

Description of the AVSPro II operating software

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Windows® XP operating system

The Windows® XP operating system was selected as the basis of the AVSPro II Automatic Sampler. It offers a variety of benefits.

The Windows® XP® operating system is known to be the most stable one among the operating systems which are available for

the industrial-standard personal computer. It has the advantage of providing certain working areas which are tailored to each user and cannot be viewed or used by the respective other co-users. Owing to the fact that each application is running within it's own area of the working memory

(addressspace) which is totally isolated from the other applications, the probability of a failure of an application impairing the functionality of the entire operating system is only extremely low.

Starting the Windows® XP operating system

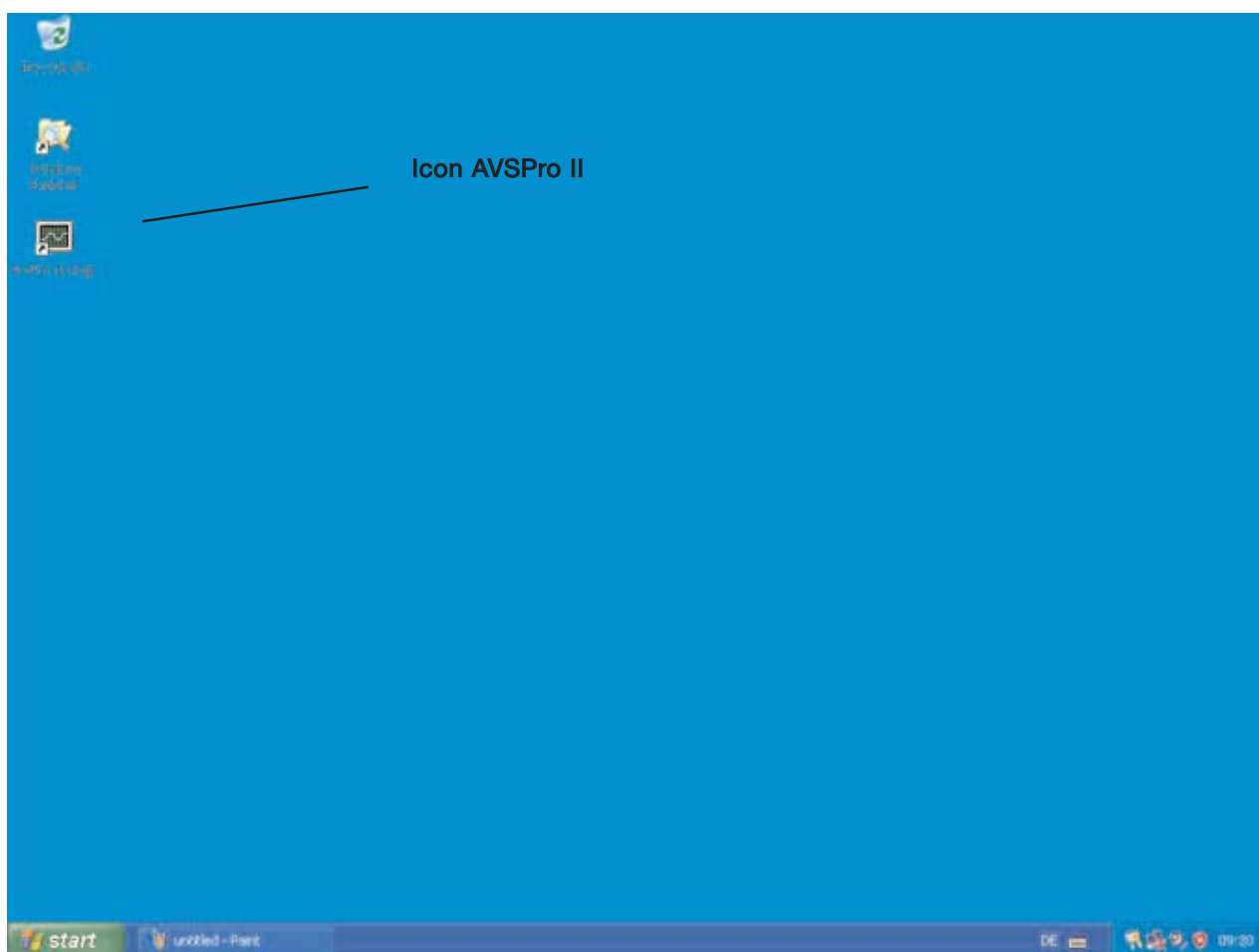


Fig. 1: Windows® XP start screen

Following the start of the Windows® XP operating system and the input of the authorisation or the password, the screen may look like the one above.

The program for the operation of the AVSPro II is started by a double click on the respective icon with the "AVSPro II" designation (please refer to arrow).

The correct screen settings will be described below, followed by the description of the use of the AVSPro II program.

To install the operating program, please follow the instructions contained on the inner page of the CD-ROM cover.

1.2.2**Installation of the documentation program**

The installation is done automatically. If the installation fails, please verify that the following files which are required for installation are present on the data medium:

- DokuAVSPro.exe
- Msflxgrd.dep
- Msflxgrd.oca
- Msflxgrd.ocx

All the files listed above have to be in the same directory. The program is started by a double click on Doku AVSPro.exe.

Hardware requirements:

- Intel Pentium CPU with 90 MHz min.
- 32 MB RAM (NT) main memory min.
- 5 MB of free space min. on the hard disk
- Printer Installation of the documentation program 1.2.2

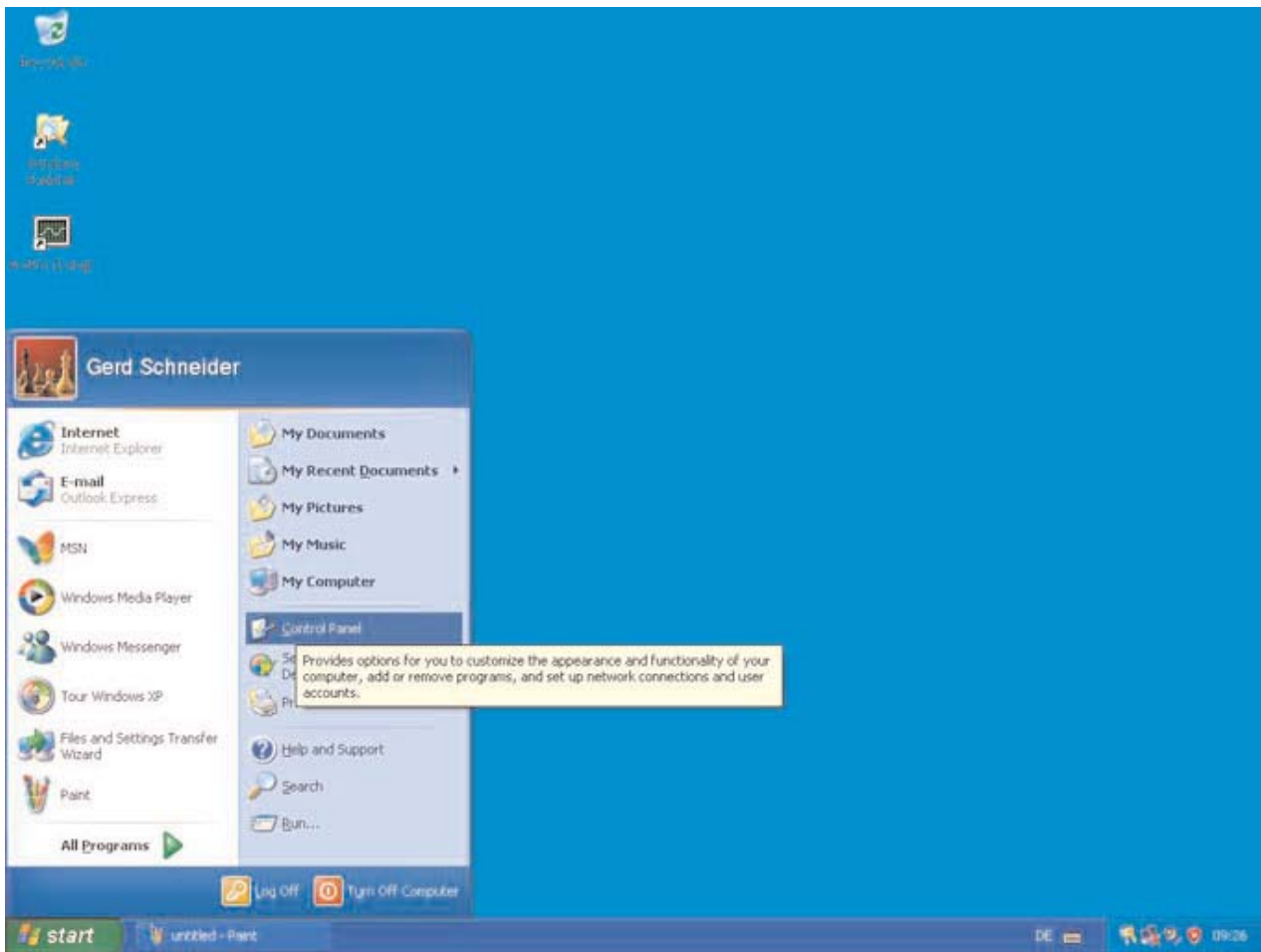


Fig. 2: Selecting system control

To get to "system control", click on the "start" button. After the "start" menu has popped up, open the "settings" menu item by pointing the mouse pointer at it.

Then open the "control panel" menu by a click. Please refer to the following illustration.

1.3.1 Control Panel

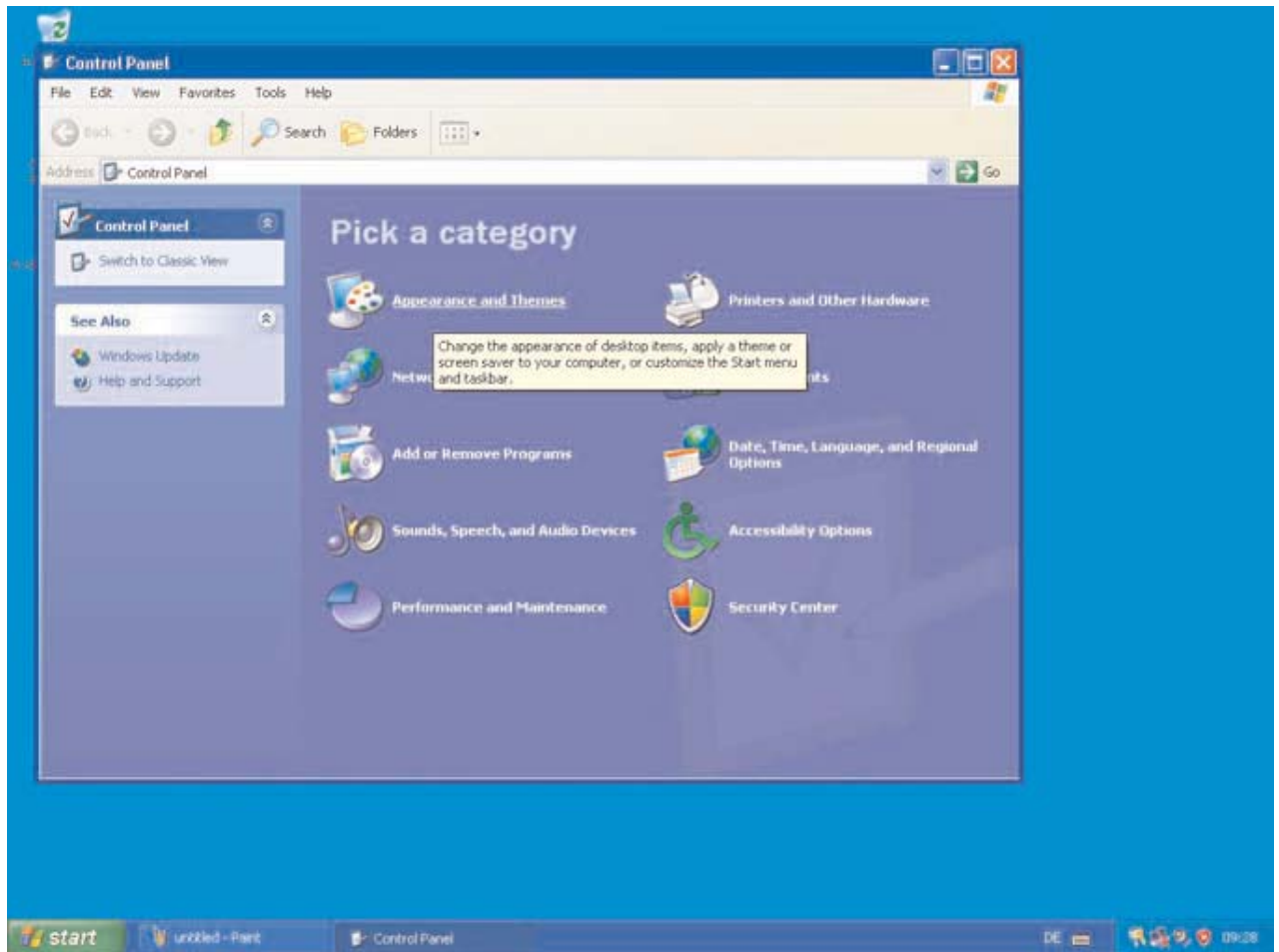


Fig. 3: Control Panel

The screen properties can be set using the screen menu tabs which become accessible after a doubleclick on the screen icon.

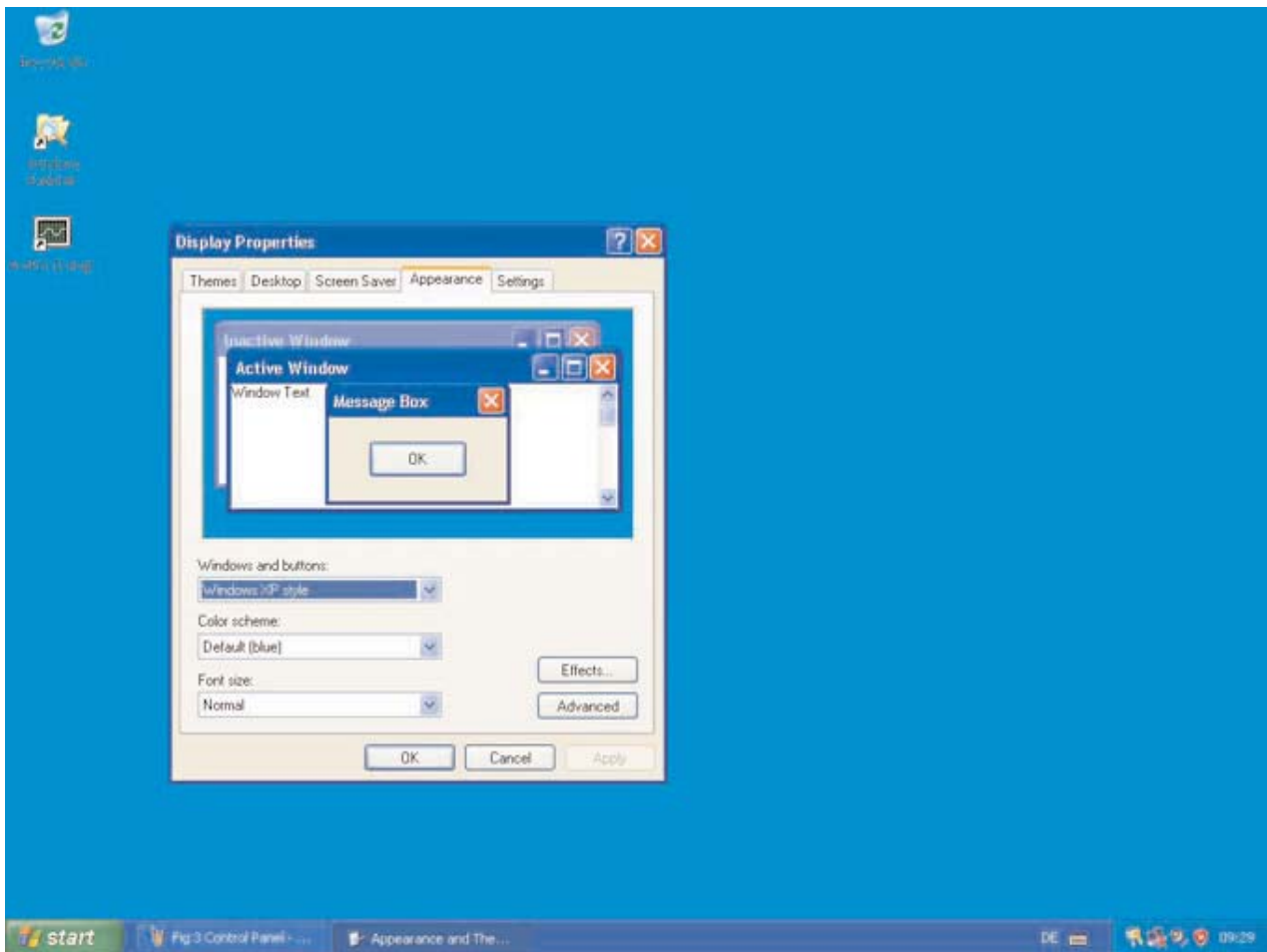


Fig. 4: Screen properties

These tabs appear after a double click on the screen icon.
The required settings are accessible on the „settings“ tab, please refer to following illustration.

1.3.3 Screen settings

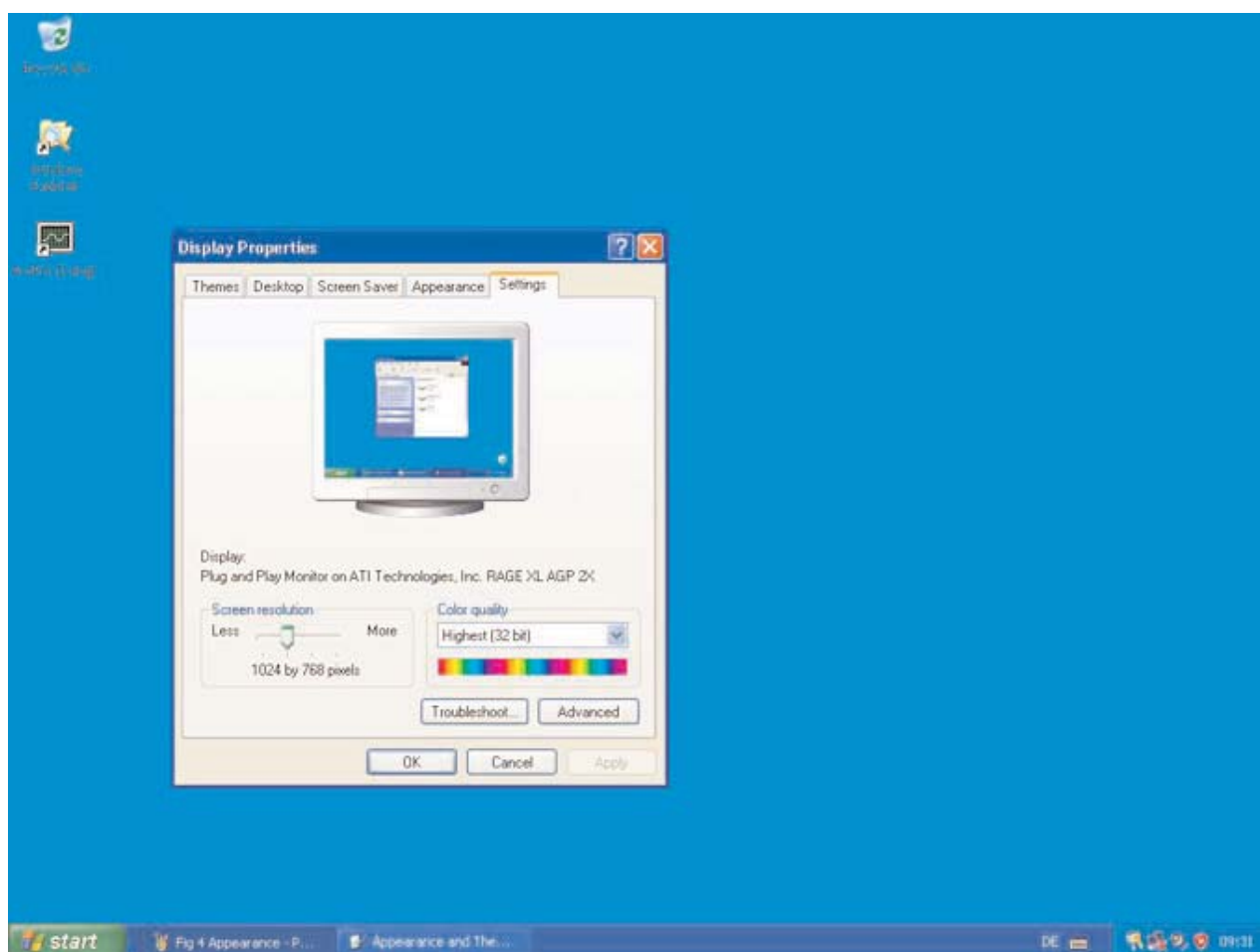


Fig. 5: Screen settings

The settings required for a correct representation of the following AVSPro II program are as follows:

- Desktop area: 800 x 600 pixels
- Font size: Large fonts
- "Color Palette" and "Refresh Rate" depend on the graphics card being used and are most largely uncritical with regard to the above settings, if these are permitted by the card.

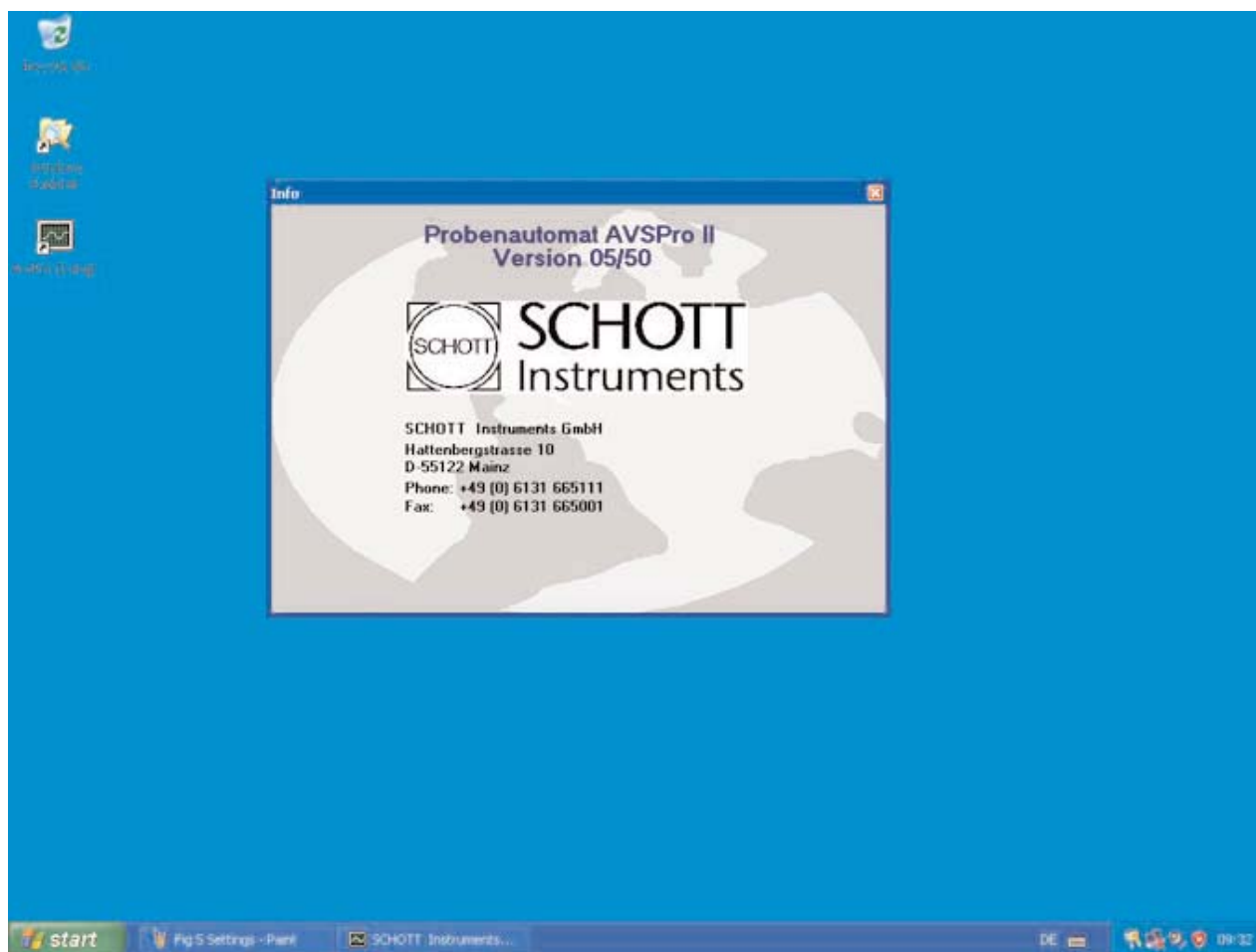


Fig. 6: Screen with company logo after program start

This screen will be displayed shortly. After it has disappeared, a safety inquiry for the sample-chamber flap switch will be performed (Section 2.1). The subsequent screens will show the various menu items you can use to get into the program. Depending on the application, there are various ways of influencing the running, the parameterisation, and the start of the program.

- Screen after version display with safety inquiry
Figure 7
- Screen after version display with negative result
Figure 8
- Screen with note:
Temperature monitoring disabled
Figure 9
- Screen after safety inquiry = Starting screen
Figure 10
- Starting screen with "file" menu popped up
Figure 11
- Starting screen with "edit" menu popped up
Figure 12
- Starting screen with "master data" menu popped up
Figure 13
- Starting screen with "extras/options" menu popped up
Figure 14

2.1

Safety inquiry for sample-chamber flap switch

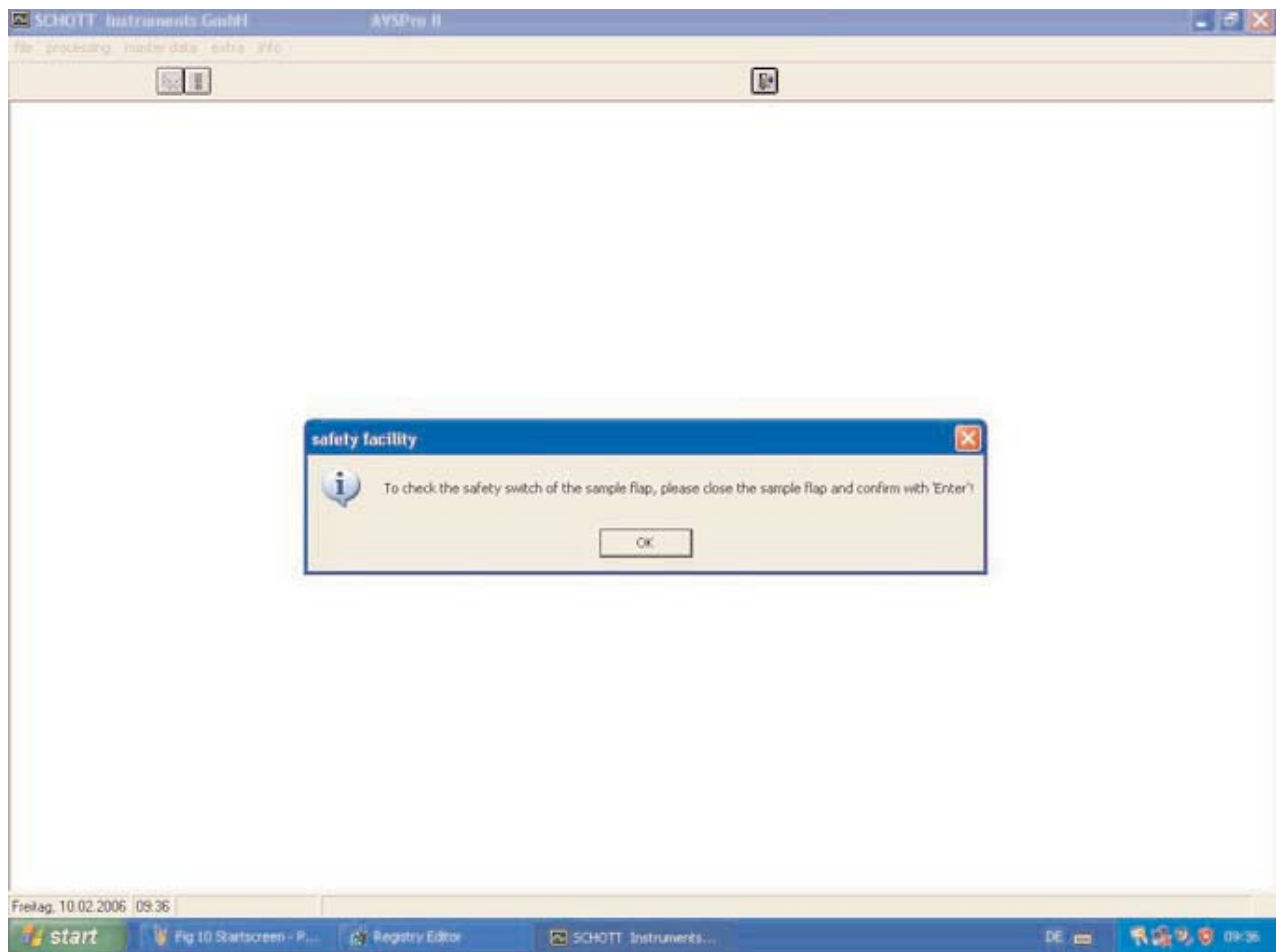


Fig. 7: Screen after display of program version

At this point a safety inquiry of the sample-chamber flap switch will be performed. The switch has to be operated at least once after each programstart to make sure that it is still functioning properly. Putting this flap switch deliberately out of operation constitutes

aviolation of the Machine Directive (CE Conformity) and is to be considered as a serious breach of safety!

