



RD-SDM02[®]
Contact Angle
Measurement
Instrument

Operation Manual



The components of the **RD-SDM02[®] system** are not resistant against acids, bases or aggressive organic solvents.

RD Support does not provide for damages due to spilling any of these substances.

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1_introduction

The **RD-SDM02®** system is a single-dosing and imaging system used to measure the Contact Angle of any liquid dropped on any flat surface in sessile drop mode and to measure advancing and receding drops. It is useful primarily in the characterization of the chemical adhesion of liquids on the sample surface, and the estimation of the quality of different surface treatments on the sample.

This manual provides instructions for the installation of the instrument and the procedure for making measurements.

1.1 Main features of the system:

- Single dosing system with one manual-dispense syringe
- Sample table with manual height adjustment
- Light source with manual-controlled light holder and diffuser for illumination intensity regulation
- Camera with 640 × 480 pixel resolution and digital zoom (up to 5x) for photos and video-recording
- Software for acquiring image (AMCAP) and measuring contact angle (ImageJ).



1.2 Standard configuration:

Syringe 1 (S-1): FREE



Warning: Liquids that react with: Glass, PTFE, PMMA, Polymethylpentene (PMP), Fluorelastomer (FPM), Polyphenylene sulphide **can not** be used with the syringe.

1.3 Computer requirements

The following minimum requirements enable **RD-SDM02®** to run without any problems:

- 1 GB (RAM)
- Windows 7 and above
- CD-ROM drive
- Colour monitor
- USB 2.0/USB 1.1

1.4 Driver installation

Camera driver:

- Insert the digital microscope CD-ROM
- If the installation doesn't start automatically then open the folder USB microscope and start the program autorun.exe
- Click on driver installation icon
- Click on Finish to conclude the installation

Download and install the ImageJ software

Contact angle:

- Download the contact angle code from open source for ImageJ

<http://bigwww.epfl.ch/demo/dropanalysis/>
<http://rsbweb.nih.gov/ij/plugins/contact-angle.html>

2_setting up

Install the **RD-SDM02®** system in a location with low vibration and light interference:

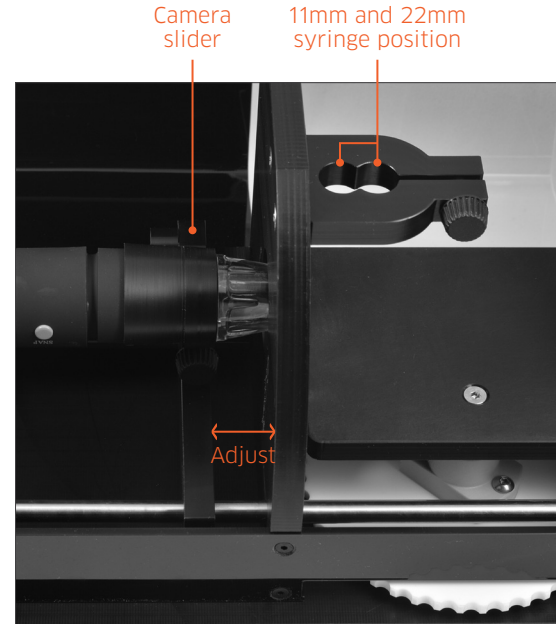
- Place the instrument on a stable laboratory bench.
- Avoid locating the instrument in the vicinity of a bright source of light.
- Avoid locating the instrument in an environment with strong variation in room temperature during measurement.
- Adjust the height of the four feet of the measuring system until the air bubble in the spirit level, located on the sample table, is positioned in the centre.
- Connect the USB cable coming from the digital camera to the USB connector of the computer.
- Connect the net adapter from the supply (12VDC/3A) with the round plug on the right side panel of the **RD-SDM02®** system.
- Connect the net adapter to the mains (AC 100-240V 50/60Hz).
- Assemble the syringe as per manufacturer's instruction in box.



Always wear appropriate gloves, goggles and clothing when manipulating liquids.

