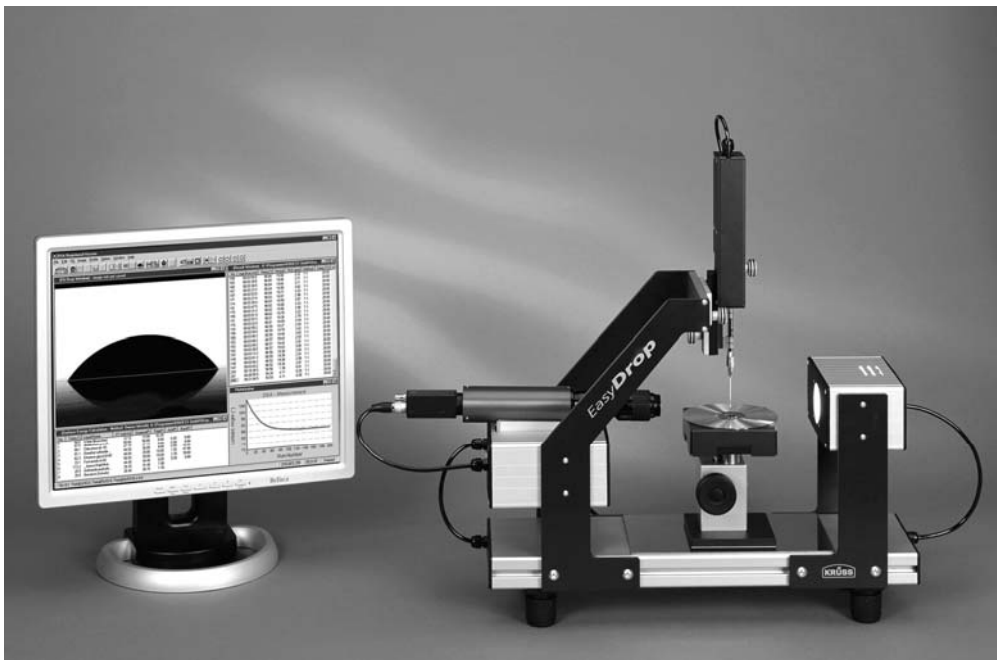




EasyDrop

standard

Drop Shape Analysis System



Installation and Operation

V1-05

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1 General information

1.1 General safety instructions



As well as this general safety information, please follow the safety instructions in the remainder of the manual text.



The *EASYDROP* is intended for use in a laboratory or pilot plant station. The general safety rules for working in a laboratory environment apply to work carried out with the *EASYDROP*.



The *EASYDROP* may only be used by trained personnel.



When carrying out measurements with substances which are poisonous, hazardous to health, irritant and/or easily inflammable, the safety regulations and, if available, information in the appropriate safety data sheets must be taken into account when handling such substances.



Do not use the *EASYDROP* in explosion-proof areas.



The controls of the *EASYDROP* and a connected computer must not be operated when wearing protective gloves, which have already been used for handling hazardous materials.



Do not use the *EASYDROP* if the unit is obviously damaged.



Disconnect the *EASYDROP* from the power supply immediately if there is any damage to the electronics, if liquids are spilled over the *EASYDROP* or if there is an escape of tempering medium.



Handle all glass parts and optical parts with care. Do not touch them with fingers or with sharp objects.

1.2 Intended use

- *EASYDROP* is intended only for measurements of the surface tension of liquids, the interfacial tensions between two liquids and measurements of the contact angle between a liquid and a solid.
- The intended use includes the exclusive use of accessories supplied by KRÜSS or substitutes with an identical design if disposable accessories are being used.
- The components of *EASYDROP* are not resistant against acids, bases or organic solvents. KRÜSS does not provide for damages due to spilling any of these substances. The same applies to damages due to corrosive vapours.

