



**DSA100**

**Drop Shape Analysis System**



**Installation and Operation**

V1-30

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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 DSA100 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 DSA100.



The DSA100 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 DSA100 in explosion-proof areas.



The controls of the DSA100 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 DSA100 if the unit is obviously damaged.



Disconnect the DSA100 from the power supply immediately if there is any damage to the electronics, if liquids are spilled over the DSA100 or if there is an escape of tempering medium.

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

## 1.2 Intended use

- The DSA100 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 the DSA100 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 Procedure if repairs should be necessary

### *Contact KRÜSS*

- ▶ Contact KRÜSS customer support.



If you did not obtain the measuring instrument directly from KRÜSS but from a dealer, please contact your dealer first. He may be able to rectify the damage. If not, contact KRÜSS customer support directly.

- ▶ You will be given a repair number. Please quote this number in your covering letter when you dispatch the unit.

### *Send us the measuring instrument or accessories*



Do not dispatch the measuring instrument or accessories without consulting KRÜSS customer support.



Components which are not directly affected by the damage may also have to be sent with the unit. KRÜSS customer support will advise you on the necessary scope of the shipment.



Remove liquids (e.g. samples, temperature control liquid) completely from the instrument and the accessories.



Clean the unit or accessories before dispatch. This applies particularly if there is contamination due to hazardous substances.

- ! Use the original packaging to pack the instrument or accessories.
  - ☞ If you no longer have the original packaging, KRÜSS can provide this at the customer's expense.
- ! Pack all components separately which were packed separately when the unit was supplied. Do not dispatch the unit in the assembled state.
- ! If the instrument or accessories were provided with transportation locks, refit these before shipping.
- ! Use box-in-box packaging.
- ☞ Our customer support department will be pleased to advise you regarding the proper packaging.

#### 1.4 Technical customer service / contact

If problems should occur when working with the DSA100 or with DSA1/DSA3, please consult the technical customer support at KRÜSS GmbH. You can contact them at:

*KRÜSS GmbH*

*Technical support*

*Borsteler Chaussee 85-99a, D-22765 Hamburg (Germany)*

*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 a DSA100 Contact Angle Measuring System. With the DSA100 and the DSA 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.

! This manual provides instructions for the installation of the instrument and the exchange of components. We strongly advise you not to carry out the installation and necessary assembly work without consulting this manual. Even if you treat the instrument carefully, errors could inadvertently occur unless you are fully aware of its properties; these could result in incorrect measurements, damage to the instrument or even injury.

☞ The system is characterized by its high degree of flexibility. All the components – movement axes, video system, dosing unit, environmental chambers – can be easily exchanged or extended. All intermediate stages are possible from fully manual operation up to PC-control of all the components.

### *Possible uses of the DSA100*

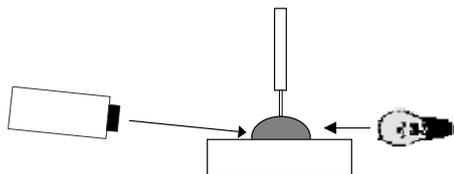
The DSA100 measuring system – depending on the hardware and software supplied – opens up the following possibilities:

- Contact angle measurements on drops of liquid in a gaseous or liquid phase
- Measurement of the surface tension of a pendant drop in a liquid or gaseous phase
- Measuring of advancing and receding drops
- Evaluation of a digitized drop image by various methods
- Calculation of the surface energy of a solid by various methods
- Automatic control of the instrument and data recording by user-defined test methods
- Measurements at low and high temperatures

- Integrated and extendable databases with substance data on liquids that can be directly linked to the measuring data
- Comfortable data management and documentation
- Extendable at any time with components such as environmental chambers, automatic axes, software-controlled optics or multiple dosing units with up to 8 syringes

### 3 DSA100 overview

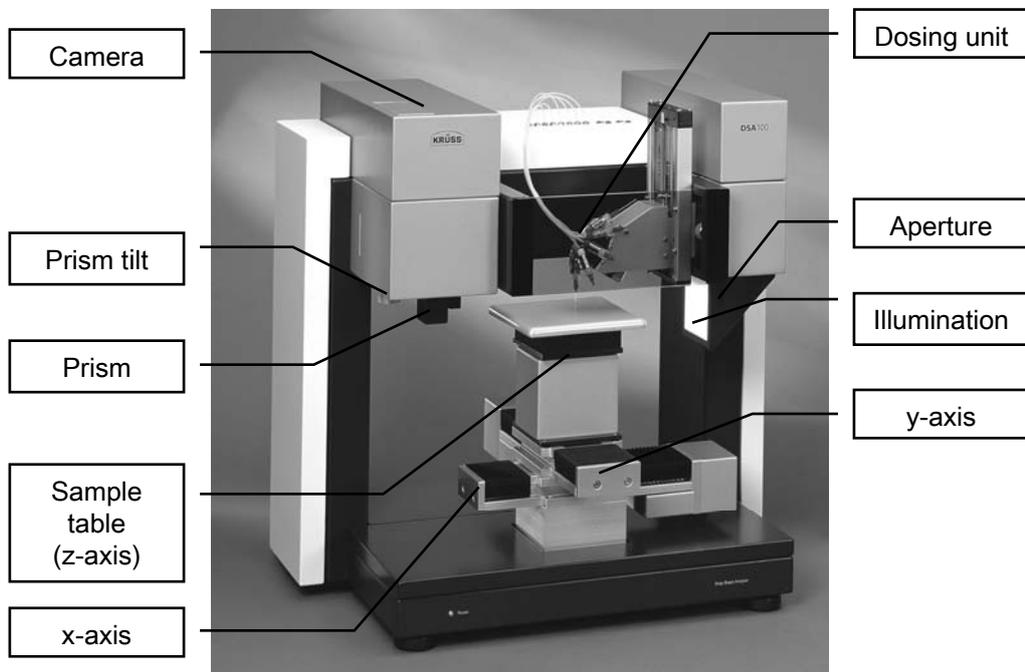
In order to measure the contact angle with the DSA100 a drop is placed on a sample located on a moveable sample table. The drop is illuminated from one side and a camera at the opposite side records an image of the drop.



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

In principle the DSA100 consists of three components:

- The sample table with up to three mobile axes or a rotating wafer table
- The video system with camera, optical system, prism, light source and aperture
- A manual or software-controlled dosing unit, single or multiple



## 4 Computer system

If you have purchased your computer from KRÜSS together with the DSA100 and if the frame grabber board has already been installed then you can skip this chapter.

### 4.1 Computer requirements

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

#### 4.1.1 General requirements

- IBM-AT or compatible personal computer (no notebook!)
- Processor with 32-Bit architecture
- CD-ROM drive
- Mouse
- VGA or SVGA graphics board
  - DSA1: recommended resolution 1024 X 768
  - DSA3: recommended resolution 1152 X 768, 16 bit colour depth
- Colour monitor
- Printer (optional)

#### 4.1.2 Requirements for the available video systems

##### *CF3200/3201*

- Free PCI-slot (full length)
- at least a Pentium III processor (>500 MHz)
- 1 GB working memory (RAM)
- Windows XP or Vista

##### *CF3216*

- Interface IEEE-1394b
- at least a Pentium III processor (>500 MHz)
- 1 GB working memory (RAM)
- Windows XP or Vista

**CF3220/21**

- at least a Pentium IV processor (>2 GHz)
- 2 GB working memory (RAM)
- Free PCI-X (64 bit), PCI (32 bit) or PCIe X4 slot (all full length)
- Windows 2000 or XP, with MS .NET framework v2.0 and MDAC v2.6

**4.2 Mounting a frame grabber board (for CF3200/3201 and CF3220/21)****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.

**Damage by electrostatic charge****CAUTION**

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.

## 4.3 Driver installation

### 4.3.1 Safety measures for driver installation

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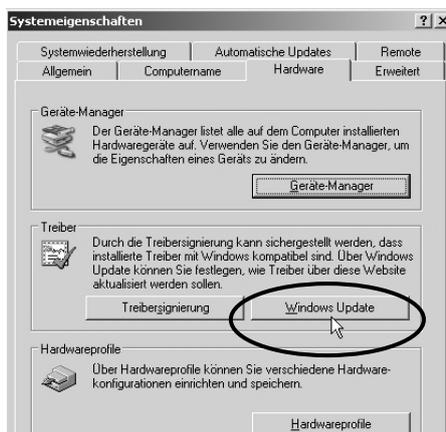
**CAUTION** **Damage due to improper driver installation**

Under Windows XP and Vista, the frame grabber board can be damaged if the automatic driver update via internet is activated.

- ▶ Deactivate the automatic driver installation before assembling the board (see below).
- 

#### *Deactivating the automatic driver update*

1. Select the *Control Panel* in the Windows start menu and open the configuration menu *System*.
2. Select the tab sheet *Hardware* and click on *Windows Update*.



3. Select the option *Never search Windows Update for drivers* and click on *OK*.



☝ Later, when the installation process is finished, the option *Ask me to search...* can be selected if this Microsoft service is desired.

! However, we do not recommend the first option *without asking me*.

#### 4.3.2 Frame grabber driver for CF3200/3201

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/DSA3 CD.

☝ After installing the frame grabber the DSA1/DSA3 software can be installed. Further information is given in the DSA1/DSA3 manual.

▶ Let the assistant search for the drivers on the DSA1/DSA3 CD. The drivers will be installed automatically after confirmation with *OK*.

### 4.3.3 Frame grabber driver for CF3220/21

- ▶ First close all running programs; several re-boots are necessary during the installation process.

The installation of the driver is to be performed in several steps:

- Step 1: Installation of the software “PFRemote”.
- Step 2: Frame grabber driver installation.
- Step 3: Installation of the “Mil-Lite” patch.
- Step 4: Possibly necessary: firmware update of the frame grabber.
- Step 5: Reducing the hardware acceleration



CAUTION

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#### Damage due to improper driver installation

If the *Mil-Lite* patch is not installed the frame grabber board can be damaged.

- ▶ Carry out the installation in exact accordance with the following instructions.
- 

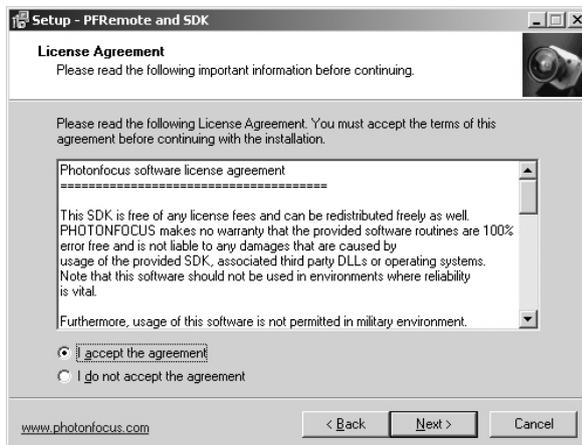
#### *Step 1: Installation of the software “PFRemote”.*

 *PFRemote* is software for camera control. KRÜSS has worked out standard parameters for the high-speed camera which are transferred to the DSA3 software with the help of prepared parameter files. (⇒ DSA3 manual, chapter about high-speed cameras.)

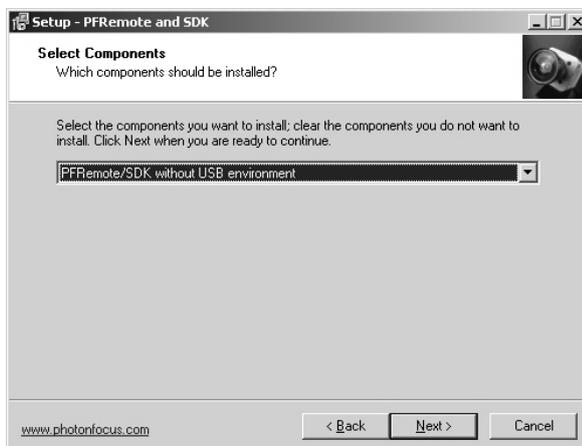
1. After switching on the computer, terminate the Windows hardware assistant.
2. Insert the DSA3-CD-ROM. Select the folder *Cameras/PxH/PFRemote* and start the program *PFInstallerxx.exe*. Continue the installation with *Next*.

 xxx stands for the version number inside the filename.

3. Confirm your license agreement and click on *Next*.



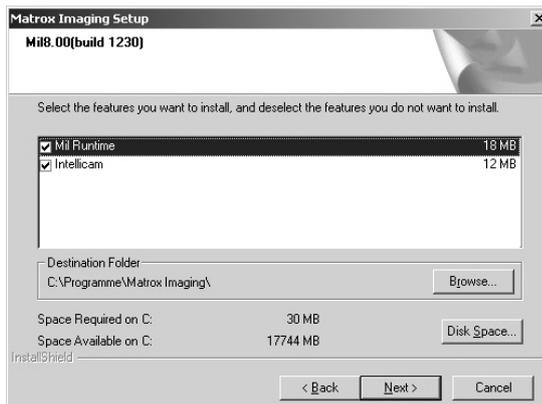
4. Skip the following information page about different camera models with *Next*.
5. Confirm the proposed installation directory with *Next* (recommended) or choose a different directory using *Browse*.
6. Confirm the installation of the two components *PFRremote* and *SDK* with the option *Without USB Environment*.



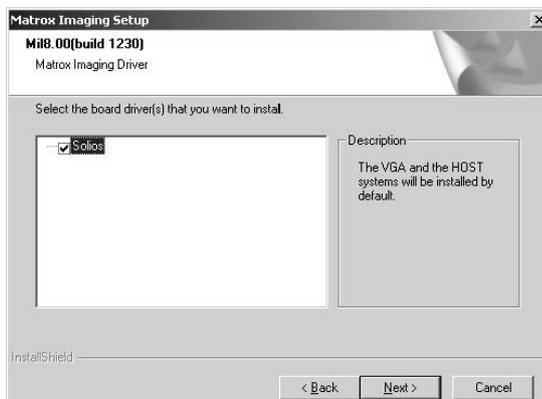
7. Confirm the proposed start menu folder with *Next* or select a custom-defined folder with *Browse*. With *Dont create* the creation of a start menu item can be obviated.
8. In the next steps short cuts can be created on the desktop or in the Windows quick launch bar. Confirm your selection with *Next*.
9. Click on *Install* to carry out the installation.
10. Before finishing, the setup program recommends reading two information texts. Conclude the installation with *Finish*.

**Step 2: Frame grabber driver installation.**

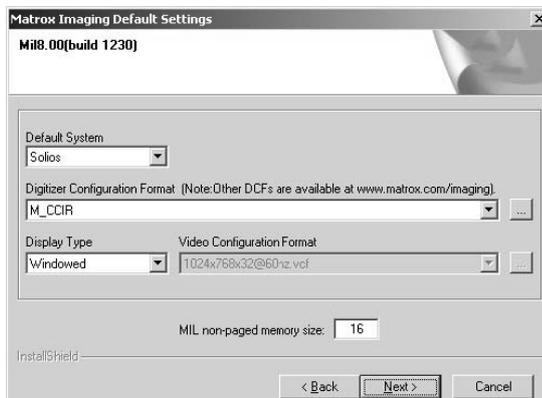
1. Select the folder *CF3220* on the DSA3-CD and start the program *setup.exe*.
2. Confirm the installation of the two components *Mil Runtime* and *Intellicam* with *Next*.



3. A welcome window opens. Continue the installation with *Next*.
4. Set a tick to the box for the *Solios* board and confirm with *Next*.



5. Leave the default settings on the following page unchanged and confirm with *Next*.



6. Confirm your license agreement and click on *Next*. Ignore the possible warning that the *Windows Logo Test* was not passed and continue with the installation.
7. Confirm the reboot of the computer at the end of the installation.

### ***Step 3: Installation of the Mil-Lite patch***

1. Select the folder *CF3220 \Mil Lite Patch* on the DSA3-CD and start the containing *.exe* program.
2. Click on *Next* in the welcome window to start the installation. A text pops up and informs you about the changes.
3. Confirm the reboot of the computer at the end of the installation.

### ***Step 4: Firmware check / frame grabber update***

- ! If a frame grabber update is necessary (see subsequent instructions), this step must not be omitted. The frame grabber can be damaged when working with a dated firmware.

1. Start the program *Intellicam* from the start menu folder *Matrox Imaging*.



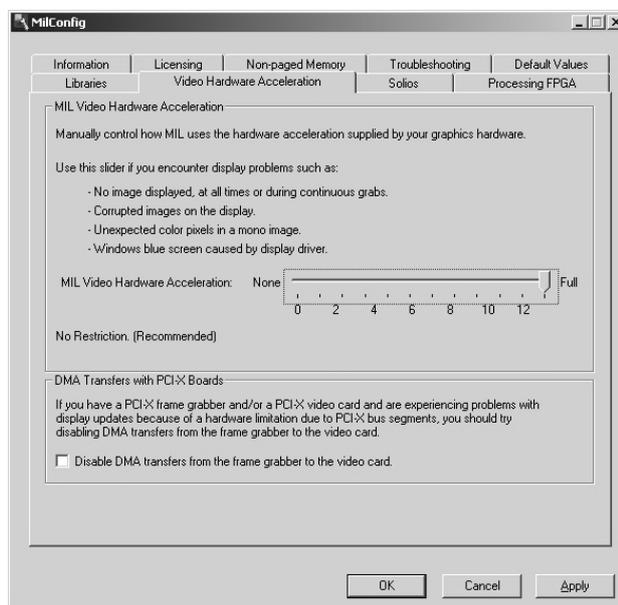
2. If a frame grabber update is necessary this is stated in a program message. Confirm this message with *OK*. The frame grabber gets updated automatically.