If this switch is not functioning perfectly, or if the sample-chamber flap was not moved, the following message will appear on the

screen and the program will not perform any movement of the linear drive!

Safety inquiry of the sample-chamber flap switch: Negative result

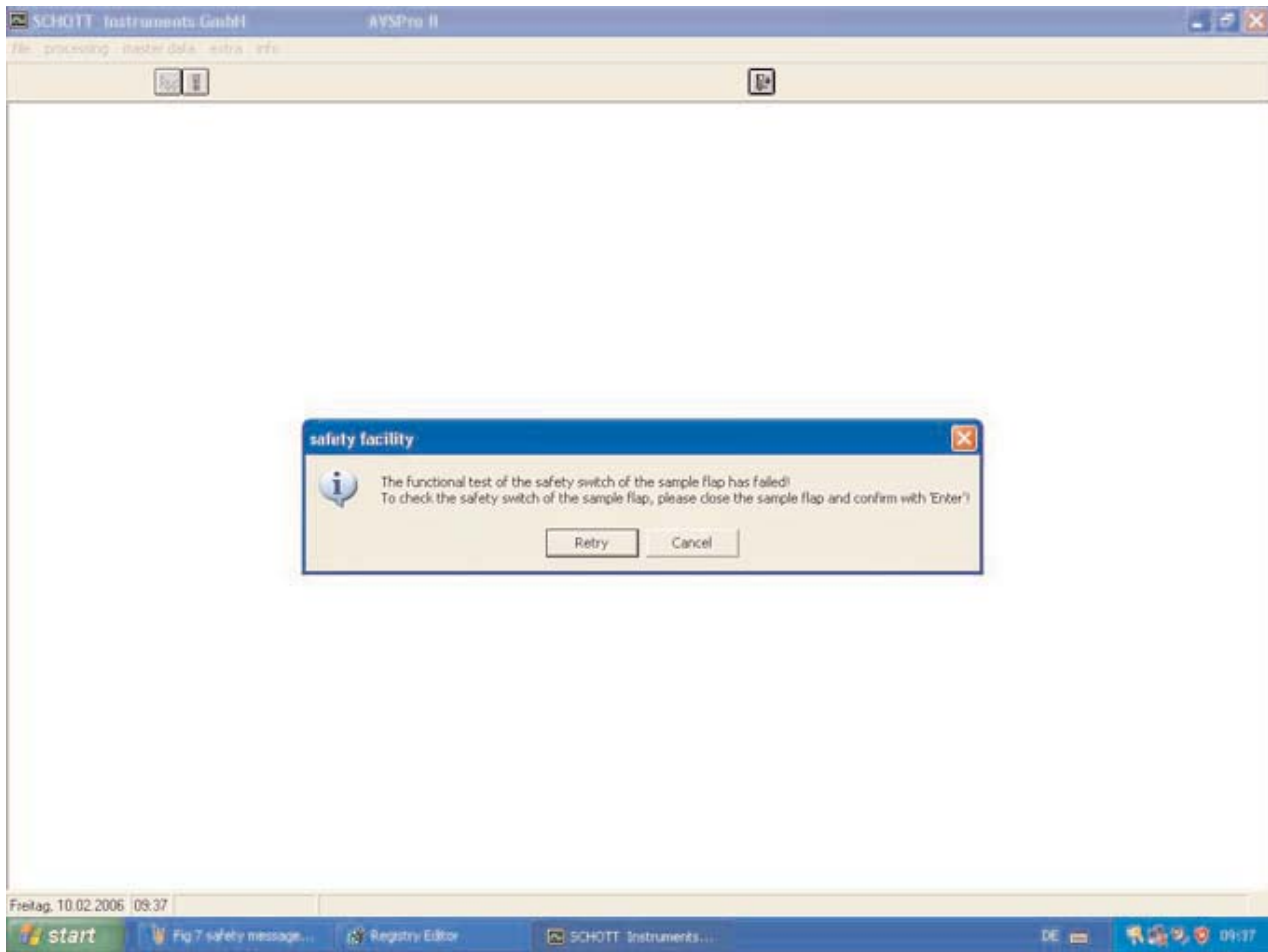


Fig. 8: Flap switch not operated or defective

The above message will appear if the flap switch was not operated, if it is defective, or if a broken line to the flap switch is present.

The motional process of the system and the start of a measurement is only possible after the flap switch has been operated and is functioning impeccably.

2.3 Starting screen with temperature monitoring disabled

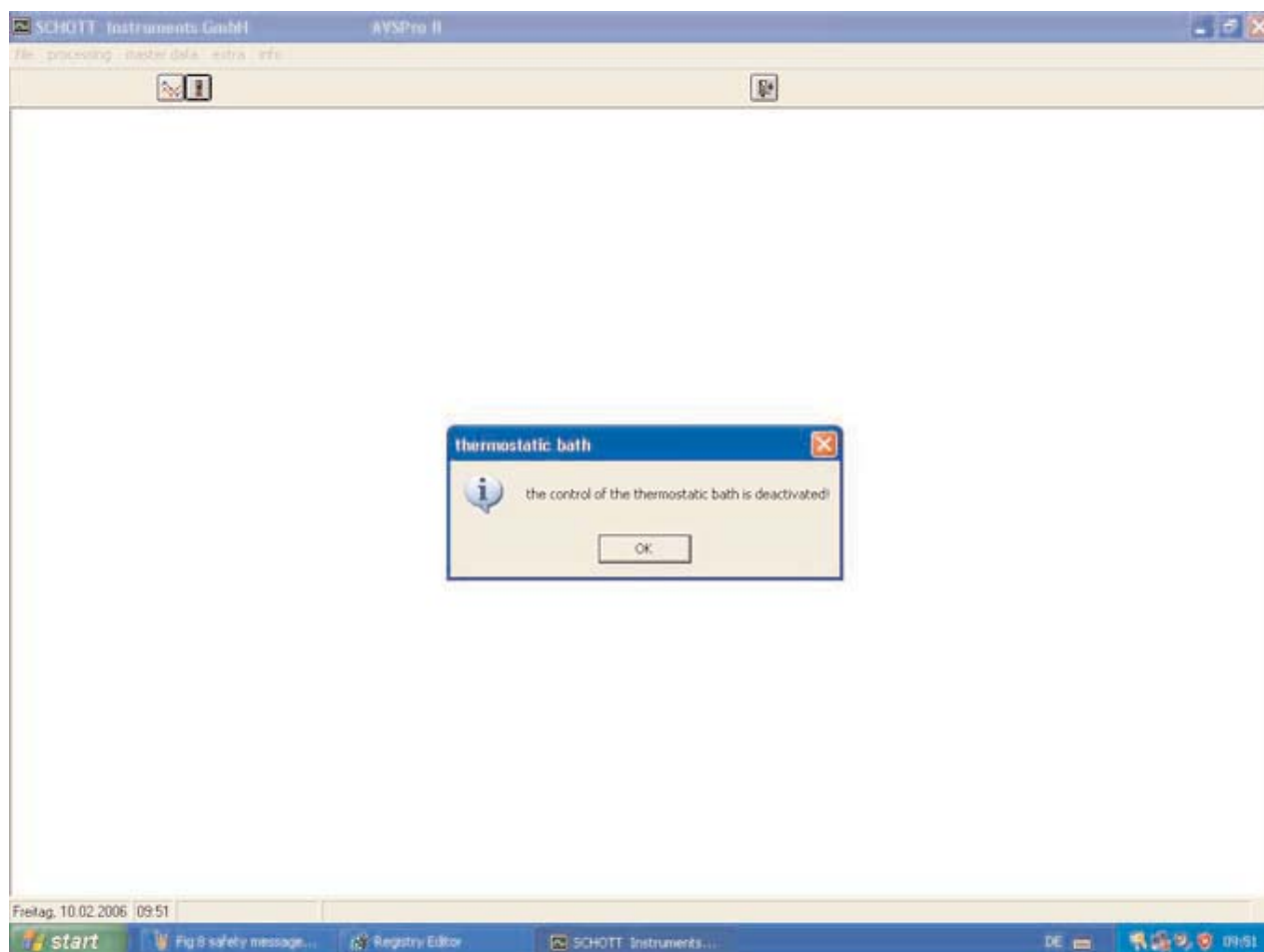


Fig. 9: Starting screen with temperature monitoring disabled

If the check (tick) of the thermostats was deactivated in the „extras, general“ menu (section 3.2), you will receive this message as soon as the measurement is to be started.

If this is desired, the test can be performed at a later time in the „extras, general“ menu (section 3.2) or in the course of the start of the measurement.

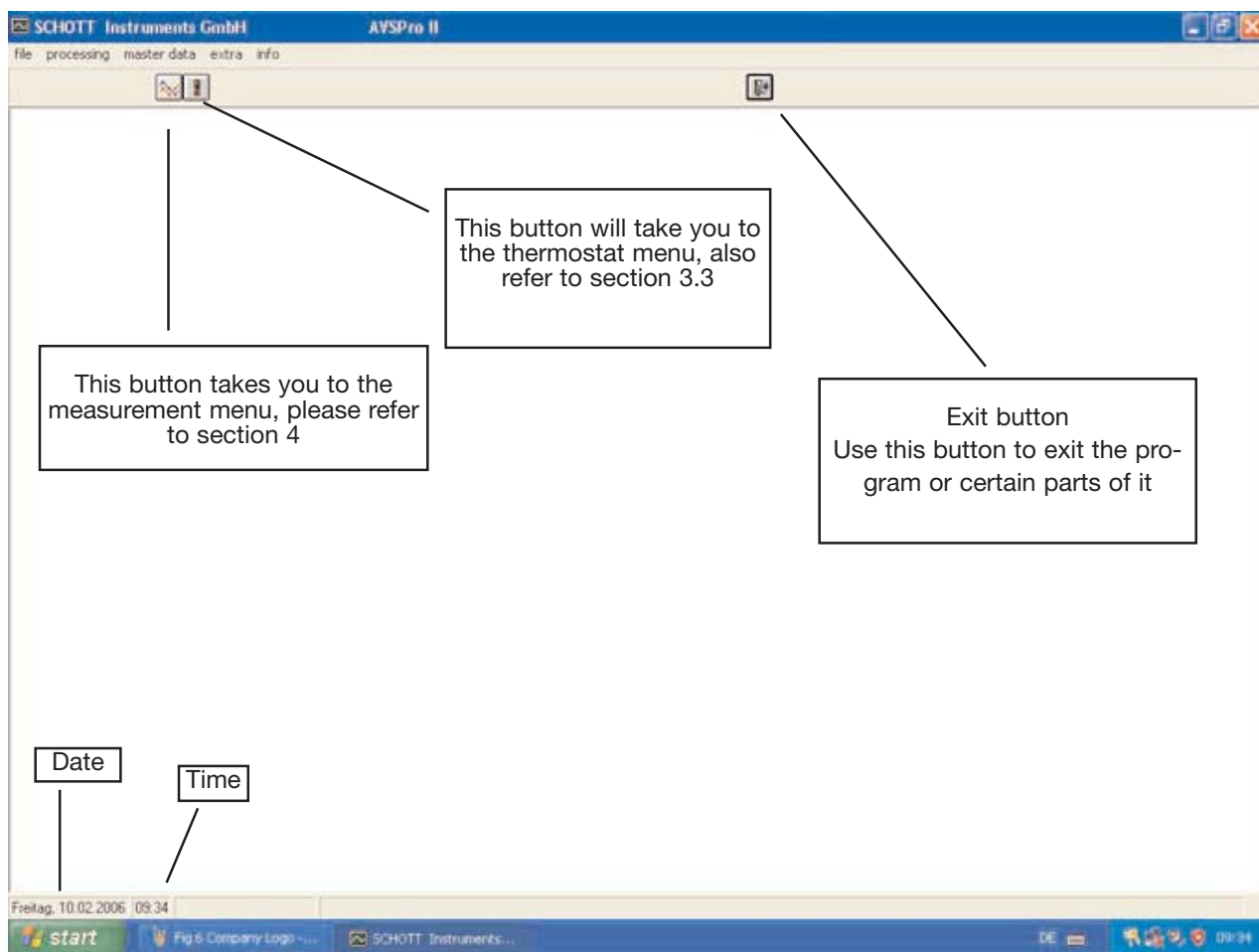


Fig. 10: Screen after trouble-free program start (starting screen)

2.4 Starting screen

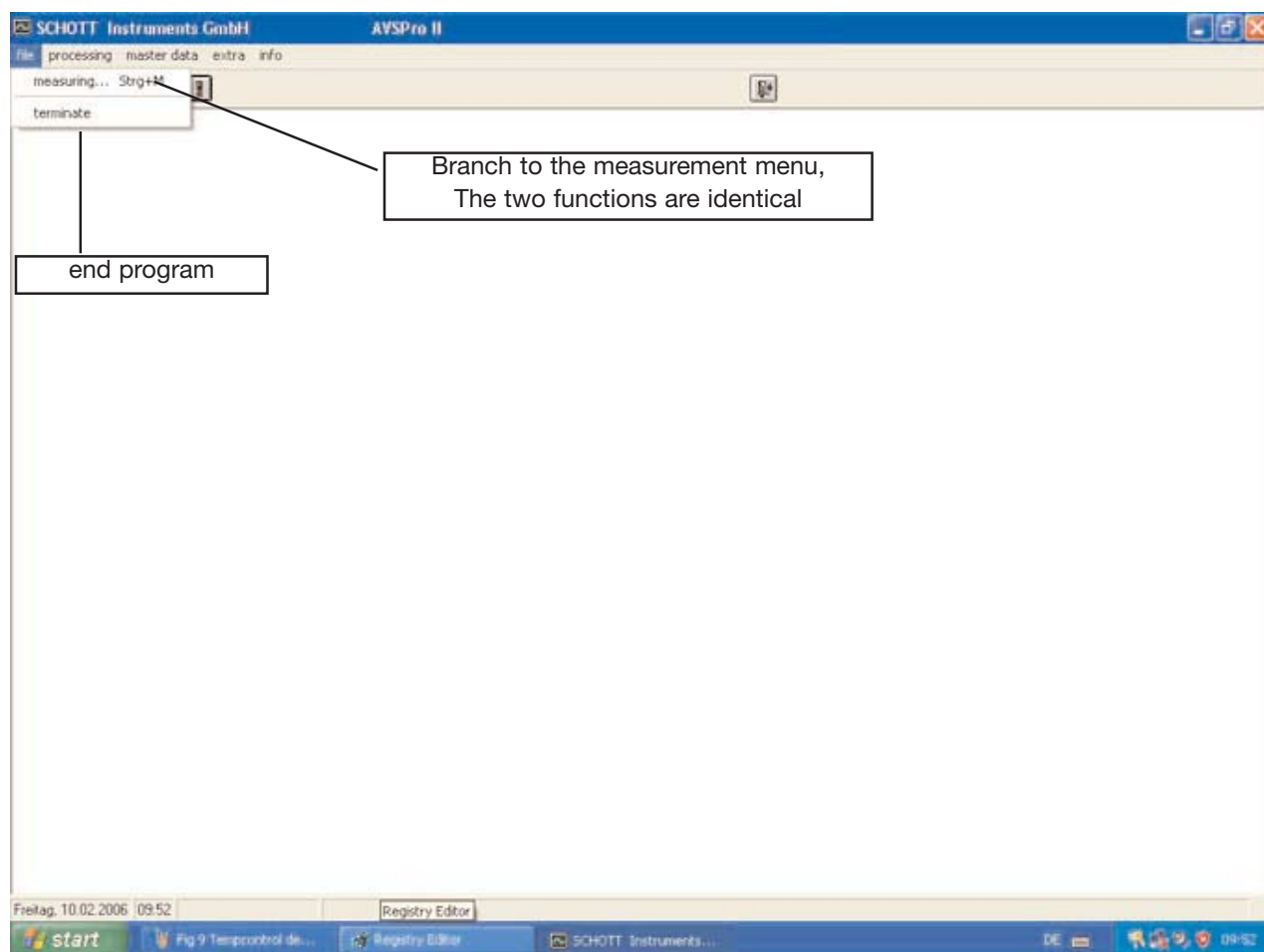


Fig. 11: Starting screen with "file" menu popped up

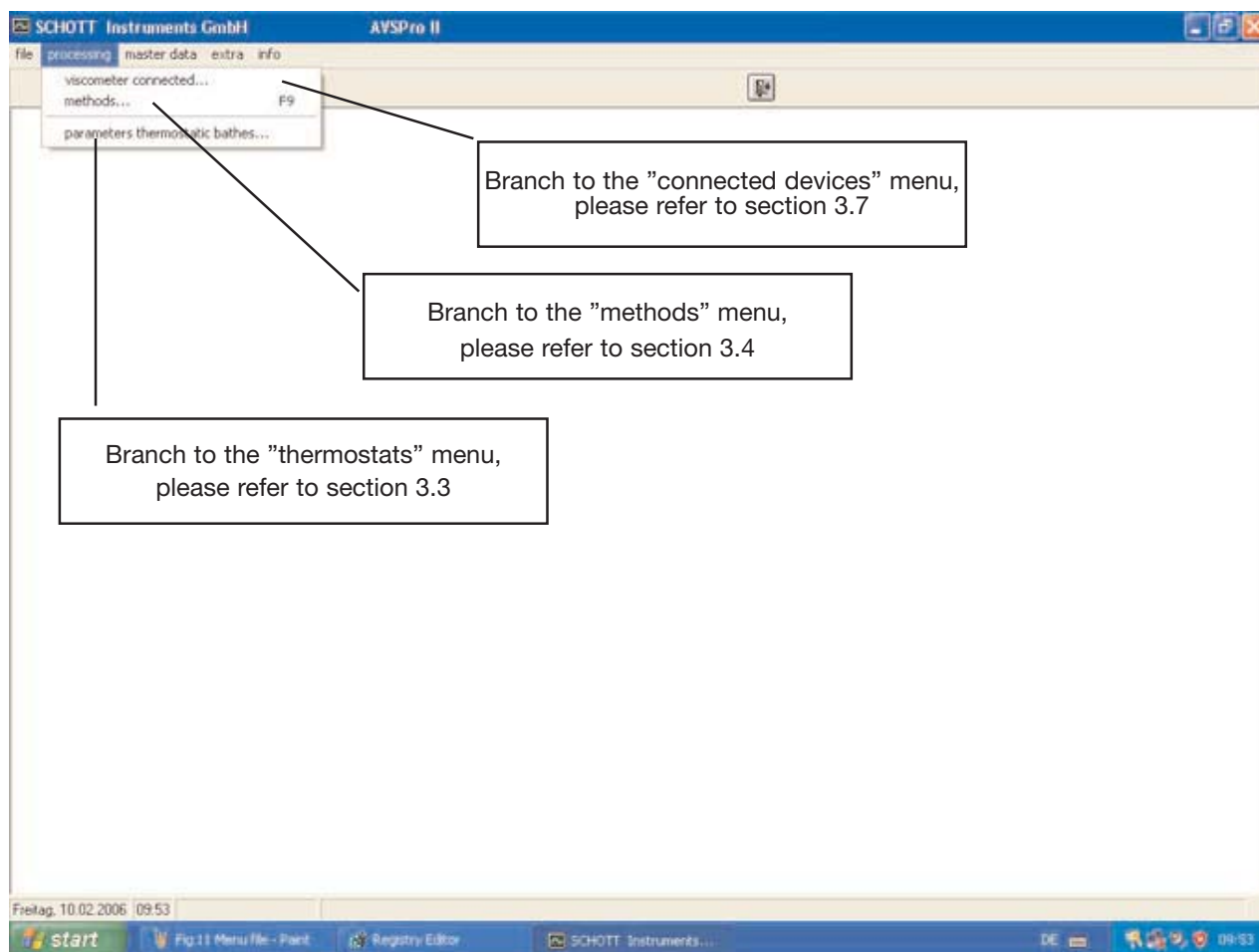


Fig. 12: Starting screen with "edit" menu popped up

2.4 Starting screen

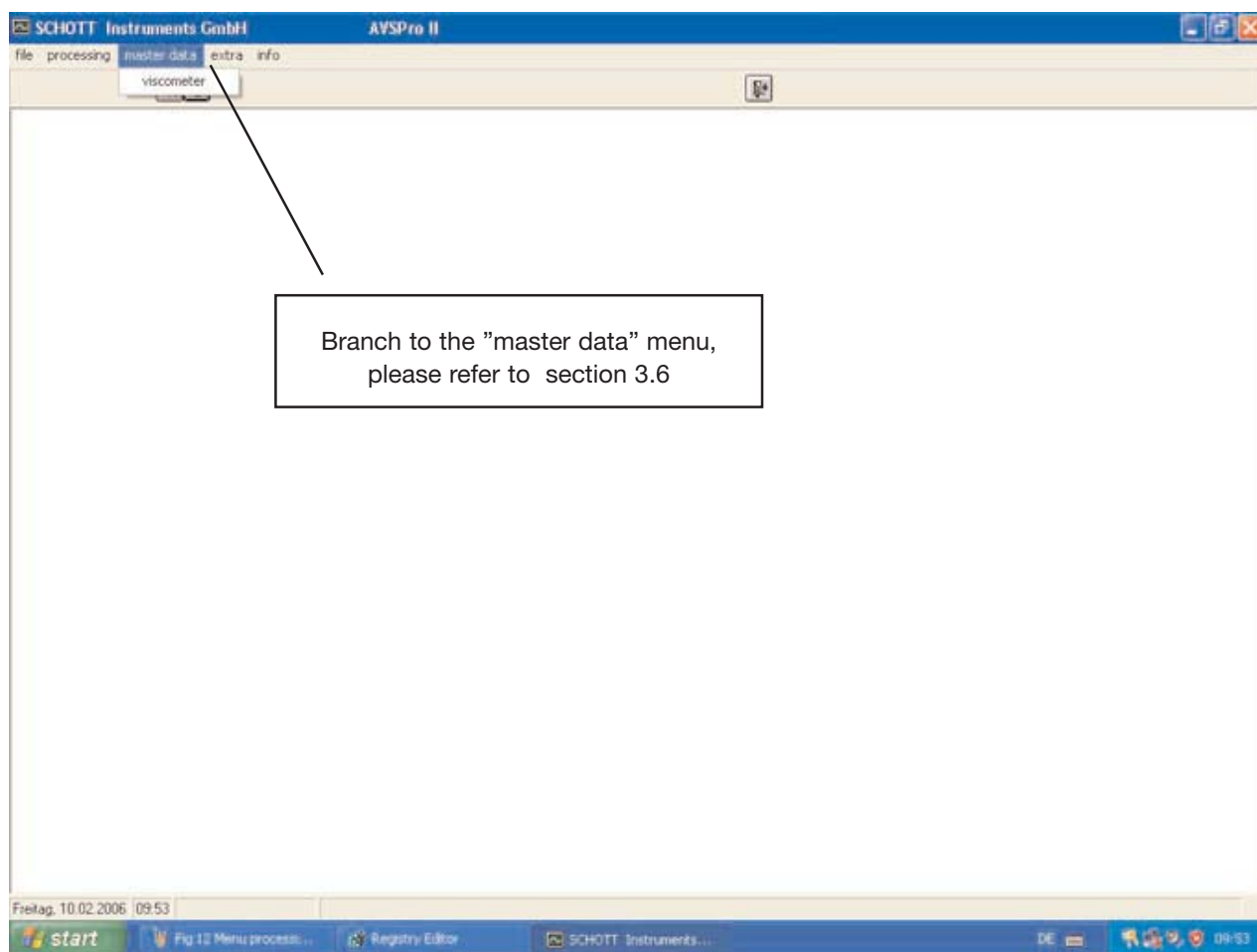


Fig. 13: Starting screen with "master data" menu popped up

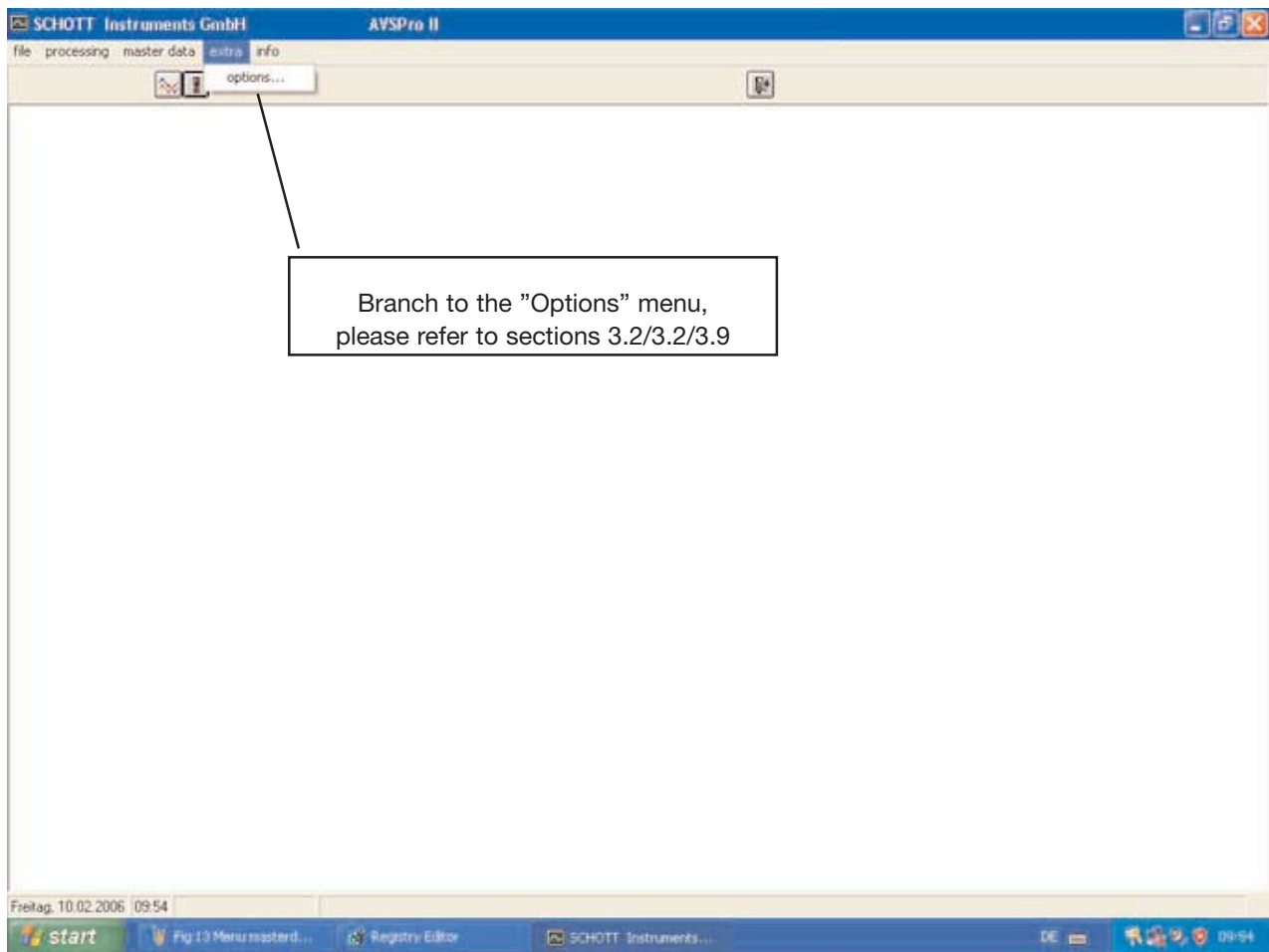


Fig. 14: Starting screen with "extras/Options" menu popped up

Description of the parameterisation process

• Start

Shortly after starting the AVSPro II program by a double click on the icon, the company logo will appear (refer to fig. 2), and the starting screen (fig. 3) is displayed. This starting screen is used to branch to the various program parts.

• Language version:

If the preset menu language is not the desired one, it can be selected through the “extras, options” menu (refer to fig.14) by selecting the “language” tabsheet (refer to fig. 15), which is opposite to the appropriate national flag.

• Thermostats/ Measurement mode:

Through the “extras,options” (fig. 14) menu item you can select the “general settings” tabsheet (fig. 16) to determine whether the thermostat(s) is/are to be included in the test performed by the application program (“Work with thermostat”). This tabsheet is also used to set the measurement mode. If you wish to work with one or more thermostat/s, you should first parameterise the thermostat/s as described in section 3.3.

• Method selection/Edit:

This item is accessible on the “edit” menu (fig. 12) under the “methods” item. As soon as the parameters of the method are set, you can use the same menu, i.e. “edit” (fig. 12), to assign a viscometer to the connected ViscoPumps.

This assignment procedure is described in section 3.4.

• Sample designation, assignment:

After the method selection and their parameterisation, the sample designation and the assignment of the samples to the viscometers available can be done here if desired; for a description, please refer to section 3.5 ff.

• Viscometer master data:

After setting the measurement mode, and if you are working in the “absolute” mode, the viscometer master data are set up at this point as is described in section 3.6. In the “relative” measurement mode, setting up viscometer master data makes only sense if you are working with viscometers with constants, if the possibility of calculating the blank value is available, and if the

calculation of the Hagenbach-Couette correction is to be used. This is also described in section 3.6.

• Connected devices:

This part of the programme shows the connected ViscoPumps and the assignment of the viscometers. Depending on the operating mode, this item can be used to make certain selections (described in section 3.7).

• Dosing parameters:

These can be accessed via the connected devices and are described in section 3.8.

• Miscellaneous settings:

Other settings such as the parameterisation of the serial interface, the PLC device control, and the learning process of docking positions are described in section 3.9.