1.3 Technical customer service

If problems should occur when working with the *EASYDROP* or with DSA1, please consult the technical customer support at KRÜSS GmbH. You can contact them at:

KRÜSS GmbH

Technical customer service

Tel: (+49) 040/514401-0

Fax: (+49) 040/514401-98

E-mail: Info@Kruss.de

2 Introduction

Dear KRÜSS GmbH Customer,

Thank you for deciding to purchase the *EASYDROP* Contact Angle Measuring System. With the *EASYDROP* and the DSA1 control and evaluation software you now have a tried and tested tool for carrying out computer-supported studies into the shapes of drops of liquid. In addition to the high-precision dosing and positioning of the liquid drops the system also permits the recording and evaluation of video images and the calculation of surface energies and surface tension with the aid of the numerous evaluation methods that have been implemented. Despite the numerous possibilities that the system offers, we have ensured that both the design and operation have remained simple, so that you can familiarise yourself quickly with the *EASYDROP* and be able to use it for your daily work in a very short time.

This manual provides instructions for the installation of the instrument. The procedure for making measurements is described in the DSA1 software manual, which is supplied together with the instrument and the software.



We strongly advise you to carry out the installation and necessary assembly work only after consulting this manual.



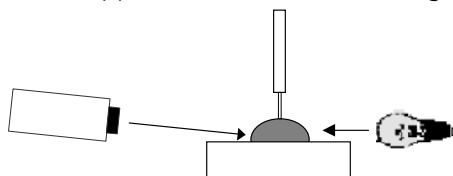
This manual is subjected to continual quality control. You can download the current manual version at any time from the download region of our homepage www.kruss.de.

Possible options with *EASYDROP*

- Contact angle measurements on drops of liquid in a gaseous or liquid phase
- Measurement of the interfacial tension of a pendant drop in a liquid or gaseous phase
- Measuring of advancing and receding drops (optional)
- Evaluation of a digitised drop image by various methods
- Calculation of the surface energy of a solid by various methods
- Integrated and extendable databases with substance data on liquids
- Comfortable data management and documentation

Measuring principle

In order to measure the contact angle with *EASYDROP* a drop is placed on a sample located on a moveable sample table. The drop is illuminated from one side and a camera at the opposite side records an image of the drop.



The drop image is transferred to a computer equipped with a video-digitizer board (frame-grabber) and shown on the monitor. The DSA1 software contains time-proven tools for analysing the drop image with whose help it is possible to calculate the contact angle, surface energies and surface tensions.

3 Computer system

If you have purchased your computer from KRÜSS together with the *EASYDROP* and if the (optional) frame grabber board has already been installed then you can skip this chapter.

3.1 Computer requirements

The following is a list of the minimum requirements to enable DSA1 to run without any problems:

- IBM-AT or compatible computer, with at least a Pentium III processor (>500 MHz).
- 1 GB working memory (RAM)
- Windows XP, Windows Vista
- CD-ROM drive
- VGA or SVGA graphics board; recommended resolution 1024 X 768
- Colour monitor
- Mouse
- Serial interface

Optional

- Free PCI slot (full length) for the CF4000/4001 (Falcon) frame grabber board
- Interface IEEE-1394b (for CF4016)
- Printer (local or network)

3.2 Mounting a frame grabber board (for CF4000/4001)



DANGER

Electric shock by charged components

Touching charged components can lead to an electric shock with fatal consequences.

- ▶ Switch off the computer and pull out the mains plug before opening the computer housing.



CAUTION

Damage by electrostatic charge

Touching the frame grabber when the body is charged electrostatically can damage electronic components.

- ▶ Before touching the frame grabber discharge yourself, for example by touching a metallic part of the computer panel.



! Mounting the board must be carried out before installing the DSA software at all circumstances.

- ▶ Please install the board in exact accordance with the following instructions. If necessary, obtain the help of a computer specialist.

1. Switch off the computer and pull out the mains plug. Open the computer housing.
2. Remove the board from the packaging and insert the board in a free PCI slot.
3. Screw the board with its fixture onto the computer housing.
4. Close the computer housing, reconnect your PC and switch it on.

3.3 Driver installation

3.3.1 Frame grabber driver for CF4000/4001

After switching-on the PC the Windows hardware assistant detects the new board. The assistant for driver installation starts.



All drivers required for installation are located on the DSA1 CD.