 If no message appears, no update is necessary. In this case just terminate the program *Intellicam*.

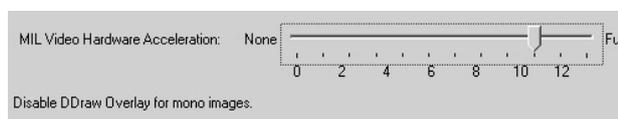
3. After the upgrade the computer switches off automatically. Reboot the computer.

### ***Step 5: Reducing the hardware acceleration***

1. Start the program *MilConfig* from the start menu folder *Matrox Imaging* → *Tools*.
2. Select the *Video Hardware Acceleration* tab.



3. Move the slider two tick marks to the left. The text *Disable DDraw Overlay for mono images* must appear in the lower left of the scale.



4. Click *OK*.

#### 4.3.4 IEEE 1394 driver for CF3216

! The IEEE 1394 driver should be installed before installing the DSA1/DSA3 Software under all circumstances.

1. Insert the DSA1/DSA3 CD.
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.

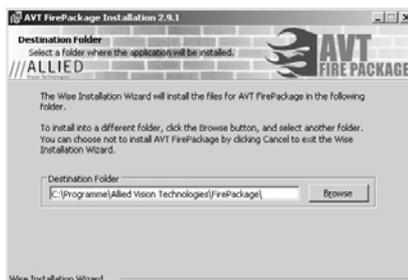
3. Click *Next* in the welcome window.



4. A warning message 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*.



- A dialogue box 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.

 IEEE 1394 boards that are not used should be deactivated in the Windows control panel.

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

## 5 Setting up

### 5.1 Opening the transport packing and checking the scope of supply

- ▶ Open the transport packing Check the DSA100 and its accessories for damage during shipment.
- ▶ Use the packaging note provided to check if the supply is complete.
- ▶ Please contact KRÜSS or your local dealer without delay if damage during shipment occurred or if the supply is incomplete.

### 5.2 Transport

- ! Two people are required for transporting the DSA100.
- ! Do not transport the instrument with storage vessels filled.
- ! Remove parts which lie on the DSA100. Take care that all components are fixed.
- ▶ Transport the DSA100 with the help of a trolley. Hold the unit firmly during transportation.
- ▶ To lift the DSA100 onto the trolley and from the trolley to the place of use: Hold the unit from both sides under the base plate.
- ! Do not hold the unit at the illumination, a dosing unit or an axis for transportation.

### 5.3 Location

- ! The measuring system should be installed 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 floor should be constructed so that it does not transmit vibrations. Vibrations caused, for example, by 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 large variations in room temperature during the measurements.

### 5.4 Levelling the instrument

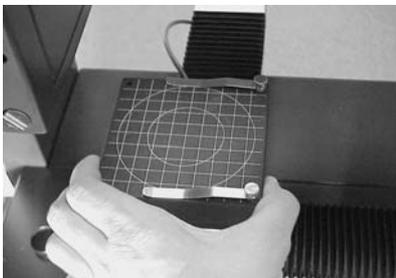
After positioning the DSA100 must be levelled.

- ☞ If not all axes have yet been assembled this step must be carried out before levelling the instrument (⇒ ch7).

For levelling, two spirit levels are located on the bottom of the standard sample table support.

- ☞ For some special sample tables, e.g. a wafer table, an external spirit level must be put on top of the sample table.

1. Remove the sample table adapter from the sample table.



2. Remove the two clips (if present) from the sample table support.

3. Turn the sample table support over.



4. Adjust the height of the four feet of the measuring system until the air bubbles in the two spirit levels are located between the markings in the middle.



## 5.5 Power supply

A net adapter was delivered with the DSA100.

- ▶ Connect the round 4-pin plug to the “24V DC” socket on the rear panel of the DSA100.



- ▶ Connect the power supply to the mains (100-240V AC).

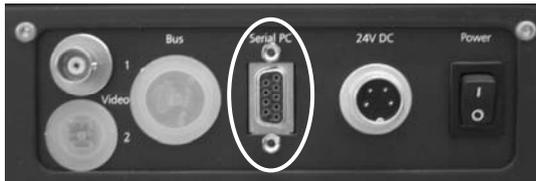
 The main switch “Power” is beside the connection. After the instrument has been switched on all the software-controlled axes, the needle selector and the syringe drives (if present) move to their zero positions for initialization.

 When the instrument is switched on the LED on the front panel lights up to show an intensive blue, when the instrument is switched off it is still weakly lit up.

## 5.6 Connecting the computer

### 5.6.1 Serial port connection

- ▶ Connect the RS232 plug (“Serial PC”) at the DSA100 rear panel with a serial interface of the computer.



A corresponding cable is within the supply of the instrument.

### 5.6.2 Serial port assignment

After the start of the software the serial port to which the DSA100 is connected must be entered.

#### *Assignment in DSA1*

- ▶ Select the menu *Options*→*Device Control Options*.



The following dialog opens:



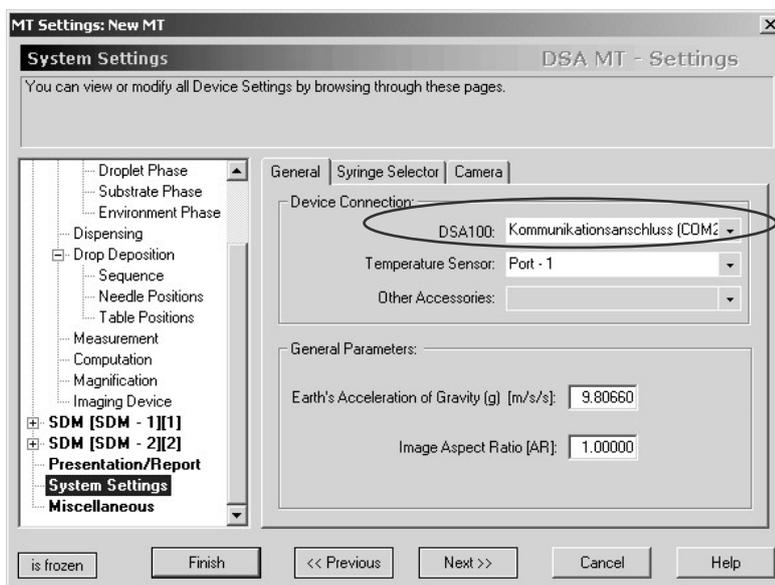
- ▶ Select the occupied COM-port from the drop-down menu.

### Assignment in DSA3

- ▶ Select the menu option *Tools*→*System Settings*.



The following dialog opens:



- ▶ Select the occupied COM-port from the drop-down menu marked above.

## 5.7 Protective glass

A protective glass to be attached to the front panel is supplied with the instrument.



The protective glass prevents accidental contact with the needle tip to avoid injury or poisoning risks. This protective glass should only be removed when conversion work is being carried out.

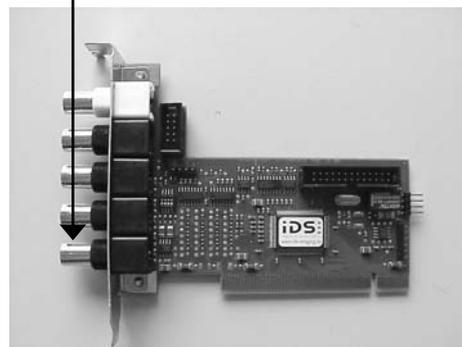
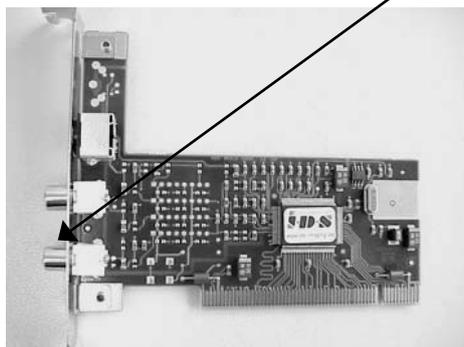


## 5.8 Connecting the camera

The instrument comes with a camera already assembled in the camera housing of the DSA100. The camera must be connected to the frame grabber board of the computer.

### *CF3200/3201*

- ▶ Connect the "Video" connection on the rear side of the camera to the frame-grabber board of the computer. Use the supplied BNC cable.



Connection with channel 1  
for "Falcon" (left) or "Falcon  
Plus" (right)

### *CF3220*

- ▶ Connect the cable with the Camera Link plug (coming from the DSA100 panel) with the connection "Channel 0" of the frame grabber board.

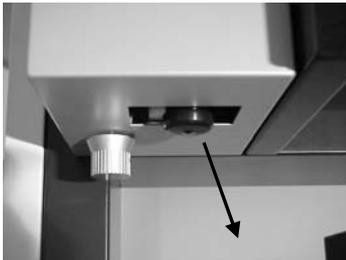
### *IEEE-1394 cameras*

- ▶ Connect the camera with a IEEE-1394 interface of the computer.

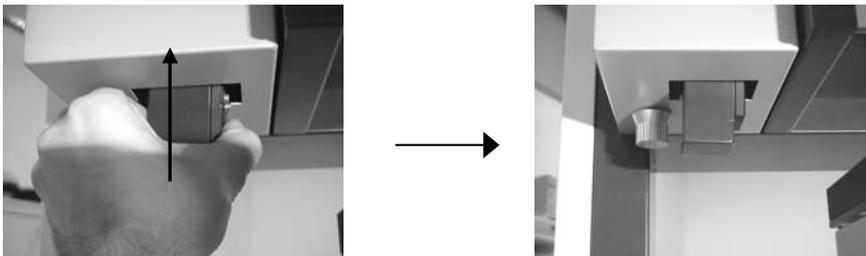
## 5.9 Assembling and adjusting the prism

! The prism is a sensitive component and must therefore be built in after delivery. Do not touch the prism glass with your fingers or sharp or pointed objects.

▶ Remove the protective cap from the objective.



▶ Insert the prism in the opening and push it upward until it clicks into position.



☞ The prism can be tilted in order to change the viewing angle of the drop. The advantage of this arrangement is that the position of the drop image does not alter and the image itself is not distorted.

☞ The tilting angle is regulated by using the rotary knob beside the prism. When the instrument is switched on the scale on the left-hand side of the housing shows the set tilt angle.



☞ The default settings are +2° for sessile and 0° for pendant drops.

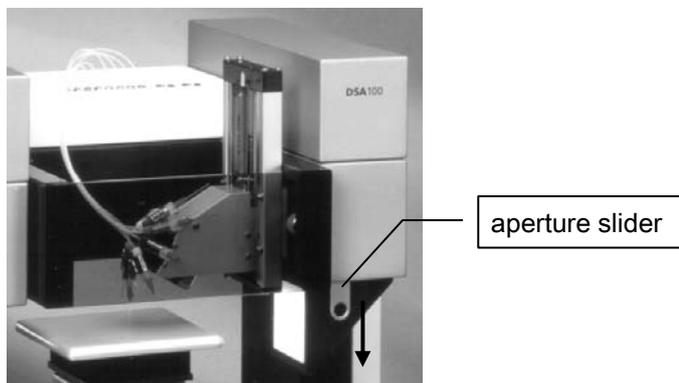
## 5.10 Illumination / aperture

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 DSA software manual

An aperture is additionally provided to measure very small contact angles ( $\Rightarrow$  DSA software manual).

### *Using the aperture*

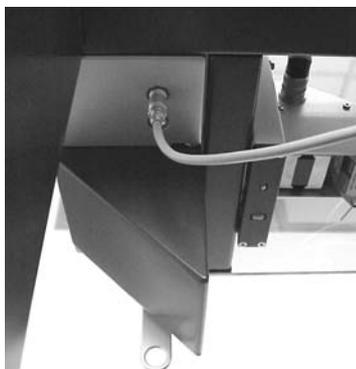
The light slit can be narrowed in order to prevent disturbing reflections at the upper side of the drop ( $\Rightarrow$  DSA software manual). To do this, pull the slider downward.



## 5.11 Connecting a temperature sensor

On the base of the illumination module there are two connectors for connecting a temperature sensor.

- ▶ Connect the temperature sensor to the rear socket (the following image shows the rear side).



## 6 Exchanging cameras

This chapter describes how to change between different camera frames.

! Before changing a camera the drivers required for its use must be installed.

### 6.1 Assembly

1. Switch off the DSA100.
2. Open the doors of the chambers at the camera side (left).

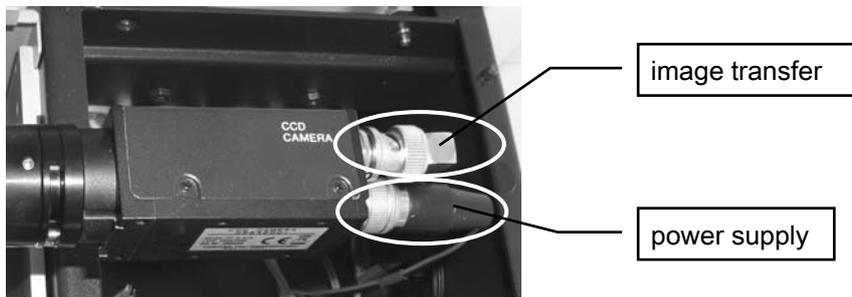


3. Remove the covers from the camera housing. In order to do that, pull the spring inside the chamber and lift up the cover.

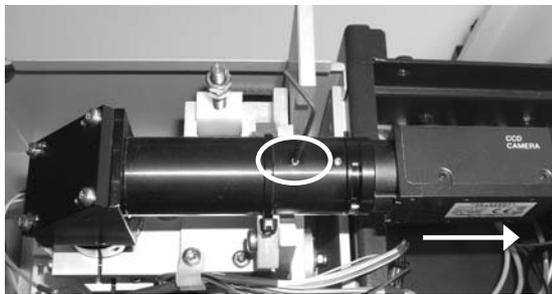


☞ For CF3220/21 and for IEEE-1394 cameras the camera cover has an outlet for the cables at the rear side. Exchange the camera covers when changing from CF3200/3201 camera to one of these cameras.

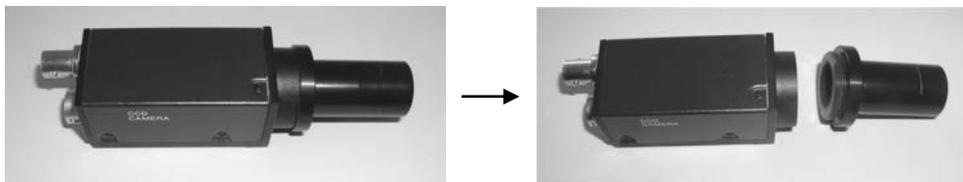
- Remove the connections from the installed camera (image: standard camera).



- Loosen the screw marked in the following image using an allen wrench (1.5 mm) and remove the camera from the guidance.



- Unscrew the tube which is screwed onto the camera.

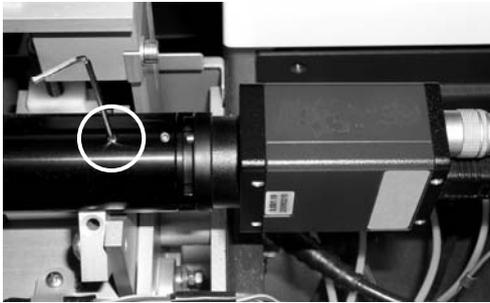


 An increased amount of force is possibly necessary.

- Put the protective cap on the removed camera and keep it safe from dust.
- Screw the tube onto the new camera. Insert the camera into the guidance.
- Connect the power supply and the port for image transfer:
  - Connection for CF3220/21
  - IEEE-1394 connection for corresponding cameras

## 6.2 Horizontal alignment

1. Switch on the DSA100 and start the DSA1/DSA3 software.
2. Place an object with an exactly horizontal edge onto the sample table and get the edge into focus ( $\Rightarrow$  DSA1/DSA3 manual).
3. Turn the camera so that the edge in focus is aligned horizontally.  
 You may use the horizontal measuring lines in the DSA software as a support ( $\Rightarrow$  DSA1/DSA3 software manual).
4. Fasten the previously loosened screw at the correct camera position.



5. Superimpose the camera cover and close the chamber.

## 7 Assembling axes and tables

-  Usually the axes are already assembled when the instrument is delivered. This chapter describes the assembly of axes or tables that were acquired afterwards.
-  If one or more software-controlled axes are to be assembled and only manual axes are currently installed, the additional installation of an interface board is necessary. In other cases the chapters 7.1 and 7.2 can be skipped.