The instrument is filled like a conventional syringe:

- Turn the screw of the syringe clockwise until the plunger is all the way into the glass part.
- Fill a small vessel with the desired measurement fluid (e.g. DI water).
- Immerse the tip of the needle of the syringe below the liquid surface.
- Retract the micrometer screw counter-clockwise in order to suck liquid into the glass part.
- Air bubbles in the syringe are removed by placing the syringe in a vertical position with the tip up.
- Tap gently and screw the plunger back in until all air is expelled.
- Return the tip into the liquid and retract the screw all the way back until past the zero.
- Turn the screw until the reading is exactly zero.
- Loosen the thumb screw on the syringe support slightly.

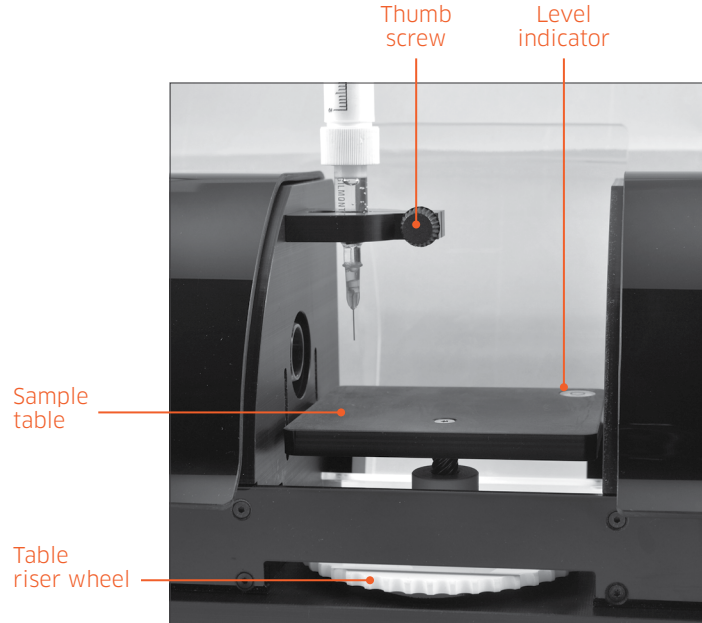


- Insert the syringe in the support position (11mm) in order to dispense volume less than 2ul or position (22mm) to dispense volume higher than 2ul.
- Tighten the thumb screw again.

3_system description

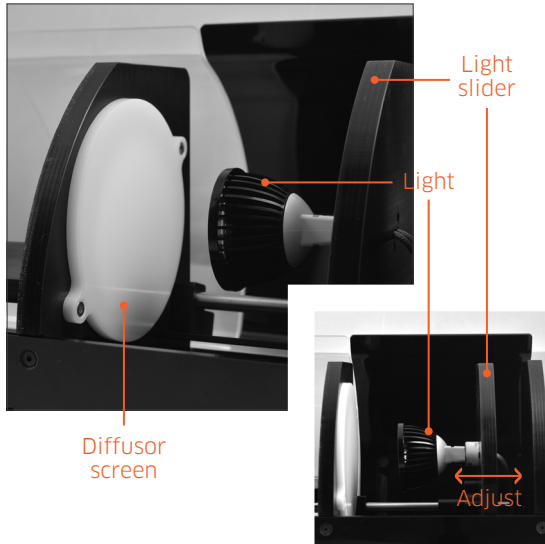
3.1 Sample table

The height of the sample table is adjusted manually with the table riser wheel.



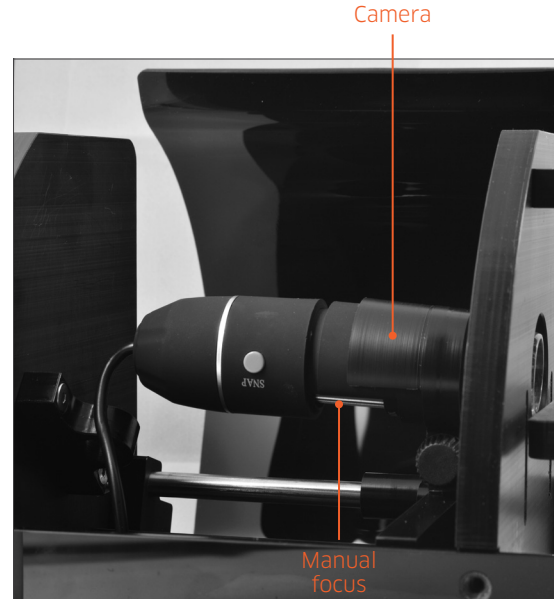
3.2 Illumination

The sample is illuminated with a 3W LED light. The illumination can be adjusted by changing the position of the manual-controlled light slider.