- ▶ Let the assistant search for the drivers on the DSA1 CD. The drivers will be installed automatically after confirmation with *OK*.



After installing the frame grabber the DSA1 software can be installed. Further information is given in the DSA1 manual.

3.3.2 IEEE-1394 driver for CF4016



The IEEE 1394 driver should be installed before installing the DSA1 Software under all circumstances.

1. Insert the DSA1 CD-ROM.
2. Open the folder *SUPPORT* → *Cameras* → *AxF*. Open the containing folder named after the version number of the installation program. Start the program *AVTFirePackage_xxx.exe*.



xxx stands for the version number inside the filename.

3. Click *Next* in the welcome window.



4. A warning appears that installing the AVT driver blocks the IEEE-1394 interface for other drivers. Click on *Next*.



5. Confirm the proposed installation directory with *Next* (recommended) or choose a different directory using *Browse*.



6. A dialogue containing installation options appears. Normally, you can use the default options. Click on *Next*.



☞ If several IEEE 1394 boards are installed and not all of them shall work together with the AVT driver: Select the option *for selected 1394 cards*. A dialogue for selecting the board(s) to be used by the AVT driver will open in the course of the installation process.

7. Start the installation with a further click on *Next*. If necessary, confirm the continuation of the installation in the warning message (*Windows Logo-Test*).
8. Click on *Finish* to conclude the installation.

3.4 Computer connection

3.4.1 Interface connection

- ▶ Connect the RS232 plug at the *EASYDROP* panel with a serial interface of the computer.



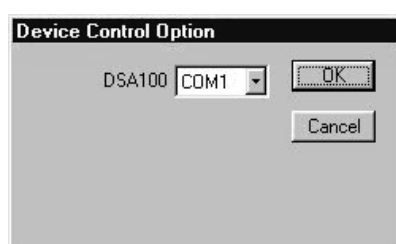
A corresponding cable is within the supply of the instrument.

3.4.2 Entering the interface used

- ▶ Start the DSA1 software. Select the menu *Options* → *Device Control Options*.



The following dialogue box will open:



- ▶ Select the occupied COM-port from the drop-down menu. Click *OK*.

4 Setting up

Please only carry out the setup and installation in accordance with the instructions in this manual.

4.1 Location

Install the measuring system in a location where it is not exposed to vibrations or interference from light.

- ▶ Place the instrument on a stable laboratory bench in a quiet location. The nature of the floor should be such that no vibrations are transmitted. Vibrations, for example due to slamming doors or passing personnel, should also be avoided.
- ▶ Do not place the instrument in the vicinity of a bright source of light; under no circumstances should it be placed in front of a window.
- ▶ Avoid drafts during the measurements. Do not place the instrument in the vicinity of cooling or heating systems or ventilation units.
- ▶ Avoid strong variations in room temperature while measurements are being taken.

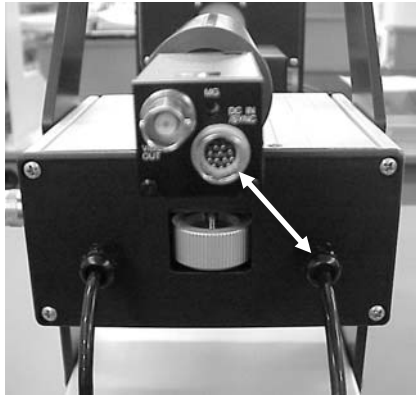
4.2 Levelling the instrument

- ▶ Place a spirit level on the device.
- ▶ Adjust the height of the four feet of the measuring system until the air bubble in the spirit level is located in the centre.



4.3 Power supply

- ▶ Connect the cable coming from the *EASYDROP* panel to the multipole plug on the rear side of the camera.