### 7.1 Assembling the interface board



#### 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.



Switch off and unplug the DSA100 before starting with the installation.

1. Open both doors of the chambers on both sides of the DSA100. If necessary, remove the liquid containers and their racks from the chambers.



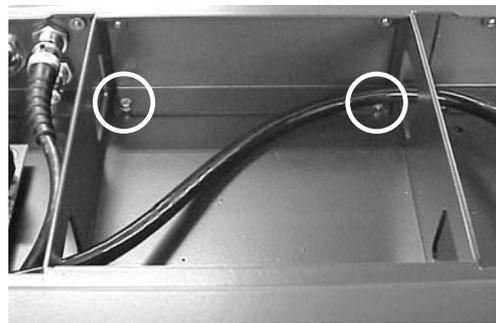
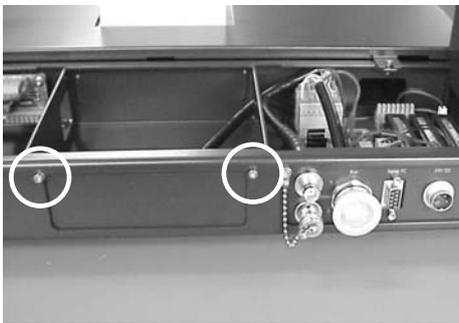
2. In both chambers, a hexagon socket screw is situated behind the stand. Screw out the screws in both chambers.



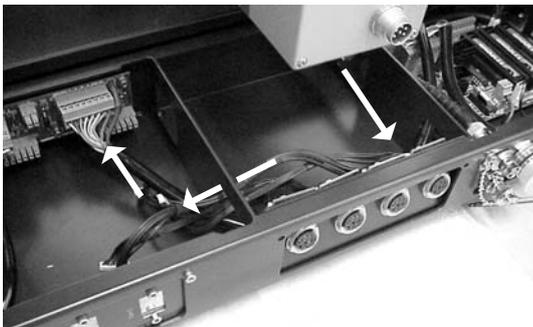
3. Remove the cover that was fixed with the screws.



4. Unscrew the middle cover. It is fixed with two hexagon socket screws on the rear side and two screws on the inside.



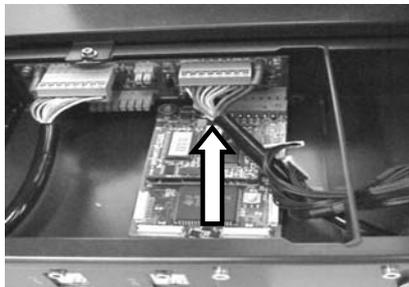
5. Place the interface board in the middle compartment, lead the connecting cables through the gap to the compartment on the left-hand side. Use the right-hand connection to plug the board.



6. Fix the plate with the axes connections with two screws each at the rear side and the inside of the compartment.



7. Press the interface board to the stop into the free socket on the lower right (seen from the rear side).

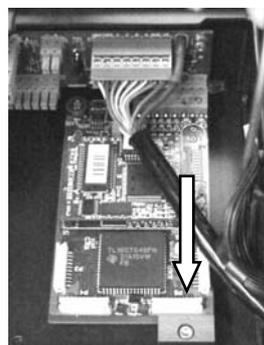
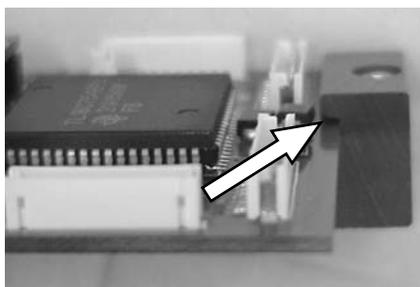


- ! Take care that the whole width of the socket is used for the board so that all poles are occupied. If the board is not properly connected it can be destroyed when switching on the DSA100.

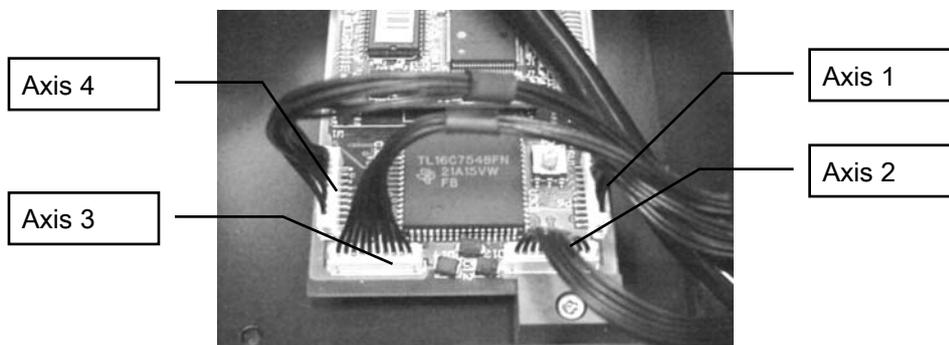
8. Fix the supporting block...



...with the screw to the bottom of the compartment so that the edge of the board is situated in the gap of the supporting block.



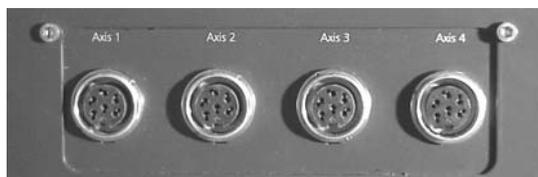
9. Occupy the sockets of the installed board with the four plugs coming from the connecting plate. The connections for axes 1 to 4 are plugged into the board in ascending order from right to left.



10. Reverse the steps 2 - 4 to reassemble the cover and to put the instrument into an operational state.

## 7.2 Connecting the software-controlled axes

The connections for the axes are located on the rear panel of the DSA100.



The x-axis (left to right), the z-axis (up and down), a wafer table or the tilting table can be connected to any of ports 1, 3 and 4; the axes are recognized automatically.

! **Port 2** is reserved for the **y-axis** (front to back). If the y-axis is connected to a different port then it will be recognized by the system as being the x-axis!

☞ The number of connection cables supplied corresponds to the number of software-controlled axes that have been ordered. The length of the cables to be used for each axis depends on the moving ranges of the axes it is assembled onto.

### 7.3 Regulating the total height with spacers

The different arrangements of the axes result in different total heights. In order to ensure that the sample table is always at the height of the optical axis distance pieces (“spacers”) must be attached or removed during the assembly of the axes.

Three different spacers can be supplied with the instrument: 36, 49 and 65 mm. Depending on the particular order, one or more spacers may have already been built in.



Each of the spacers has three threaded holes for screwing onto a different spacer and four threaded holes at the corners for screwing an axis onto the spacer:



### 7.3.1 Spacer selection

The following table shows which spacers should be used on the frame of the DSA100 for the various combinations of axes and environmental chambers.

<i>z-axis 163 mm</i>	<i>z-axis 173 mm</i>	<i>1 horiz. axis</i>	<i>2 horiz. axes</i>	<i>Environ- mental chamber</i>	<i>Wafer table</i>	<i>Spacer</i>
•						65 + 49
	•					65 + 36
•		•				49 + 36
	•	•				65
•			•			49
	•		•			36
•				•		65 + 36
	•			•		65 + 36
•		•		•		65
	•	•		•		65
•			•	•		36
	•		•	•		36
	•	•			•	49

 For special combinations please consult our customer support.

 In special cases, for example to adapt the system to large samples, the sample table support can be removed or a different combination of spacers be assembled.

### 7.3.2 Spacer assembly

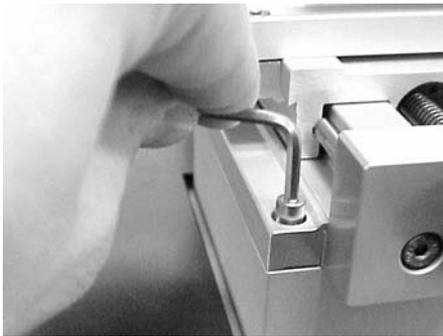
! For safety reasons first remove the prism and keep it in a safe place when carrying out the assembly work.

1. If axes have already been installed, move them so that the attachment screws are exposed.

☝ *With software-controlled axes:* please consult the DSA software manual to see how the axes are moved.

2. Remove all the cable connections from the axes.

3. Screw off the four screws that connect the lowest axis to the spacer (4 mm allen wrench).



! Hold the axis firmly with your other hand so that it cannot fall to the ground.

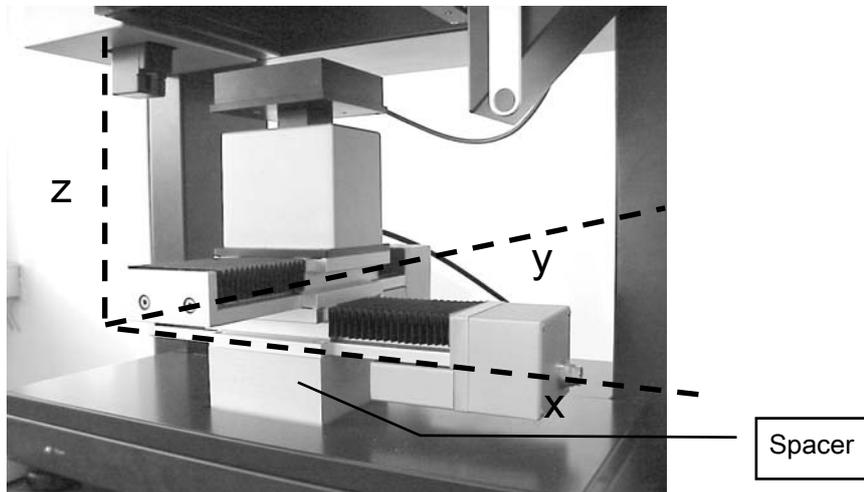
4. Remove the clips that are attached with the screws and remove the axes from the spacer.

5. If the attached spacer has to be removed, loosen the four screws used to attach the spacer to the DSA100 frame.

6. Screw the required spacer(s) to the DSA100 frame or to a spacer that is already in position.

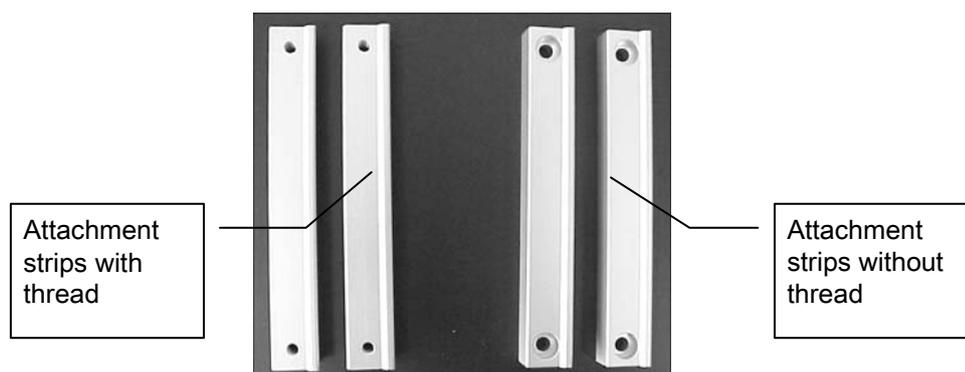
## 7.4 Carrying out the assembly of the axes

Up to three axes, manual or software-controlled, can be assembled on the frame at the same time. The arrangement from bottom to top is **Spacer - x - y - z**:



Each axis is either screwed onto a spacer or onto another axis. To assemble an axis, attachment strips are required as follows:

- Two strips without threads for attaching an axis to a spacer
- Two strips with threads for attaching a z-axis to an x-axis or y-axis
- Four strips, two with and two without threads, for attaching a y-axis to an x-axis

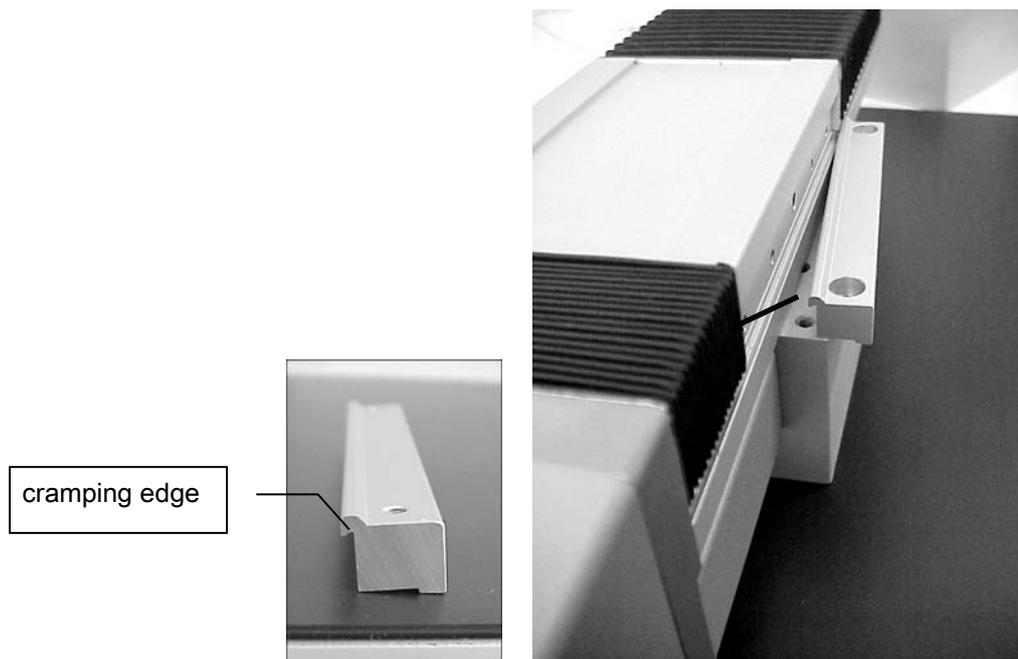


☞ If only the z-axis is present then no attachment strip is required; the axis is screwed directly onto the spacer.

! Not always are all strips used which were delivered. Keep the unneeded strips save for the occasion of further upgrades.

### 7.4.1 Assembling an x- or y-axis on a spacer

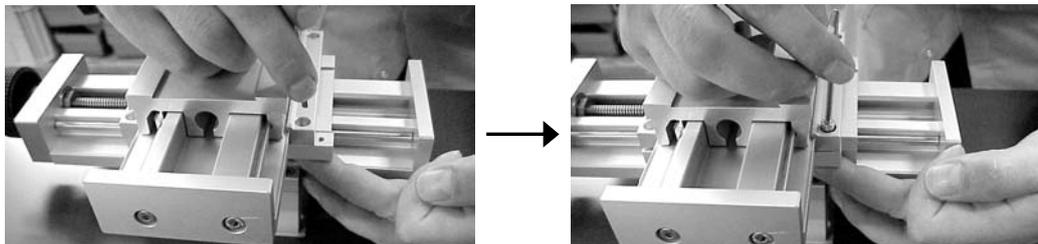
1. Place the axis on the built-in spacer and hold it firmly. The axis should be positioned so that the spacer is located below the centre of the range of movement of the axis.
2. Place the non-threaded attachment strips on the spacer so that the cramping edges fit inside the ridges of the axis.



3. Slide the strip along the axis so that the openings in the strips and spacer lie above each other.
4. Screw down the strips with four screws.
  - ! Tighten up the screws in sequence to achieve uniform stress and avoid tilting.

### 7.4.2 Assembling a y-axis on an x-axis

1. Place the y-axis on the x-axis. Place one of the attachment strips with threaded openings below the y-axis so that the cramping edges fit inside the ridges of the x-axis. Hold the strip firmly.
2. Place two non-threaded attachment strips with their cramping edges inside the ridges of the y-axis. Slide the strips so that the openings on the upper strip coincide with threaded openings of the lower attachment strip.



Fix the strips with two screws lightly so that the axis can still slide about.

3. Treat the other side of the axis in the same manner. Slide the y-axis so that it lies as centrally as possible above the x-axis.
4. Fasten the screws.
  - ! Tighten up the screws in sequence to achieve uniform stress and avoid tilting.

### 7.4.3 Assembling a z-axis

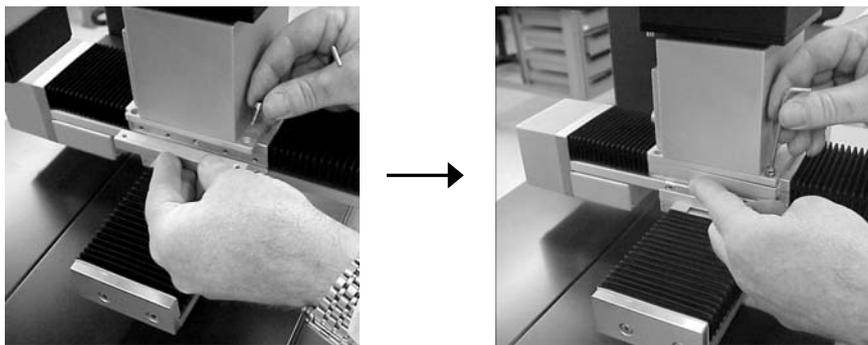
#### *Assembly on a spacer*

If only the z-axis is used then this is screwed directly onto the spacer without any attachment strips.