3.3 Zoom and focus

Focus and digital zoom of the image are regulated manually at the camera.

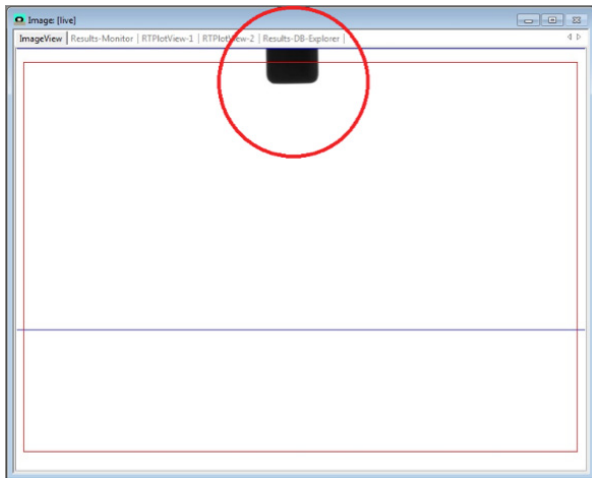


4_operating in sessile drop mode (single drop measurements)

Purpose: Contact Angle measurement of any liquids on any solid surface.

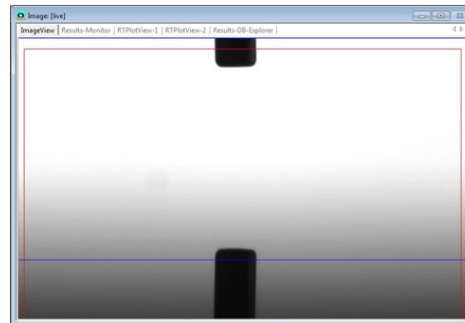
The following procedure describes how to use the **RD-SDM02®** system to do one or a batch of single drop Contact Angle measurements (SDM) with the manual dispense syringe:

- Turn on the computer.
- Switch on the **RD-SDM02®** main power. (The lamp should light up).
- Double-click on the AMCAP icon to start the camera software.
- The live image is displayed. Place your hand in between the lamp and the objective to make sure that the camera is live.
- Move the sample table down using the riser wheel. Use the thumb screw to move the tip of the syringe down until the tip is visible on the screen. See image on next page.



Droplets & nozzle purge:

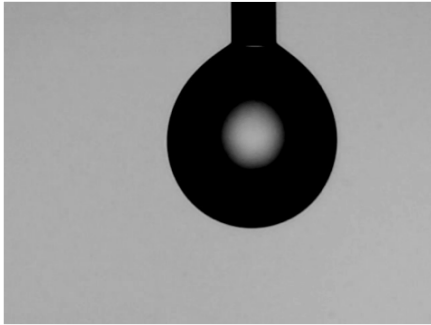
- > Place a cleanroom wipe on the sample holder.
- > Dispense the liquid by turning the micrometer screw **clockwise** until droplets are continuously flowing. Refill the syringe if necessary (see page 5).
- > Clean the tip of the syringe with a cleanroom wipe.
- Place your sample on the table. Centre the sample and move the table up until the surface is visible at the bottom of the live image. In most cases, the reflection of the tip will be visible on the surface. See image below.



- Set the digital zoom at 2x by opening the Video capture filter icon on the menu bar. The optimal position is when the needle occupies max 10% of the image.
- Adjust the focus of the camera so that the tip of the syringe is clear and at the centre of the live image.
- Use the manual focus wheel to adjust (see page 7).

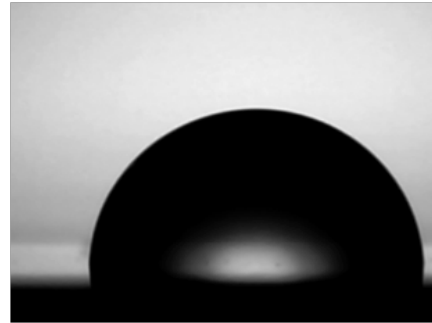
Generating the drop:

- Dispense the liquid with the micrometre screw until drop reaches an optimal size. A good droplet volume might be $2\mu\text{l}$ which can be reached by rotating the micrometre screw 1 mark on its scale (see image below).