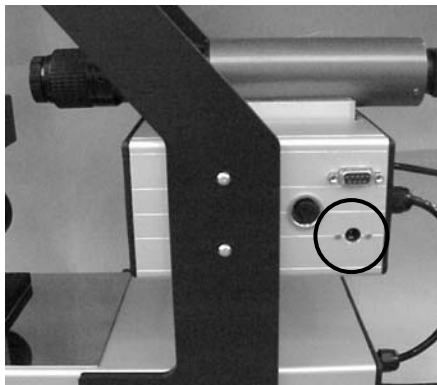


CF4000/4001



CF4016

- ▶ Connect the net adapter from the supply (12V DC / 2,5 A) with the round plug on the side panel of the *EASYDROP*.



! Only use the net adapter that was delivered with the instrument.

- ▶ Connect the net adapter to the mains (100-240V AC).

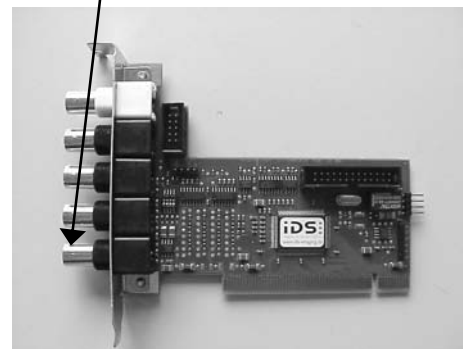
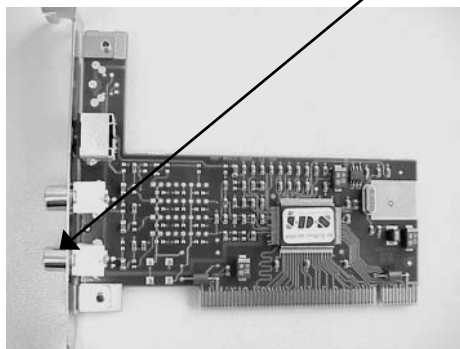
4.4 Connecting the camera

4.4.1 Connection for CF4000/4001

- ▶ Connect the "Video2" connection on the rear side of the camera to the frame-grabber board of the computer.



camera connection
(to PC)



Connection with channel 1
for „Falcon“ (left) and
„Falcon Plus“ (right)

4.4.2 Connection for CF4016



- ▶ Connect one of the camera connections to an IEEE-1394 b interface of the computer.

5 Setting up the dosing system

There are two dosing systems available for *EASYDROP*:

- manual single dosing system DO4000
- software-controlled single direct dosing system DO4010

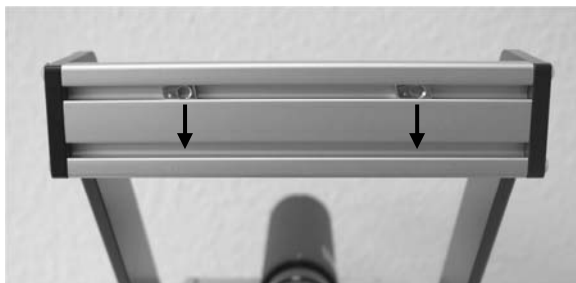
5.1 Manual single dosing system DO4000

5.1.1 Assembling the syringe support

1. Unscrew the T-shaped fixture with the two setscrews at the front.



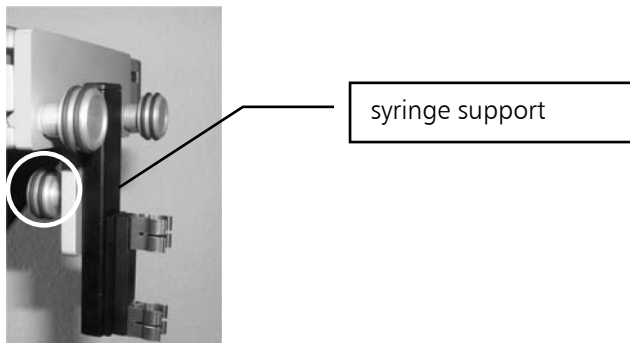
2. Remove the two nuts from the top rail and put them into the bottom rail.




3. Fix the T-shaped fixture by screwing the setscrews into the nuts. Move the fixture to the central position before tightening the screws.



4. Attach the syringe support to the fixture. To do this, lead the guiding rail over the rider and fix the syringe support with the lower set screw.