! Tighten up the screws in sequence to achieve uniform stress and avoid tilting.

#### *Assembly on an x- or y-axis.*

1. Place the z-axis centrally on the metal block of the x- or y-axis.
2. Place one of the threaded attachment strips below the z-axis so that the cramping edge fits inside the ridge. Slide the strip and the z-axis until the openings of the z-axis coincide with the openings in the strip.



3. Fix the strip lightly so that the axis can still slide about.
4. Fix the second strip in the same way.
5. Slide the axis to the central position above the lower axis.
6. Screw down the strips with four screws.

! Tighten up the screws in sequence to achieve uniform stress and avoid tilting.

## 7.4.4 Assembling a wafer table

The wafer table cannot be used together with the x-axis, but only as an alternative to it. If an x-axis is already attached then it must be removed before assembling the wafer table.

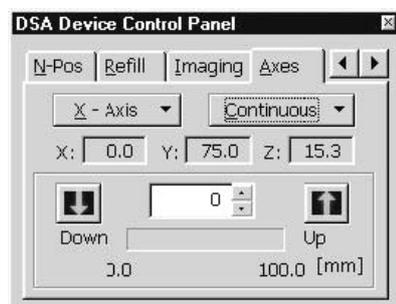
 Assembling a tilting table should be carried out with two persons.

### *Removing the x-axis (if present)*

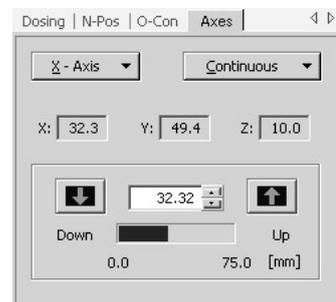
**!** For safety reasons first remove the prism and keep it in a safe place when carrying out the assembly work.

1. If software-controlled axes are installed then switch on the computer and start the DSA software.
2. *With manual axes:* wind the axis to the back until the screws are exposed.

*With software-controlled axes:* Select the register card *Axis* respectively *Axes* in the *Device Control* panel.

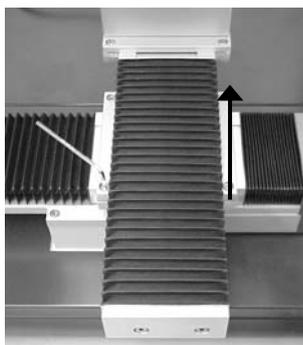


**DSA1**



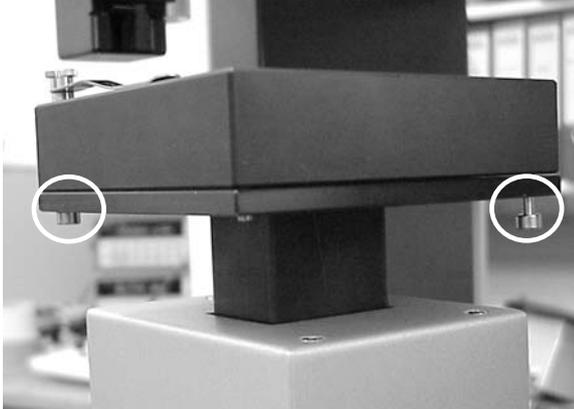
**DSA3**

Select the y-axis with the button at the top left and use the *Up* button to move the axis until the screws are exposed. A further click on the button stops the movement.



3. Remove all the cable connections from the axes.

4. Loosen the screws beneath the sample table support. Remove the sample table support from the z-axis.

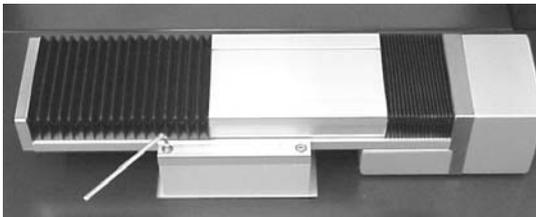


- ! Place a cloth over the rear side of the DSA100 frame in order to prevent scratches during the further steps.

5. All the axes are fastened with attachment strips and screws. Remove the attachment screws for the y-axis (3 mm allen wrench).

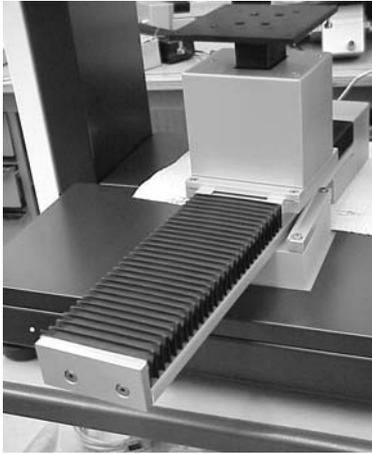
- ! Hold the y-axis firmly so that it cannot fall to the ground.

6. Screw off the remaining x-axis in the same manner.



7. Replace the currently assembled spacer with the 49 mm spacer.

- Place two non-threaded attachment strips on the spacer (y-direction) without fastening them down. Now place the y-axis on the spacer so that the grooves of the attachment strips are located on the guide ridges of the y-axis.



- Fix the attachment strips with four screws lightly so that the axis can still be moved. Move the whole axis so that the spacer is located in the centre of the range of movement of the axis.

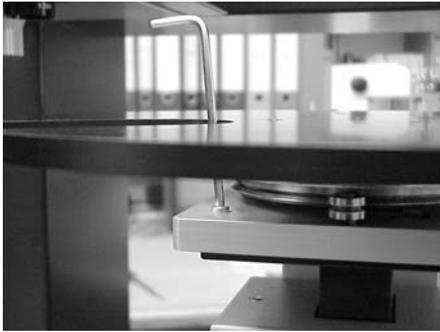
- Fix the strips.



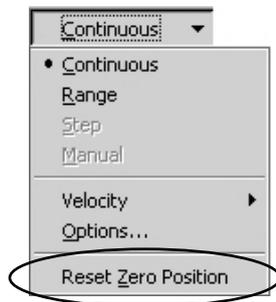
- ! Tighten up the screws in sequence to achieve uniform stress and avoid tilting.

**Assembling and installing a small wafer table ST3220/3270**

- ▶ Place the wafer table on the sample table. The wafer table must be attached with four hexagon socket screws (4 X 8 mm). Rotate the wafer table manually and use the gap in order to screw in the screws.



- ▶ *In case of a software-controlled wafer table:* Switch off the DSA100. Connect the wafer table with one of the ports Axis1, Axis3 or Axis4 on the rear panel of the DSA100. Switch on the DSA100. Close the DSA software and then start it up again. Call up the menu command Reset Zero Position from the tab sheet Axis respectively *Axis* in the *Device Control* panel.



### Assembling and installing a large wafer table ST3220/3280



#### Damage of the prism by the wafer table

When driven too far upward the wafer table can collide with the prism and damage it.

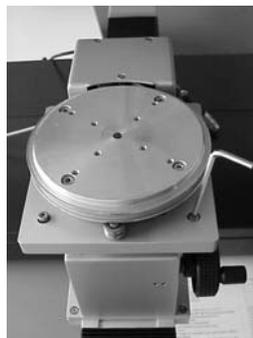
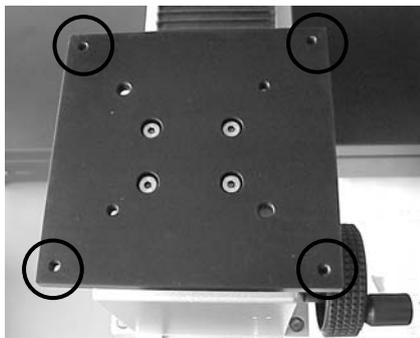
- ▶ Before driving the wafer table upward, check if there is enough space between the prism and the wafer table.
- ▶ Move the table slowly and do not use the movement mode *Continuous* in the DSA software.

! The prism must be adjusted to a tilting angle of  $2^\circ$  for sessile drops ( $\Rightarrow$  ch. 4.6).

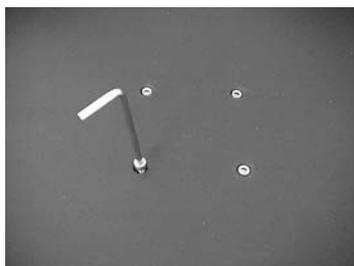
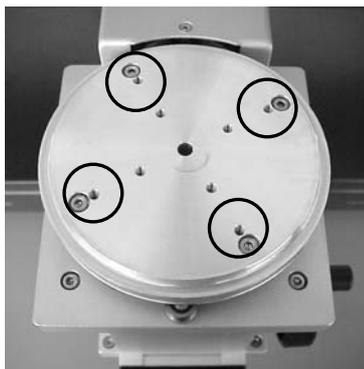
☞ The large wafer table is to be used together with the long y-axis PS3210. A currently assembled shorter y-axis must be exchanged.

☞ The large wafer table can be assembled easier when a dosing system is already attached to the DSA100.

1. Attach the z-axis to the y-axis as described in ch. 7.4.2.
2. Attach the rotating axis to the platform of the z-axis using four hexagon socket screws.



3. Attach the platform to the rotating axis using four hexagon socket screws.



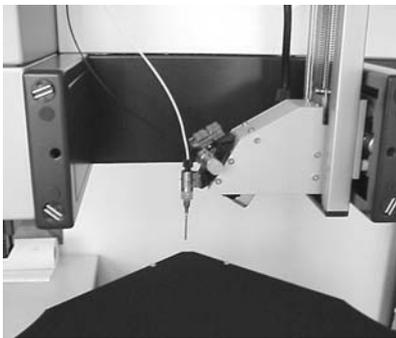
4. *For manual y-axis:* Drive the axis to the front position.

*For software-controlled y-axis:* Connect the y-axis to the port AXIS 2 of the rear panel of the DSA100 and switch on the DSA100. The y-axis initializes and drives to the front position automatically.

5. Loosen the four screws that fix the y-axis so that the whole y-axis can slide forward and backward manually.



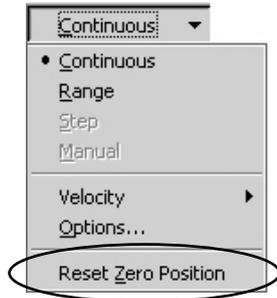
6. Rotate the sample table so that the maximum length is aligned to the y-axis (i.e. the pointed ends show to the front and the rear side).
7. To achieve the whole driving range of the axis, push the y-axis to a position where the needle of the dosing system reaches the outermost position of the sample platform.



-  The axis can also be adjusted to the central position. This can be done to make the DSA100 better accessible from the front side, but only if there is sufficient space behind the DSA100.



8. Fix the y-axis when the position is adjusted
9. *In case of a software-controlled wafer table:* Switch off the DSA100. Connect the wafer table with one of the ports Axis1, Axis3 or Axis4 on the rear panel of the DSA100. Switch on the DSA100 again. Close the DSA software and then start it up again. Call up the menu command *Reset Zero Position* from the tab sheet *Axis/Axes* in the *Device Control* panel.



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## 7.5 Tilting Table PA3220

### 7.5.1 Safety instructions for working with the Tilting Table

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**WARNING**

#### Risk of injury from unexpected Tilting Table movement

At the first start-up the Tilting Table automatically moves to its starting position. This could result in hands being pinched or in injuries caused by falling objects.

- ▶ Keep out of the range of movement of the Tilting Table during switch-on.
  - ▶ Before switch-on check that all the assembled items are securely fastened and remove any objects lying on the instrument.
- 



**WARNING**

#### Risk of injury from unexpectedly rapid Tilting Table movement

If high movement speeds are set for the control of the axes then an unexpectedly rapid movement of the Tilting Table could cause injuries.

- ▶ Before using the Tilting Table set the movement speed for the axes to medium or slow (⇒ DSA software manual).
- 



**CAUTION**

#### Risk from escaping liquids (toxic, highly flammable or corrosive)

When working with a multi-dosing system liquids can escape when the table tilts. This could represent a risk depending on the hazard class of the liquid.

- ▶ Fill the storage bottles with max. 10 ml test liquid.
- 



**CAUTION**

#### Damage by projecting y-axis

The long y-axis (range of movement 350 mm) could be damaged during the tilting process.

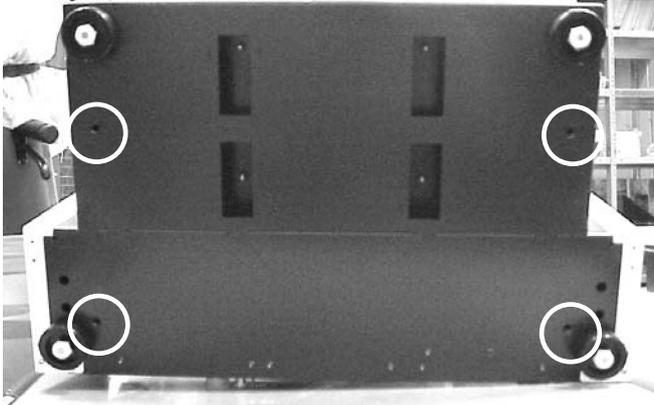
- ▶ Before the tilting movement move the axis so that it does not project from the side moving downward.
  - ▶ Carefully check the maximum possible axis tilt angle at the required axis setting by increasing the tilt angle step by step; do not exceed this maximum angle.
- 

**ATTENTION** Do not operate the tilting table in case of an installed high-temperature dosing system DS3241.

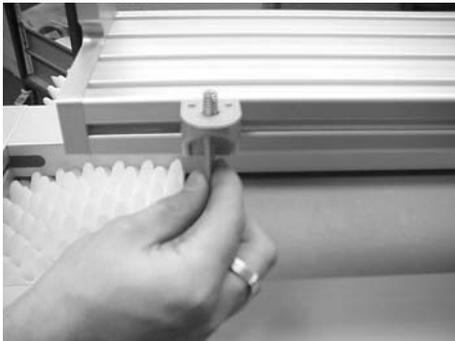
## 7.5.2 Assembling the tilting table

 Assembling a tilting table should be carried out with three persons.

1. Turn the DSA100 aside. Four threaded holes are driven into the bottom.



2. Unscrew the four feet of the DSA100.
3. Put the DSA100 onto the tilting table so that the rear panel connections of the DSA100 and the tilting table lie on the same side.
4. Screw the four clamps delivered with the tilting table into the threaded holes to fix the DSA100 at the table.



5. For save transport the tilting table is fixed with four fixing screws. Loosen these screws (three turns counter clockwise) as described on the signs at the tilting table.



6. The Emergency Stop button is pressed after delivery. Turn the button clockwise to release it.



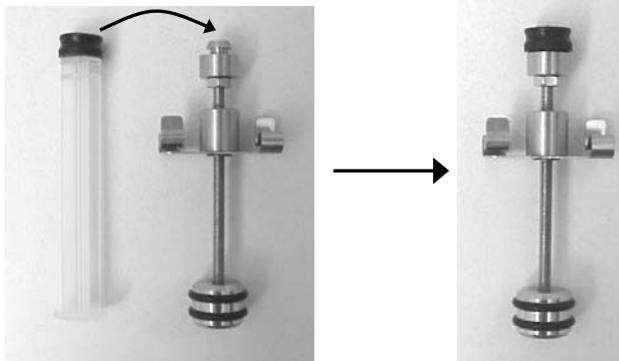
7. Connect the port on the rear side of the tilting table with one of the ports AXIS 1, 3 or 4 at the rear panel of the DSA100. Port AXIS 2 is reserved for the y-axis.

## 8 Single-Dosing units

### 8.1 Manual single-dosing unit DS3200/3201

#### 8.1.1 Assembling the syringe

1. Take a syringe out of the packaging and pull out the plunger.
2. Remove the rubber attachment from the syringe plunger and place it on the metal syringe plunger with setscrew.

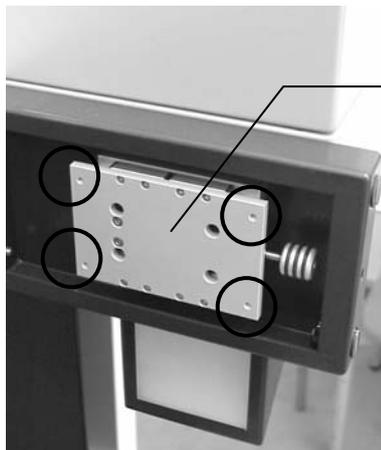


3. Rotate the plunger upward and push it into the disposable syringe.
4. Rotate the syringe and slide its head under the holding clip.



### 8.1.2 Inserting the manual dosing unit

1. Use the four hexagon socket screws provided to fasten the stand of the manual dosing unit to the attachment plate.



Attachment plate

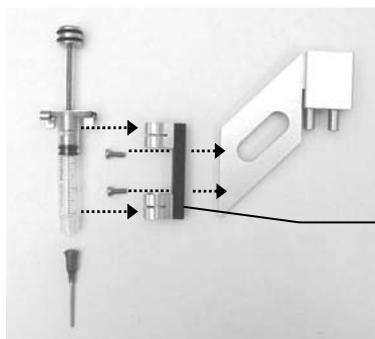


For some dosing units, manual screws are provided instead.