Abridged index:

3.1 Selection of the language version

Fig. 15 from page 24

3.2 General selection

Fig. 16 from page 25

3.3 Parameterisation of the thermostats

Fig. 17 ff. from page 26

3.4 Editing methods

Fig. 20 ff. from page 30

3.5 Sample designation, assignment

Fig. 37 ff. from page 48

3.6 Viscometer master data

Fig. 40 ff. from page 51

3.7 Connected devices

Fig. 48 ff. from page 59

3.8 dosing parameters

Fig. 50 ff. from page 61

3.9 Miscellaneous settings

Fig. 51 ff. from page 62

3.1

Selection of the language version

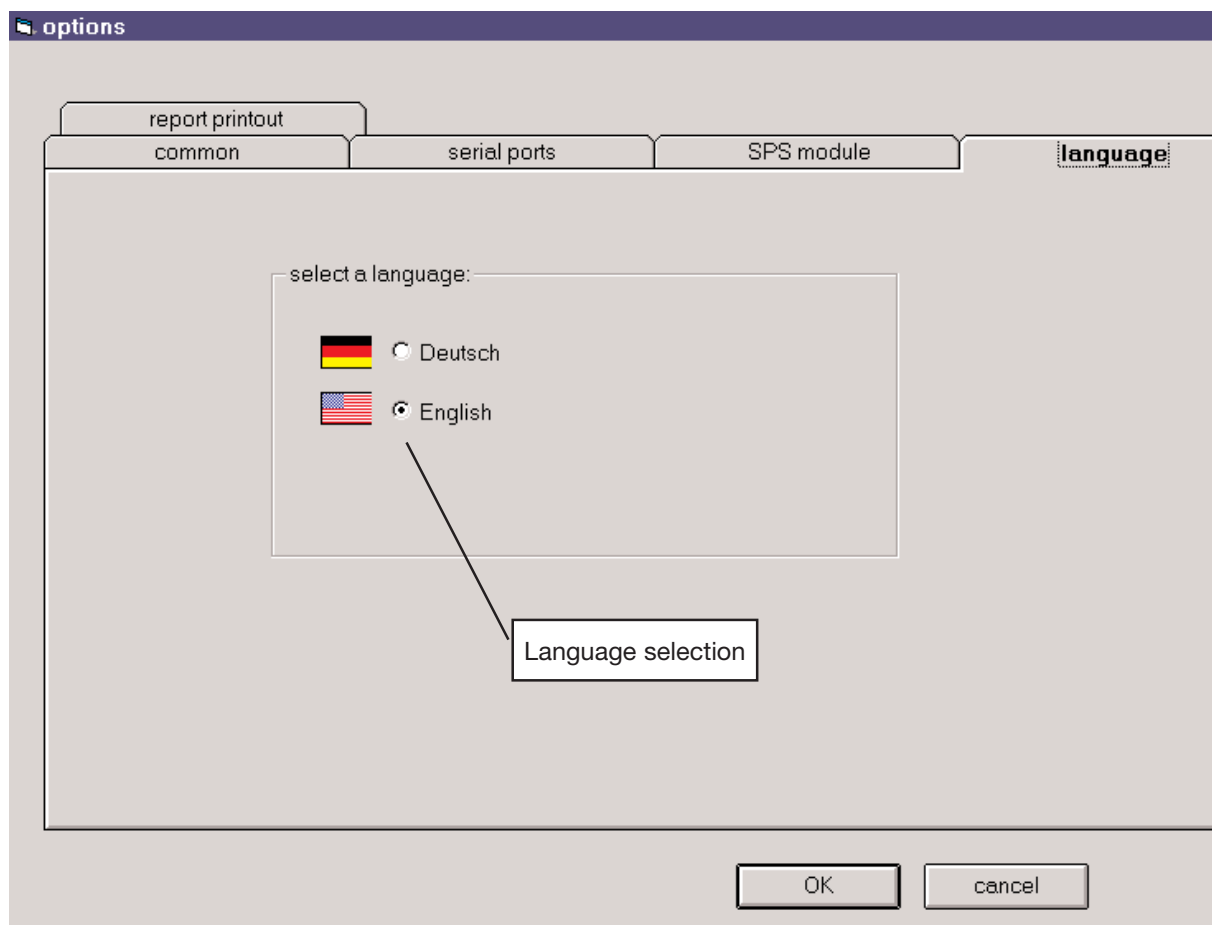


Fig. 15: Tabsheet for the selection of the menu language

At this point the user can make a choice between the German and the English language. If, in addition, the program is based on a country-specific version of the Windows® XP operating system, it may happen that certain messages within the program, which are requested on the operating system level, will appear in the respective national language.

• **Please note:**

There may be additional problems, for instance, if a data record which was created using the German version of Windows® XP was taken over to a system on which the English version of Windows® XP is running, since there may be differences in the decimal-separation sign (German: “comma”, English:

“. decimalpoint”).

This may result in errors while reading the database which can only be eliminated by in-linking a correct country-specific version.

options

report printout **common** serial ports SPS module language

timeout COM ports

timeout answer: seconds

if there is no response of the device connected after this timeout the communication will be terminated.

perform delta %

no. of meas. (inclusive) to perform delta %

from: to:

measuring mode

☒ mode absolute viscosit

☐ mode relative viscosity

work with thermostatic bath...

☐ control thermostatic bath

OK cancel

Fig. 16: Tabsheet for general settings

This tabsheet can be used for a the general settings such as measurement mode, response times of the serial communications, check for runaways, as well as the thermostat monitoring.

3.3

Parameterisation of the thermostats

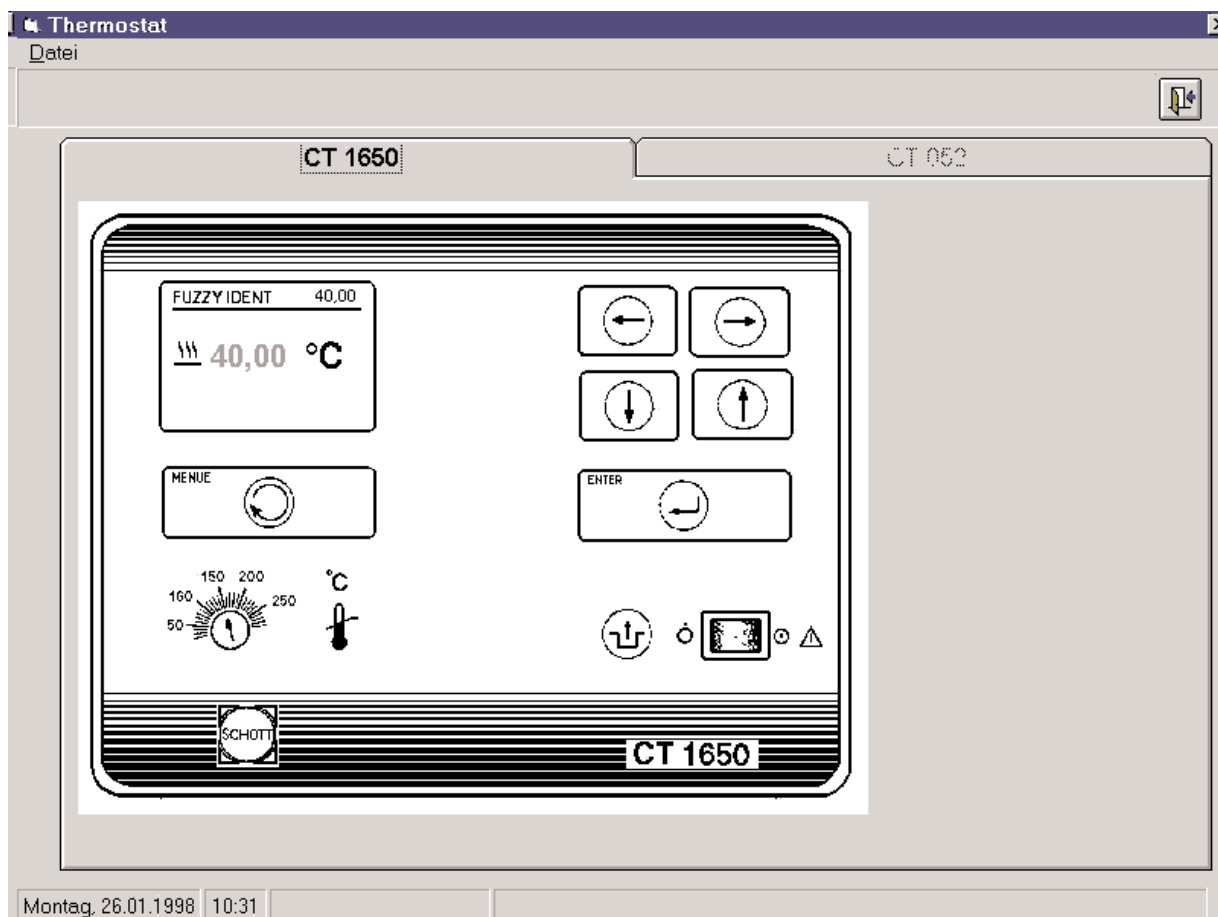


Fig. 17: CT 1650 immersion-type thermostat

These settings are accessed via the starting screen (figure 10) by means of the relevant button. The selection of the thermostat type can be done using the tab sheet. Below is a description of the settings for the CT1650 type.

The CT 1650 immersion-type thermostat can be used for absolute as well as for relative determination of viscosity. If this immersion-type thermostat is found during the initialisation of the system, the number of the viscometers and ViscoPumps available for use will be automatically limited to four.

The setting is made in analogy with the description of the operating instructions of the thermostats. Use the mouse pointer to select the “menu” and “enter” actionfield. After selecting the “menu” action field, you may input the working temperature and the limit temperature and confirm them using the “enter” action field.

Following is a description of the use of the CT 52 immersion-type thermostat. Up to two thermostats of this type can be used. It is intended to enable working with two different working temperatu-

res (especially for the determination of the viscosity index, please refer to section 3.4.1, as described below).

Both the CT 1650 immersion-type thermostat as well as the CT 52 immersion-type thermostat are controlled and monitored through the AVSPro II operating software. If the set tolerance is exceeded the user will receive a corresponding message of information and be prompted for action!

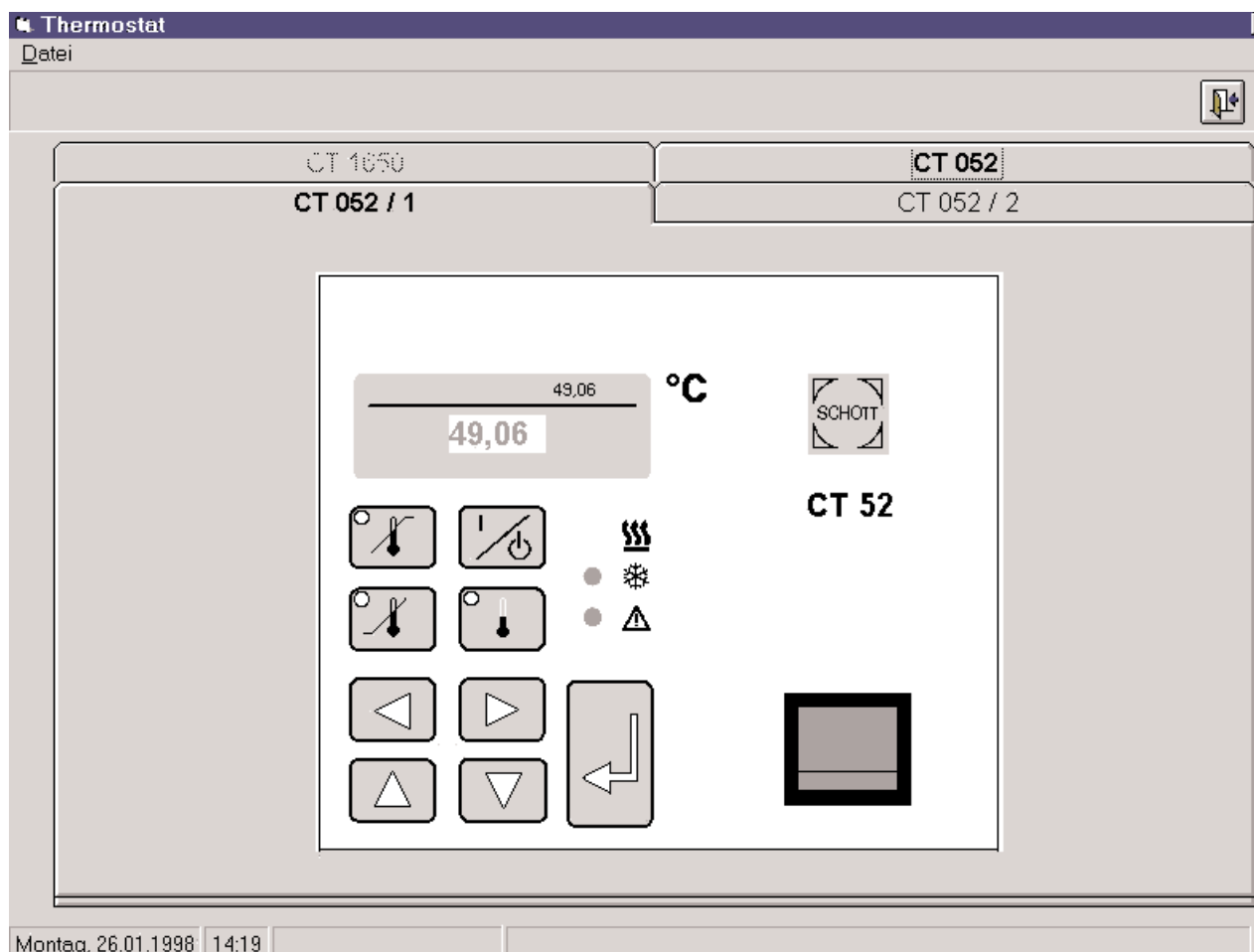


Fig. 18: CT 52/1 immersion-type thermostat

As is the case with the CT 1650 immersion-type thermostats, the setting is made in analogy with the process described in the respective operating instructions.

The CT 52 immersion-type thermostat together with the CT 53 thermostat bath can be incorporated twice in the system, which is therefore conceived for CT52/1 and CT 52/2 (also refer to Fig. 19). If two thermostats are in use

it is possible to have two different temperatures available for measurements within the system at the same time. This is particularly intended for the determination of the viscosity index (please refer to section 3.4).

In this case it is possible to perform in parallel 4 VI determinations using 4 Micro TC Ubbelohde viscometers and the 56 type sample carrier for each determination.

It is also possible to use two light-optical measuring stands in one CT 52 immersion-type thermostat with the CT 53 thermostat bath. (Please refer to the operating instructions of the thermostat type being used.)

3.3

Parameterisation of the thermostats

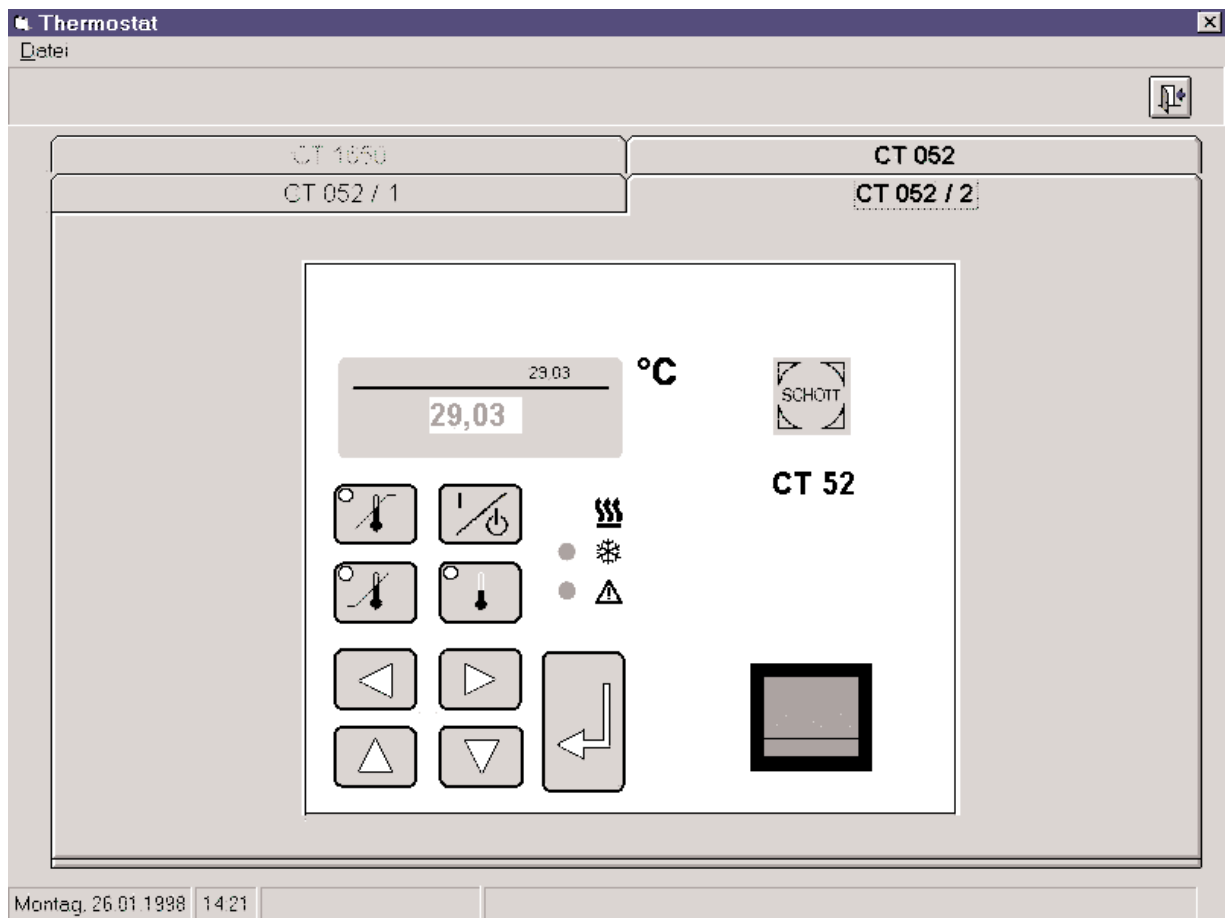


Fig. 19: CT 52/2 immersion-type thermostat

For details on the use of the device, please refer to the description of the CT 52/1 immersion-type thermostat on the preceding page.

The measurement methods are set up after the setting of the measurement mode (section 3.2).

selection of methods

file processing master data

absolute viscosity relative viscosity t0-flowtime

selection of methods individual entry common entry

viscometer type ASTM-Ubbelohde

viscosity range 6 bis 30

viscometer size 1c

viscosity index ☐ It has to be secured, that thermostatic bath no.1 runs at 40°C and thermostatic bath no.2 runs at 100°C and in both thermostatic bathes the same amount of viscometers is present!

rack size 16 (100 ml)

barcode ☐

Fig. 20: Tabsheet for method set-up (absolute)

Using this tabsheet, and on the basis of the viscometer type and the viscometer range, it is possible to preselect a viscometer and to select the size of a sample carrier (rack size) being used.

The following viscometer types are available for use:

DIN Ubbelohde
ASTM Ubbelohde
Micro Ubbelohde
Micro TC Ubbelohde
Cannon Fenske Routine
Micro Ostwald

The 56 type sample-carrier size (17 - 20 ml) requires the use of viscometers of the microtype.

After the selection of the measurement range has been made, the size suggested for use will be displayed.

If the viscometer master data (please refer to section 3.6) do not provide any viscometer of this size, you will be informed at the start of the measurement that no viscometer constant was yet

assigned to the respective viscometer.

In this case you have to proceed to the assignment in the master data, since otherwise the measurement will not be possible (please refer to section 3.6)

Notes on working with the “viscosity index” function in the absolute mode:

The calculation will be performed according to DIN ISO 2909!

If the viscosity index function is activated on the tabsheet according to figure 20, the following conditions have to be met in order to ensure proper working results:

Two CT 53 thermostat baths with CT 52 immersion-type thermostats have to be present. In these thermostats, two viscometers belonging together have to be built in, i.e., these viscometers have to be present at the same positions within the baths, e.g. Pos 1, Bath 1 / together with Pos 1 / Bath 2 etc.

Each of the sample carriers has to be loaded pair-wise:

16 type sample carrier:

If 4 viscometers are loaded, row 1 with the positions 1 - 4 is dedicated to thermostat 1 (Pos 1-4), and row 2 with the positions 5-8 is dedicated to thermostat 2 (Pos 1-4) and so on.

This means that the same samples have to be set in the positions 1,5-2,6-3,7- etc.

56 type sample carrier:

If 4 viscometers are loaded, row 1 with the positions 1 - 4 is dedicated to thermostat 1 (Pos 1 -4), and the positions 5 - 8 are dedicated to thermostat 2 (Pos 1 - 4) and so on.

In this case one row is dedicated to the determination in four viscometers.

• **Please note:** If any viscometer in any thermostat fails for whatever reason, the corresponding viscometer in the other bath will be put out of operation as well.

3.4.1.1

Absolute Mode / Common input

The screenshot shows a software window titled "selection of methods" with a menu bar (file, processing, master data) and navigation buttons. The "absolute viscosity" tab is selected, and within it, the "common entry" sub-tab is active. The main area contains the following fields and controls:

- no. of measurement:** 3
- temp equ. time:** 3 min.
- Hagenbach correction:** ☒
- delta t % :** 10 %
- temperature tol.:** 10 °C
- rinsing mode:** A dropdown menu showing "next sample". To its right are buttons for "<- add" and "delete ->".

A list of rinsing methods is displayed on the right side of the window:

- next sample
- solvent 1
- solvent 2

A message at the top of the main area reads: "selected common entry of parameters! All entrys are valid all samples!"

Fig. 21: Tabsheet for shared parameterisation in "absolute" mode

The parameters to be input or selected at this point will apply to all samples jointly!

· Note on the setting of the number of rinsing processes:

The rinsing-mode field can be used to fashion a specific rinsing sequence.

"Add" will define the number and method of the rinsing processes.

If, for instance, rinsing is to be performed three times with the next sample, the "next sample" has to be included three times in the "rinsing mode".

Other rinsing parameters such as suction rate, quantity to be used, purging with air etc. are described in section 3.8, dosing parameters.

The screenshot shows a software window titled "selection of methods" with a menu bar (file, processing, master data). The main area has tabs for "absolute viscosity", "relative viscosity", and "t0-flowtime". Under "absolute viscosity", there are sub-tabs: "selection of methods", "individual entry" (which is highlighted), and "common entry". A callout box points to the "sample no.:" field, which contains the value "1", with the text "Sample counter up / down". Below this are fields for "no. of measurem:" (3), "temp equ. time:" (3 min.), "Hagenbach correction:" (checked), "delta t %:" (10 %), "temperature tol.:" (10.00 °C), and "rinsing mode:" (empty). To the right of the "rinsing mode" field are buttons "<- add" and "delete ->". A dropdown menu labeled "next sample" is open, showing "solvent 1" and "solvent 2".

Fig. 22: Tabsheet for single parameterisation in "absolute" mode

The parameters to be input or selected at this point apply individually to specific samples, i.e. it is possible to select different parameters for each individual sample!

The sample counter enables the sample parameters to be entered or verified individually.

· Note on the setting of the number of rinsing processes: The rinsing-mode field can be used to fashion a specific rinsing sequence.

"Add" will define the number and method of the rinsing processes. If, for instance, rinsing is to be performed three times with the next sample, the "next sample"

has to be included three times in the "rinsing mode" field by clicking the "add" button.

Other rinsing parameters such as suction rate, quantity to be used, purging with air etc. are described in section 3.8, dosing parameters.

3.4.1.3

Absolute Mode / Method selection / Editing

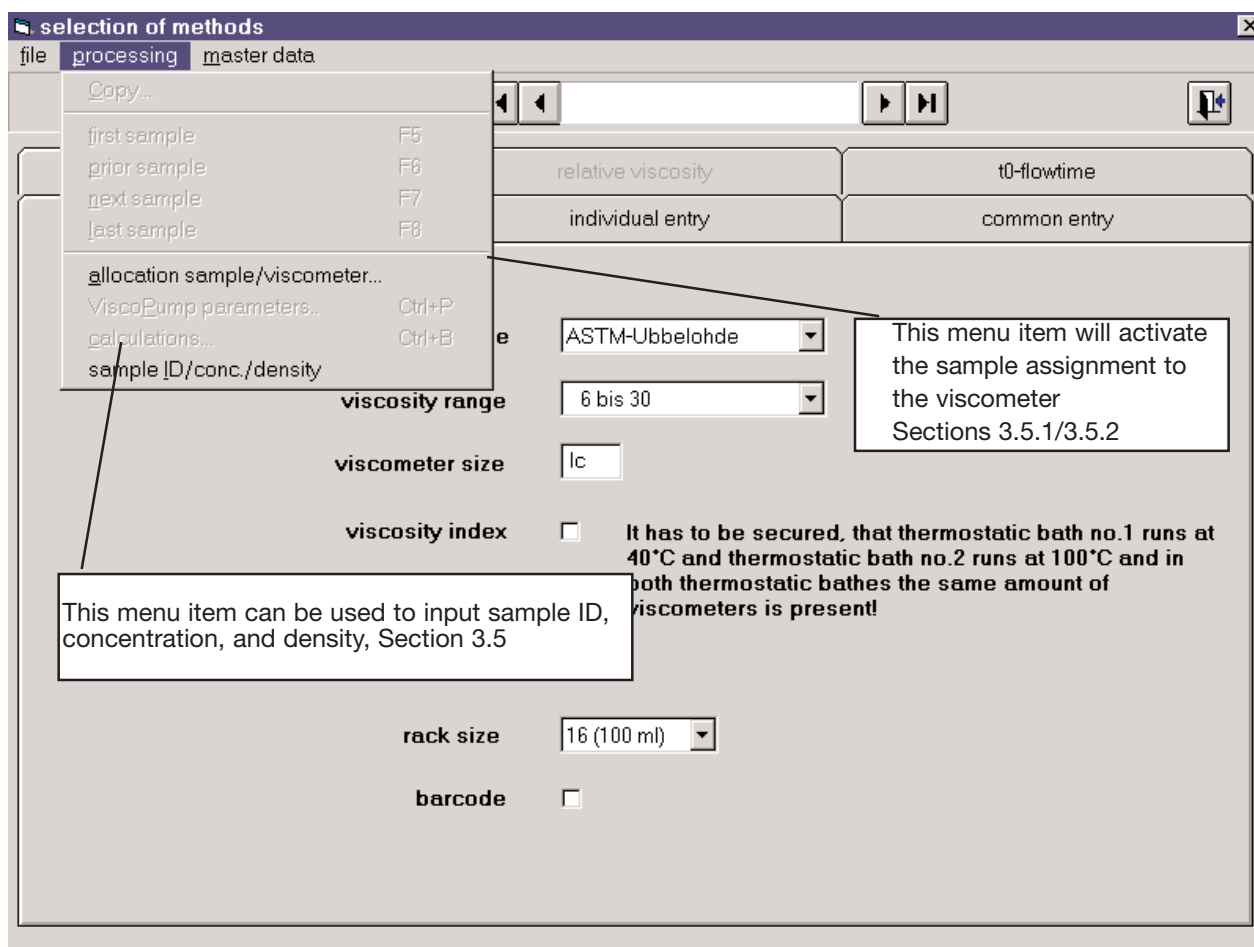


Fig. 23: Methods selection tabsheet in "absolute" mode, "edit" menu popped up

From this point you can jump to the available program branches shown.

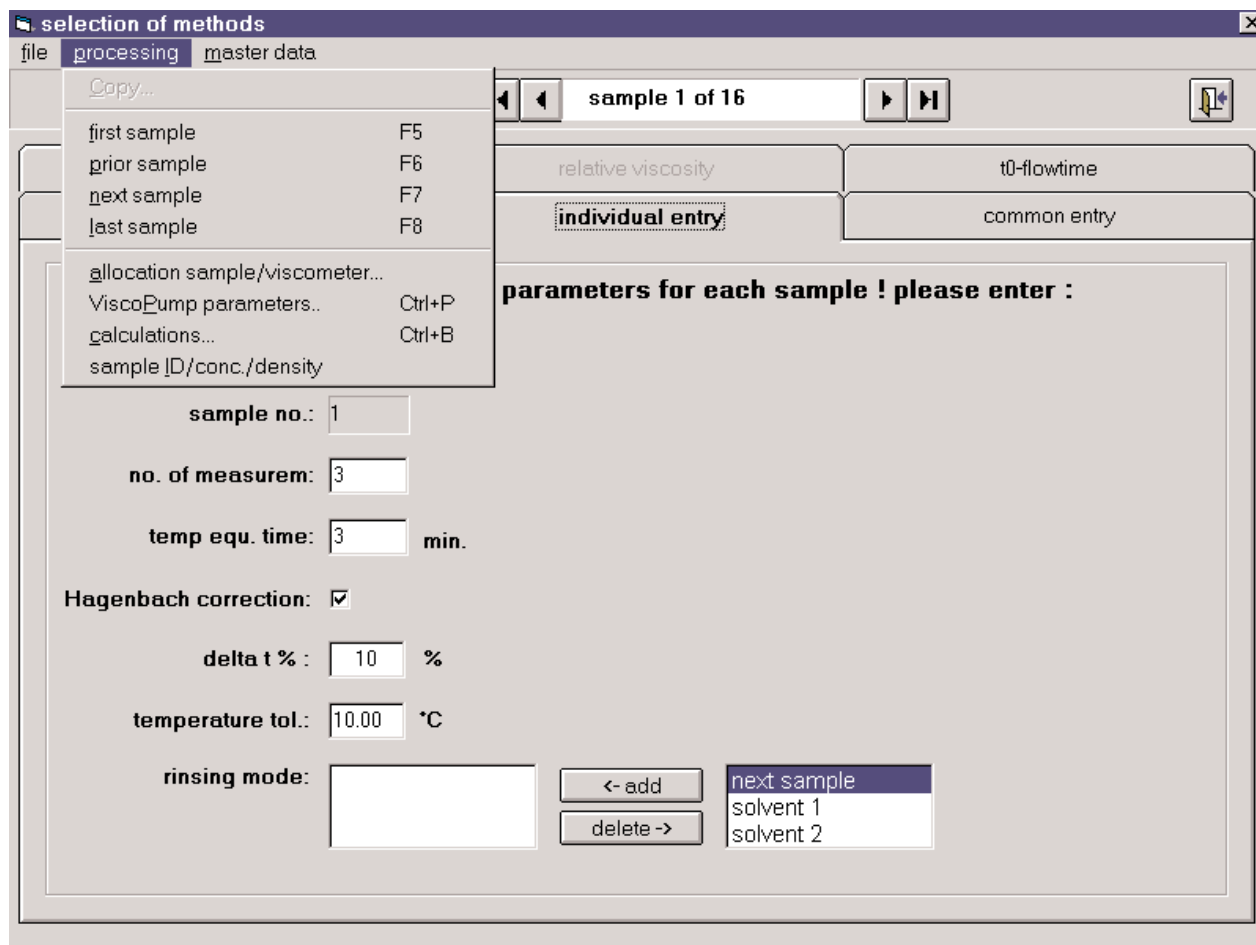


Fig. 24: Tabsheet for single parameterisation in "absolute" mode, "edit" menu popped up

The available branches of the program as shown here can be accessed from this point.