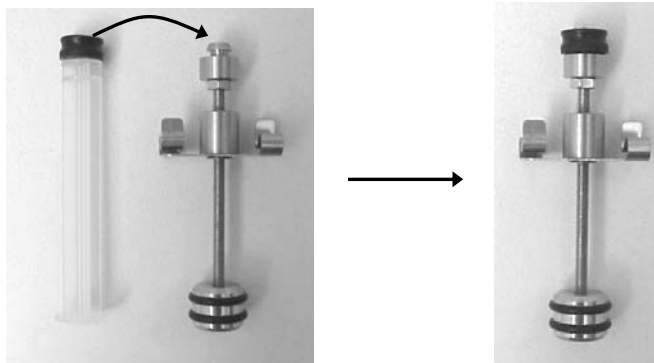


-  The proper height of the dosing system depends on the measuring method (sessile or pendant drop). It can be regulated by loosening the screw and pushing the syringe support upwards or downwards.

5.1.2 Assembling the syringe

Disposable syringes are used for the manual dosing system DO4010.

1. Remove the disposable syringe from the package. Pull out the plunger.
2. Remove the rubber attachment from the syringe plunger and place it on the metal syringe plunger with setscrew.



3. Rotate the plunger upward and push it into the disposable syringe.

4. Rotate the syringe and slide its head under the holding clip.

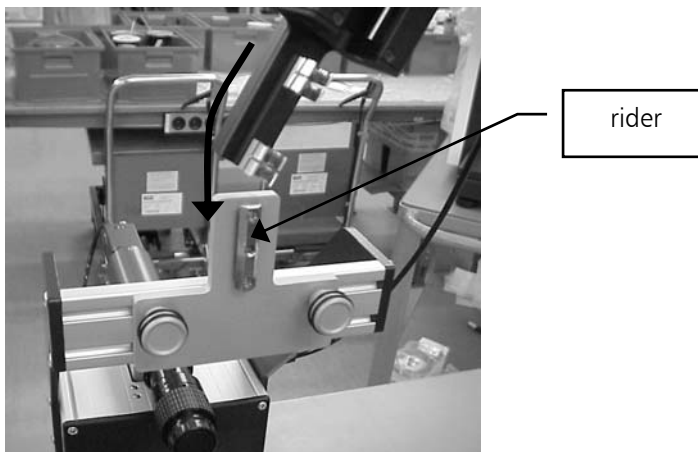


5. Click the syringe into the clamp of the syringe support.

5.2 Software-controlled single-dosing system DO4010

5.2.1 Assembling the syringe support

- ▶ Attach the syringe support to the dosing system fixture by leading it with the guiding rail over the rider.



- ▶ Fix the syringe support with the screw behind the fixation plate.



The proper height of the dosing system depends on the measuring method (sessile or pendant drop). It can be regulated by loosening the screw and pushing the syringe support upwards or downwards.

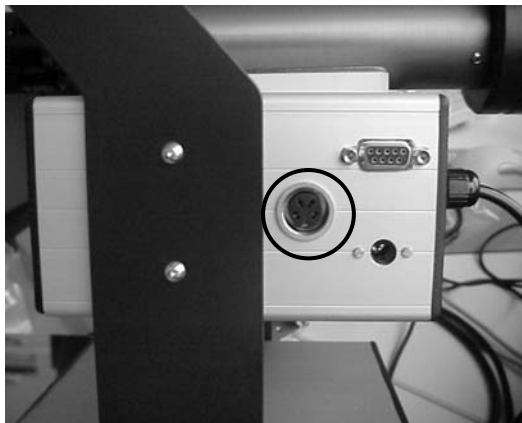
5.2.2 Assembling the syringe

1. Loosen the screw on the syringe support slightly (do not remove it!). Insert the syringe in the syringe support. To do this, press down the fastening for the syringe plunger and insert the plunger.



 There are two types of syringe adapters:

- with wide clips for disposable plastic syringes
 - with narrow clips for reusable glass syringes
2. When the syringe plunger has been inserted tighten the screw again.
 3. Connect the dosing system to the plug on the side panel of the *EASYDROP*.