The setscrew on the right-hand side is used for adjusting the dosing unit to the optical axis.

2. Assemble the syringe holder as shown in the following illustration.



Syringe adaptor

3. Place the syringe holder with the two pins in the holes of the dosing stand and fasten it to the stand with the screw.

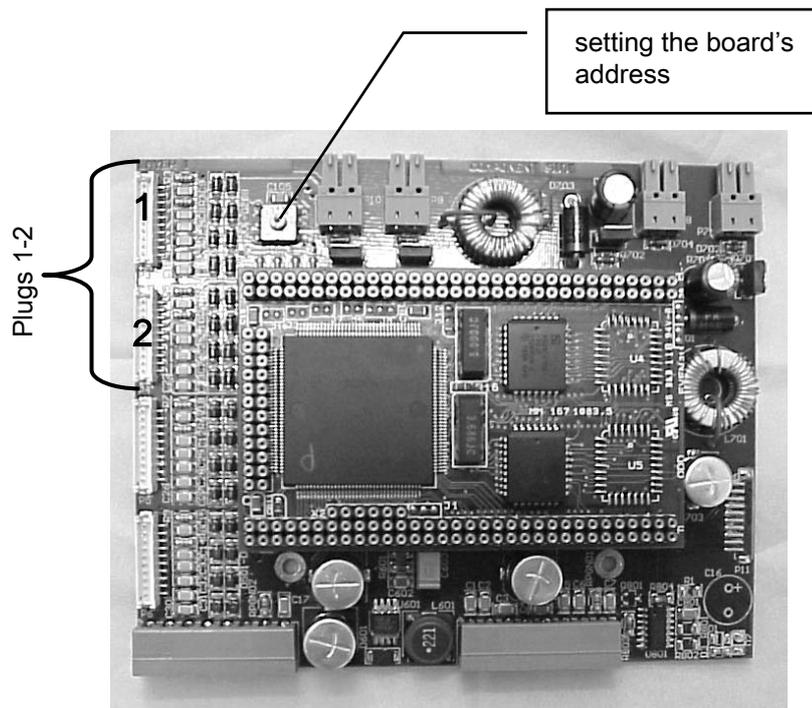


## 8.2 Software-controlled single-Dosing unit DS3210

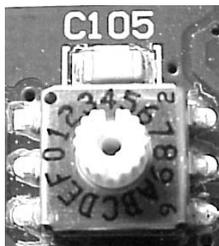
This chapter contains installation instructions for the Dosing unit DS3210 and the belonging electronic module EM3200.

### 8.2.1 Addresses and connections of the electronic module EM3200

The electronic module EM3200 must be addressed and connected properly.



- ▶ Turn the screw so that the slit points to position 4.



## 8.2.2 Installing the electronic module EM3200



**CAUTION**

Switch off and unplug the DSA100 before starting with the installation.

---

### **ATTENTION** Damage by electrostatic charge

Touching the board 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.

---

! Take care that the whole width of the socket is used for the board so that all poles are occupied. If the board is not properly connected it can be destroyed when switching on the DSA100.

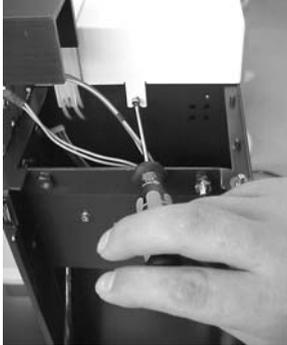
1. Open the doors of both compartments.



2. Remove the covers from the illumination housing and the camera housing. In order to do that, pull the spring inside the chamber and lift up the cover.



3. Unscrew the upper cover from both sides (screws at the top of the left and right chamber) and remove it.

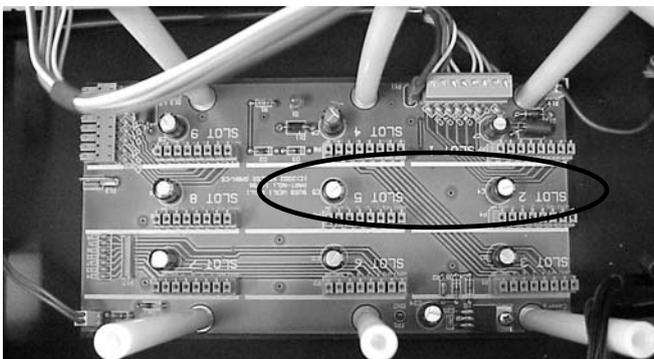


4. The BUS board for plugging in the EM3200 board is located underneath the cover, more precisely underneath the three white plastic frames (board support).



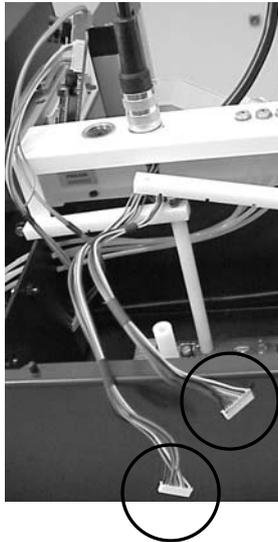
Loosen one screw on each of the frames and turn them aside.

5. From the rear view of the DSA100 the connections of the BUS board are labelled upside down. Plug the EM3200 into two ports so that the electronic components point to the front of the DSA100.



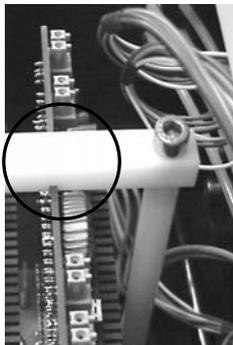
 Depending on the current equipment, ports can already be occupied.

6. Connect the two plugs coming from the connection of the dosing unit...



...to the two ports 1 and 2 of the installed electronics board in an arbitrary order (⇒ ch. 8.2 ).

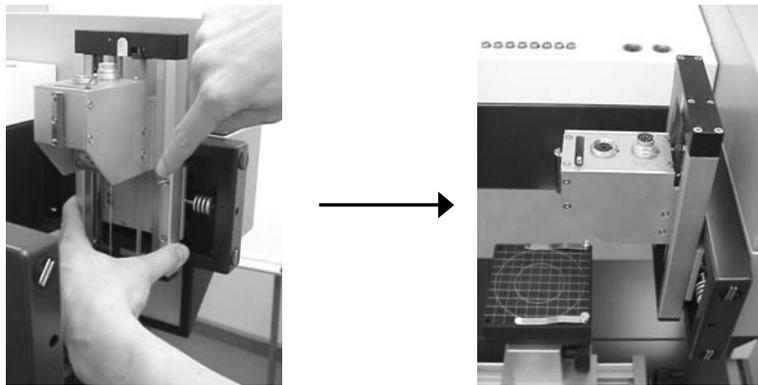
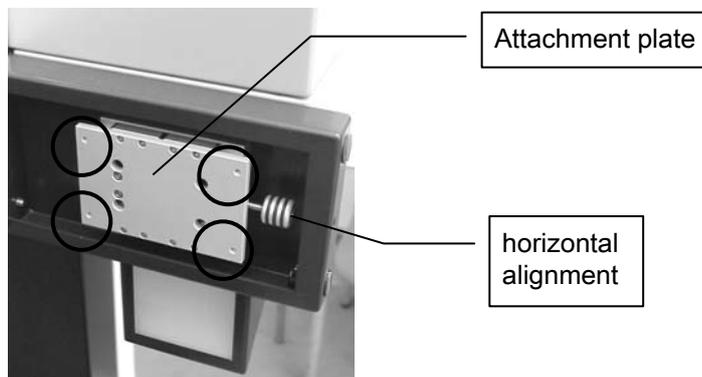
7. Return the supporting frames and fix them. Take care that the edge of the board lies in the gaps of the frames.



8. Reassemble the covers removed in steps 2 -4.

### 8.2.3 Assembling the single-dosing unit

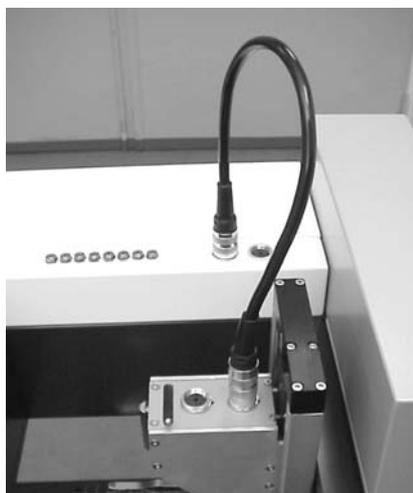
1. Use the four hexagon socket screws provided to fasten the stand of the manual dosing unit to the attachment plate.



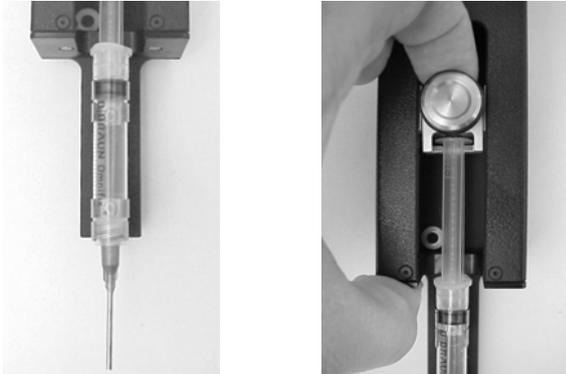
☞ For some dosing units, manual screws are provided instead.

☞ The setscrew on the right-hand side is used for adjusting the dosing unit to the optical axis.

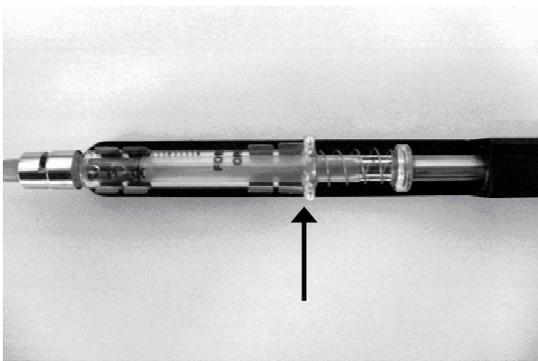
2. Connect the right-hand plug of the dosing carriage to the left-hand plug on the upper side of the DSA100 housing.



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



Push the syringe against the clamp as far as it will go.

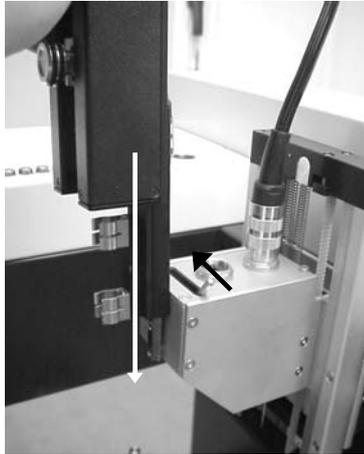


☝ There are two types of syringe adapter:

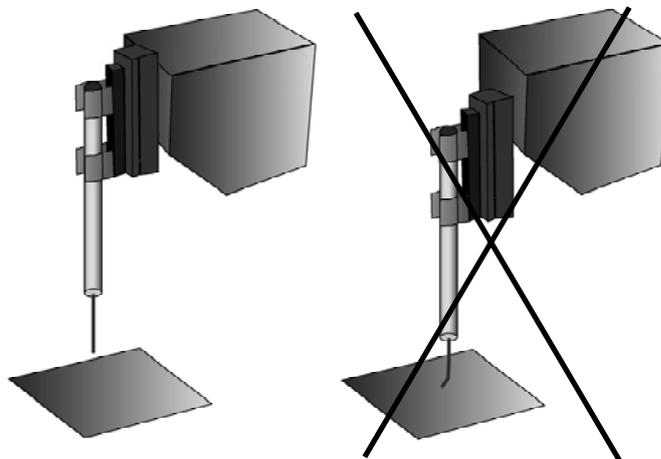
- with wide clips for disposable plastic syringes
- with narrow clips for reusable glass syringes

4. When the syringe plunger has been inserted tighten up the screw again.

5. Place the syringe unit on the dosing carriage. This is done by placing it over the guide rail of the carriage and moving back the lever to fix the syringe unit in position.



- ! Attention! The moment the DSA100 is switched off, the slide carrying the dosing unit can move downwards because it is no longer kept in position by the motor. If the syringe unit is fixed too low, the syringe can touch the sample and destroy it.
- ▶ Fix the syringe unit when the instrument is switched off. Take care that the needle is in a small distance above the sample height required for measurements. Also, readjust the height when using other syringes or needles.
- ! Once the syringe unit is fixed, please still take care not to move the sample table above the position required for measurements.



6. Connect the syringe unit to the remaining plug on the dosing carriage.



#### 8.2.4 Notes for operating the dosing unit DS3210

Some functions of the DSA software are restricted to multi-dosing units and cannot be used for DS3210.

☞ Due to the simplified syringe control of the DS3210, no information about the current syringe driver position is transferred to the software. Therefore, the filling level display and the Auto-Refill function do not work for single-dosing.

☞ The Auto-Delivery function for automatic surface detection is also blocked.

⇒ For further information please consult the DSA software manual.

## 9 Multi-dosing unit DS3226-3228

### *Notes concerning usable test liquids*

- ! The valves and fittings of the dosing unit are not resistant against all liquids. Only use liquids tested by KRÜSS which are listed on page 99 in the appendix. Please contact KRÜSS if you want to use liquids that are not listed there.

### *Notes concerning the structure of this chapter*

The installation of a multi-dosing unit is to be performed in several steps:

- assembling the syringe driver unit(s) ⇒ ch. 9.1
- installing the electronic module(s) EM3200 ⇒ ch. 9.2
- copying the “DCM.ini” file (no. of syringes) ⇒ ch. 9.3
- initializing the syringe drivers ⇒ ch. 9.4
- assembling the syringes ⇒ ch. 9.5
- assembling the syringe revolver ⇒ ch. 9.6
- setting up and filling the storage bottles ⇒ ch. 9.7
- adjusting the dosing unit ⇒ ch. 9.8

-  For installing a multi-dosing unit the DSA software must already be installed (⇒ DSA software manual).

## 9.1 Assembling the syringe driver unit(s)

Depending on the number of syringes one or two syringe driver units with two to four syringe drivers each must be assembled to left and right-hand chamber of the DSA100.

### *Overview*

The following table shows the required combinations for all multi-dosing units.

<i>dosing unit</i>	<i>syringe driver units</i>
DS3222 (2 syringes)	2-fold driver left
DS3223 (3 syringes)	3-fold driver left
DS3224 (4 syringes)	4-fold driver left
DS3225 (5 syringes)	3-fold driver left 2-fold driver right
DS3226 (6 syringes)	4-fold driver left 2-fold driver right
DS3227 (7 syringes)	4-fold driver left 3-fold driver right
DS3228 (8 syringes)	4-fold driver left 4-fold driver right

### *Procedure*

1. Open the compartment into which the syringe driver unit must be assembled.



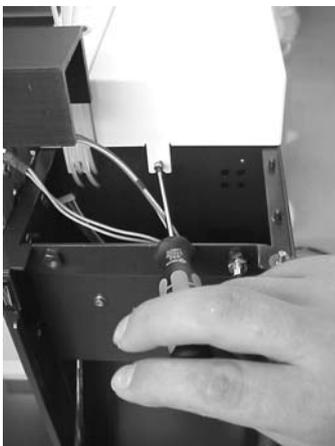
2. Remove the door of the compartment by pulling the lower spring inside the compartment and lifting up the door.



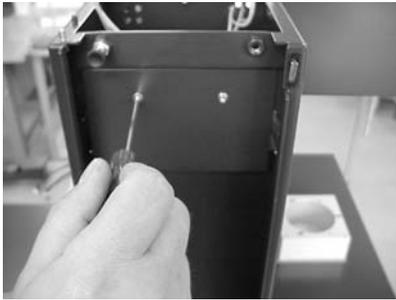
3. Remove the covers from the illumination housing and the camera housing. In order to do that, pull the spring inside the chamber and lift up the cover.



4. Unscrew the upper cover from both sides (screws at the top of the left and right chamber) and remove it.



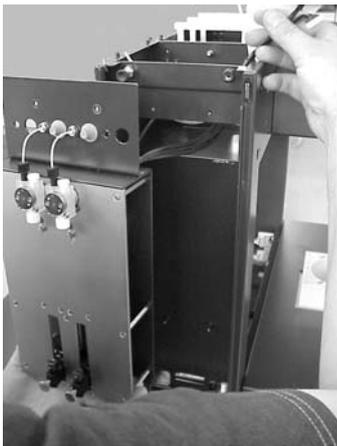
5. Unscrew the covering plate that is fixed with two screws and remove it.



6. Also unscrew the two screws located below.



7. Lift the syringe driver unit to be assembled into the compartment and lead the connecting cables through the gap that was previously covered.