Signification of the menuitems:

- First sample:
Used to invoke the first sample
- Preceding sample:
Used to invoke the preceding sample
- Next sample:
Used to invoke the next sample
- Last sample:
Used to invoke the last sample

The following menu items will be described below the respective sections:

Specific sample/viscometer assignment

Section 3.5.1- 3.5.2

- ViscoPump parameters
Section 3.9.4

- Calculations
Section of 3.4.1.6

- Sample ID/concentration/ density
Section 3.5

- Use of the keyboard:
Shift & E / F5
Used to invoke the first sample

- Shift & V / F6
Used to invoke the preceding sample

Shift & N / F7

Used to invoke the next sample

Shift & L / F8

Used to invoke the last sample

Shift & A

Branched to:
Specific sample/viscometer assignment

Shift & P

Branched to:
ViscoPump parameters

Shift & B

Branched to:
Calculations

Shift & I

Branched to:
Sample ID/conc./density

3.4.1.5

Absolute mode / Common input / Editing

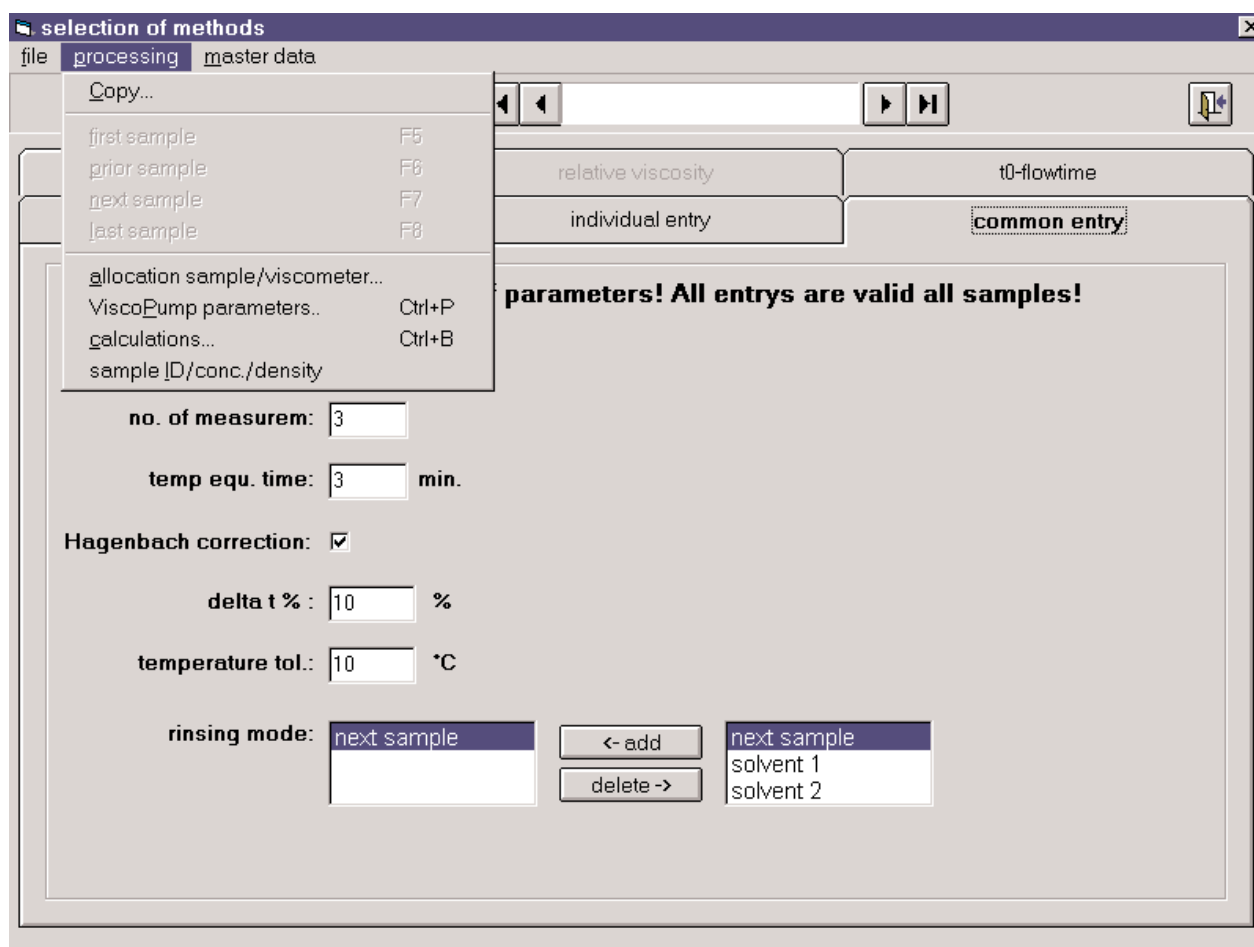


Fig. 25: Tabsheet for shared parameterisation in "absolute" mode

The available branches of the program as shown here can be accessed from this point.

Signification of the menu items:
· Copying:

The copying function is invoked
Section 3.4.3

The following menu items will be described below the respective sections:

Specific sample/viscometer assignment

Section 3.5.1- 3.5.2

· ViscoPump parameters
Section 3.9.4

· Calculations
Section of 3.4.1.6

· Sample ID/concentration/density
Section 3.5

Use of the keyboard:
Shift & K

Used to invoke the copying function

Section 3.4.3

Shift & A

Branched to:
Specific sample/viscometer assignment

Shift & P

Branched to:
ViscoPump parameters

Shift & B

Branched to:
Calculations

Shift & I

Branched to:
Sample ID/conc./density

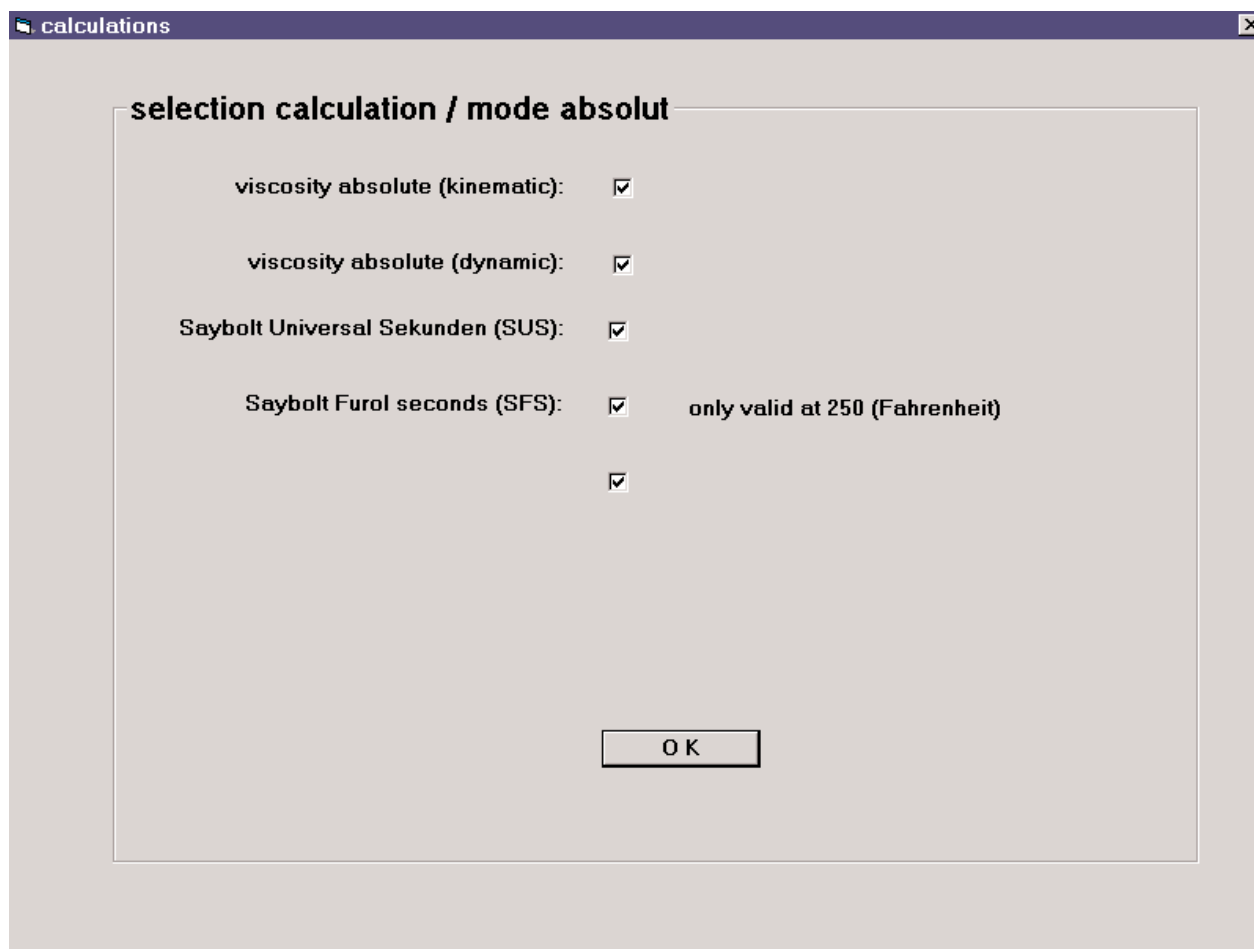


Fig. 26: Calculations in "absolute" mode

The following calculations can be made for both „shared“ as well as for „individual“ assignment:

- Absolute kinematic viscosity
- Absolute dynamic viscosity (requires knowledge and input of the respective sample density), refer to section 3.5, sample ID,

concentration, density Sayboldt Universal Seconds (SUS), procedure according to ASTM D 2161

Sayboldt Furol Seconds (SFS), procedure according to ASTM D2161

· Own calculation:
Allows the calculation according to own algorithms (Formulainterpreter, since this interpreter works individually, its details including an accurate specification have to be inquired from SI Analytics!).

3.4.2

Relative mode / Method selection

selection of methods

file processing master data

absolute viscosity relative viscosity t0-flowtime

selection of methods individual entry common entry

polymer Polyester

solvent different solvent

viscometer ASTM-Ubbelohde

viscometer size 1c

using design. constant ☐

using real constant ☒

rack size 16 (100 ml)

barcode ☐

Fig. 27: Tabsheet for method set-up (relative)

This tabsheet enables the method to be set up by selecting the polymer and the solvent. On the basis of this combination the viscometer - or viscometers (if more than one possibility is present) - will be proposed.

You can select and confirm the desired viscometer from this proposal list. If the viscometer master data (please refer to section 3.6) do not provide any viscometer of this size, you will be informed at the start of the mea-

surement that no t_0 was yet assigned to the respective viscometer. In this case you have to proceed to the assignment in the master data (please refer to section 3.6), since otherwise the measurement will not be possible.

The calculation of Hagenbach Correction requires an input to know whether the recommended constant or the actual constant is to be used. This is important if the t_0 runtime (the blank value) is to be calculated from a known

solvent viscosity (also refer to the viscometer master data section 3.6).

The size of the sample carrier used (rack size) can be selected, with the selection of the 56 type sample carrier permitting only the use of the microviscometers (MicroUbbelohde, TC Micro Ubbelohde, and MicroOstwald).

The screenshot shows a software window titled "selection of methods" with a menu bar (file, processing, master data) and navigation buttons. The "relative viscosity" tab is active. Below it, the "common entry" sub-tab is selected. The main area displays the following parameters:

- no. of measurem:** 3
- temp equ. time:** 3 min.
- Hagenbach correction:** ☒
- delta t %:** 10 %
- temperature tol.:** 10 °C
- rinsing mode:** next sample

To the right of the "rinsing mode" field is a list box containing "next sample", "solvent 1", and "solvent 2", with "next sample" currently selected. Buttons for "<- add" and "delete ->" are positioned between the field and the list.

Fig. 28: Tabsheet for shared parameterisation in "relative" mode

The parameters to be input or selected here will apply jointly to all samples!

Note on the setting of the number of rinsing processes:

The rinsing-mode field can be used to fashion a specific rinsing sequence.

"Add" will define the number and method of the rinsing processes. If, for instance, rinsing is to be performed three times with the next sample, the "next sample" has to be included three times in the "rinsing mode" field by clicking the "add" button.

Other rinsing parameters such as suction rate, quantity to be used, purging with air etc. are described in section 3.8, dosing parameters.

For details, please refer to this section.

3.4.2.2

Relative mode / single input

selection of methods

file processing master data

absolute viscosity relative viscosity t0-flowtime

selection of methods individual entry common entry

selected common entry of parameters! All entries are valid all samples!

no. of measurement: 3

temp equ. time: 3 min.

Hagenbach correction: ☒

delta t % : 10 %

temperature tol.: 10 °C

rinsing mode: next sample

<- add delete ->

next sample
solvent 1
solvent 2

Sample counter up/ down

Fig. 29: Tabsheet for single parameterisation in "relative" mode

The parameters to be input or selected at this point apply individually to specific samples, i.e. it is possible to select different parameters for each individual sample!

The sample counter enables the sample parameters to be entered or verified individually.

Note on the setting of the number of rinsing processes:

The rinsing-mode field can be used to fashion a specific rinsing sequence.

"Add" will define the number and method of the rinsing processes. If, for instance, rinsing is to be performed three times with the next sample, the "next sample" has to be included three times in

the "rinsing mode" field by clicking the "add" button.

Other rinsing parameters such as suction rate, quantity to be used, purging with air etc. are described in section 3.8, dosing parameters.

For details, please refer to this section.

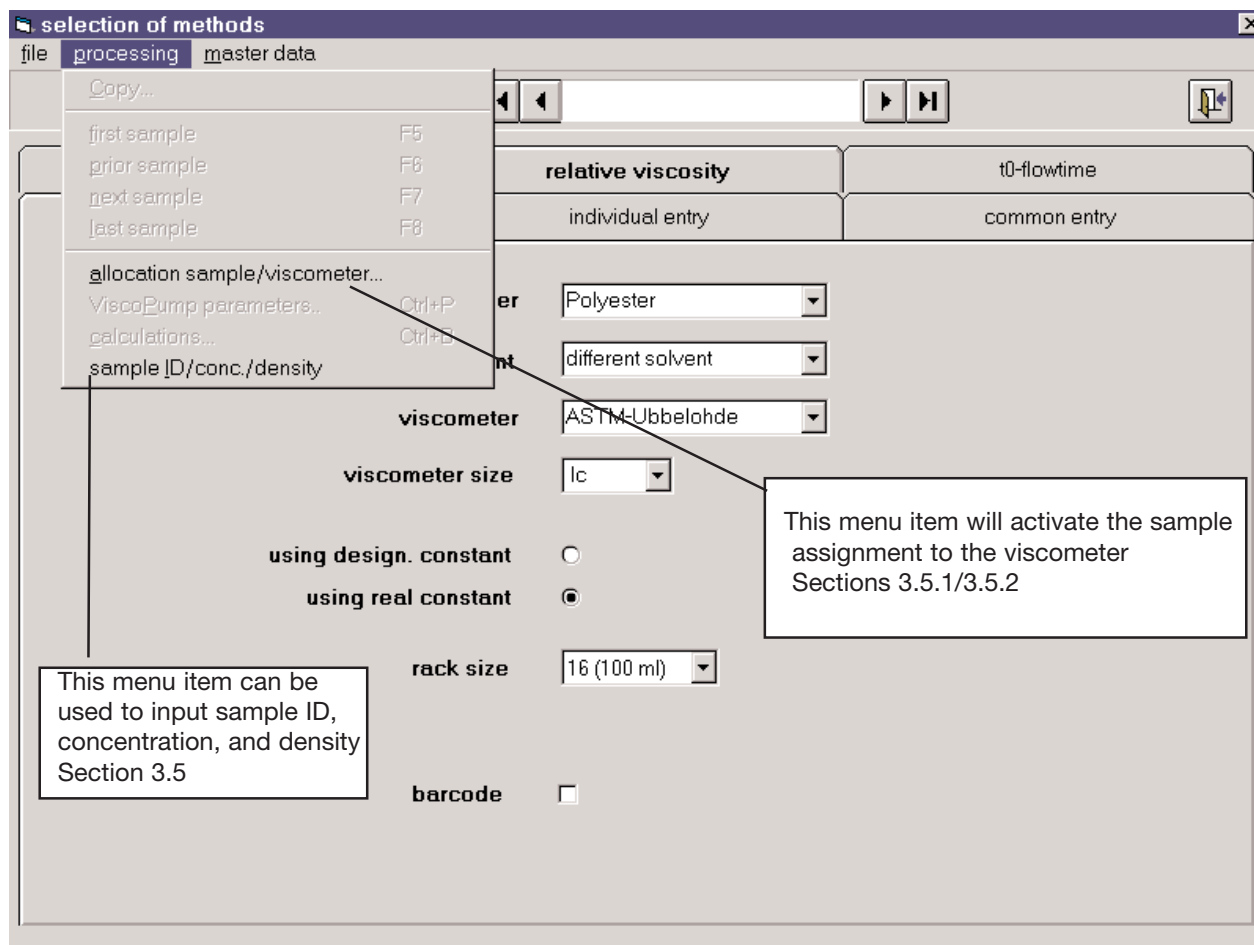


Fig. 30: Methods selection tabsheet in "relative" mode, "edit" menu popped up

From this point you can jump to the available program branches shown.

3.4.2.4

Relative mode / single input / editing

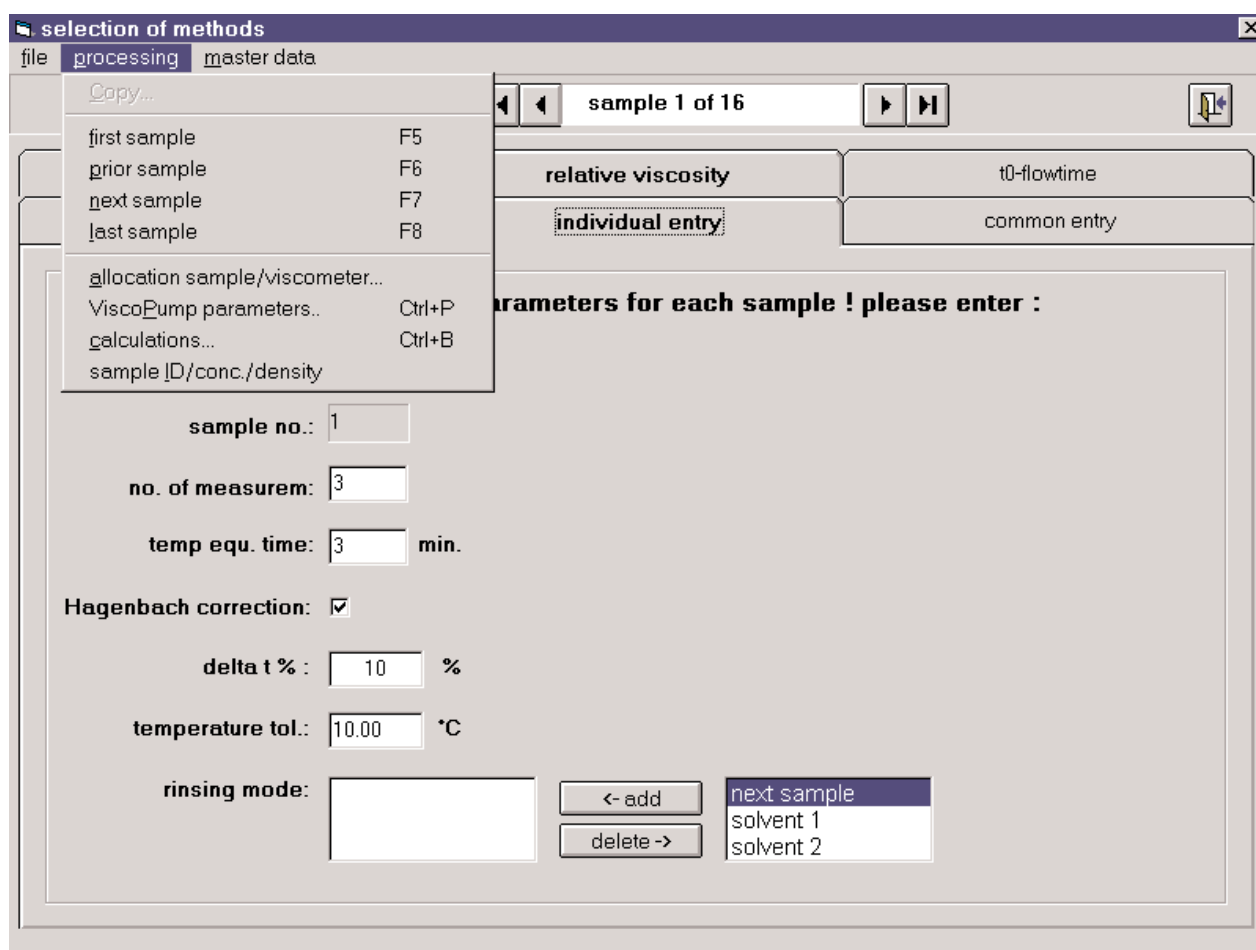


Fig. 31: Tabsheet for single parameterisation in "relative" mode / "edit" menu popped up

Signification of the menu items:

- First sample:
Used to invoke the first sample
- Preceding sample:
Used to invoke the preceding sample
- Next sample:
Used to invoke the next sample
- Last sample:
Used to invoke the last sample

The following menu items will be described below the respective sections:

- Specific sample/viscometer assignment
Section 3.5.1- 3.5.2
- ViscoPump parameters
Section 3.9.4

- Calculations
Section of 3.4.1.6
- Sample ID/concentration/ density
Section 3.5
- Use of the keyboard:
Shift & E / F5
Used to invoke the first sample
- Shift & N / F7
Used to invoke the next sample
- Shift & L / F8
Used to invoke the last sample
- Shift & Z
Branched to:
Specific sample/viscometer assignment

- Shift & P
Branched to:
ViscoPump parameters
- Shift & B
Branched to:
Calculations
- Shift & I
Branched to:
Sample ID/conc./density
- Shift & V / F6
Used to invoke the preceding sample

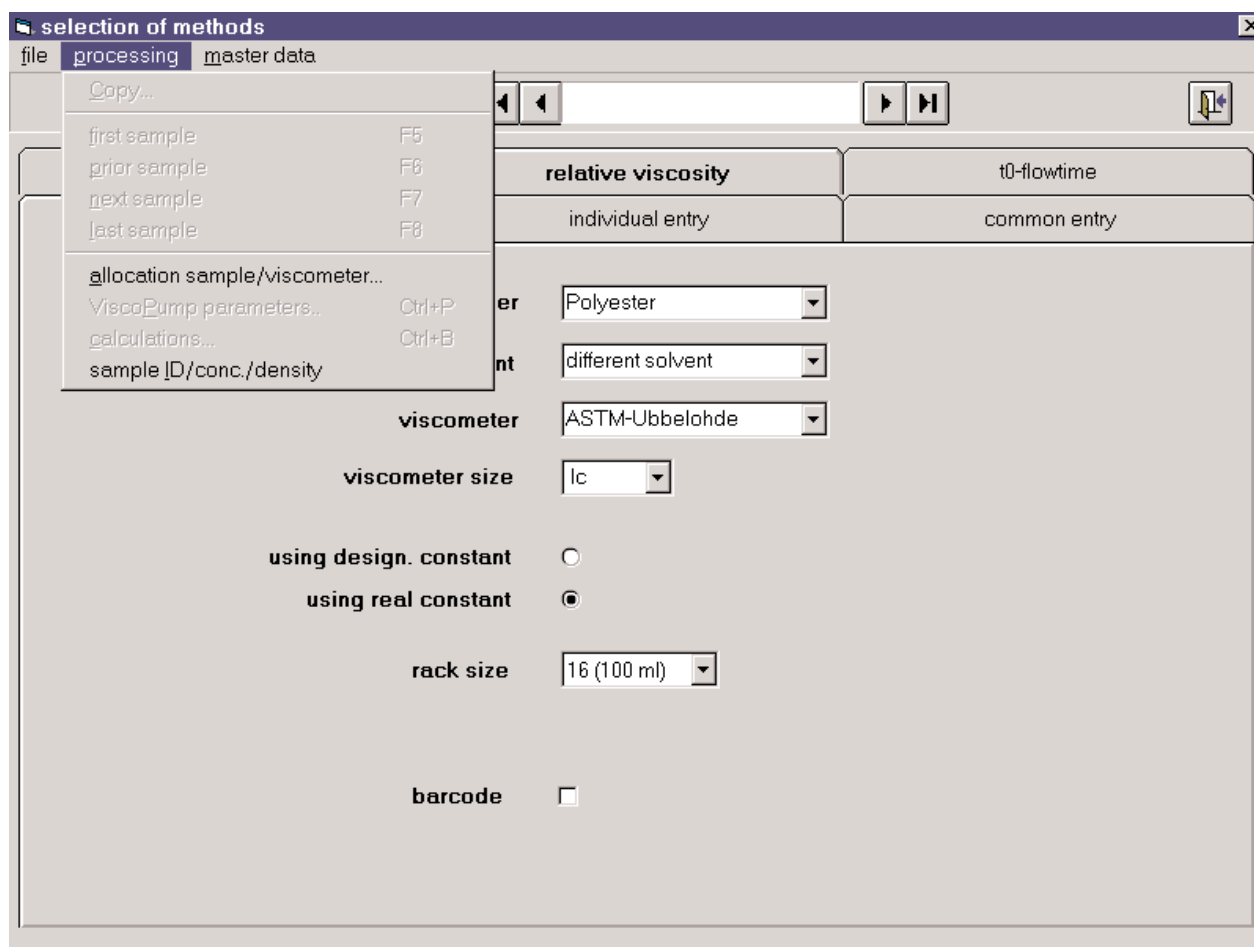


Fig. 32: Tabsheet for shared parameterisation in "relative" mode /
"edit" menu popped up

Signification of the menu items:

Copying:

The copying function is invoked
Section 3.4.3

The following menu items will be
described below the respective
sections:

Specific sample/viscometer
assignment

Section 3.5.1- 3.5.2

ViscoPump parameters

Section 3.9.4

Calculations

Section of 3.4.2.6

Sample ID/concentration/
density

Section 3.5

Use of the keyboard:

Shift & K

Used to invoke the copying fun-
ction

Section 3.4.3

Shift & A

Branched to:

Specific sample/viscometer
assignment

Shift & P

Branched to:

ViscoPump parameters

Shift & B

Branched to:

Calculations

Shift & I

Branched to:

Sample ID/conc./density

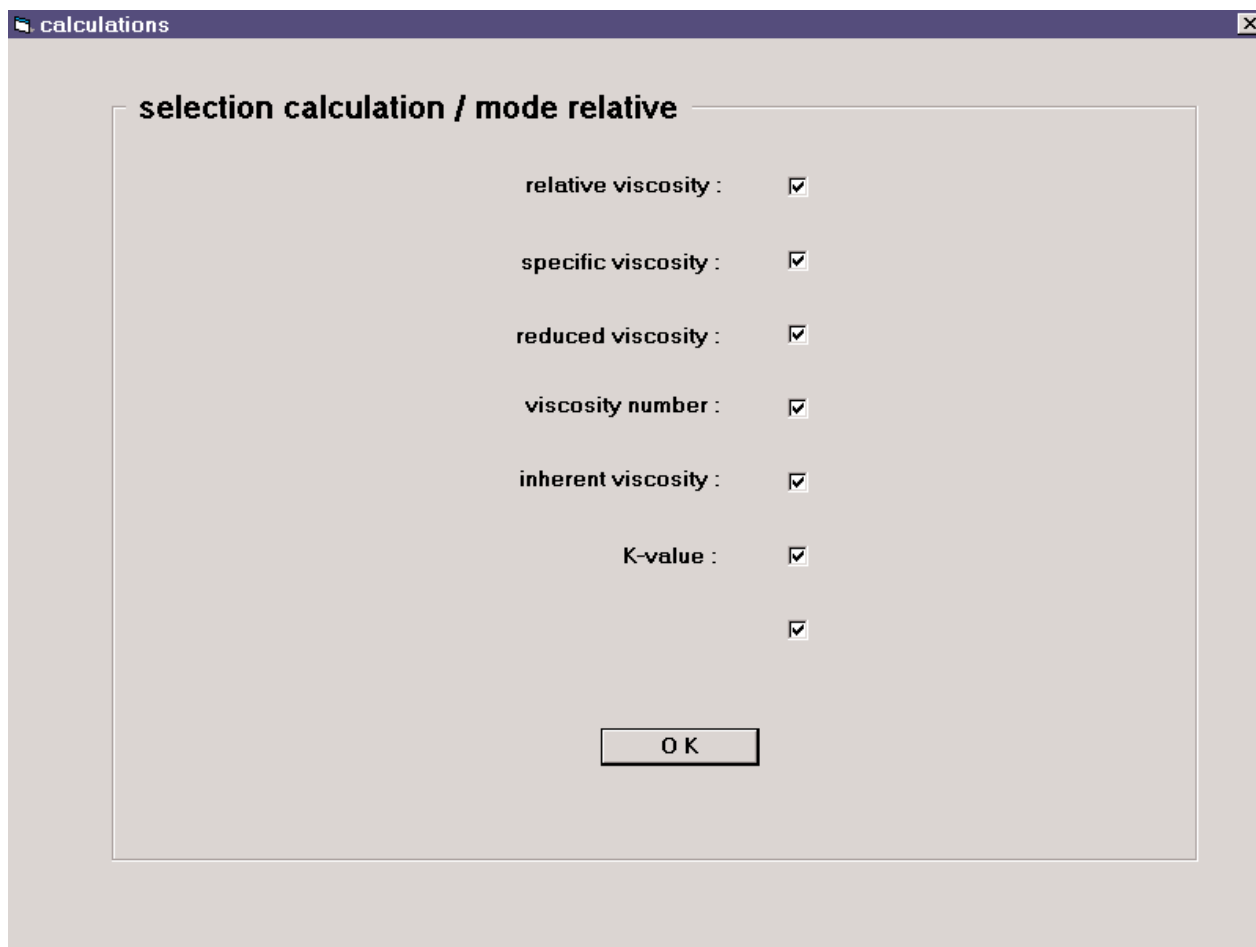


Fig. 33: Calculations in "relative" mode

The following calculation types are available in "relative" mode:

Relative viscosity:
 $\eta_{\text{relative}} = \frac{\text{Solution runtime}}{\text{Solvent runtime}}$

Specific viscosity:
 $\eta_{\text{specific}} = \frac{\text{Solution runtime}}{\text{Solvent runtime}} - 1$

Reduced viscosity:
 $\eta_{\text{reduced}} = \frac{(\text{Solution runtime} / \text{Solvent runtime}) - 1}{\text{Concentration}}$

Viscosity number:
 An alternative designation of reduced viscosity

Inherent viscosity:
 $\eta_{\text{inherent}} = \frac{\log(\eta_{\text{relative}})}{\text{Concentration}}$

K value:
 Calculation according to DIN 53726

Own calculation:
 Allows the calculation according to own algorithms (Formula interpreter, since this interpreter works individually, its details including an accurate specification have to be inquired from SI Analytics!).