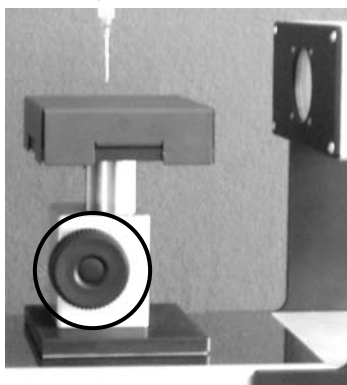
6 Handling the *EASYDROP*

After set-up, most operations needed for measurements are done inside the DSA1 software which is delivered with a separate manual. This manual only covers the manual operations at the *EASYDROP*.

6.1 Sample table height

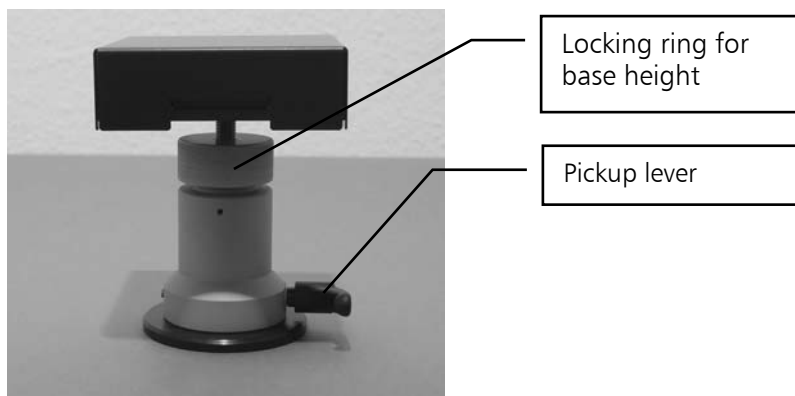
6.1.1 Standard sample table

The height of the sample table is regulated manually with the screw at the table.



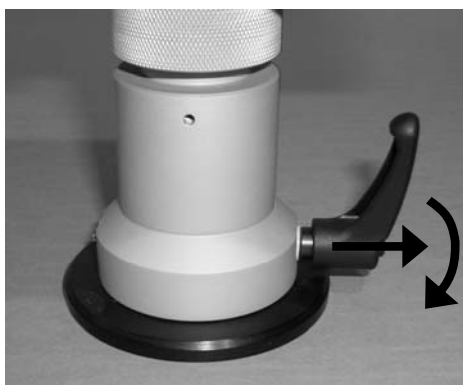
6.1.2 Optional pickup sample table

With the pickup sample table, the drop can be collected from the needle with the help of a lever.



Adjusting the lever position

- ☞ There are several locking positions for the lever. The lever should be adjusted so that the handle points forward when the sample table is in the bottom position.
- ▶ Move the lever so that the sample table is in the bottom position.
 - ▶ Pull out the lever. Turn the lever to the front and allow it to engage in the front locking position.



Adjusting the base height

- ☞ The base height of the sample table should be adjusted so that the sample surface appears in the lower part of the image when the sample table is in the bottom position.
1. Loosen the locking ring by turning it anticlockwise.
 2. Hold the locking ring firmly and turn the sample table in order to set the required height:
 - anticlockwise: up
 - clockwise: down
 3. Hold the sample table in the required position and tighten the locking ring.
 4. Adjust the height of the dosing system so that, when the sample table is in its highest position, the needle is just above the sample.

- ☞ A drop hanging from the needle should come into contact with the sample in this position.