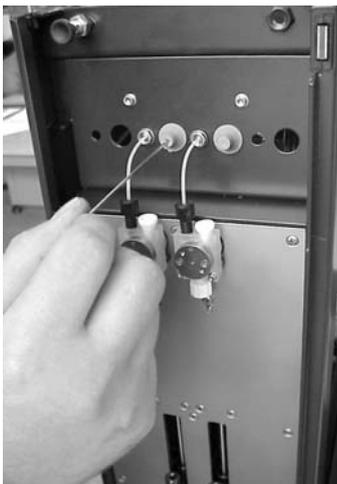


- ! If two different syringe driver units are to be assembled please pay attention to the correct assignment to the left and right-hand compartment (⇒ page 72).

- Fix the syringe driver unit (in example picture: unit with two drivers) with the four previously removed hexagon socket screws using the corresponding holes.

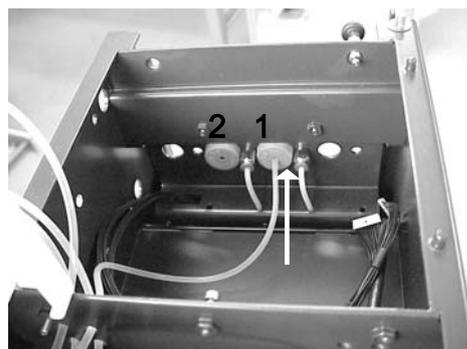
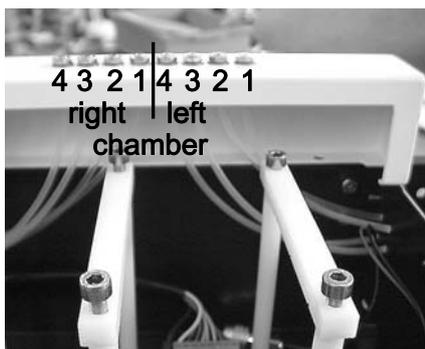


- Push through the rubber stoppers with a pointed object.

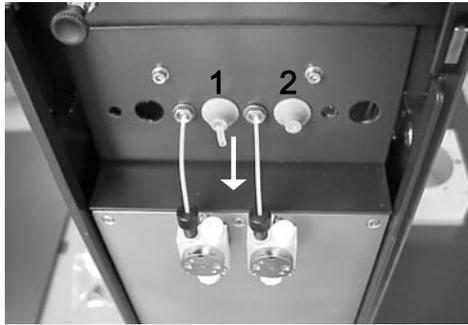


- From the upper panel, eight tubes lead to the inside of the device. These tubes serve as leads between syringes and dosing needle for the actual dosing tubes that are assembled in a later step.

The following figure (rear view) shows the order of these tubes. Lead the tube no. 1 to syringe position 1 (to the compartment for the first syringes).

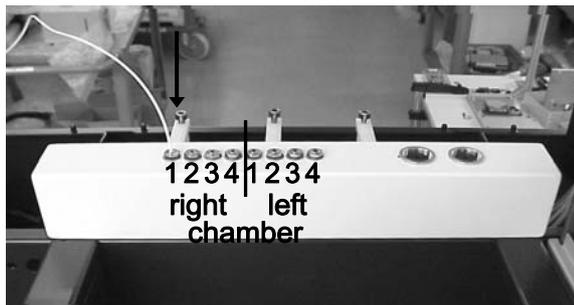


11. Thread the tube through the pierced rubber stopper so that about 0.5 cm jut out.



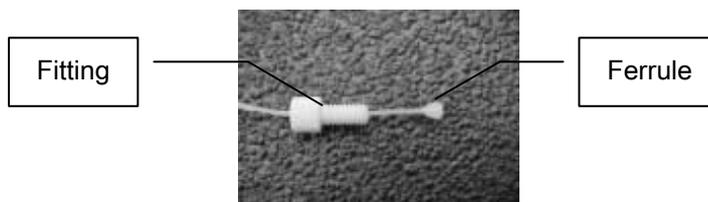
Proceed in the same way with the other tubes.

12. In the accessories case you find thin coloured tubes. Thread these tubes from the upper side of the housing through the leading tubes until they reach the compartments with the syringe driver units (the picture shows the front view).

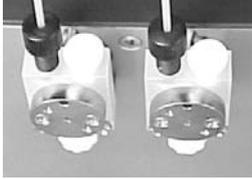


-  For all further installation steps the colours of the accessories (fittings) should suit the dosing tubes. It lends itself to use the colours as codes for the test liquids used.

13. Take one fitting and one ferrule (see image) from the accessories case for each dosing tube. Thread the free end of the tube in the compartment through a fitting and put a ferrule on the tip of the tube.



14. Screw off the protective caps from the valve blocks and screw on the fitting with tube and ferrule.



- ! Screwing the fitting too tight can damage the ferrule and squeeze off the tube. Do not use tools; the fitting should be easily unscrewed manually.

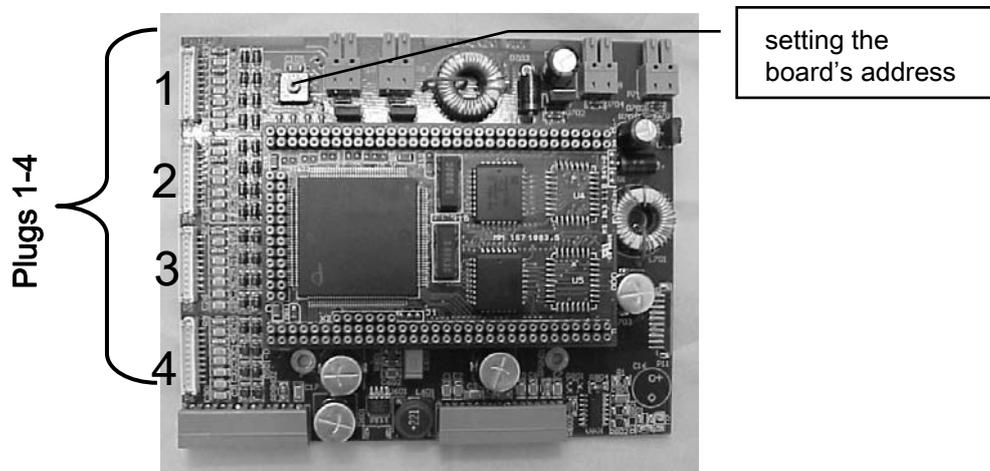
- ☞ Leave the DSA100 housing open in order to install the electronic module(s) EM3200.

## 9.2 Installing the electronic module(s) EM3200

Depending on the number of syringes belonging to the dosing unit, one, two or three electronic modules EM3200 must be installed which control the syringe revolver and all syringe drivers. This chapter contains an overview for the occupation and addressing of the modules (⇒ ch. 9.2.1 ) and instructions for assembling them (⇒ ch. 9.2.2 ).

### 9.2.1 Occupation and addressing of the modules

The electronic module EM3200 must be addressed and connected properly.



The first module to be plugged receives the address 4, the second and third the addresses 5 and 6 in ascending order. For setting the address the slit of the screw must point to the required address number.



Both the syringe revolver and the syringes drivers are connected to the electronic module(s):

- The connections of the syringe revolver always occupy ports 1 and 2 of the first electronic module (address 4).
- The syringe drivers occupy the further ports in a special order that depends on the number of drivers. The plugs coming from the syringe drives are marked with 1 to 4 dots; the left syringe driver unit is assigned to syringe numbers 1-4, the right-hand side unit to numbers 5-8.

**Overview**

The following table contains an overview for the electronic modules EM3200 to be installed for the different dosing units and their addresses and occupation.

<i>dosing unit</i>	<i>Number of EM3200</i>	<i>addresses</i>	<i>Occupation</i>
DS3222 (2 syringes)	1	4	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver 3,4: syringe drivers 1, 2
DS3223 (3 syringes)	2	4, 5	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver <b>Module 2 (Adr. 5)</b> 1,2,3: syringe drivers 1-3
DS3224 (4 syringes)	2	4, 5	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver <b>Module 2 (Adr. 5)</b> 1,2,3,4: syringe drivers 1-4
DS3225 (5 syringes)	2	4, 5	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver 3,4: syringe drivers 1, 2 <b>Module 2 (Adr. 5)</b> 1,2,3: syringe drivers 3-5
DS3226 (6 syringes)	2	4, 5	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver 3,4: syringe drivers 1, 2 <b>Module 2 (Adr. 5)</b> 1,2,3,4: syringe drivers 3-6
DS3227 (7 syringes)	3	4, 5, 6	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver 3,4: syringe drivers 1, 2 <b>Module 2 (Adr. 5)</b> 1,2,3,4: syringe drivers 3-6 <b>Module 3 (Adr. 6)</b> 1: syringe driver 7
DS3228 (8 syringes)	3	4, 5, 6	<b>Module 1 (Adr. 4)</b> 1,2: syringe revolver 3,4: syringe drivers 1, 2 <b>Module 2 (Adr. 5)</b> 1,2,3,4: syringe drivers 3-6 <b>Module 3 (Adr. 6)</b> 1,2: syringe drivers 7, 8

## 9.2.2 Carrying out the installation

### Damage by electrostatic charge

#### CAUTION

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

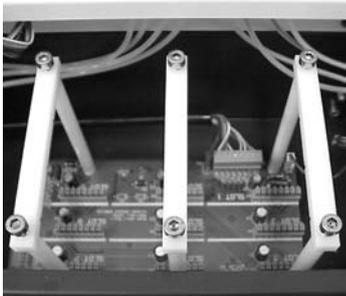
- ▶ Before touching the electronics board discharge yourself, for example by touching a metallic part of the panel.



Switch off and unplug the DSA100 before starting with the installation.

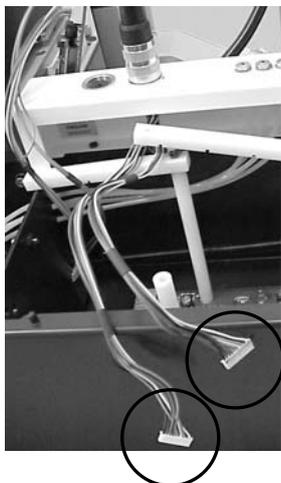
- ! Take care that the whole width of the socket is used for the board so that all poles are occupied. If the board is not properly connected it can be destroyed when switching on the DSA100.

1. The BUS board for plugging in the EM3200 board(s) is situated underneath the cover, more precisely underneath the three white plastic frames (board support).



2. The frames serve to support the boards plugged in the BUS board. Loosen one screw on each of the frames and turn them aside.

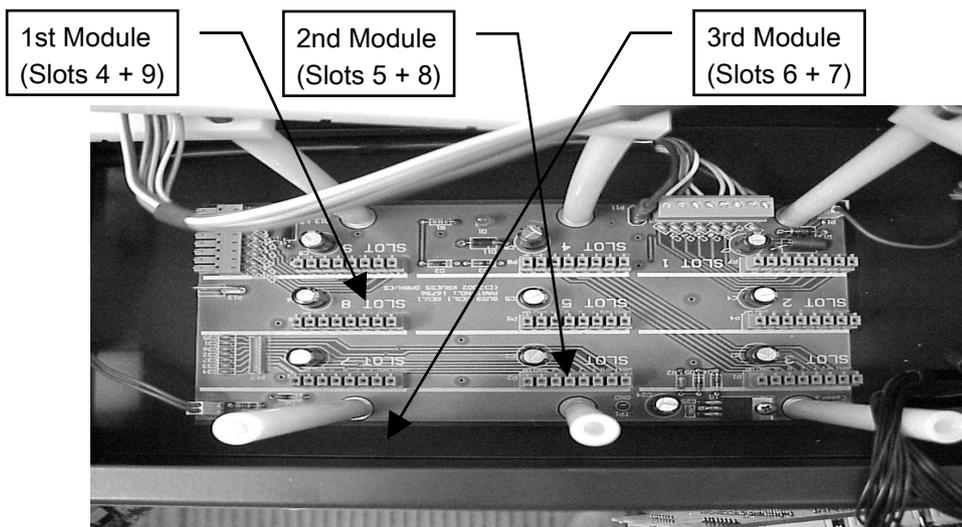
3. Connect the two plugs coming from the connection of the dosing unit...



...to the two ports 1 and 2 of the first EM3200 board to be installed (address 4) in an arbitrary order (⇒ page 71).

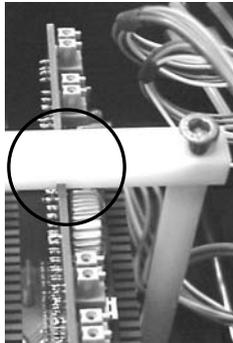
4. Connect the other ports of all electronic modules as described on page 72. Pay attention to the assignment of the plugs 1-4 and 5-8 coming from the syringe drives to the ports 1-4 of the modules to be connected.
5. From the rear view of the DSA100 the connections of the BUS board are labelled upside down. The slots of the BUS board can be occupied at will, the components are recognized automatically.

☞ We recommend the following order due to overview.



☞ Depending on the current equipment, ports can already be occupied.

- Return the supporting frames and fix them. Take care that the edge of the board lies in the gaps of the frames.

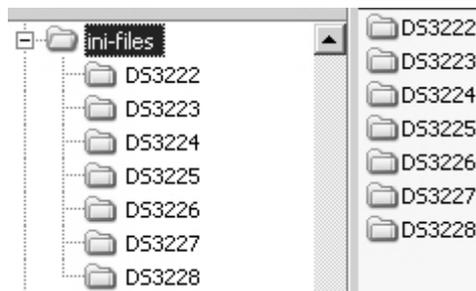


- Reassemble the covers (⇒ ch 9.1).

### 9.3 Copying the “DCM.ini” file (no. of syringes)

In order that all available syringes can be controlled an initialization file (.ini) matching the dosing unit must be copied from the DSA-CD into the installation folder of the DSA software on the computer.

- Insert the DSA installation CD (DSA1 or DSA3) in the CD drive.
- Open the folder *ini-files*.



- Open the folder for your multi-dosing unit (DS3222-DS3228).
- Copy the file “DCM.ini” into the Windows clipboard.
- Open the installation folder of the DSA version installed on your computer.
- Paste the previously copied “DCM.ini” file from the clipboard into the installation folder. Confirm that the existing file is to be overwritten.

## 9.4 Initializing the syringe drivers

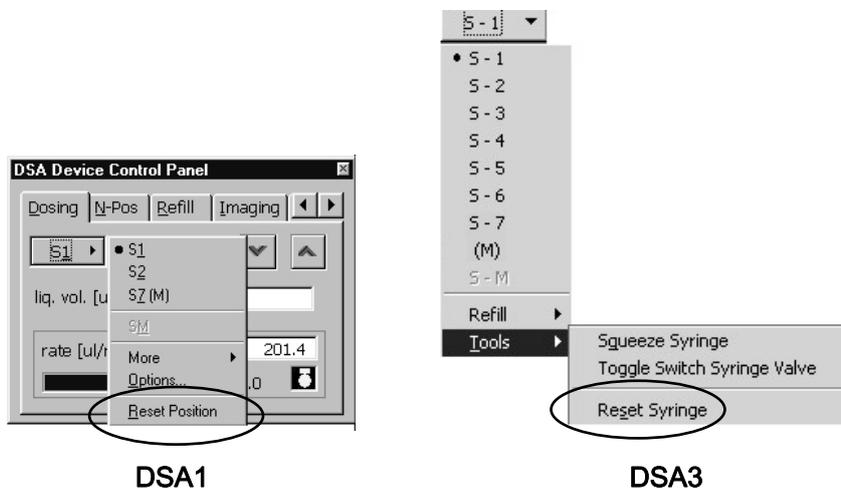


### Risk from escaping liquids (toxic, highly flammable or corrosive)

If syringes are already inserted and filled, liquid which escapes during the initialization can lead to a risk depending on the hazard class of the liquid

- ▶ Empty the syringes and lead the liquid into a waste container before starting the initialization.

1. Switch on the DSA100 and start the DSA program.
2. *Only for DSA1:* Click on the Icon .
3. Select the tab sheet *Dosing* from the *Device Control* panel. Under the button on the left side, a drop-down menu opens for selecting syringes.
4. Select the syringes one after another (except the one marked with *M*) and carry out the menu order *Reset Position* (DSA1) respectively *Reset Syringe* (DSA3) for each syringe. The syringe drivers are moved into their start positions and initialized.

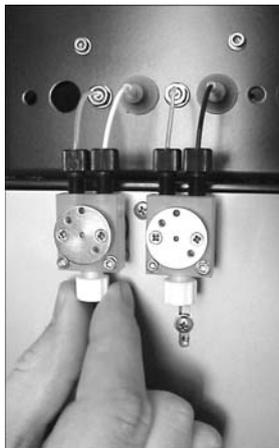


## 9.5 Assembling the syringes

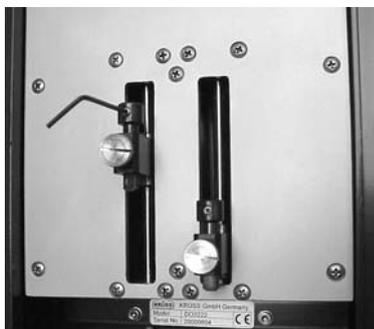
1. Open the compartments containing the syringe driver units.
2. Remove one of the syringes and the belonging allen wrench from the packaging.
3. Loosen the screw at the syringe plunger and remove the head.