3.4.3 Copying function

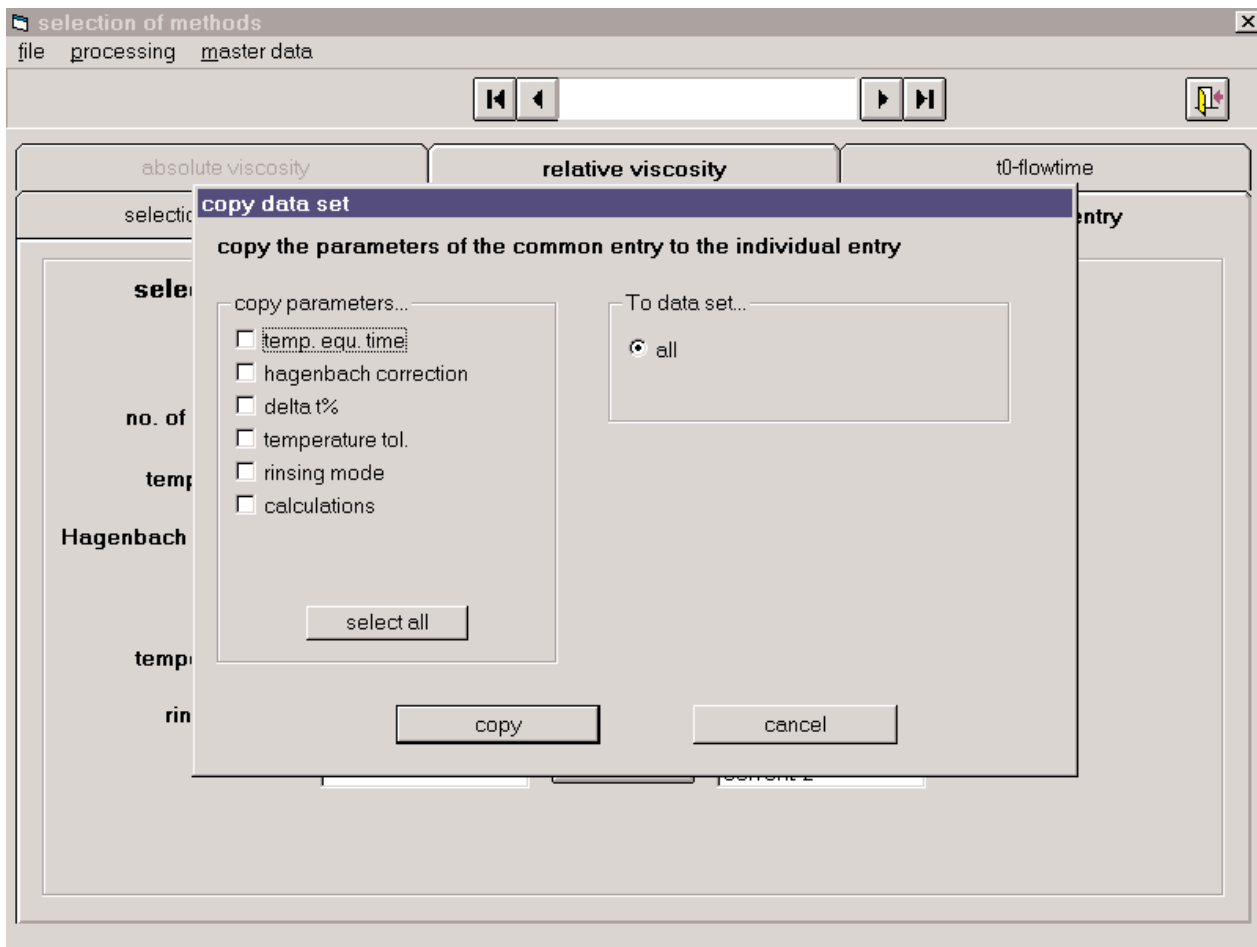


Fig. 34: Copying function, accessible from both modes

This copying function facilitates the takeover of parameters from the shared input to specific input if only few parameters of the individual samples are different from each other.

The parameters marked by the selection boxes will be copied and are then available for the respective samples in the specific assignment.

3.4.4

Determination of the blank value

The screenshot shows a software window titled "selection of methods" with a menu bar containing "file", "processing", and "master data". Below the menu bar are navigation buttons (back, forward, search) and a search input field. The main area has three tabs: "absolute viscosity", "relative viscosity", and "t0-flowtime". The "t0-flowtime" tab is selected and contains the following text and input fields:

determination of t0-flowtime selected ! All entrys are valid for the solvent!

no. of measurem:

temp equ. time: min.

Hagenbach correction: ☒

delta t % :

temperature tol.: °C

no. rinses :

Fig. 35: Determination of the blank value

This program part is used to input the individual parameters for the measurement of the blank value of the solvent for the determination of the relative viscosity of a polymer solution belonging to the individual viscometers being used.

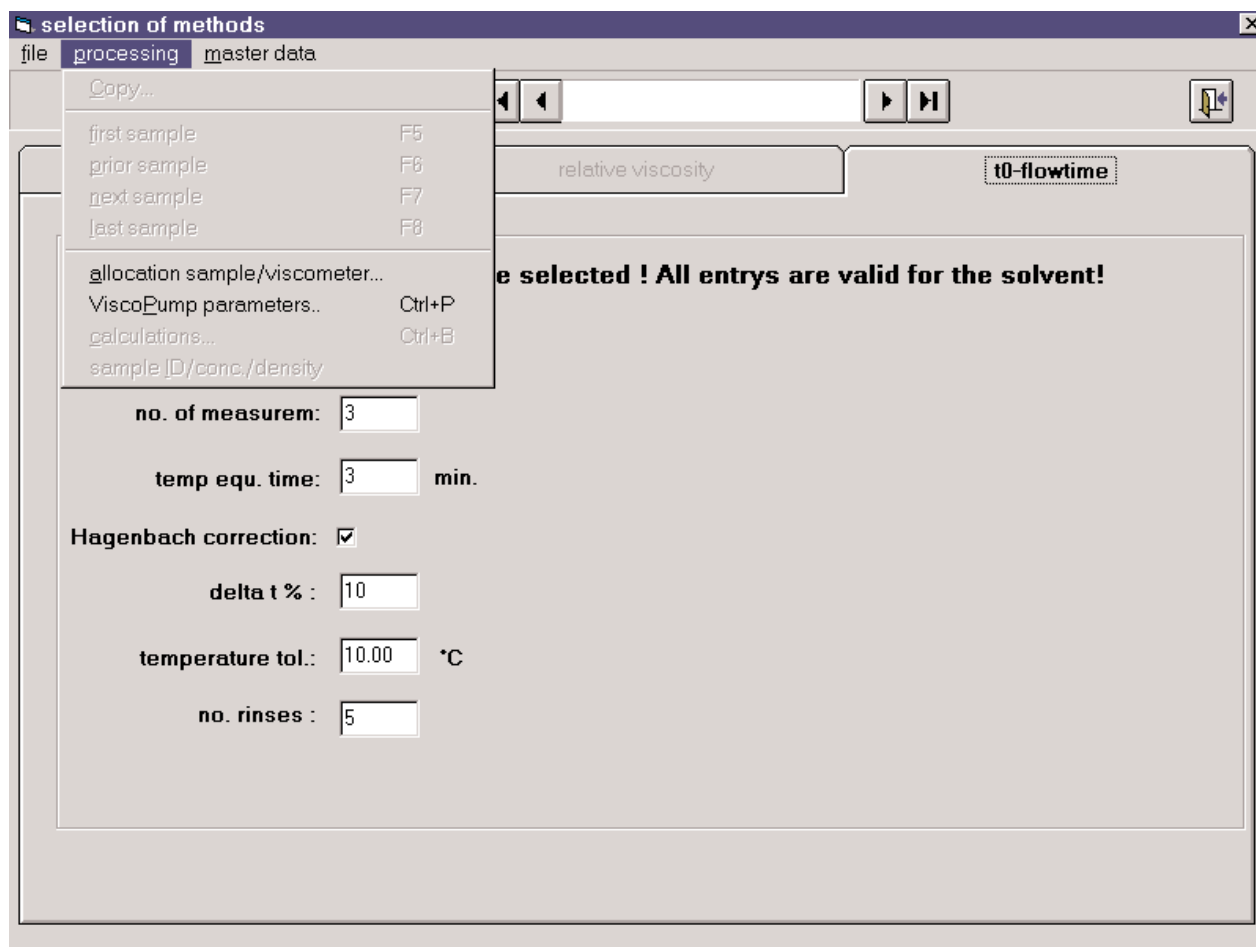


Fig. 36: Determination of the blank value,
"processing" menu popped up

If the „specific assignment sample/viscometer“ program item (sections 3.5.1- 3.5.2) is invoked, the respective sample can also be assigned to the respective viscometer in the case of the determination of the blank value.

3.5

Sample designation / concentration / density

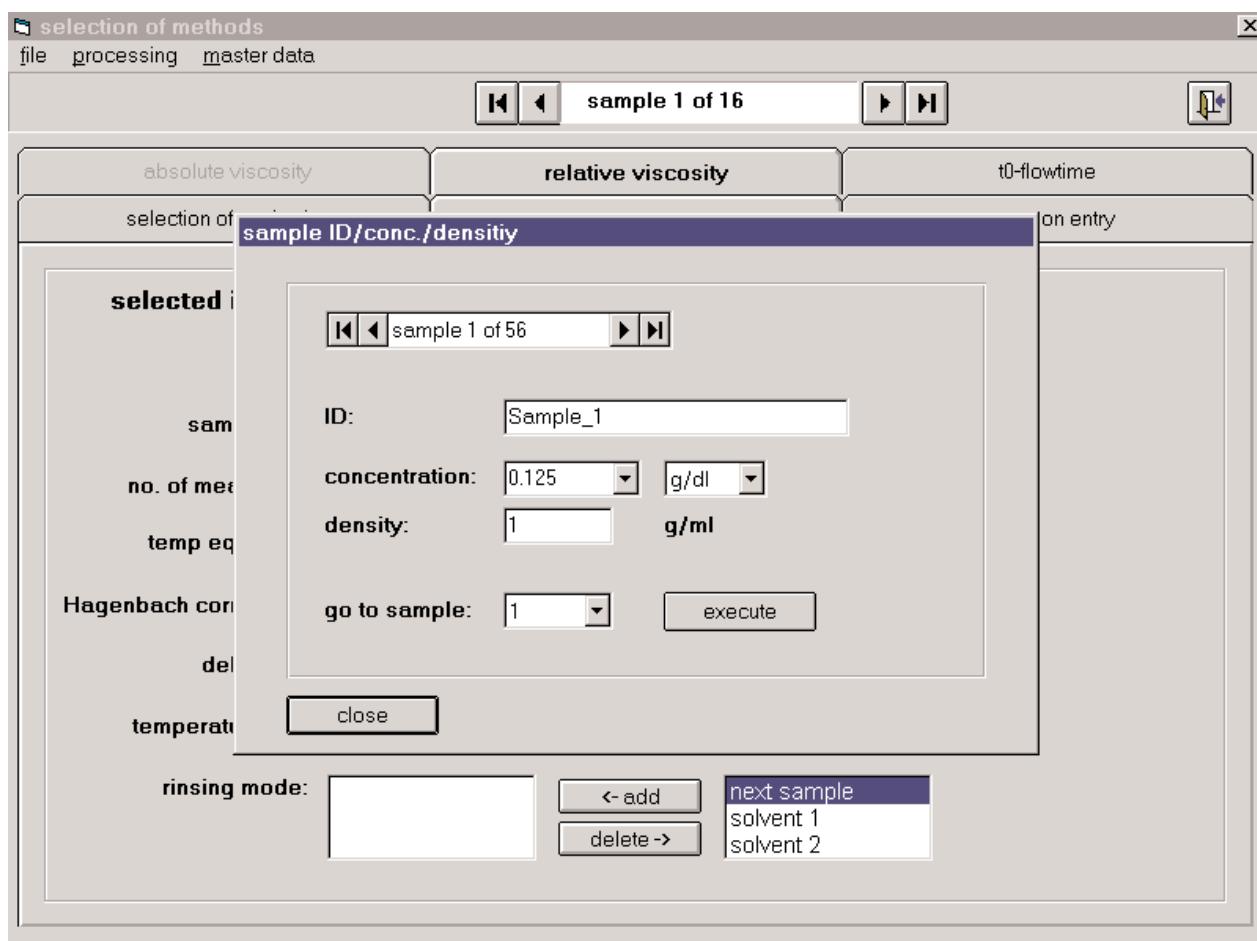


Fig. 37: Sample designation, concentration, and density menu item
(can be selected in both modes, example: "relative")

This item can be used for the input of a designation, the concentration, and the density for each individual sample. These values will apply for both the shared as well as for single input.

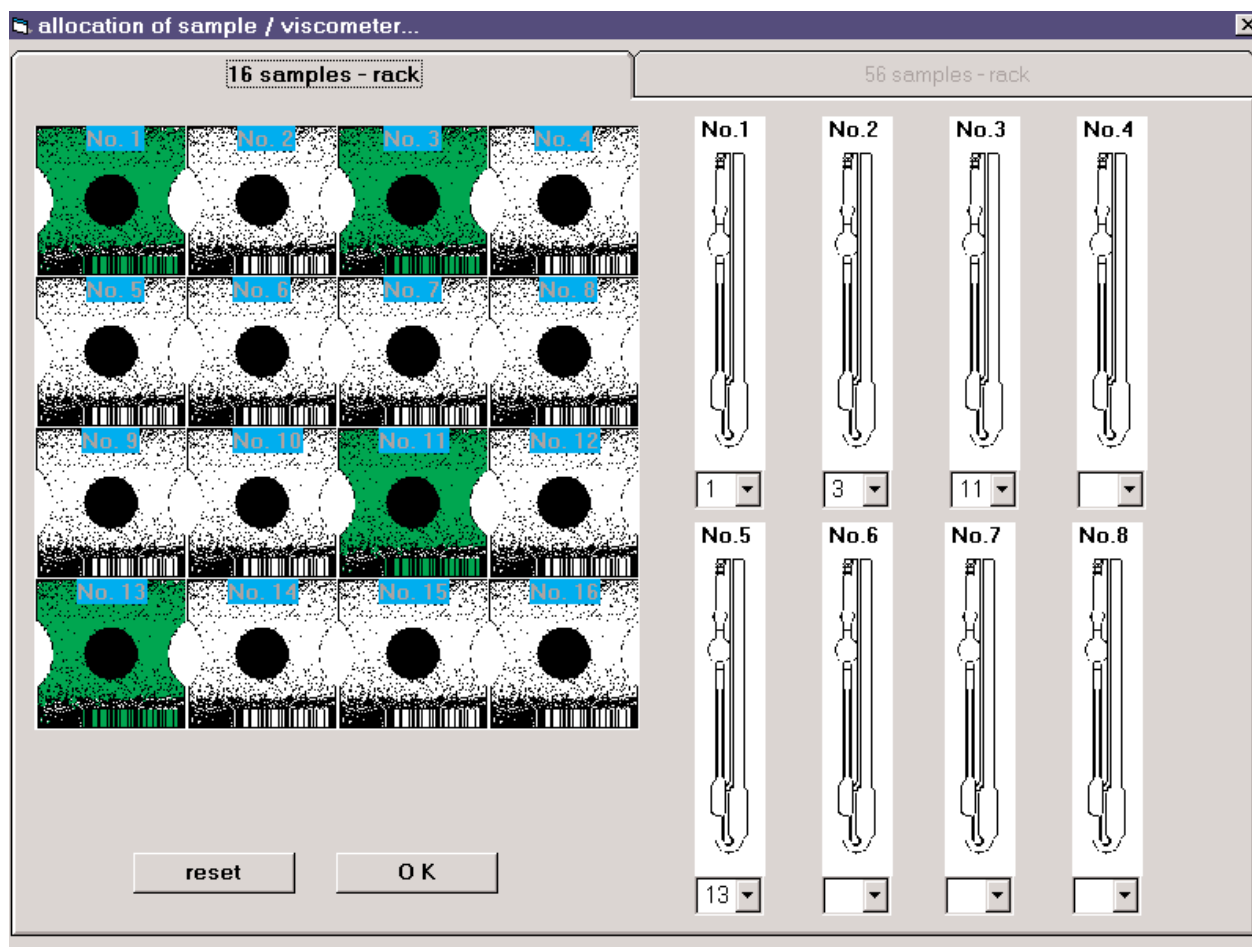


Fig. 38: Assignment of sample with 16 type sample carrier

The assignment of the samples to the viscometers is done by clicking on the symbolised sample cap and dragging the sample over the respective viscometer, with the left mouse key kept down; a red margin will then appear around the viscometer selected.

By releasing the left mouse key, the respective sample number will be permanently assigned to this viscometer. This can be verified by popping up the number field below the viscometer. If this function is not used, the default condition (normal condition) will

be worked off, i.e. sample 1 into the next free viscometer, with the sequence not necessarily being the numerical one!

The viscometer used is always the next one which is identified as free during the internal inquiry of the ViscoPumps!

• **Please note:**

If the specific assignment of the samples to the viscometers is actually performed, the number of the samples in the method selection can no longer be changed.

Deletion of assigned viscometers: By a double click on the respective sample symbol the assignment of the respective sample is deleted.

Another function consists in the assignment by groups: With the "Ctrl" key depressed, use the left mouse key to arrange the samples to be assigned to groups. The entire group will then be assigned to the desired viscometer.

3.5.2

Sample assignment / 56 type sample carrier

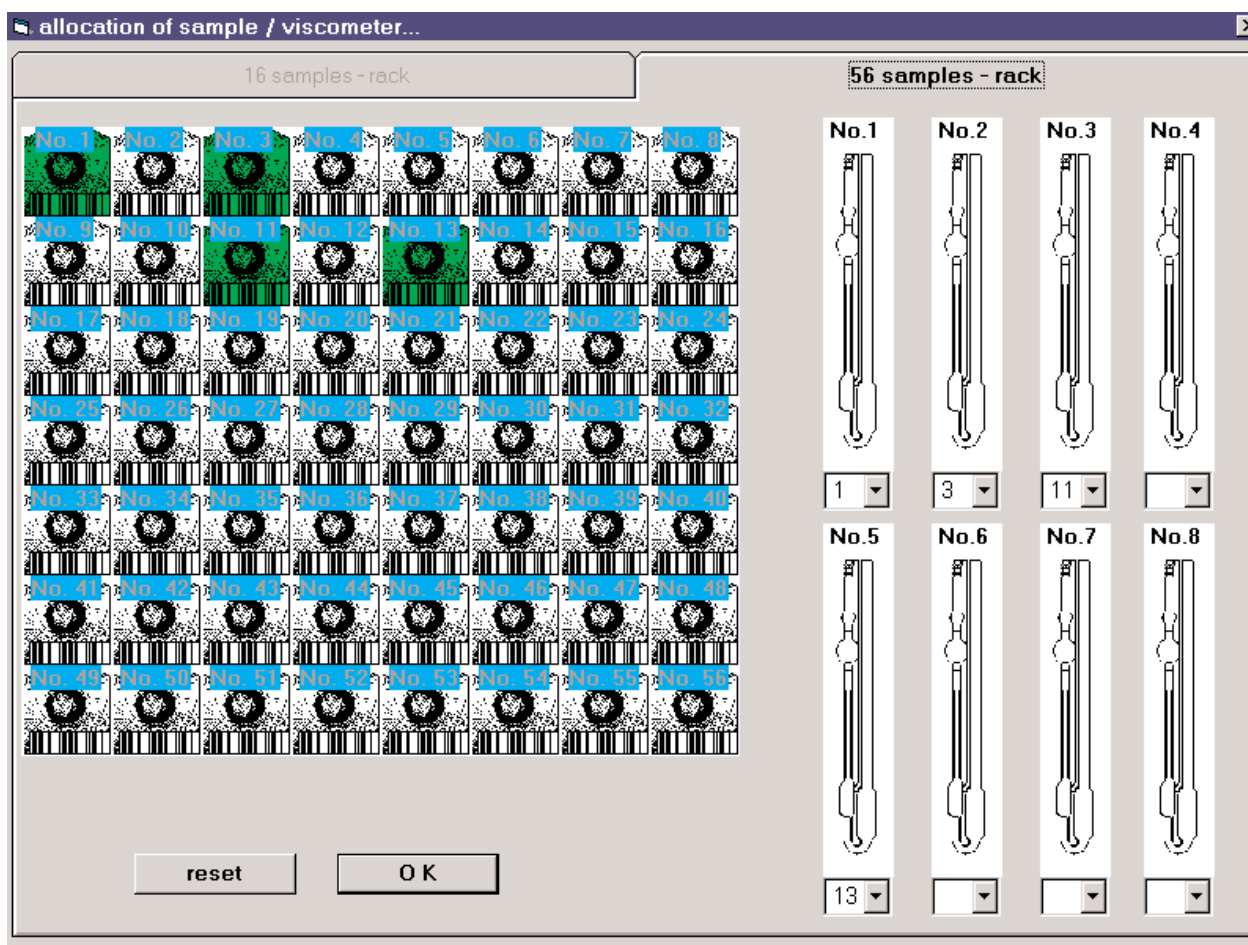


Fig. 39: Assignment of sample with 56 type sample carrier

As was described for the 16 type sample carrier, this is the point where the samples can be assigned to the viscometers.

The assignment is done by clicking on the symbolised samples cap and dragging the sample over the respective viscometer, with the left mouse key kept down; a red margin will then appear around the viscometer selected. By releasing the left mouse key, the respective sample number will be permanently assigned to this viscometer.

This can be verified by popping up the number field below the viscometer.

If this function is not used, the default condition (normal condition) will be worked off, i.e. sample 1 into the next free viscometer, with the sequence not necessarily being the numerical one! The viscometer used is always the next one which is identified as free during the internal inquiry of the ViscoPumps!

• **Please note:** If the specific assignment of the samples to the viscometers is actually performed, the number of the samples in the method selection can no longer be changed.

Deletion of assigned viscometers:

By a double click on the respective sample symbol the assignment of the respective sample is deleted.

Another function consists in the assignment by groups:

With the "Ctrl" key depressed, use the left mouse key to arrange the samples to be assigned to groups. The entire group will then be assigned to the respectively desired viscometer.

master data viscometer

file processing

DS 1 von 14

name/designator: MicroTC_1

viscometer type: Micro-Ubbelohde with TC-sensors

remark:

constant: 0.01 mm²/s²

t0-flowtime (blind value): 10.00 s determination: MANUAL

viscosity solvent:

Delete, view section 3.6.4

Save, view section 3.6.3

Create, view section 3.6.3

Fig. 40: Input screen for viscometer master data

This screen is used to input the viscometer master data. It serves to facilitate for the user the administration, assignment, and use of existing or newly added viscometers as easy as possible.

All the data for a viscometer once captured, the viscometer to be used can be selected quickly from the viscometers selection screen (section 3.7, connected devices, selection).

The new set-up is done using button 1, storage is done using button 2, and to delete a data record button 3 should be used. Further possibilities are described below.

3.6.1

Setting up the viscometer master data / editing

The screenshot shows a software window titled "master data viscometer". At the top, there is a menu bar with "file" and "processing". The "processing" menu is currently open, displaying two options: "rename viscometer" and "calculate t0-flowtime". Below the menu bar, there is a status bar showing "DS 1 von 14". The main area of the window contains several input fields and labels:

- name/designator:** MicroTC_1
- viscometer type:** Micro-Ubbelohde with TC-sensors (selected from a dropdown menu)
- remark:** (empty text field)
- constant:** 0.01 mm^2/s^2
- t0-flowtime (blind value):** 10.00 s
- determination:** MANUAL
- viscosity solvent:** (empty text field)

Fig. 41: Master-data, "processing" menu popped up

This menu is used to access the „re-name viscometer“ (section 3.6.1.1) and „calculate blank value“ (section of 3.6.1.2) editing items.

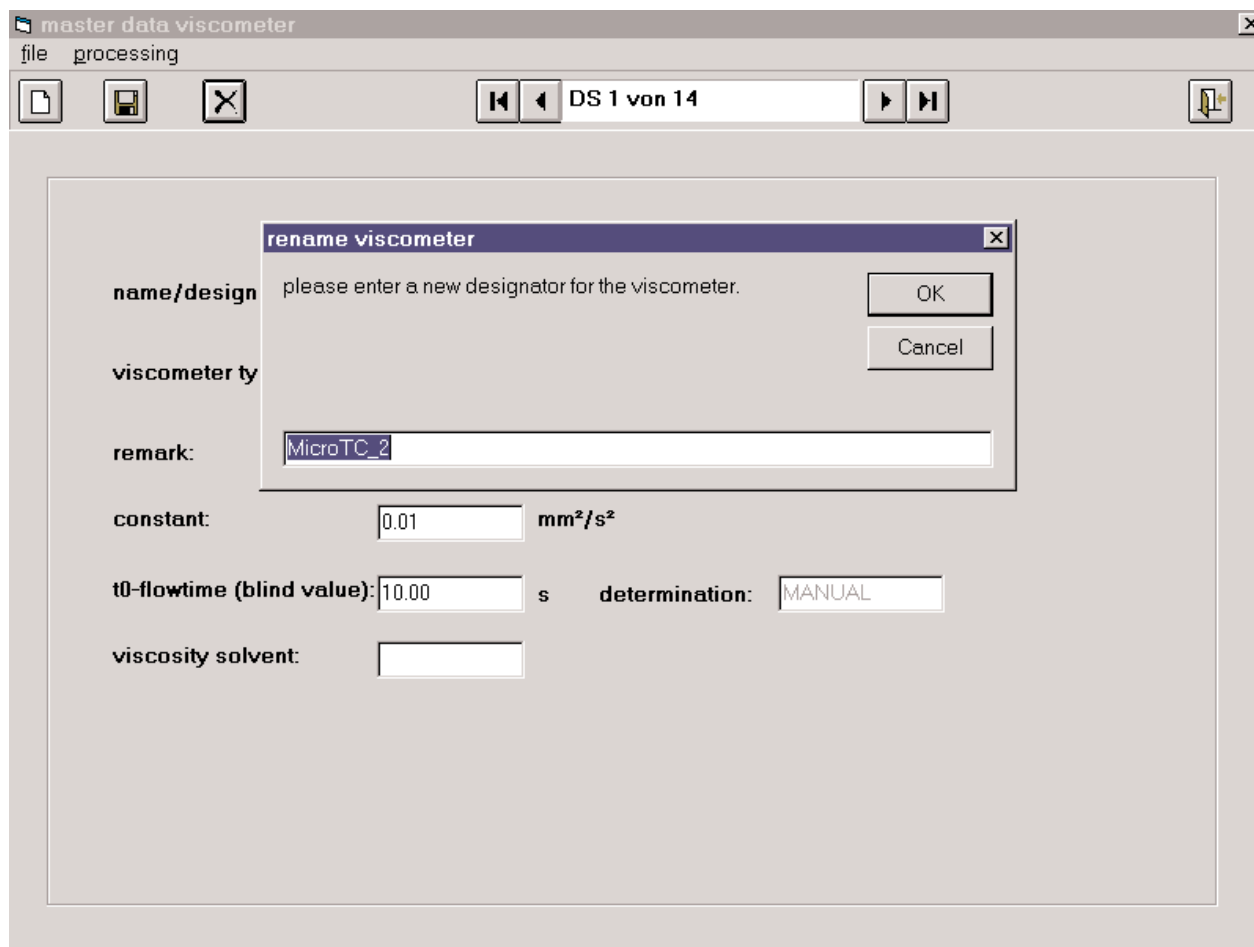


Fig. 42: Re-naming a viscometer

This input field is accessed via the „master data, edit“ menu (please refer to section 3.6.1, Figure 41).