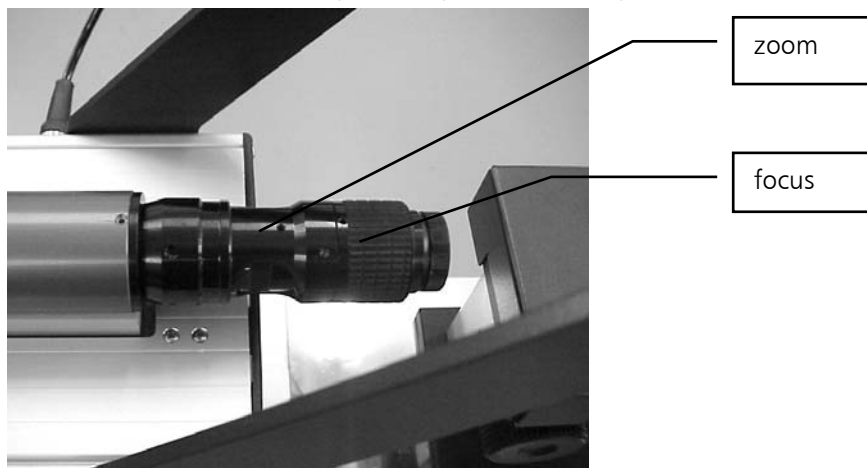
6.2 Illumination

The sample is illuminated with a software-controlled illumination. The illumination has to be adjusted to the individual measurement requirements.

⇒ For specific information please look up in the DSA1 software manual.

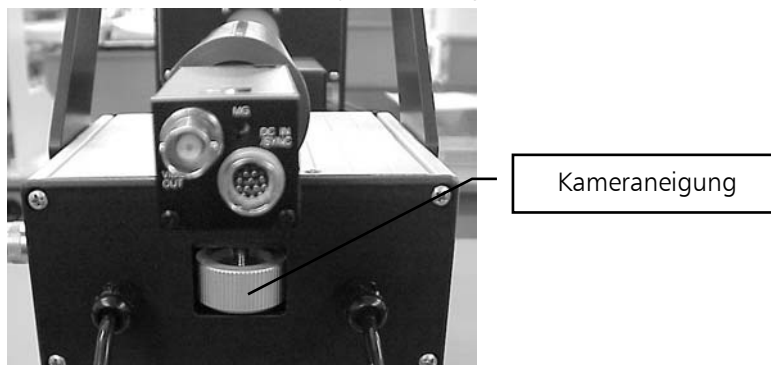
6.3 Zoom and focus

Zoom and focus of the image are adjusted manually at the camera.



6.4 Camera inclination

The camera inclination is adjusted using the round setscrew beneath the camera.



6.5 Dosing and drop positioning

⇒ For information about optimising drop sizes and drop images and for carrying out the image analysis please consult the DSA1 manual.

Contact angle (*sessile drop*)

For contact angle measurements, the thin needle for sessile drops is used. The drop is usually produced at the tip of the needle and then picked up by turning the sample table upwards and back downwards again.

Dynamic measurements (advancing or receding drops; see DSA1 manual) are only possible with the software-controlled dosing system DO4010. The dosing system must be positioned so that the needle appears in the image. Then the sample table with the sample are positioned just below the tip of the needle. During the measurement, the needle remains in the upper part of the drop.

Surface tension (*pendant drop*)

For surface tension measurements, the thick needle for pendant drops is used. The dosing system must be positioned so that the needle appears at the top of the image. A drop as large as possible is produced at the tip of the needle and remains there for being analysed with DSA1.

7 Maintenance

7.1 Cleaning and care

- ▶ Use cotton-wool tips soaked with a solvent (e.g. isopropanol) to clean the lens of the objective.
- ▶ Use a wet cloth to clean the instrument's surface.
 - ! Do not use solvents or cleaning agents to clean the instrument's surface.
- ▶ During downtime put the protective cap onto the objective and the dust cover over the instrument.

7.2 Calibration

KRÜSS offers the drop contour standard sets CP22-26 for calibration of the optics and the drop shape analysis. The procedure for the calibration is described in the corresponding manuals for these standards.

7.3 Maintenance by the KRÜSS support

For maintenance procedures that exceed those described above KRÜSS offers a service contract.



A calibration is also carried out within the scope of a service contract.

Appendix

I. Technical data

Measuring range	1-180°
Accuracy	$\pm 0.1^\circ$
Objective	6x zoom
Camera	monochrome interline CCD, 25/30 fps
Light source	halogen lamp
Dimensions	520 x 160 x 530 mm (WxDxH)
Max. sample dimensions	300 x ∞ x 50 mm (WxDxH)
Weight	approximately 10 kg
Power supply for net adapter	110/220 V, 50/60 Hz
Working voltage	12 V / 2.5 A
Power consumption:	30 W

II. Technical support

If you have any technical questions concerning the *EASYDROP* or the DSA1 software, please contact our technical customer service department.

