as .csv and report (.pdf) to USB memory device (requires FAT32 file system format) – to USB label printer (labels approx. 90x29 mm) – to AP Connect lab software (with export options as .csv, .pdf and MS Excel files)

Ambient conditions – indoor use only

Temperature	+15 °C to + 35 °C (+59 °F to +95 °F)
Air humidity, relative	maximum 80 % up to 31 °C (88 °F), linearly decreasing down to 50 % at 40 °C (104 °F); non-condensing
Absolute altitude	maximum 4000 m
Pollution degree	2 according to EN 61010:2010 + A1:2019 + A1:2019/AC:2019
Airborne noise emitted	less than 60 dB/A

Power supply

At instrument	DC 24 V / 3 A
AC adapter	90 VAC to 264 VAC; 47 Hz to 63 Hz
Power consumption	70 W maximum

Compliance

CE mark; EMC directive EN 61326-1:2013, RoHS

Housing material

Top and side cover	Crastin® S600F40 NC010
Cover of valve slot	styrene-butadiene, coated with a poly acrylate resin varnish
Touch screen	PET (polyethylene terephthalate)
Bottom and back side	stainless steel 1.4404 (AISI 316L)

Languages

English (default), Chinese (simplified), French, German, Hungarian, Italian, Japanese, Polish, Portuguese, Russian, Spanish, Turkish

Table 12: Weight and dimensions

Instrument	Net weight	Shipping weight	Dimensions
DMA 1002 Petro	approx. 6.6 kg (instrument)	approx. 10 kg (box with all parts)	330 mm x 365 mm x 205 mm

Appendix A.1 Optional accessories

Drying cartridge (Mat. No. 65085) for DMA 1002 Petro

– to prevent condensation in the cell at measuring temperatures below the dew point (refer to Section 4.3.3 [▶ 13])

Set Battery Holder SVM 1001 (Mat. No. 252968)

– to operate the instrument with a rechargeable battery

The battery is not available from the Anton Paar GmbH!

Recommended battery models (CE certified) come with required cables and connectors.

Disclaimer:

1.1 The instrument is supplied without a battery. The instrument can also be operated with a rechargeable battery of the types listed below. It is a non-binding recommendation of Anton Paar GmbH to use the following rechargeable batteries:

- *Jauch JPB20AHB (lithium battery ICR 18650)*
- *XTPower® XT-20000QC3*

1.2 Anton Paar GmbH is not the manufacturer of the recommended batteries and does not offer any warranty for the recommended batteries. In case of using a recommended battery as well as in case of using any other battery the following applies:

The warranty for the instrument is excluded, if the defect on the instrument was caused by the battery.

Anton Paar GmbH shall not be liable for any damage to the instrument and/or for any consequential damage, if the damage was caused by the battery.

All claims as well as liability for damages or losses resulting from (i) a use of a defective and/or outdated battery or (ii) a non-professional installation of a battery are excluded.

*In all other respects, the General Terms of Delivery of Anton Paar GmbH (*https://www.anton-paar.com/corp-en/terms-and-conditions/*) shall apply.*

Appendix B EU declaration of conformity

Docusign Envelope ID: C0B1338E-DFDD-47B8-B7D0-6A4980871F08

EU Declaration of Conformity

(original)

Anton Paar

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

Product designation:	**DMA 1002 Petro**
	DMA 1102 Petro
Model:	**DMA 1002 Petro**
	DMA 1102 Petro
Material number:	105014, 105015

are 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, 17.04.2025

Signed by:
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DI Steffen Riemer, MBA
Executive Director
Business Unit Measurement

DocuSigned by:
7179E18160D8435...
Fatemeh Rezaei, MSC
Head of Viscometry
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