In the dialogue line the designation assigned to the viscometer will be shown.

It can be modified by simply over-writing it. All the other data record (DS) are accessible using the counter (DS: n of nn).

3.6.1.2

Setting up the viscometer master data / t_0 calculation

The screenshot shows a software window titled "master data viscometer" with a menu bar containing "file" and "processing". Below the menu bar are icons for file operations and a status bar showing "DS 1 von 14". The main area contains a form with the following fields:

- name/design**: A text input field.
- viscometer ty**: A text input field.
- remark**: A text input field.
- constant**: A numeric input field with the value "0.010" and the unit "mm²/s²".
- t0-flowtime (blind value)**: A numeric input field with the value "10.00" and the unit "s".
- determination**: A dropdown menu with the value "MANUAL".
- viscosity solvent**: A text input field.

A dialog box titled "calculating 0-flowtime" is open over the form. It contains a text prompt: "please enter the viscosity of the solvent." and two buttons: "OK" and "Cancel".

Fig. 43: Master data, calculation of the t_0 runtime (blank value)

The input field which is accessible above the "master data, processing" menu item (please refer to section 3.6.1, Figure 41) is used to input the viscosity of the solvent which is used to calculate the theoretical t_0 runtime of the solvent in the respective viscometer using the constant of the viscometer.

Operating note/Warning:

Please note that this runtime corresponds to the theoretical value and is not suited to take into account any individual variations of the Hagenbach-Couette Correction which are caused by the real constructional shape! If corrections of a value of more than 1% of the resulting runtime are to be expected, errors may

occur in the determination of the relative viscosity. This applies in particular to short runtimes and high relative viscosities (greater than approx. 2.0) in the viscometers with a small capillary diameters (size 0 to I).

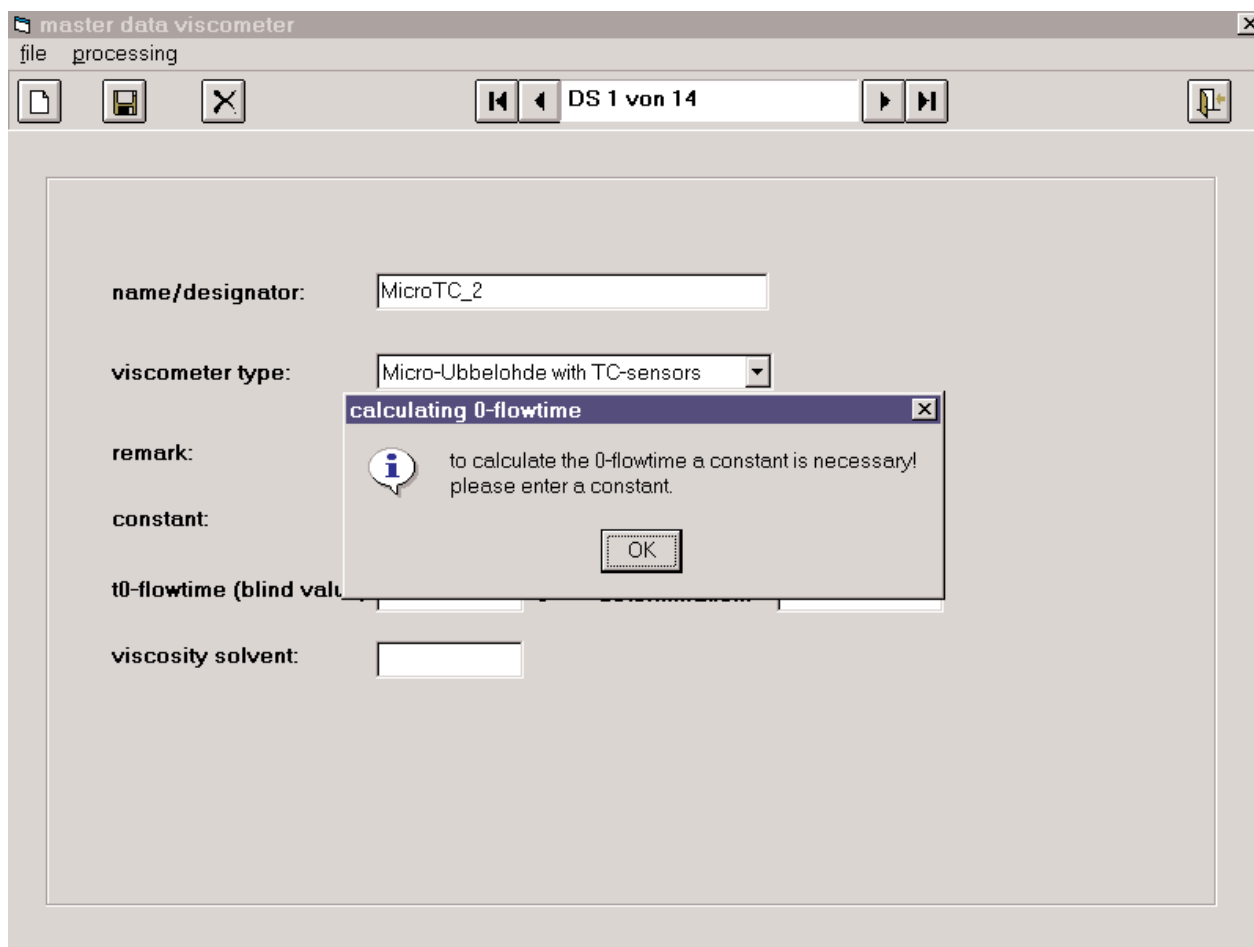


Fig. 44: Error message during the calculation of the blank value

If the blank value is to be calculated on the basis of the input of the solvent viscosity (please refer to section 3.6.1.2), the constant of the corresponding viscometer is required.

If this constant is missing, the above error message will appear. To remove it, please proceed according to the description in section 3.6, Figure 40.

3.6.3

Setting up the viscometer master data / storage

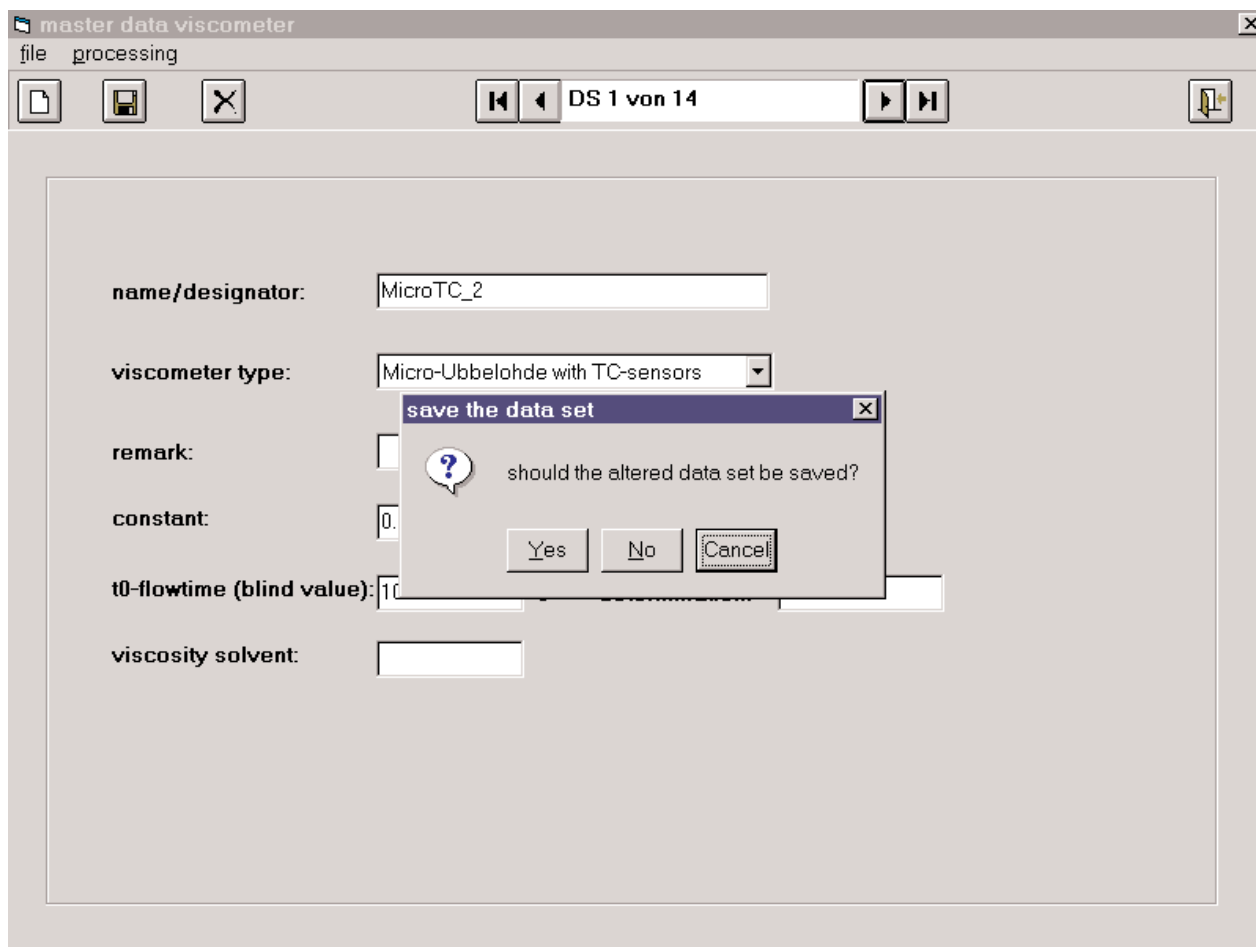


Fig. 45: Prompt for storage of the data record

Each time a new data record has been set up, modified, or deleted, a prompt to know whether the data record is to be taken over will appear when exiting the respective menu item.

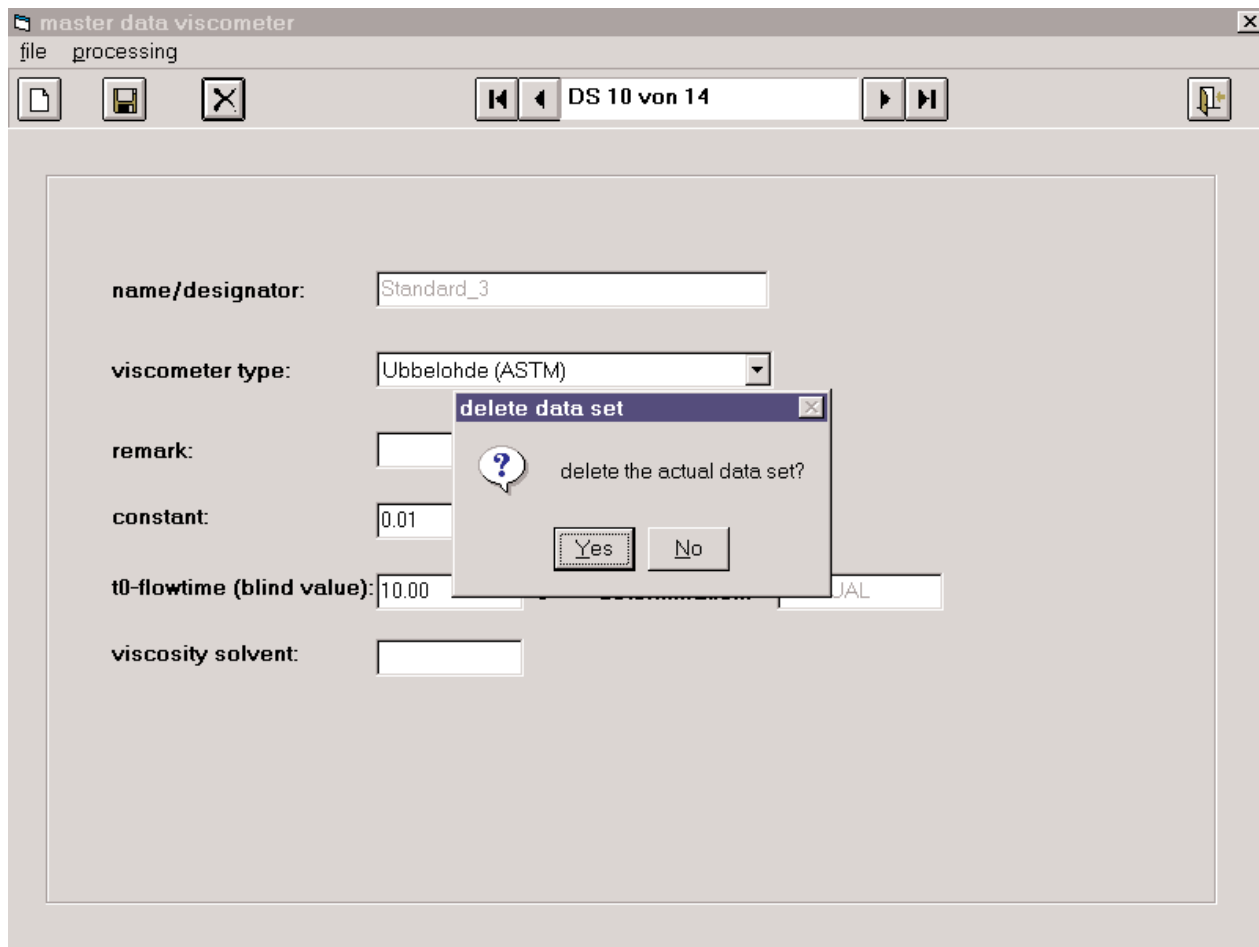


Fig. 46: Master data, delete data set

Explicit prompt to inquire whether a data set is to be deleted after the „delete“ button was pressed.

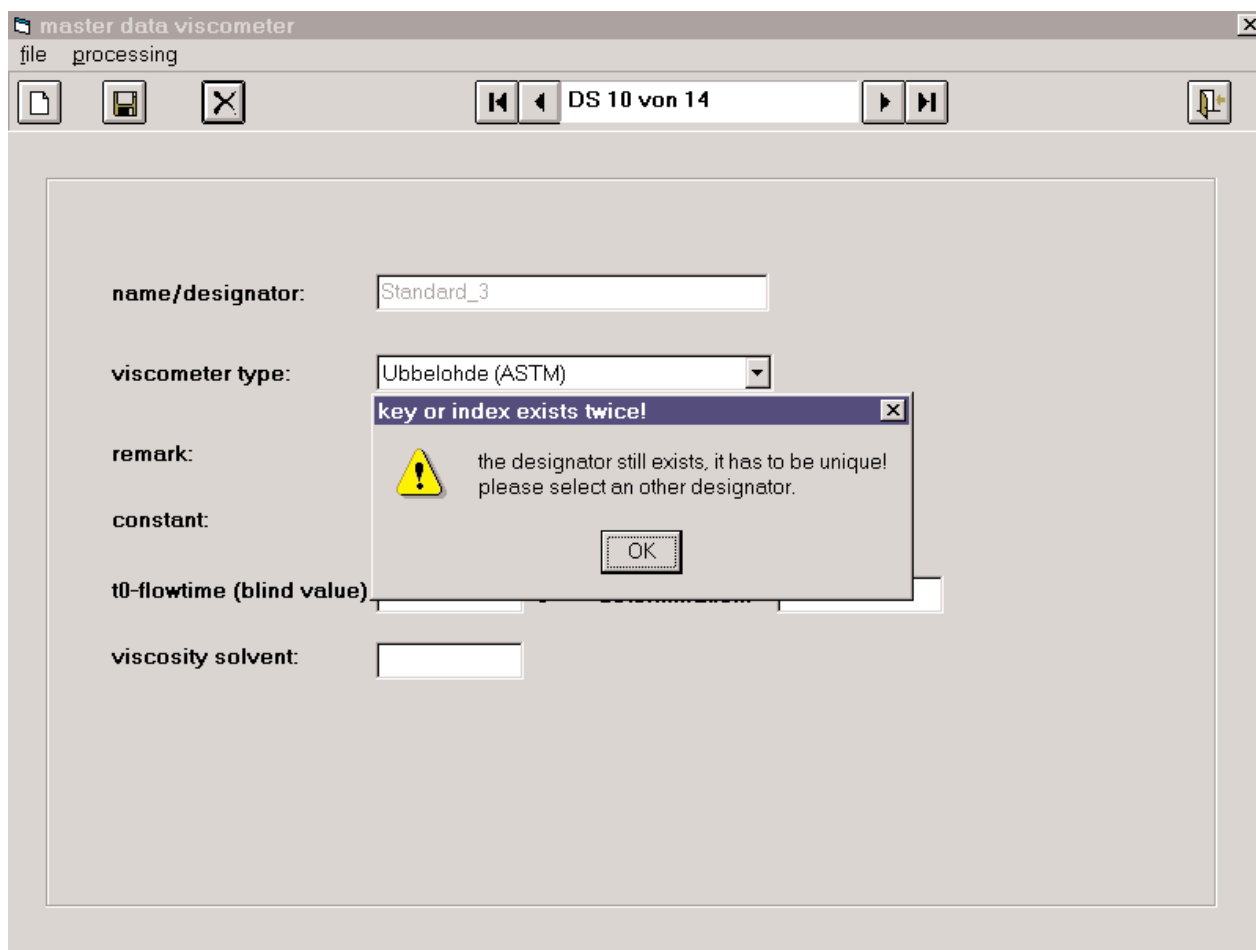


Fig. 47: Double designator or index during input

This message appears, for instance, if the name or the designation of the viscometer is already present in the database. A different designation has to be selected.

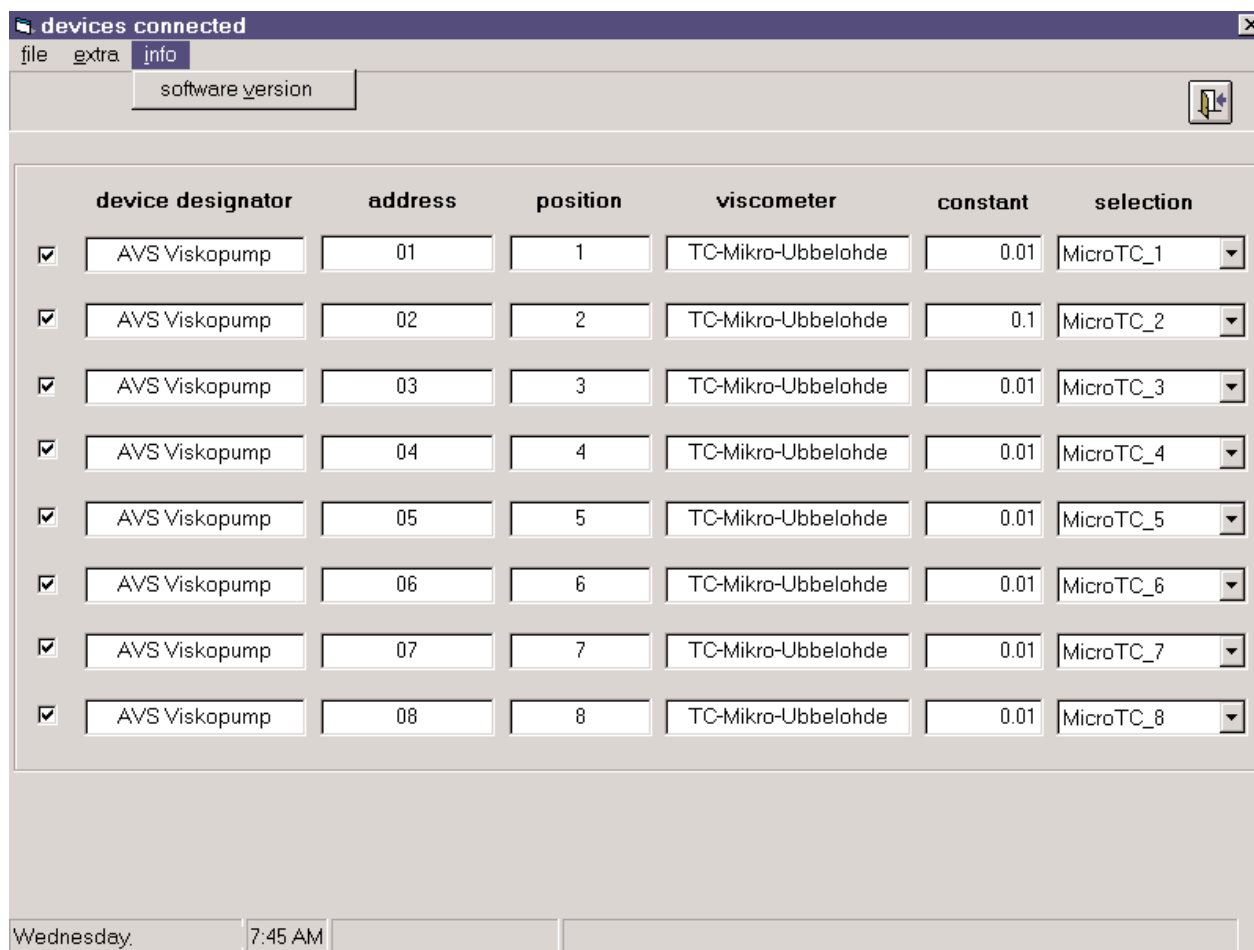


Fig. 48: "Connected devices" screen

This screen appears after the selection of the „connected devices“ menu item on the starting menu using the „edit“ menu bar (please refer to Figure 12). At this point, the ViscoPumps which were found during the initialisation are displayed. The selection box belonging to the viscometer (ahead of the device designation) enables a ViscoPump to be selected and cancelled during the running process.

Important note:

If a ViscoPump is deactivated during running operation, the entire measurement process will be stopped after this moment, i.e. the sample will be sucked off

after reactivation of the pump and will then be lost! For program-technical and safety reasons it is not possible to resume work at the process-control point at which deactivation occurred. This way of action is only suggested in cases in which an unpredictable event might cause a hazard. If required, it is recommended to stop the running of the program only (please refer to figure 61, "measurement" screen, "edit" menu).

The address and position fields show the ViscoPumps in their actual physical plug-in places, together with the corresponding address.

The physical position in the rack frame of the ViscoPumps does not necessarily have to match the logic address!

The viscometer field can be used to select the viscometer type from the list, where as the constant field is used to input the corresponding constant, otherwise any viscometer which was entered in the master data (please refer to section 3.6, viscometer master data) will be entered in the selection field.

3.7 Connected devices

Please note that for process-technical reasons no viscometers of different makes must be used in the respective measurement positions.

If a viscometer including the corresponding ViscoPump have been deactivated from the side of the program for reason of a TC

error or another error detected by the system, the viscometer can be dismantled, replaced, or cleaned after stopping the measurement process (please refer to Figure 61, "measurement" screen, "edit" menu). If required, this screen can be used to input the new constant so that the measu-

rement process can resume again. This is particularly recommended in "absolute" mode in the VI determination mode, since otherwise two viscometers belonging together would have to be deactivated.

3.7.1 Connected devices, software version

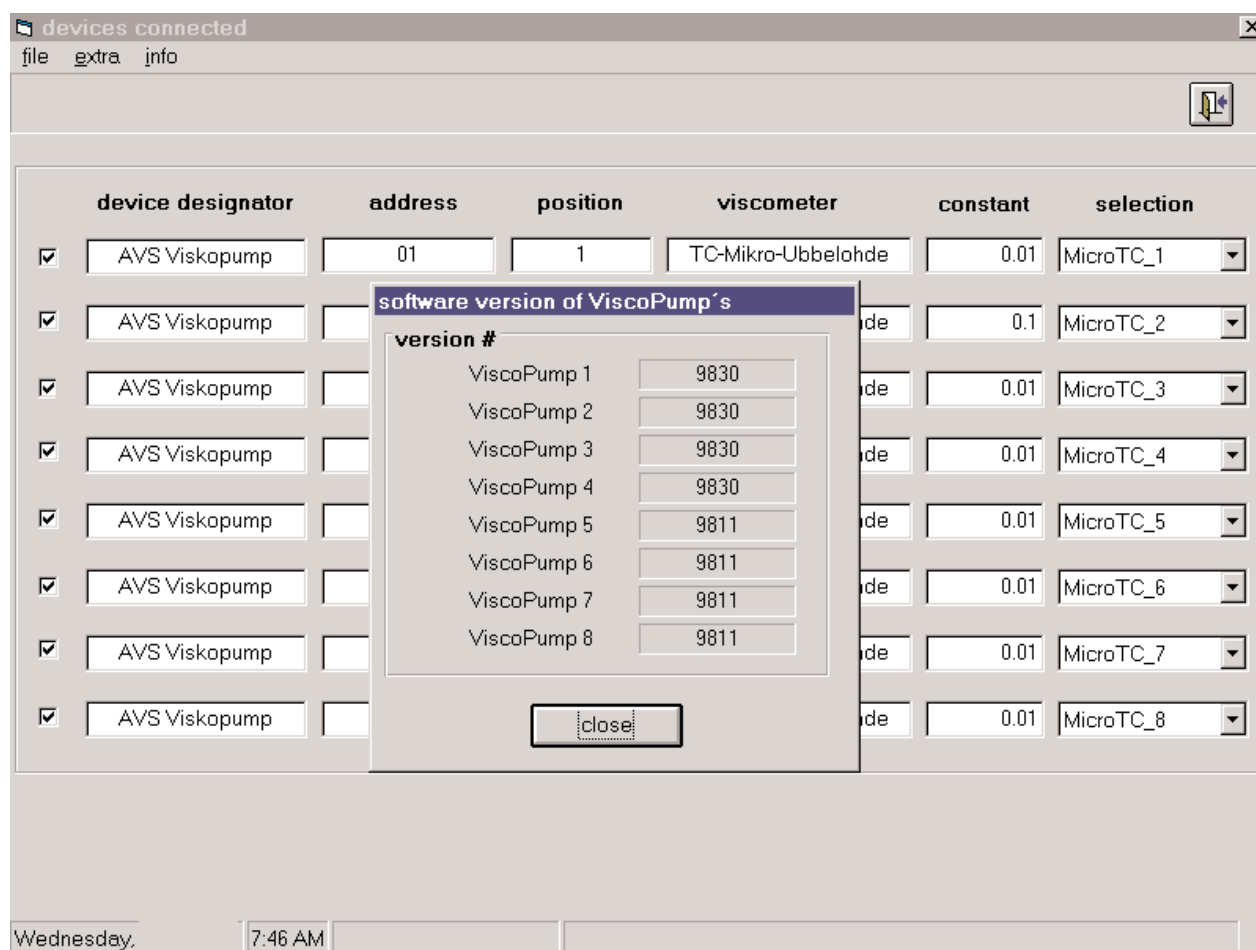


Fig. 49: Connected devices, software version

This information boxes displayed after invoking the "info, software version" menu item in Figure 48.

It allows to verify whether all the ViscoPumps are equipped with the same software version.

This is, for instance, useful in the case of a subsequent fitting of ViscoPumps.

	type	taking sample			steps/s	air		take after...	
		volume		speed		amount		rinsing	sample
ViscoPump 1	TC-Mikro-Ubbelohde	5.00	ml	0200	steps/s	5.00	ml	☒	☒
ViscoPump 2	TC-Mikro-Ubbelohde	5.00	ml	0180	steps/s	5.00	ml	☒	☒
ViscoPump 3	TC-Mikro-Ubbelohde	6.00	ml	0500	steps/s	5.00	ml	☒	☒
ViscoPump 4	TC-Mikro-Ubbelohde	5.00	ml	0400	steps/s	5.00	ml	☒	☒
ViscoPump 5	TC-Mikro-Ubbelohde	6.00	ml	0400	steps/s	5.00	ml	☒	☒
ViscoPump 6	TC-Mikro-Ubbelohde	6.00	ml	0230	steps/s	5.00	ml	☒	☒
ViscoPump 7	TC-Mikro-Ubbelohde	6.00	ml	0350	steps/s	5.00	ml	☒	☒
ViscoPump 8	TC-Mikro-Ubbelohde	5.00	ml	0380	steps/s	5.00	ml	☒	☒

Fig. 50: Viscometer dosing parameters

The „dosing parameters“ input screen can be accessed via the “extras, dosing parameters” menu selection item in Figure 48. It permits the viscometer-specific parameterisation of the filling quantities, the filling rates, and

the purging air for rinsing. At the same time it is possible to determine whether and when the dosing unit/dosing needle is to be air-purged in order to reduce carry over contamination.

• **Please note:**

The total quantity of sample during rinsing (in the case of rinsing with the next sample) and measuring must not exceed the quantity contained in the sample bottle.