KRÜSS GmbH

Technical customer service

Borsteler Chaussee 85 – 99a

22453 Hamburg

Email: Info@Kruss.de

Tel.: +49/040/514401-0

Fax.: +49/040/514401-98

Please also visit our web site:

<http://www.kruss.de>

III. **Warranty and caveat emptor**

The warranty terms and deadlines are described in the general terms and conditions of KRÜSS GmbH.

There is no warranty claim if the device was damaged due to careless usage or improper treatment or if it was not used according to purpose, and if the instructions and danger warnings in the manual were not observed.

The warranty claim is void if changes on the device are performed by the customer or a third party without prior consultation of KRÜSS GmbH, which go beyond the activities described in the manual. This also applies to repair work, which was independently performed or carried out by a third party.

IV. **Copyright and right to make alterations**

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EG-KONFORMITÄTSERKLÄRUNG

DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ
ISO/IEC Guide 22 & EN 45014

Wir bestätigen, dass das Produkt / We confirm that the product / Nous confirmons que le produit

EasyDrop

den Anforderungen entspricht, die in den EU-Richtlinien zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die Sicherheit elektrischer Betriebsmittel (2006/95/EG) und der elektromagnetischen Verträglichkeit (89/336/EWG) festgelegt sind. / is in conformity with the EC directive 2006/95/E.E.C. according to Safety Requirements and 89/336/E.E.C. according to Electromagnetic Compatibility. / est conforme aux obligations de protection pour une harmonisation des prescriptions relatives à la compatibilité électromagnétique C.E. 89/336/C.E.E. et sûreté matériel électrique 2006/95/C.E.E.

Diese Erklärung gilt für alle Exemplare, die nach den anliegenden technischen Unterlagen - die Bestandteil dieser Erklärung sind - hergestellt werden. / This declaration is valid for all products which are produced in accordance with the technical documentation which is part of this declaration. / Cette déclaration est valable pour tous les appareils qui ont été fabriqués selon les documents techniques ci-joints faisant parties intégrantes de cette déclaration.

Zur Beurteilung des Erzeugnisses hinsichtlich der Elektromagnetischen Verträglichkeit wurden die folgenden Vorschriften angewendet: / For verification of conformity with regard to Electromagnetic Compatibility the following standards are applied: / Pour la vérification du produit concernant sa compatibilité électromagnétique, les prescriptions suivantes sont appliquées:

EN 61326-1:1997/A1:1998: Elektrische Betriebsmittel für Leittechnik und Laboreinsatz –
EMV-Anforderungen
Electrical equipment for measurement, control and laboratory use –
EMC requirements
Matériels électriques de mesure, de commande et de laboratoire –
Prescriptions relatives à la CEM

Zur Beurteilung des Erzeugnisses hinsichtlich der Gerätesicherheit wurden die folgenden Vorschriften angewendet: / For verification of conformity with regard to Safety Requirements the following standards are applied: / Pour la vérification du produit concernant sa sûreté électrique, les prescriptions suivantes ont été appliqué:

EN 61010-1:1994/A2 :1996 : Sicherheitsbestimmungen für elektrische Meß-, Steuer-, Regel- und Laborgeräte
Safety requirements for electrical equipment for measurement, control and laboratory use
Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire

Diese Erklärung wird verantwortlich für den Hersteller: / This declaration is given under sole responsibility of: / Cette déclaration engage le constructeur:

KRÜSS GmbH Wissenschaftliche Laborgeräte

Borsteler Chaussee 85-99a
D-22453 Hamburg

abgegeben durch: / from: / émis par:

Herrn /Mr. /M. Dr. Thomas Rauch
Geschäftsführer / General Manager / Directeur Général



D-22453 Hamburg

26.07.2007

Unterschrift / Signature