

# DropMaster



## Contact Angle Meter

Contact Angle, Liquid Surface Tension, Surface Free Energy

# **DMs-401**

# DMS-401

The DMS-401 is a compact yet high performance surface measuring instrument for the measurement of static and dynamic contact angles, surface free energy of solids and surface and interfacial tension of liquids. Its functions can be easily extended due to its sophisticated modular design.

Optional accessories, such as computer controlled dispenser, temperature control devices, external tilting stage system are available.



## FEATURES OF THE DMS-401

### Fast image capture with 60fps

Sequential droplet images are captured at a rate of 60 frames per second. This allows the measurement of contact angles and surface & interfacial tensions as a function of time.



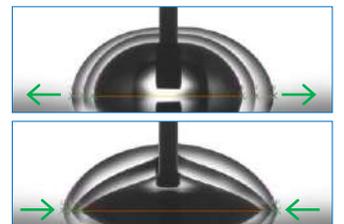
A 333fps image capture system is available as an option for demand of higher speed image capturing.

**Applications:** Initial spreading, absorbing property, effect of surface active agents

### Extension/Contraction method

Advancing/Receding Angles are measured by increasing and decreasing the volume of captive droplet. The optional automatic dispenser system is required for smooth and precise dynamic motion of the volume change, to ensure reliable measurements.

**Applications:** Coating property, repellency, characterization of droplet hysteresis



### Sliding method

Advancing/Receding Angles are measured using an external stage, tilting the measuring instrument. The angle at which a droplet starts sliding from the solid surface is determined as Sliding Angle. The Adhesive Energy between the droplet and the solid surface is analyzed at the same time. The optional Sliding method kit is required.

**Applications:** Repellency/hydrophobicity, characterization of droplet hysteresis



## Surface Free Energy analysis of solids

Solid surface free energies and their polar and dispersive components are analyzed from the results of contact angle measurements with different probe liquids. Geometric mean, Harmonic mean, acid-base, Interaction analysis (Work of Adhesion, Interfacial Free Energy), Young-Dupré, Zisman are available. An optional Surface energy kit with 5 probe liquids and a set of needles is available.

**Applications:** Adhesive property, characterization of surface modification, evaluation of hydrophilicity/hydrophobicity

## Surface/Interfacial Tension of liquids

The optional pendant drop kit allows for measuring surface and interfacial tension of liquids using the pendant drop method. The advantages compared to conventional Wilhelmy plate method and du Noüy ring method are as follows:

- measurement with small liquid amount (less than 1mL)
- high temperature control such as molten polymer applications
- suitable for liquids which surfaces change quickly after exposure to air

## Automatic recognition of drop deposition

The droplet deposition from the needle tip to the solid surface is recognized automatically and the time interval between deposition and recognition can be set individually. This function is very useful for samples that spread fast after depositing.

## Live image, droplet volume monitoring

The image monitor displays a live image of the actual droplet and its droplet volume in  $\mu\text{L}$ . Using the optional automatic dispenser, the droplet volume is controlled by FAMAS software.

## Brightness and focus adjustment

With help of the brightness level indicator and the focusing aid with index graph and value displayed in the image screen, operators can easily adjust a perfect image for precise measurements

## Black & white threshold level adjustment

The threshold level to determine the binary image can be adjusted before and after measurement to distinguish to the droplet's contour from its surroundings. Both relative and absolute adjustments are possible to optimize image analysis.

## Data chart & variable data

Besides the contact angle data, the droplet volume, sessile drop volume, absorbed droplet volume, residual droplet ratio, droplet height and radius are obtained at the same time.

Contact angles measured as a function of time can be displayed in a chart.

## Movie converter

The images of the contact angles measured as a function of time can be easily and quickly converted to a MPG-1 or AVI movie file.

## Droplet calibration standard

The droplet calibration standard for standard view is a basic accessory. It is made of soda-lime glass bearing one full circle for calibration and three droplet silhouettes of  $5^\circ$ ,  $60^\circ$  and  $108^\circ$  for periodic inspections of measurement accuracy.

With the help of this tool, users can easily perform routine maintenance to ensure reliability of their measurements over long periods of time.

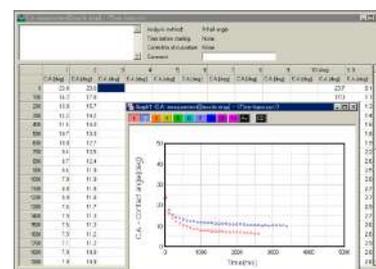
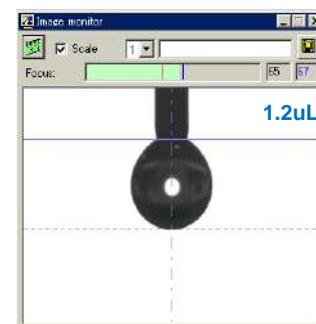
A droplet calibration standard for calibration of the camera wide-view setting, as well as pendant drop calibration standards for standard and wide-view setting can be obtained optionally. A certificate of accuracy of the full circle and droplet silhouettes can also be obtained optionally.