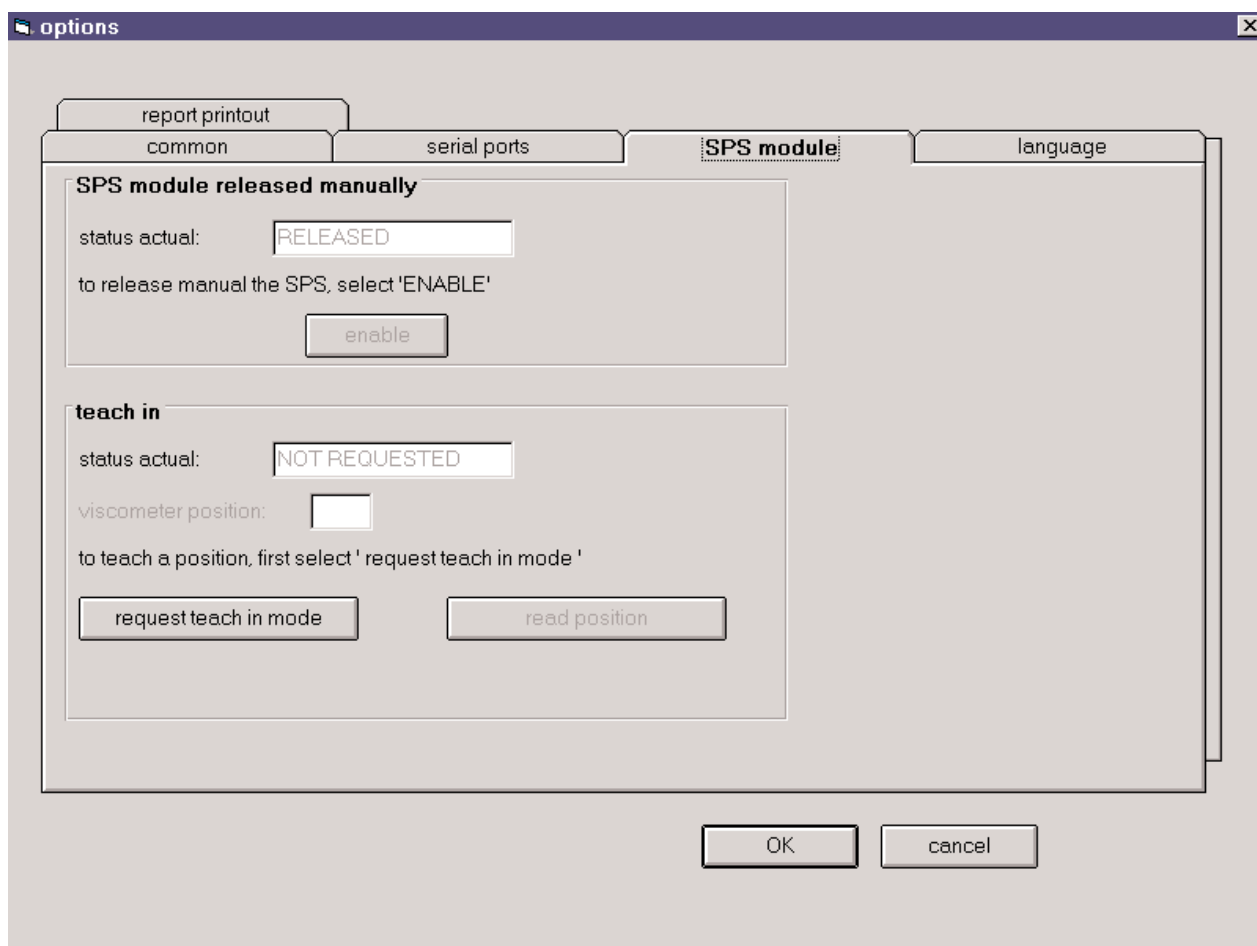


Fig. 51: Tabsheet for PLC device control (SPS)

This tabsheet can be used on the one side for the explicit manual release of the PLC module, unless this has already been done automatically within the program run (which should be the normal case), on the other hand this is the point where the “Teach In” function (learning function) can be run.

(For basic information, please refer to the following pages.)

To do so, plug the so-called “TeachIn Box” into the corresponding plug connection. For exact details of the procedure, please refer to the set-up instructions starting at section 8.

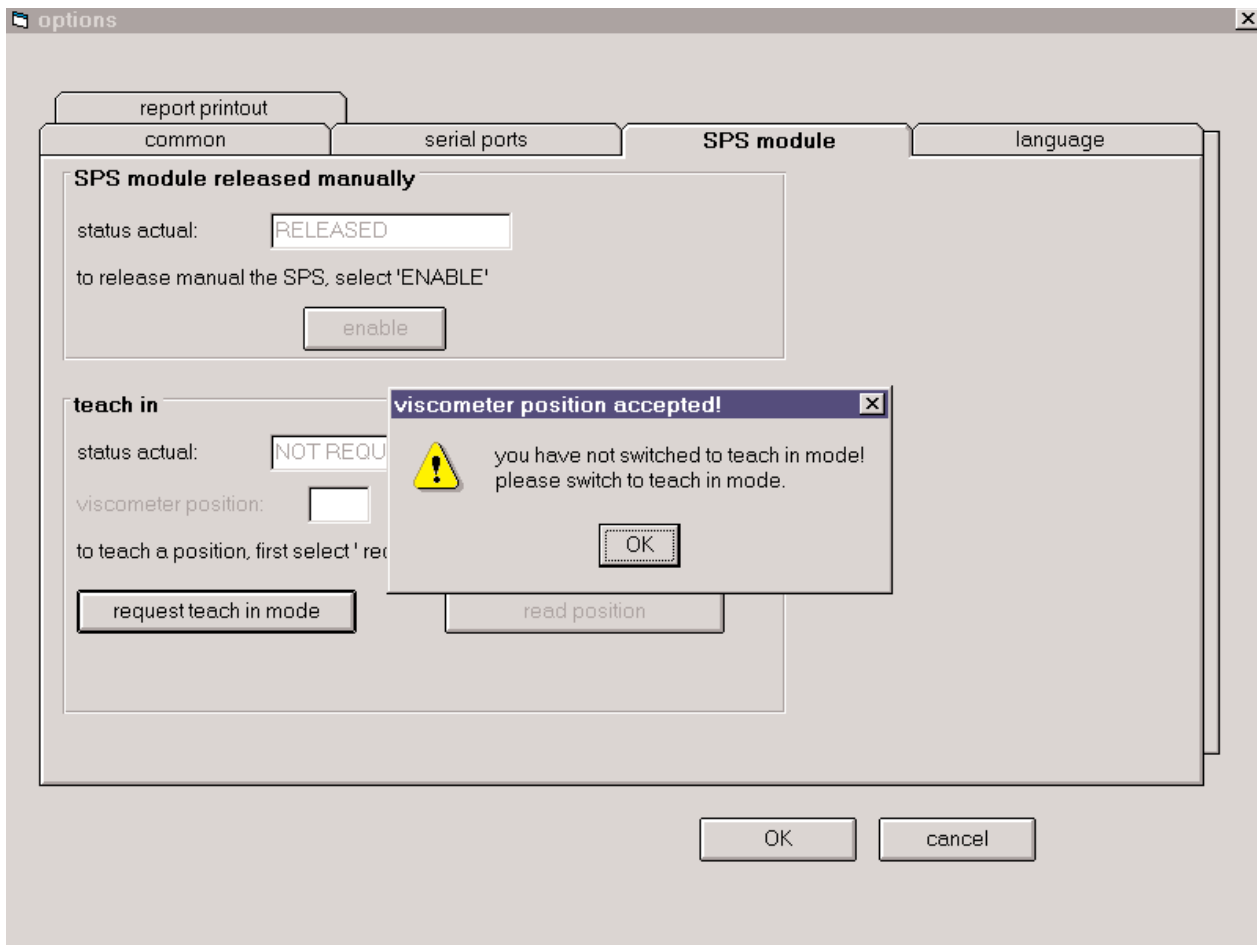


Fig. 52: Learning of docking positions (Teach In)
Message: Key switch not operated

Running the “Teach In” function requires the key function to be operated. On the above screen the system is informing you that the function was requested, but the keyswitch was not operated.

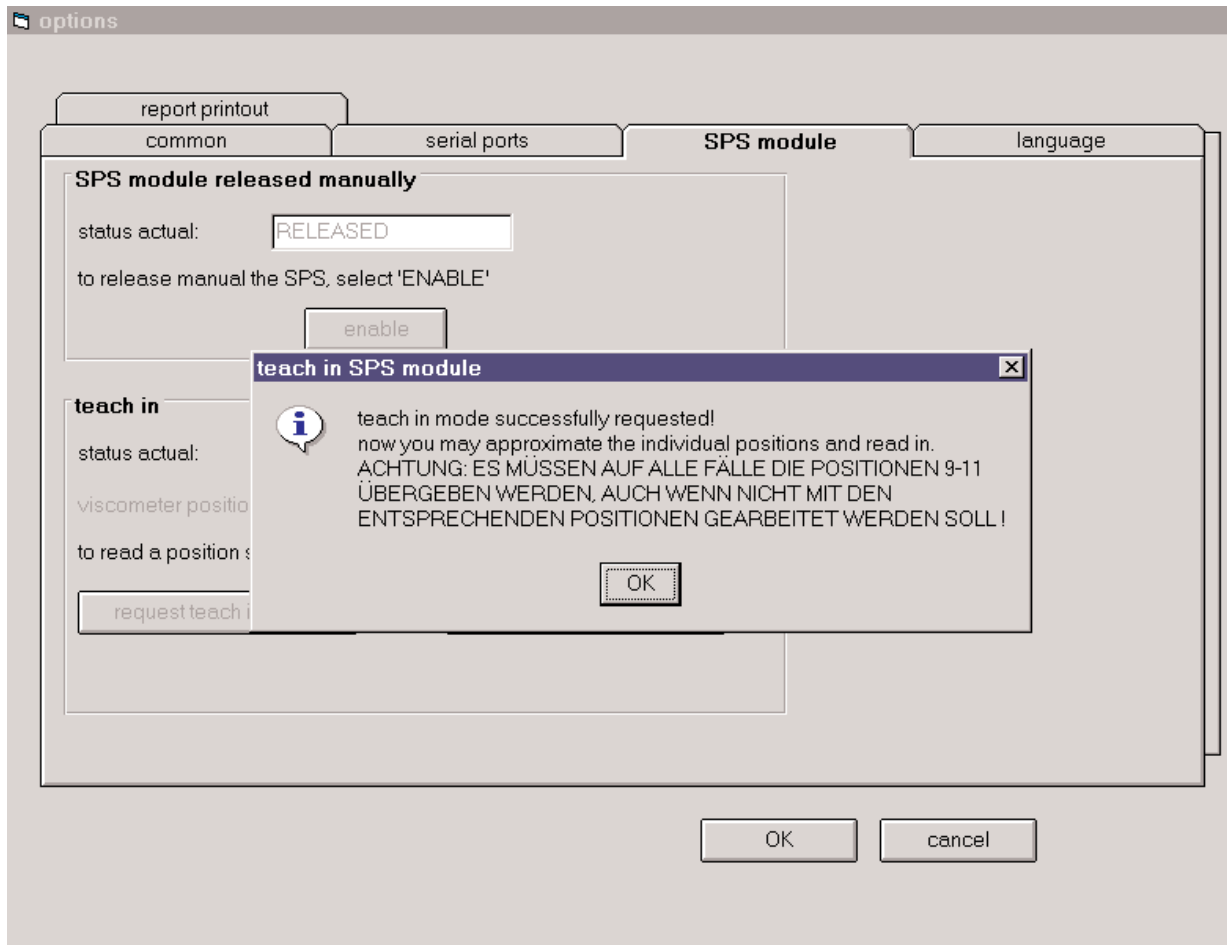


Fig. 53: Learning of docking positions (Teach In)
Message: "Teach In" function requested

On the above screen the system is informing you that the key switch was operated and the function was thus requested.

• **Please note:**

The positions 9 up to 11 have to be taught in in every case. Regardless, if one uses them or not!

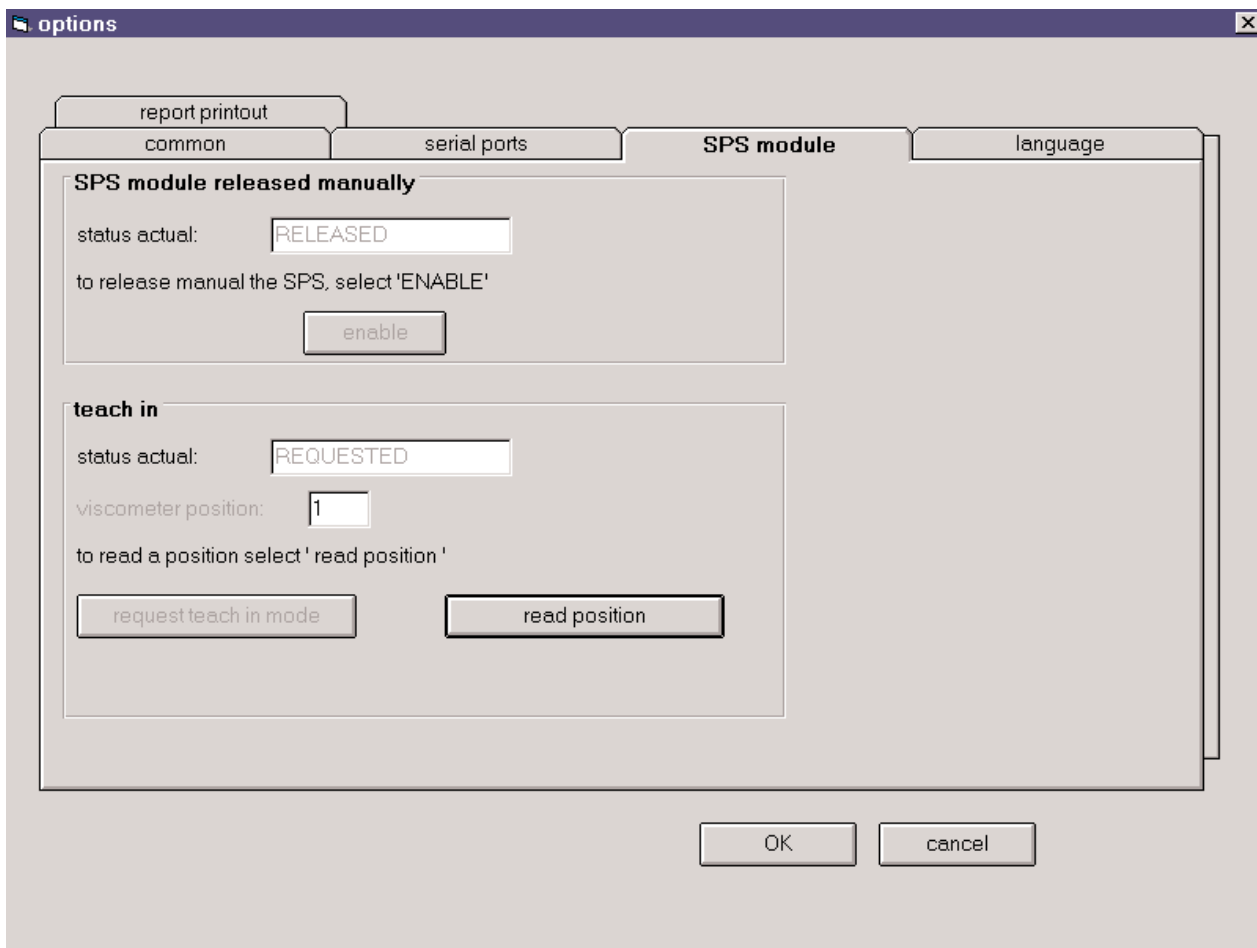


Fig. 54: Learning of docking positions (Teach In)

Message: Position transferred (in the example. "1")

To enable precise positioning of the transfer needle to the docking station, you may use the function "needle down" / "needle up". This function will be enabled by pressing the center button of the teaching box.

The motion "up" and "down" will be performed by pressing simultaneously with the center button wether the "left" or the "right" button.

• **Please note:**

To avoid permanent damage oft the sytem, you **must** move the needle to the upper position before teachng a further docking station for a new position.

3.9.1.4

PLC device control / other settings / learning mode

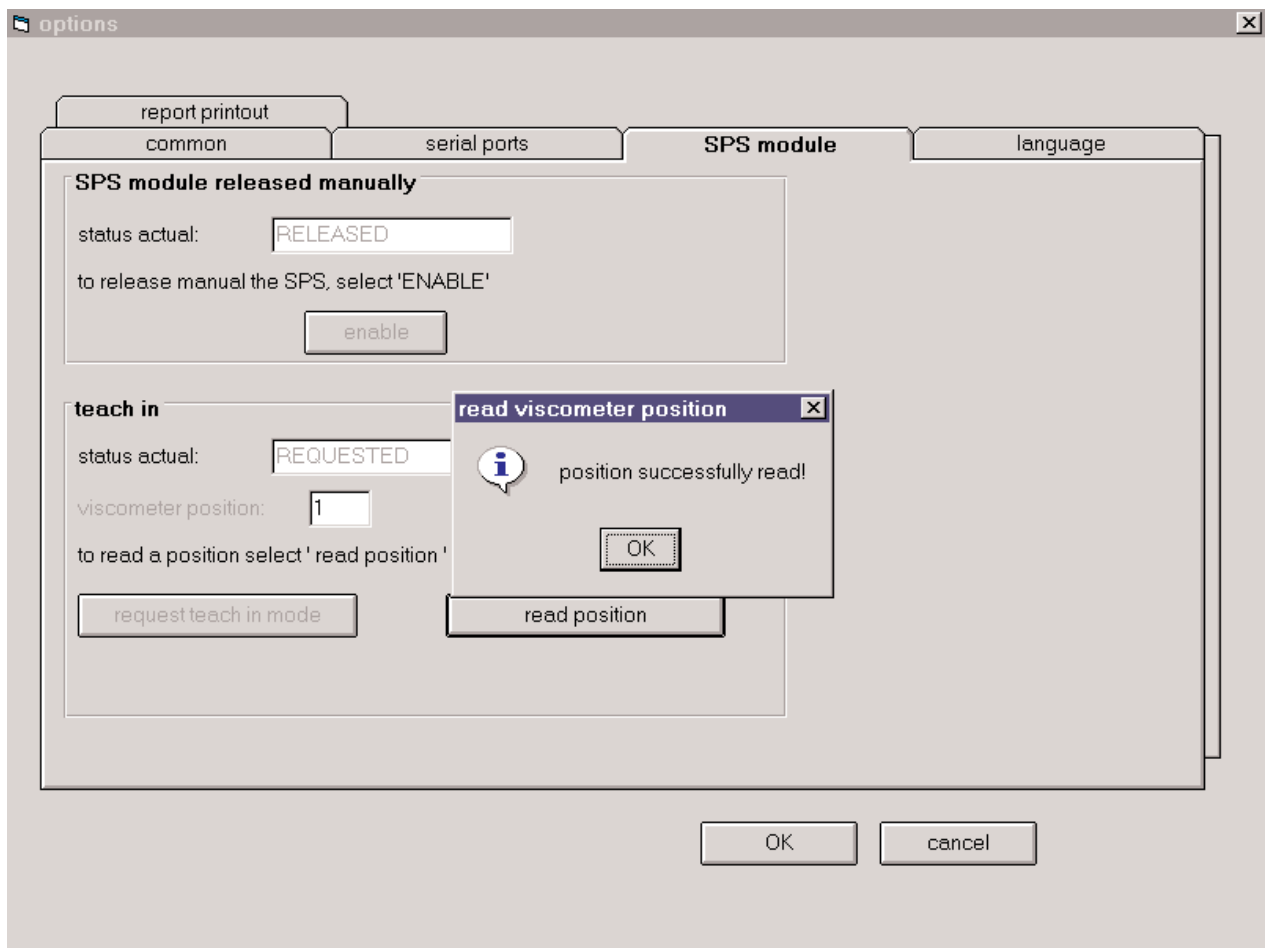


Fig. 55: Learning of docking positions (Teach In)
Message: Position transfer successful

This message will appear upon a successful transfer of a position by the PLC module.

The screenshot shows a software window titled 'options' with a close button (X) in the top right corner. It contains five tabs: 'report printout', 'common', 'serial ports', 'SPS module', and 'language'. The 'serial ports' tab is selected and active. Inside this tab, there are four sections for serial ports: COM 1, COM 2, COM 3, and COM 4. Each section contains fields for 'baud rate', 'parity', 'data bits', 'stop bits', and a 'comment' text box. COM 1 is configured with a baud rate of 4800, parity 'n (Kein)', data bits 7, stop bits 2, and a comment 'daisy chain connection'. COM 2 is configured with a baud rate of 9600, parity 'e (Gerade)', data bits 7, stop bits 1, and a comment 'SPS module'. COM 3 and COM 4 have empty fields for the first four parameters and a comment of 'NOT AVAILABLE'. At the bottom of the window are 'OK' and 'cancel' buttons.

Port	Baud rate	Parity	Data bits	Stop bits	Comment
COM 1	4800	n (Kein)	7	2	daisy chain connection
COM 2	9600	e (Gerade)	7	1	SPS module
COM 3					NOT AVAILABLE
COM 4					NOT AVAILABLE

Fig. 56: Tabsheet for setting the serial interface

Under normal conditions, up to 4 serial interfaces may be present within a PC system. The software will look for the parameters required for the devices and input them here.

No manual setting is possible or necessary!

The name of the peripheral device will be entered as a comment. In the present example: for interface Com1: PLC device control, and for interface Com2: Daisy chain.

This card is only intended for information purposes, for instance, if the indication of the communication interface is required in the course of a possible software upgrade of the PLC control.

The screenshot shows a software window titled 'options' with a close button in the top right corner. Inside the window, there are four tabs: 'common', 'serial ports', 'SPS module', and 'language'. The 'report printout' tab is currently selected and highlighted. Below the tabs, the 'report printout' section is titled 'layout of report printout'. It contains a table with five rows and four columns. The first column lists positions: 'top 1', 'top 2', 'top 3', 'bottom 1', and 'bottom 2'. The second column contains empty text input boxes. The third column is labeled 'text' and also contains empty text input boxes. The fourth column contains empty text input boxes. At the bottom of the dialog box, there are two buttons: 'OK' and 'cancel'.

layout of report printout			
top 1		text	
top 2		text	
top 3		text	
bottom 1		text	
bottom 2		text	

Fig. 57: Tabsheet for log fashioning

The above fields are used for individually fashioning the log or for inputting the required designations.

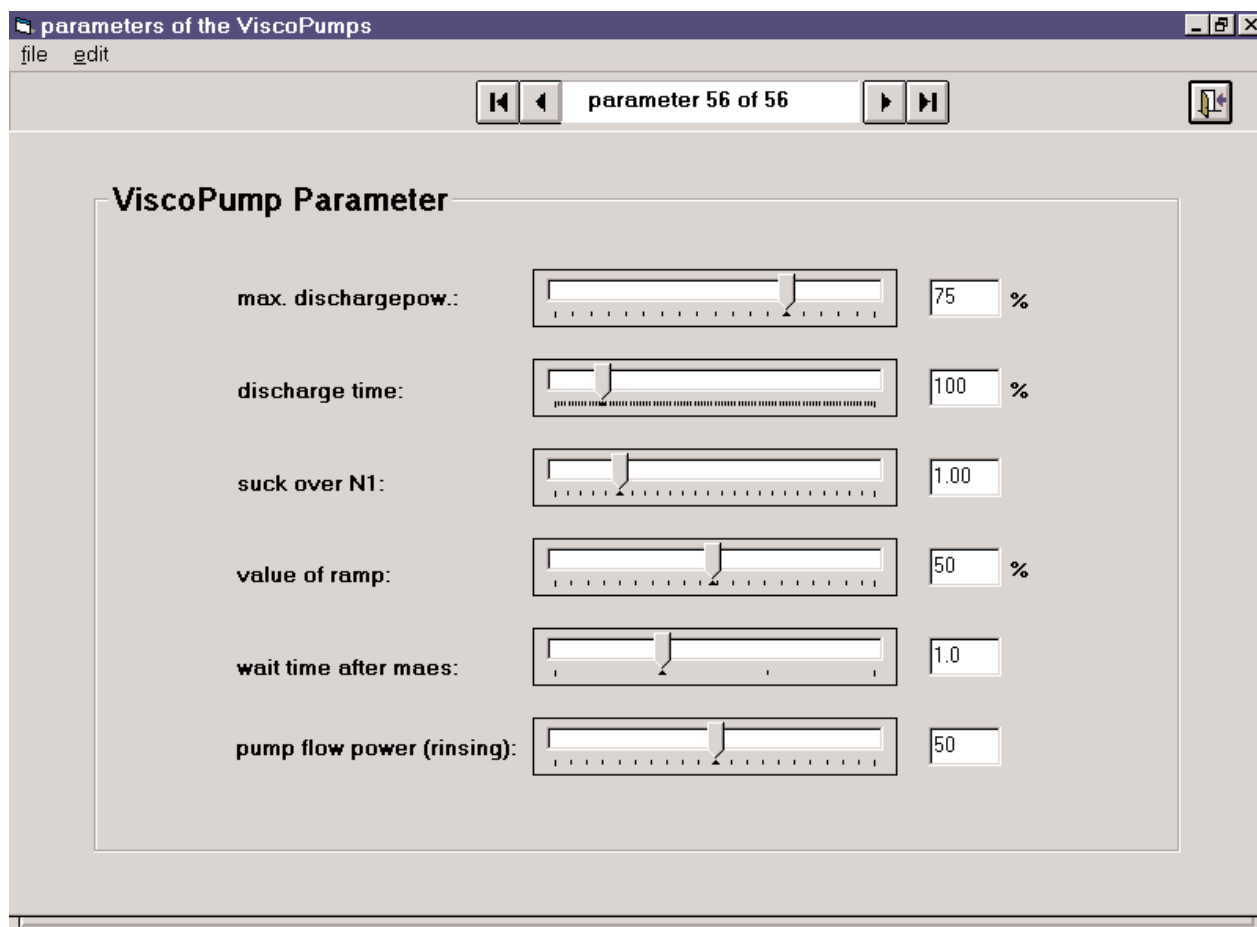


Fig. 58: Setting the ViscoPump parameters

In order to make the adaptation of the working mode of the viscometers to the samples to be measured as versatile as possible, comprehensive individual setting possibilities of the working points of the ViscoPumps were provided in the form of the sliding controls shown above. The maximum suction power is the final vacuum achievable at the discharge end of the rotary-type pump.

The evacuation time (which is calculated from the runtime and a constant- dependent factor) is to be increased individually by a further addition 30 and 100%.

The sucking action above N1, is the time which the sucking procedure is performed after the

upper photoelectric barrier has been passed. It too can be influenced by a factor between 0.7 and 3.

The ramp, i.e. the slope or rate at which the increase of the upward sucking speed occurs, is set using this sliding control. The waiting time following the measurement refers to the time which is supposed to lapse before a new measurement can be started. It serves to control the after-flow, since in the course of a laminar flow within the viscometer, depending on the toughness, a certain quantity of sample will still adhere to the wall of the viscometer.

The “rinsing” pump performance determines the pressure which is used to blow the sample out of the viscometer during the rinsing process.

Warning: If this pressure is too high, it may happen that the sample is pressed through the venting line into the ViscoPump, and with aggressive solvents it may cause serious, irreversible damage there. The so-called default values, i.e. the basic settings, are marked on the controls by a small black triangle in the scale and can be set in the “edit” menu.

Please refer to section 3.9.4.1, ViscoPump parameters, “edit, standard” menu.

3.9.4.1

ViscoPump parameters / "edit" menu

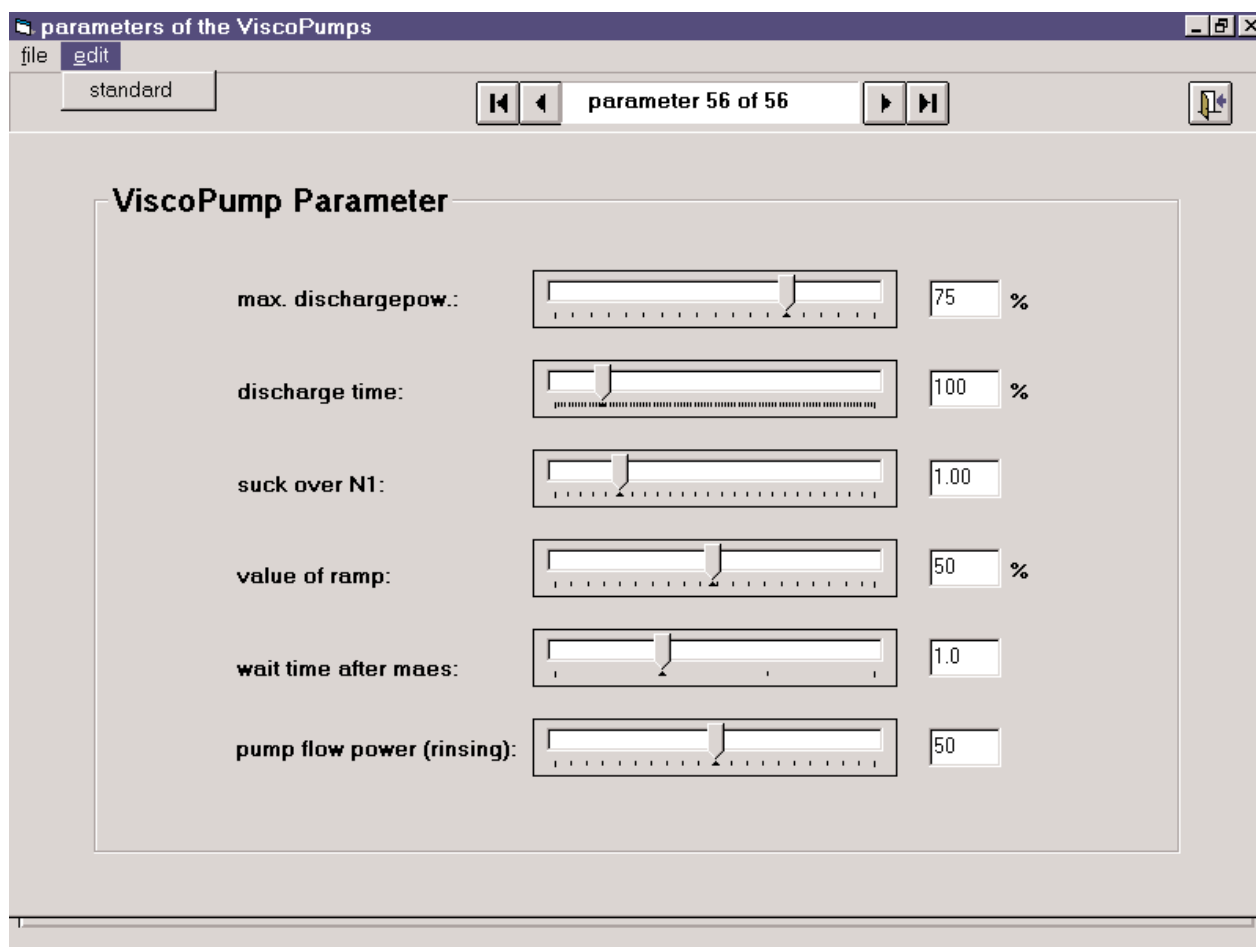


Fig. 59: Setting the ViscoPump parameters, "edit, standard" menu

The "edit, standard" menu enable the parameters to be reset to the standard values (default values). It is possible to assign different parameters for each of the samples (single input in method selection, section 3.4.1.2 for absolute mode, section 3.4.2.2 for relative mode).