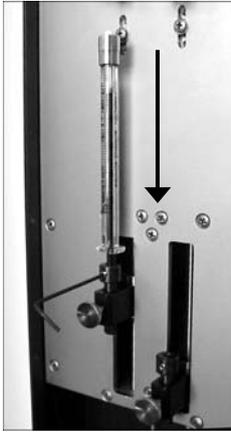
4. Remove the protective cap from the valve block.



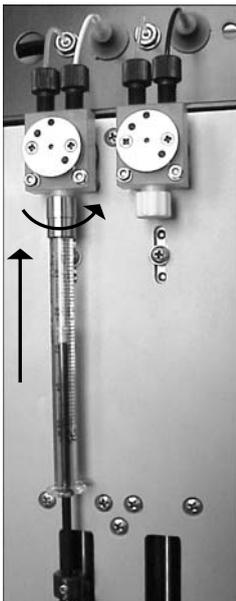
5. Loosen the screw at the syringe adapter of the syringe drive using the allen wrench.



6. Push the syringe plunger into the syringe so that the length of the syringe with plunger fits between the syringe driver and the valve block. Lead the plunger to the stop into the syringe adapter and fix it with the hexagonal socket screw.



7. Push the syringe upwards and screw it into the luer-lock adapter.



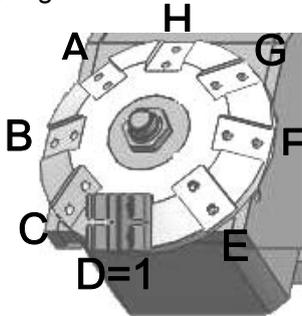
8. Repeat steps 2 - 7 for the other syringes.

## 9.6 Assembling the syringe revolver

### 9.6.1 Assigning the revolver positions

Eight positions are located on the syringe revolver to which eight dosing needles are assigned at maximum. In order to let the revolver find the correct position when a syringe is selected, clamps and needles must be assembled to the revolver positions correctly.

Letters A - H are assigned to the positions of the revolver. When the multi-dosing system is delivered, position D of the syringe revolver is usually already occupied with a clamp – this position is always used for the first syringe, regardless of how many syringes are used for the dosing system.



The occupation of all other positions depends on the number of syringes used.

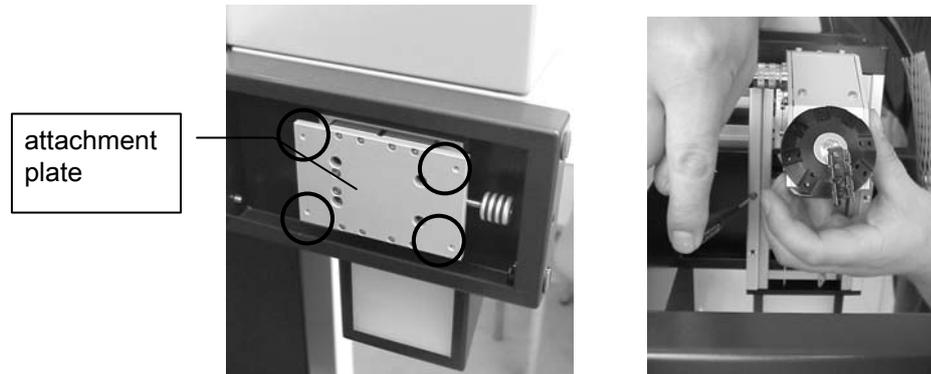
**Overview**

The following table shows the occupation of the syringe revolver for all multi-dosing systems available.

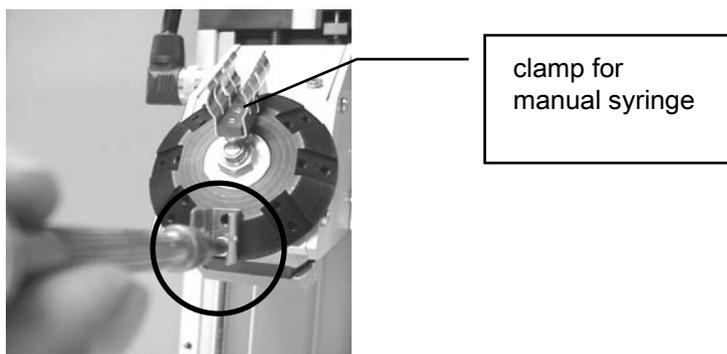
<i>Dosing unit/ Syringes</i>	<i>Occupation</i>	<i>Dosing unit/ Syringes</i>	<i>Occupation</i>
<b>DS3222</b>  2 autom.  1 manual (m)		<b>DS3223</b>  3 autom.  1 manual (m)	
<b>DS3224</b>  4 autom.  1 manual (m)		<b>DS3225</b>  5 autom.  1 manual (m)	
<b>DS3226</b>  6 autom.  1 manual (m)		<b>DS3227</b>  7 autom.  1 manual (m)	
<b>DS3228</b>  8 autom.			

## 9.6.2 Carrying out the installation

1. Use four hexagon socket screws to screws the syringe revolver to the attachment plate for the dosing unit. For some dosing systems, manual screws are provided instead.



2. Screw the clamps with two screws each onto the required positions of the syringe revolver. An extended clamp is to be used for the manual syringe.



3. Assemble the needle carriers onto the free tubes for the test liquid. You require a needle adapter, a metal shell with a small ring, a fitting and a ferrule from the accessories case.

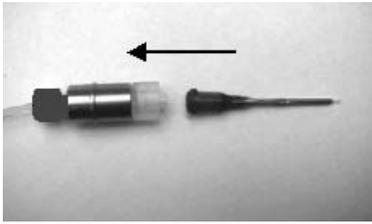
Put the components together like this:



- ! The metal rings are already located in the shells, please take care not to loose them.

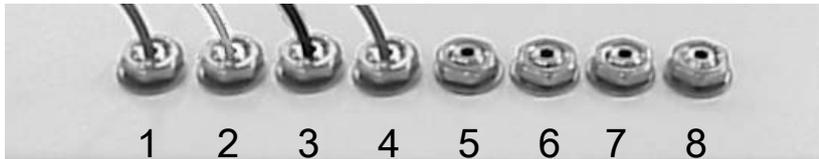
- ☞ Choose the colours of the fittings matching to the tubes.

4. Screw the needles into the needle carriers.

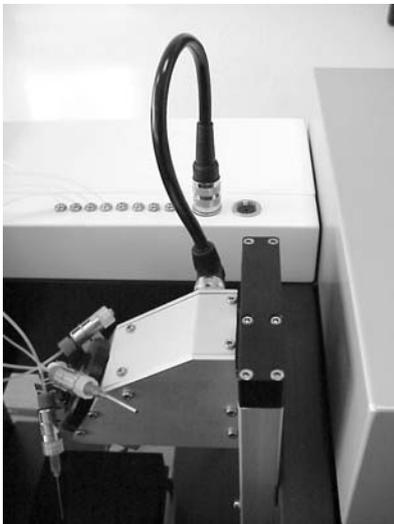


 The thin needles are intended for sessile drops, the thicker ones for pendant drops (surface tension measurements).

5. Click the needle carriers into the clamps of the syringe revolver. Make sure that the bottles and liquids are correctly assigned to the syringe positions (image shows front view).



6. Connect the syringe revolver to the left-hand connector on the upper side of the DSA100 housing.



## 9.7 Setting up and filling the storage bottles

1. Put the rack for the test liquid bottles into the chamber(s).



2. Lead the tube from the syringes through the cap inserts and caps of the bottles.



3. Puncture the silicone seal with one of the needles supplied. Leave the needle in the hole.



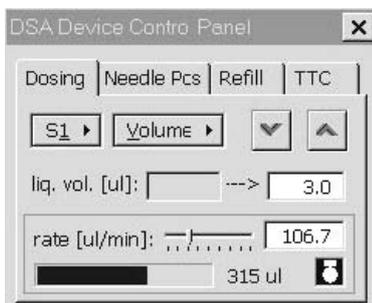
4. Fill the storage bottles with the test liquids. Make sure that the bottles and liquids are correctly assigned to the positions (max. 1-8). Label the bottles.
5. Place the cap inserts in the caps and screw the caps onto the storage bottles. Place the storage bottles in the recesses provided for them in the base of the compartment.

 The storage bottles delivered by KRÜSS stick to the bottom of the rack magnetically.

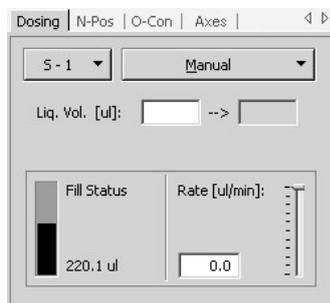
## 9.8 Adjusting the dosing unit

In a further step the dosing unit must be adjusted with respect to the camera so that the middle horizontal needle position is also in the middle of the recorded image.

1. Start the DSA software. Either the live image or a stationary image can be seen in the frame grabber window. The camera symbol in the symbol bar must be shown as being pressed ; if this is not the case please click on the icon.
2. Select the tab sheet *Dosing* from the *Device Control* panel.



DSA1

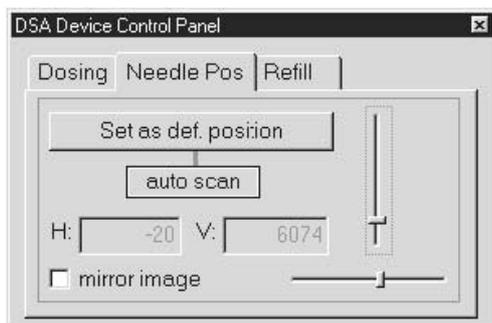


DSA3

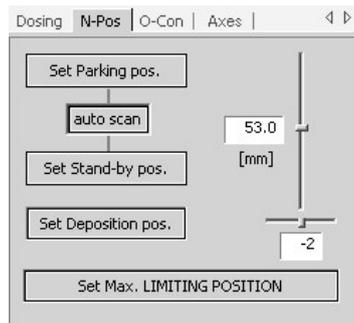
Click on the button at the top left. Select Syringe 1 (*S1*) in the drop-down menu.

-  If a different syringe had been selected previously the syringe selector will rotate to Position 1.

3. Select the tab sheet *Needle Pos* (DSA1) respectively *N-Pos* (DSA3).



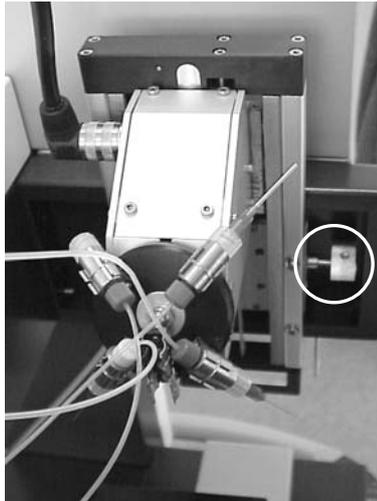
DSA1



DSA3

4. Move the horizontal slide controller to the middle position. The displayed value must be set to zero.
5. Use the vertical slide controller (or the  $\leftarrow \downarrow \rightarrow$  key) to move the syringe to a position between the camera and the light source.

6. Set the illumination, zoom and focus for the needle image. For software-controlled optics, this is carried out in the tab sheet *Imaging* (DSA1) respectively *O-Con* (DSA3).
7. Use the setscrew on the right-hand side of the dosing unit to bring the needle in the middle position in the video image.



8. Zoom the needle image and repeat the procedure in order to set the middle position as accurately as possible.

## 10 Environmental chambers

Several environmental chambers are available for the DSA100 which allow temperature- or humidity-controlled measurements. This chapter contains the necessary installation instructions.

### 10.1 Thermostatted Chambers TC30 and TC40

Thermostatted Chambers TC30 and TC40 are used for drop shape analysis above and below room temperature.



WARNING

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#### Risk of burns from hot chamber and tube

At higher operating temperatures contact with the chamber and tube could cause burns.

- ▶ Wear heat-resistant gloves.
  - ▶ Allow the chamber to cool down before working on it.
- 

! In order to avoid soiling the viewing window, do not touch it with your fingers. Avoid contacting the window with sharp objects.

#### *Temperature range and thermostating method*

- TC30: 5°C – 90°C\* by using a connected thermostat,
- TC40: -30°C – 160°C\* by using a Peltier element. A liquid thermostat must additionally be connected for counter-cooling.

! Do not set the temperature to values outside the given range. Otherwise the chamber could be damaged.

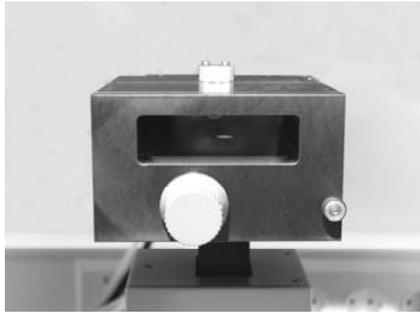
Both the thermostatted chambers need to be connected to an external thermostat. In most cases the thermostat liquid used is water.

- ▶ Silicone oil must not be used as a thermostat liquid because it attacks the seals and tubes. Vegetable oils and ethylene glycol are suitable liquids.

\* measured at the centre of the base plate.

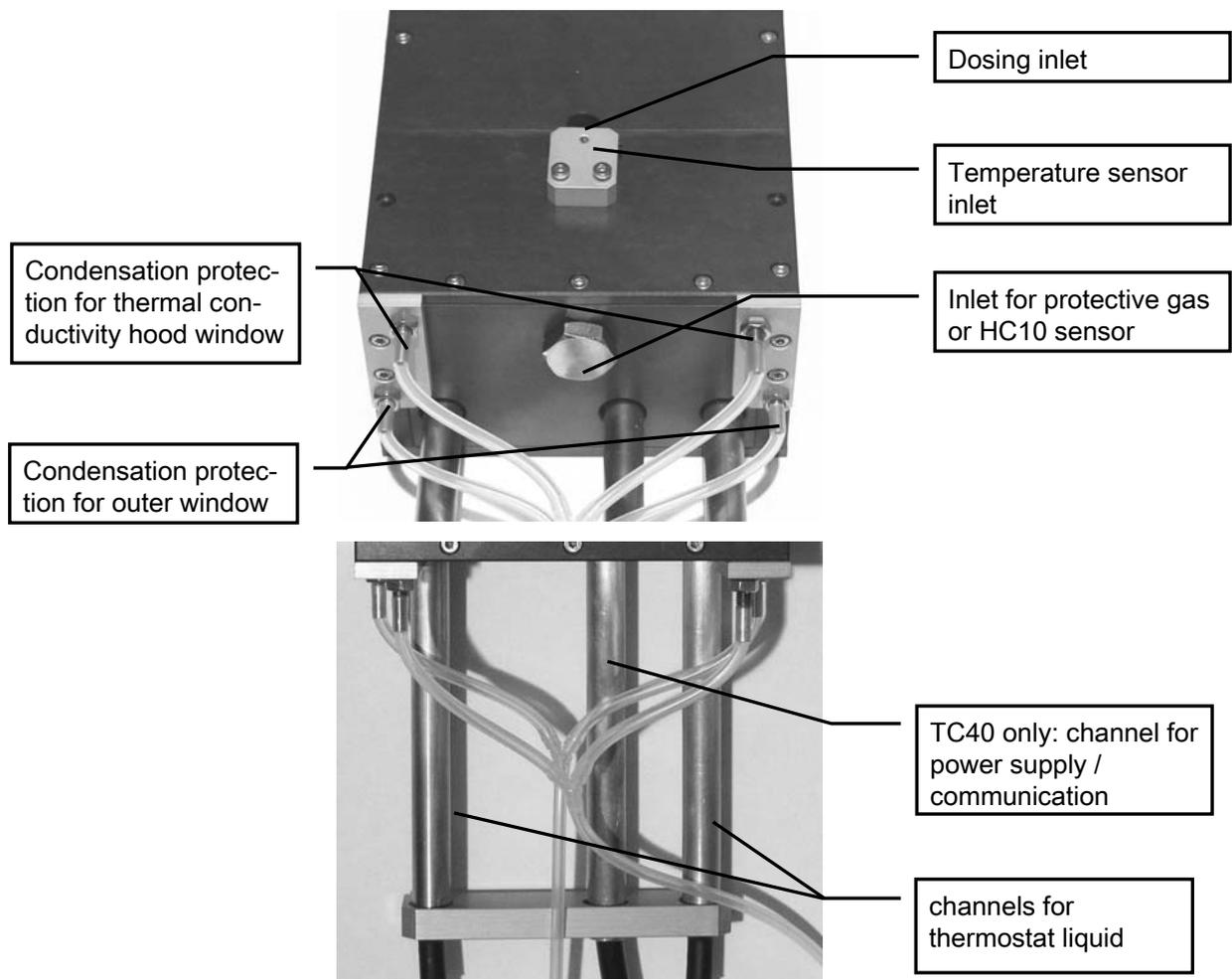
### 10.1.1 TC30/40: Assembly on the DSA100

1. Move the assembled dosing unit upward.
2. Move the sample table downward. Remove the sample table adapter.
3. Place the chamber on the sample table.