Depositing the drop:

- Move the table up until the droplet touches the surface. The droplet will be transferred to the sample.
- Adjust the focus (if necessary) so that the drop shape takes about $2/3$ of the image's width (see image below).



- Adjust the light holder and diffuser in order to regulate the intensity and reduce reflections (if necessary). The intensity should be set so that elements on the sample are not visible.

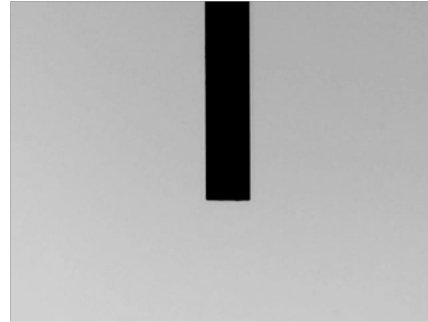
- In the camera software go into **<capture>** and **<take a picture>** in order to get a snapshot of the live image.
- In order to save the image in to desired folder go into **<capture>** and **<snapshot location>**

Contact angle (sessile drop) analysis:

- The computation is done on the saved image.
- Start the ImageJ software.
- Click on the button FILE in the menu bar and click on the OPEN in order to load the desired image.
- Follow instruction from open source in order to measure contact angle.

Advancing/receding drop measurement

Dynamic measurement is only possible if the dosing system is positioned such that the tip of the needle appears in the image (see image below). Then the sample table with the sample is positioned just below the tip. During the measurement the needle remains in the upper part of the drop.



5_maintenance and storage

5.1 Cleaning

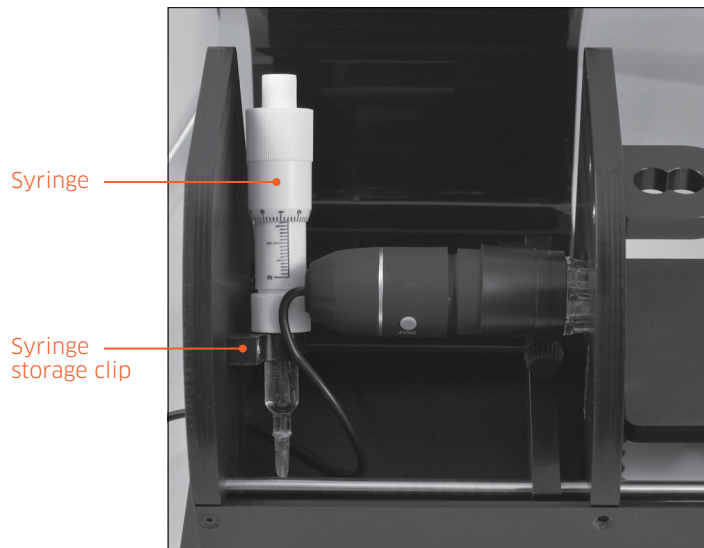
- Use cotton wool tips soaked with isopropanol to clean the lens of the digital camera.
- Use a wet cloth (DI water) to clean the instrument's surface.

5.2 Calibration

RD Support offers the drop contour standard set for the calibration of the drop shape analysis. The calibration procedure is described in the **Operating in sessile drop mode** section.

5.3 Storage

Your **RD-SDM02**[®] can be conveniently stored by removing the syringe from its operating position and securing it in the clamp behind the camera on the inside of the right hand side outer wall.



6_technical data

Measuring range	5-180°
Accuracy	±1°
Objective	5x digital zoom
Droplet size	Adjustable, 2 µL minimum
Syringe capacity	2 mL
Camera	Digital Microscope HD colour CMOS sensor
Light source	LED lamp
Instrument dimension	440 x 160 x 170 mm (WxDxH)
Weight	2 Kg
Sample table	110 x 90 mm (WxD)
Max. measurement area	75 x 75 mm (WxD)
Max. sample thickness	15 mm
Power supply for net adapter	AC 100-240V 50/60Hz
Working voltage	12V/3A
Power consumption	3W

Product video on **YouTube**



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