## STANDARD COMPONENTS

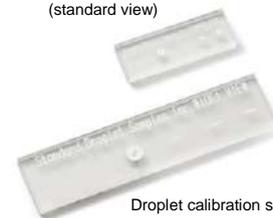
Item	Q'ty	Item	Q'ty
DMs-401 main body*1	1	Manual dispenser	1
Glass syringe set with 22G SUS needle	5	Set of Teflon coated needles, 2x 18G & 2x 22G	1
Droplet calibration standard (standard view)	1	Acrylic plate (for practice)	1
AC/DC adapter	1	USB cable	1
FAMAS software and license key	1	Operation manual (English) *2	1

\*1 Main body features camera, LED lamp, stage devices and dispenser holder on its chassis.

\*2 A windows PC is required to operate the instrument and can be ordered optionally.



Droplet calibration standard (standard view)



Droplet calibration standard (wide view)

# DMs-401

## SPECIFICATIONS

Measuring methods	Sessile drop, Advancing/receding angle, Pendant drop, Sliding angle (option)	
Analysis methods	Contact angle: $\theta/2$ , Tangent, Curve fitting (ellipse, circle)	Surface and interfacial tension: Young Laplace, $d_s/d_e$
	Surface free energy of solids: Owens-Wendt, Kaelble-Uy, Kitazaki-Hata, Wu, acid-base, Zisman	
Measuring range	Contact angle: 0 to 180 °	Surface and interfacial tension: 0 to 2000 mN/m
Display resolution	Contact angle: 0.01 °	Surface and interfacial tension: 0.01 mN/m
Accuracy <sup>1)</sup>	Contact angle: 0.2 °	Surface and interfacial tension: 0.2 mN/m
Optical system	Manual focus with 3 step manual zoom Field of view: 4.0 x 5.3 mm, 7.2 x 9.6 mm, 10.2 x 13.6 mm $\pm 5$ %	
Sample stage size	150(W) x 100(D) mm	
Applicable sample size	150(W) x 100(D) x 35(H) mm, weight 300 g max.	
Stage travel range	X-axis: 150 mm, manually via rotation knob Z-axis: 20 mm, manually via rotation knob, additional 20mm via lockable sliding device	
Droplet dispensing	Standard: Manual dispenser Option: Computer-controlled dispenser	
Dispensing resolution	0.1 $\mu$ l	
Droplet deposition	Manually via stage up/down movement	
Measuring temperature	Standard: Ambient Option: Jacket type temperature-controlled (+5 to +90 °C) Heater type temperature-controlled (ambient to +180 °C and ambient to +380 °C)	
Instrument dimensions	294(W) x 461(D) x 288(H) mm	
Instrument weight	6.0 kg	
Power supply	AC100 to 240V, 50/60 Hz, 5.5 W 15 VA	
Operating environment	Temperature: +10 to +35 °C, humidity: 30 to 80 %RH (non-condensing) Positioned away from sources of electrical noise and vibration	

<sup>1)</sup> Accuracy is the repeatability in terms of standard deviation based on manufacturer's calibration standard.

## SELECTION OF OPTIONAL ACCESSORIES

### JACKET TYPE STAGE SET



For contact angle measurements in a temperature range from about +5 to +90 °C.

A refrigerated/heated circulator is required for the temperature control and a surface thermometer is required to measure the solid's surface temperature.

### JACKET TYPE CHAMBER SET



For surface and interfacial tension measurements in a temperature range from about +5 to +90 °C.

A refrigerated/heated circulator is required for the temperature control, and a surface thermometer is needed to measure the liquid's surface temperature.

### HEATER TYPE STAGE PACKAGE



For contact angle measurements in a temperature range from ambient to +180 °C.

The temperature controller 202E with PID control system and with two built-in type K thermocouple thermometers is included.

### HEATER TYPE CHAMBER PACKAGE



For surface and interfacial tension measurements in a temperature range from ambient to +380 °C.

The temperature controller 402E with PID control system and with two built-in type K thermocouple thermometers is included.

### AUTOMATIC DISPENSER SET



Computer controlled dispenser unit for quick and precise creation of droplets, inclusive a control box.

### SURFACE THERMOMETER



Portable thermometer with a built-in platinum resistance sensor.

### THREE-STATE MEASUREMENT KIT



Set for contact angle measurements of a liquid on a solid surface while immersed in a liquid. Liquids and air-bubbles can also be deposited on the solid surface from beneath.

### PD KIT



Set of SUS needles, glass cuvettes and standard pendant drop samples to measure the surface and interfacial tension using the pendant drop method.

### FE KIT



Set of 5 probe liquids and 4 Teflon coated needles for the analysis of surface free energy of solids.

### IMAGE CAPTURE SYSTEM 333



High speed camera for image capturing with a maximum of 333fps.

For detailed information, please contact our sales partner or us directly at +81-48-483-2629 or at [overseas-sales@face-kyowa.co.jp](mailto:overseas-sales@face-kyowa.co.jp).

Specifications and designs and designs are subject to change without notice.

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