4. Screw the chamber onto the sample table from below.

### 10.1.2 Connections



### ***Thermostat connection***

Connect the Quick-Lock connections at the tube ends to a flow-through thermostat.



### ***TC40 only: Power supply / Communication***

- ▶ Make sure that the instrument is switched off. Plug the mains cable into the socket on the rear panel of the control unit. Connect the control unit to the mains supply.
- ▶ Connect the cable from the TC40 to the socket on the front panel of the control unit. This is done by turning the plug until the suitable position has been reached and then turning the ring clockwise until the plug clicks into position.



### ***Condensation protection***

At a high relative humidity condensation could form on the viewing and measuring window with measurements below room temperature. In order to prevent this, the assembled tube connections are used to direct a stream of air through the chamber and past the windows.

- ▶ Measurements without thermal conductivity hood: Connect the two lower connections to a supply of compressed air (approx. 500 mbar).
- ▶ Measurements with thermal conductivity hood: Connect the upper and lower connections to a supply of compressed air (approx. 500 mbar).

### ***Protective gas connection***

A connection is provided in the centre of the rear panel of the chamber for working under a protective gas. If condensation protection is also necessary then additionally connect the protective gas to the connections provided for it. In both cases do not set too high a value for the gas flow, as this could result in temperature variations.

☞ A good guideline value is 500 mbar.

### ***External PT100 temperature sensor***

The temperature above the sample can be measured with an external PT100 temperature sensor.

☞ If the thermal conductivity hood is used then this must be placed in position before the temperature sensor is inserted.

- ▶ With the drawer closed slide the sensor into the guide provided for it on the top of the chamber.



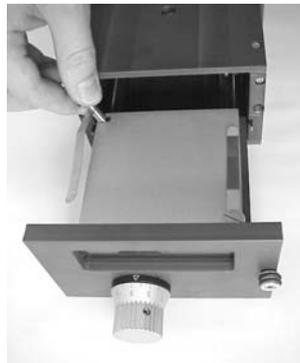
- ▶ Insert the plug of the PT100 into the socket provided for it on the illumination unit of the DSA100 (⇒ ch. 5.11).

! Make sure that the inserted samples do not come into contact with the sensor; if necessary pull the sensor out slightly.

### 10.1.3 Using the thermal conductivity hood

 The optionally used thermal conductivity hood is made from a highly thermally conductive material and ensures optimal thermal transport in the interior of the chamber. It should be used when there is a great difference to the outside temperature and whenever temperature variations are to be minimized. However, if the thermal conductivity hood is used the target temperature will be achieved more slowly. If you are more concerned with speed than accuracy of the temperature regulation then you can dispense with the hood.

1. Pull out the drawer, remove the two holding clips and position the sample on the plate.



2. If present, pull out the external PT100 temperature sensor.
3. Position the hood so that the slot points to the rear.



4. Push the drawer back into the chamber.
5. If necessary insert the PT100 temperature sensor PT100 and fix it at a height just above the sample.

### 10.1.4 TC40 only: setting and reading off the measuring temperature

This chapter covers only the Peltier chamber TC40; with the TC30 the temperature is controlled by the connected thermostat.



**WARNING**

#### Risk of burns from chamber heating up unexpectedly

If too high a temperature has previously been set then burns could occur after switching on the control unit.

- ▶ After use reset the temperature at the control unit to room temperature.
- ▶ Observe which set temperature appears on the display after switch-on and, if necessary, set a lower value.



**CAUTION**

#### Damage resulting from operation without counter-cooling

The Peltier element could be damaged if it is heated up without counter-cooling.

- ▶ Always switch the thermostat on before the control unit and set a suitable temperature (⇒ p. 92).
- ▶ Make sure that the flow is not impeded by kinks in the tube.

Immediately after the mains switch is switched on the control unit initializes itself and is ready for use after about 3 seconds. The required temperature is set by using the "CONTROLLER" on the control unit of the TC40.



The set temperature is shown in the lower line of the display. The upper line shows the actual temperature of the heating element (not the temperature measured at the external temperature sensor).

The set temperature is set by using the two arrow keys (▲ = temperature increase; ▼ = temperature decrease). Short presses alter the temperature in 0.1°C steps; longer presses change the setting rapidly.

 The two keys  and  have no function for TC40; if they are pressed only the temperature unit °C will be shown.

### ***Setting the thermostat***

With the TC40 the thermostat is used to mediate between room temperature and target temperature.

! The given temperature limits of 160°C or -30°C can only be achieved when the Peltier element is supported by the thermostat.

👉 As a rule of thumb the temperature difference between the measuring temperature and the thermostat liquid should not exceed 30°C when cooling down and 70°C when heating up. However, greater temperature differences can be used in the temperature range between -10 and 120°C.

The following Table assumes that water is used as the thermostat liquid:

<b><i>Measuring temperature range</i></b>	<b><i>Recommended thermostat setting</i></b>
-30°C to 10°C	2°C
-10°C to 120°C	20°C
50°C to 160°C	85°C

## 10.2 Humidity Chamber HC10

The Humidity Chamber HC10 is used together with thermostatted Chambers TC30 or TC40.

! If a TC40 is used then not the Peltier element is used for thermostating. Instead the temperature control of both thermostatted chambers is carried out by an external thermostat.

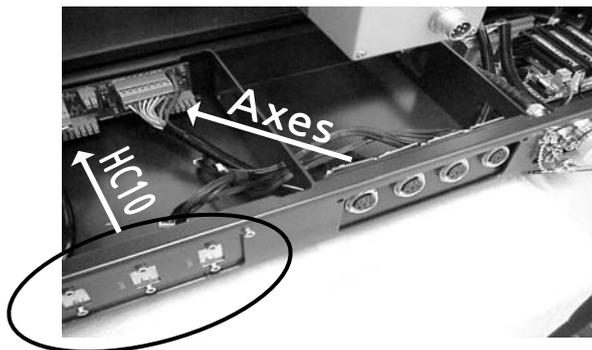
! When measuring with TC40 with the HC10 chamber connected, a temperature of 120°C must not be exceeded.

### 10.2.1 Assembling the interface board

If Humidity Chamber HC10 is not acquired together with the DSA100, but is delivered subsequently, then an interface board and the connection socket for the HC10 must additionally be built into the DSA100.

This is done as described in ch. 7.1 for the axes, but with two differences:

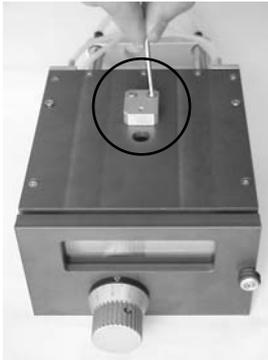
- The connection socket for the chamber is built into the left-hand side of the rear panel of the DSA100.
- The connection plate is also built in on the left. The right-hand side is reserved for the axes.



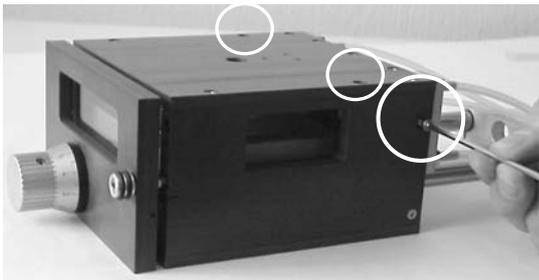
### 10.2.2 Preparing the Thermostatted Chambers TC30/40

Thermostatted Chambers TC30/40 must be converted before the Humidity Chamber HC10 is installed.

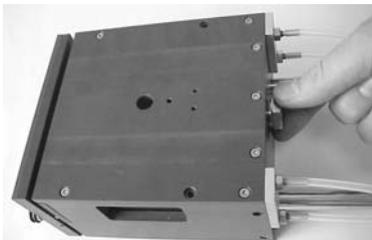
1. Screw off the guide for the temperature sensor from the top of the chamber.



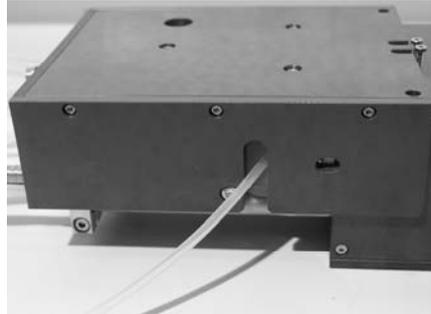
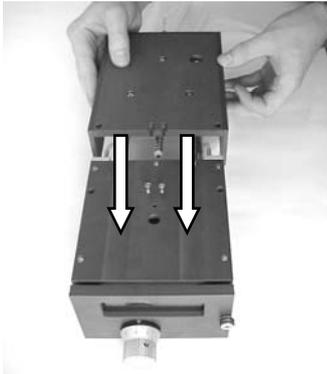
2. Screw out the two upper screws at the back on both the left-hand and right-hand chamber sides and the two screws on the top as shown in the illustration.



3. Screw out the large screw on the rear panel (or the protective gas connection, if present).



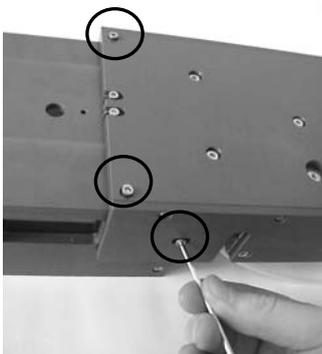
4. Screw the two screws used to hold the temperature sensor guide into their openings for a few turns.
5. Slide the HC10 Chamber over the Thermostatted Chamber from the rear. Lead the tube for the condensation protection through the opening in the side.



Push the chamber until it reaches a stop against the two screws on the top.



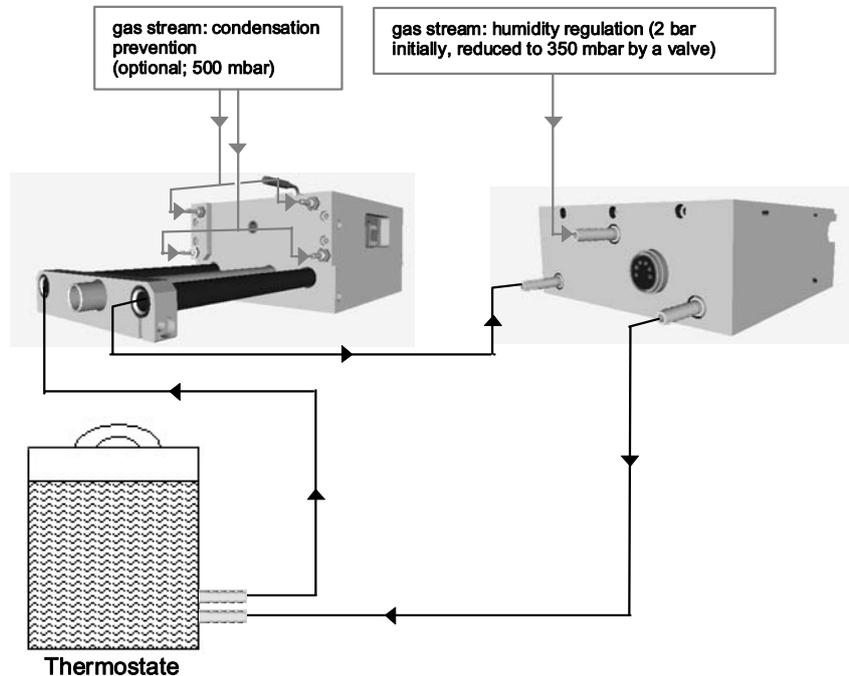
6. Fasten the HC10 Chamber on the thermostatted chamber with two screws each on the sides and top.



### 10.2.3 Liquid and gas connections

1. Connect a liquid thermostat to the two chambers in series.
2. Connect the HC10 Chamber to a compressed air supply (1-2 bar).
  - ! The flow control valve reduces the pressure of the gas to a constant value of 350 mbar. This is permanently set and locked at this value. Do not try to adjust the valve.
3. Optional: connect the gas flow for condensation protection to a special compressed connection (approx. 500 mbar).

- ☞ The following illustration shows all the gas and liquid connections for operating the humidity chamber.



- ! The gas connection on Chambers TC30/40 should only be used when the observation window is actually affected by condensation. The additional flow of air reduces the atmospheric humidity that can be achieved and reduces the accuracy of the humidity control.
- ! If a low humidity in the air is required then dried gas must be used (e.g. dried in a silica gel air drier). If the flow of gas is produced by a compressor then the air must be dried if the humidity of the air used for the measurement is to be lower than the atmospheric humidity.
- ! Oil-free gas must be used for all gas connections (air filter!).

#### 10.2.4 Power supply and instrument communication

- ▶ Connect the multi-pin connection on the rear panel of the HC10 to the corresponding connection on the rear of the DSA100 frame (left-hand connector plate, rear view).

### 10.2.5 Thermal conductivity hood

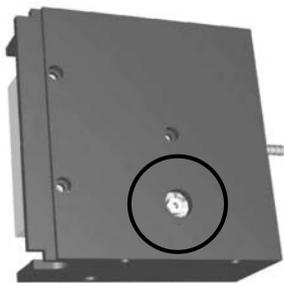
- ☞ We recommend using the thermal conductivity hood for measurements with the HC10. This reduces variations in temperature and humidity.
- ▶ Screw off the plate on the rear panel of the thermal conductivity hood (Torx 9 wrench).



- ▶ Place the thermal conductivity hood in the chamber as described in ch.10.1.3.

### 10.2.6 Filling / Filling level

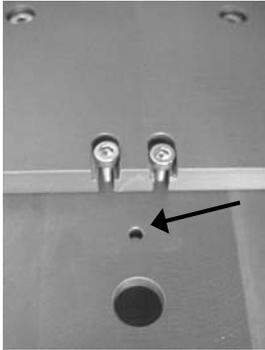
- ▶ Screw out the screw marked in the illustration. Fill the chamber to the brim with demineralized water.



- ! Use only demineralized water to prevent calcification.
- ! Depending upon the set humidity the water will evaporate at different rates. When the chamber is less than one-third full with water its performance falls off rapidly. During operation you should check the filling level about once every three hours and top up with water as necessary
- ! If you are working with an inclined table then the screw must be screwed in after filling. If the standard axes are used it can be left unscrewed.

### 10.2.7 Inserting a temperature sensor

☝ As the sensor holder has been removed from the Thermostatted Chamber in order to attach the HC10, the temperature sensor is inserted in the free opening.



- ▶ Pierce one of the silicone seals provided, push the sensor through the opening and insert the temperature sensor in the opening of the Thermostatted Chamber so the silicone seal lies on the opening.
  - ! During the measurement the temperature sensor should be inserted in the chamber as far as possible without touching the sample.
- ▶ Insert the plug of the PT100 into the socket provided for it on the illumination unit of the DSA100 (⇒ ch. 5.11).

## Appendix

### I. Usable test liquids for the multi-dosing unit DS3222-3228

#### *List of tested liquids*

The following liquids were tested with the multi-dosing unit DS3222-3228 and can be used as standard test liquids.

- Water
- Diiodomethane
- Ethylene glycol
- $\alpha$ -bromo-naphthalene
- Glycerol
- n-Hexadecane
- Benzyl alcohol

! Please contact KRÜSS if you want to use liquids that are not listed there.

#### *Materials of the dosing unit that come into contact with the test liquid*

! Do not use test liquids to which the materials listed in the table below are not resistant:

<i>Component</i>	<i>Material:</i>
Syringes	Glass, PTFE
Tubes	PTFE
Valve heads	Polymethylpentene (PMP)
Valves	Fluorelastomer (FPM) Polyphenylene sulfide

## **II. Technical support**

Should technical problems with the DSA100 or the DSA-Software occur please contact our technical support service or your local dealer:

*KRÜSS GmbH*

*Borsteler Chaussee 85 – 99a*

*22453 Hamburg Germany*

*E-mail: Info@Kruss.de*

*Tel.: +49/040/514401-0*

*Fax: +49/040/514401-98*

Please also visit our webpage on the Internet:

*[www.kruss.de](http://www.kruss.de)*

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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.

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DÉCLARATION DE CONFORMITÉ  
ISO/IEC Guide 22 & EN 45014

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

## **DSA100**

den Anforderungen entspricht, die in den EU-Richtlinien zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die Sicherheit elektrischer Betriebsmittel (73/23/EWG) und der elektromagnetische Verträglichkeit (89/336/EWG) festgelegt sind. / is in conformity with the EC directive 73/23/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 C.E. 73/23/C.E.E.

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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

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Borsteler Chaussee 85-99a; D-22453 Hamburg

abgegeben durch: / from: / émis par:

Herrn /Mr. /M. Alexander Bünz  
Geschäftsführer / General Manager / Directeur Général



D-22453 Hamburg 04. 04. 2004

Unterschrift / Signature