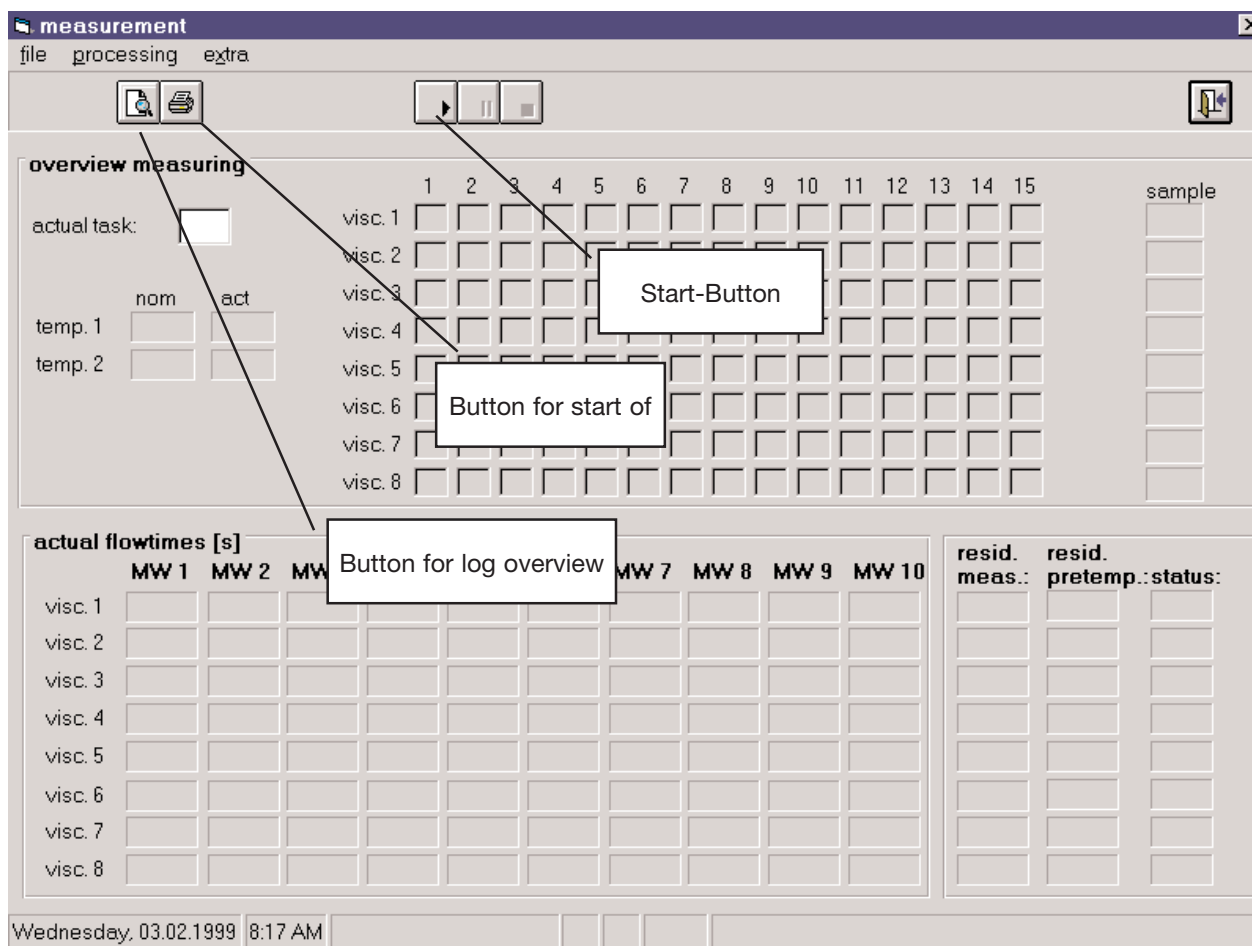


Fig. 60: Overview screen for the measurement

This screen appears if the measurement is initiated using the "measurement" button or the corresponding menu item.

The measurement process will be started after pressing the "start" button or from the "edit" menu (please refer to section 4.2).

This screen can also be used to start the print out or viewing of logs.

4.2

Measuring / overview / editing

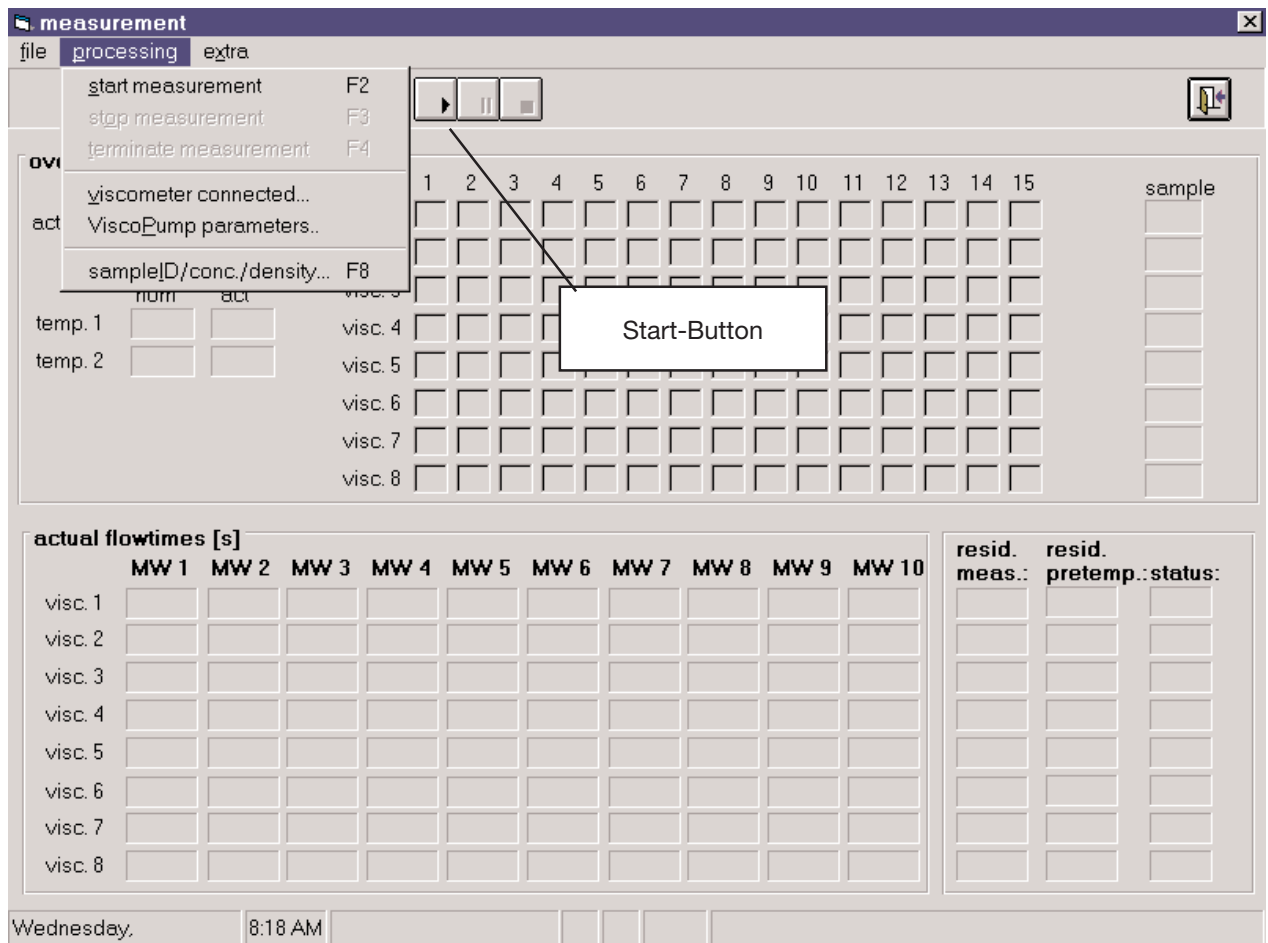


Fig. 61: Measurement screen, "processing" menu popped up

This menu can be used to access the "connected viscometers", the "ViscoPump parameters", or the "sample ID, concentration, or at density" program items.

The measurement process will be started after pressing the "start" button, or also from the "edit" menu.

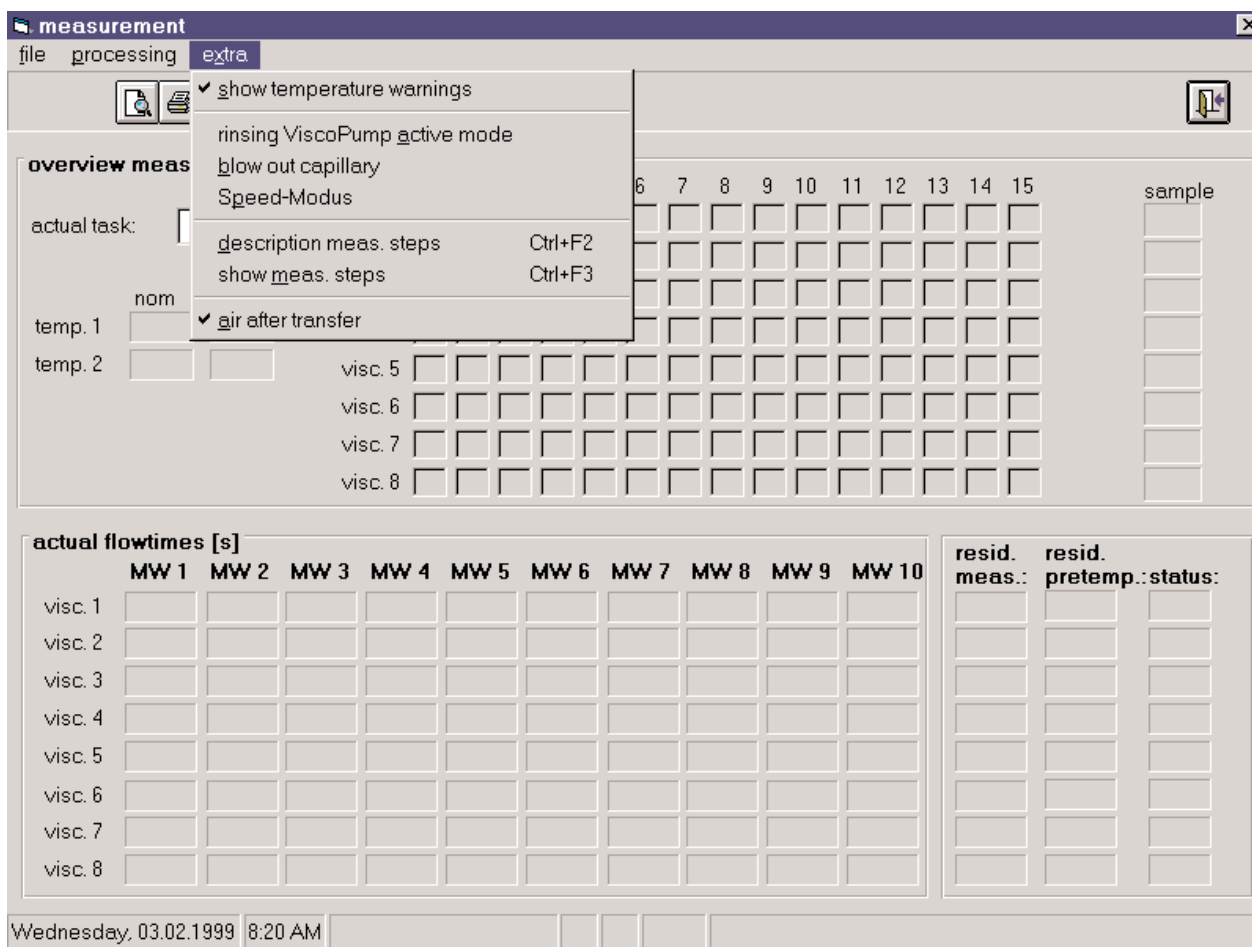


Fig. 62: Measurement screen, "extras" menu popped up

The "extras" menu is used to set the following options:

The activation of the menu item is indicated by a check ahead of the entry. The activation has to be repeated for each menu item, since the menu will be closed automatically upon activation!

Temperature warning:

This means that a warning message will appear on the screen if the set temperature tolerance is exceeded (please refer to method selection).

ViscoPump active rinsing:

In this process the rinsing liquid is blown out under pressure after pumping up by way of a reversi-

on of the running direction of the rotary pump.

Please note the use warning contained in section 3.9.4 (ViscoPump parameters).

Purge capillary:

This feature enables the capillary to be blown out after each measurement cycle.

Speed mode:

A working mode in which the individual viscometers are filled in parallel; this requires a rinsing process using solvent and drying of the capillary to reduce carry over by contamination.

Measurement-step description:

At this point the individual measurement steps (1-15) are described which are shown in series within the matrix (please refer to Figure 47).

Display measurement steps:

At this point, the individual steps are shown which are just being performed within the viscometer run-off (please refer to Fig. 48).

Air after transfer:

This item can be used to define whether the air is to be blown out after the transfer (in order to blow any residual volume out of the transfer unit).

4.4

Measuring / "measurement steps" information

measurement

file processing extra

overview measuring

actual task:

temp. 1 nom act

temp. 2 nom act

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	sample
visc. 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 7	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
visc. 8	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

actual flowtimes [s]

	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8
visc. 1								
visc. 2								
visc. 3								
visc. 4								
visc. 5								
visc. 6								
visc. 7								
visc. 8								

Wednesday, 03.02.1999 8:21 AM

description of the measuring steps

- 1 = allocate a new sample to actual viscometer
- 2 = move to rinsing solvent
- 3 = load rinsing solvent and move to viscometer
- 4 = transfer air after rinsing
- 5 = transmit param. for rinsing to ViscoPump
- 6 = rinse viscometer
- 7 = open solenoid
- 8 = move to sample
- 9 = identify sample
- 10 = load sample and move to viscometer
- 11 = transfer air after sample
- 12 = transmit param. for meas. to ViscoPump
- 13 = proceed with measuring
- 14 = proceed with calculations
- 15 = discharge sample

Fig. 63: Measurement screen, "extras, measurement-steps description" menu selected

The screenshot shows a software window titled "measurement" with a menu bar (file, processing, extra) and a toolbar. The main area is titled "overview measuring" and contains a table with 15 columns (1-15) and 8 rows (visc. 1-8). To the left of the table are input fields for "actual task:", "temp. 1" (with "nom" and "act" sub-labels), and "temp. 2". To the right of the table is a "sample" column. An overlay window titled "actual measuring step" is open, showing a list of tasks (Task 1 to Task 8) and a table with columns "W 6", "MW 7", "MW 8", "MW 9", "MW 10", "resid. meas.:", "resid. pretemp.:", and "status:". The status bar at the bottom shows "Wednesday, 03.02.1999 9:55 AM".

Fig. 63: Measurement screen, "extras, measurement-steps display" menu selected

This "task list" displays the presently running system steps, inquiries, etc. belonging to the individual viscometers.

Fig. 65: Measurement screen: Measurement parameters after start of measurement

In this section the following parameters are finally set, or displayed once again for an overview, respectively, prior to the actual start of the measurement.

Parameter determination:

At this point it is defined which kind of method input shall be applied, i.e. input by shared or single definition, blank value determination.

Sample assignment:

At this point you can define whether individual sample assignment or the normal sequence (sample 1 into viscometer 1 etc) shall be applied.

Start of the measurement process:

This point is used to decide whether the start of the measurement is to be performed by a rinsing process or directly with the feeding in of the samples.

Rack size:

A piece of information to know which sample carrier is being used.

Safety discharge into:

At the beginning of each new measurement cycle the dosing unit is emptied, since it cannot be established whether it is filled with a sample or not. This empty-

ing process can either be made into a viscometer or into any separate waste position.

Back:

This will scroll back to the starting screen.

Advance:

The definite start of the measurement.

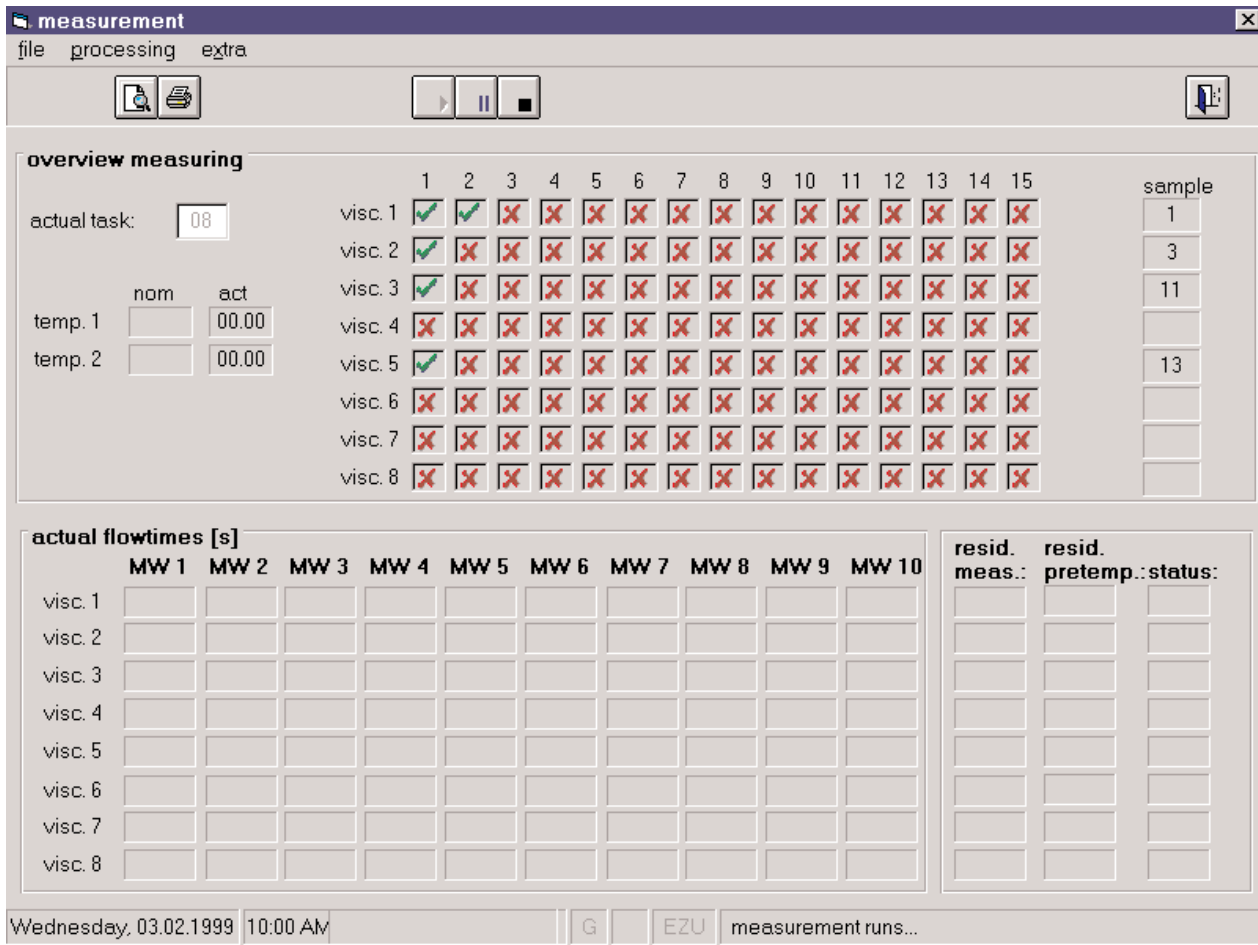


Fig. 66: "Measurement" overview screen

The above screen will appear upon the start of the measurement process. The upper part of the graph shows the connected viscometers including the program steps. At this point you get an overall overview of the status of the running measurements. The individual measurement values for the respective viscometers as well as the status of the respective viscometers are

shown in the lower part of the graph. Their remaining time for temperature equilibration and the number of measurements remaining to be performed are displayed. The symbols to the far right represent the current state of the process of the respective viscometer.

↑ = The ViscoPump pumps upwards
 ↗ = The optoelectric barrier was passed
 ↘ = The lower optoelectric barrier was passed

4.8

Messages after measurement start

4.8.1

Temperature control is disabled

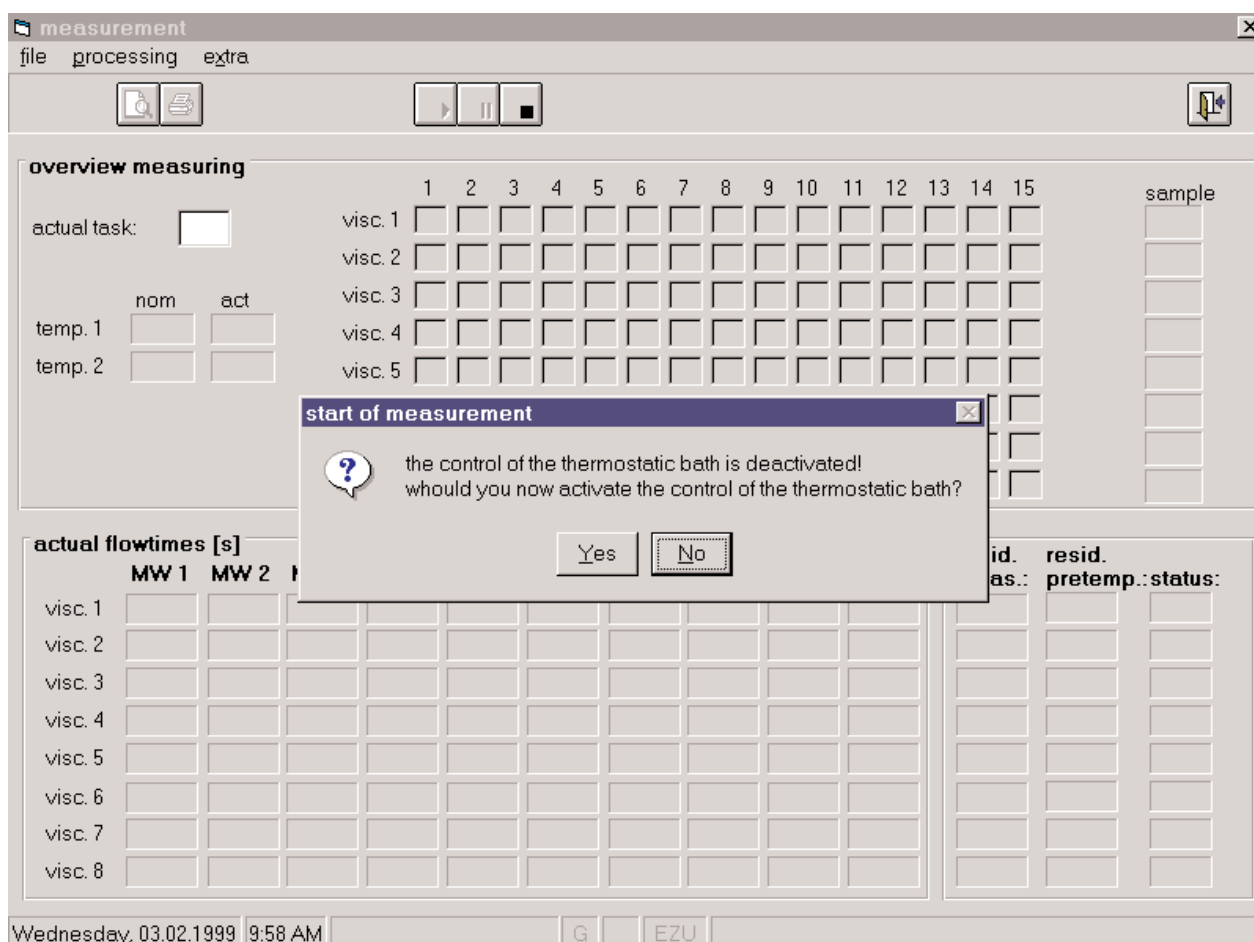


Fig. 67: "Measurement" overview screen, Message: "Temperature control disabled"

This message will be displayed after an attempt to start the measurement if the user has explicitly disabled the control of thermostats in the "extras, general" menu item (please refer to a section 3.2).

This message box can now be used to revoke this condition by pressing the "yes" button; otherwise the condition will be maintained if "no" has been selected. Subsequently, the following screen messages will appear.

4.8.2 No thermostat type identified

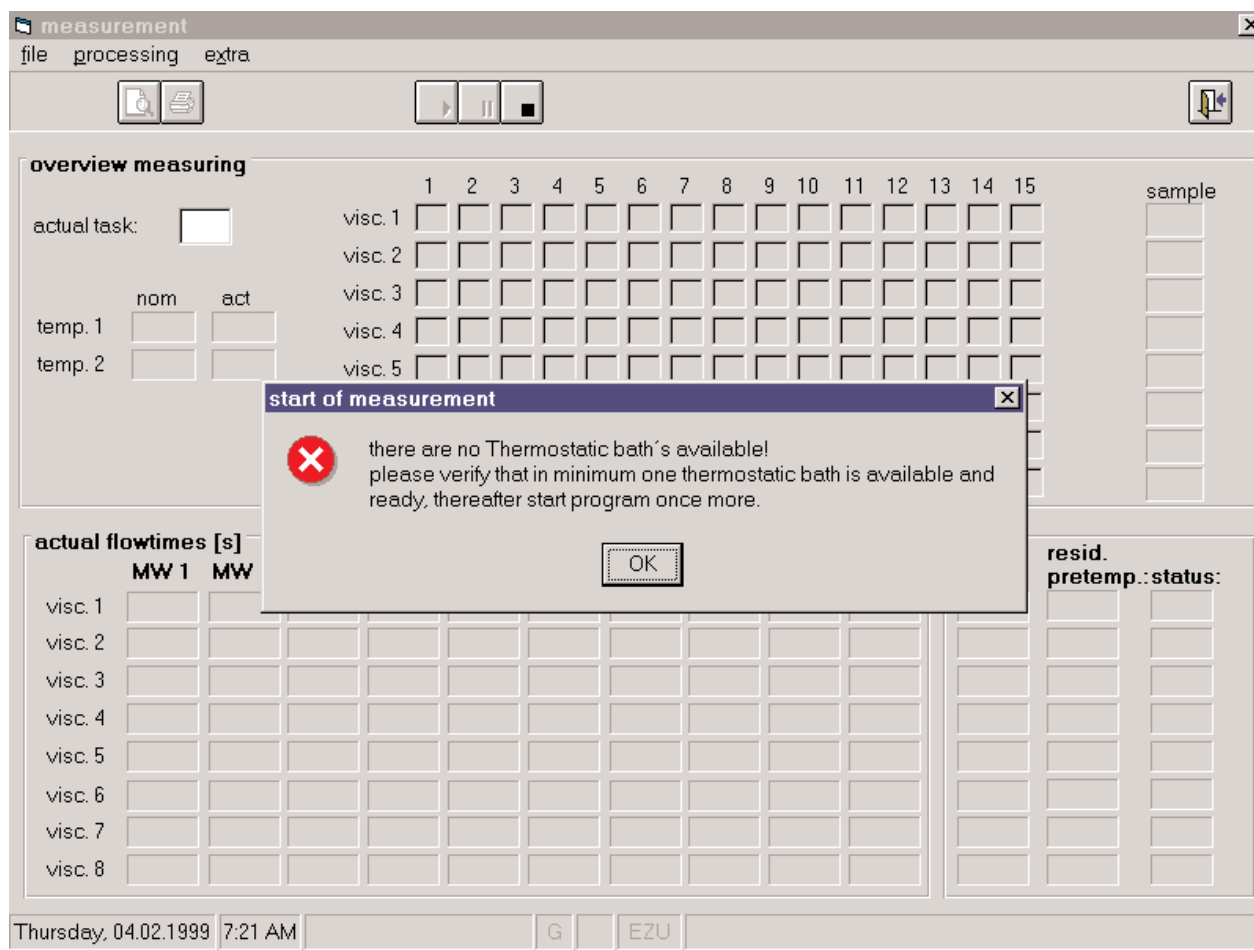


Fig. 68: "Measurement" overview screen, Message:
"no thermostat type identified"

If the thermostat is not connected to the system, the software cannot decide which thermostat type is to be used for the assignment of the transfer positions.

Please note: If an incorrect thermostat type is input here, this may lead to malfunction, since the positions for transfer will not match the so-called "taught-in" positions.

(Also refer to section 3.9.1.1 ff., learning function, and section 8.2.2, erroneous positioning of the transfer station).

4.8.3

Working temperatures are missing

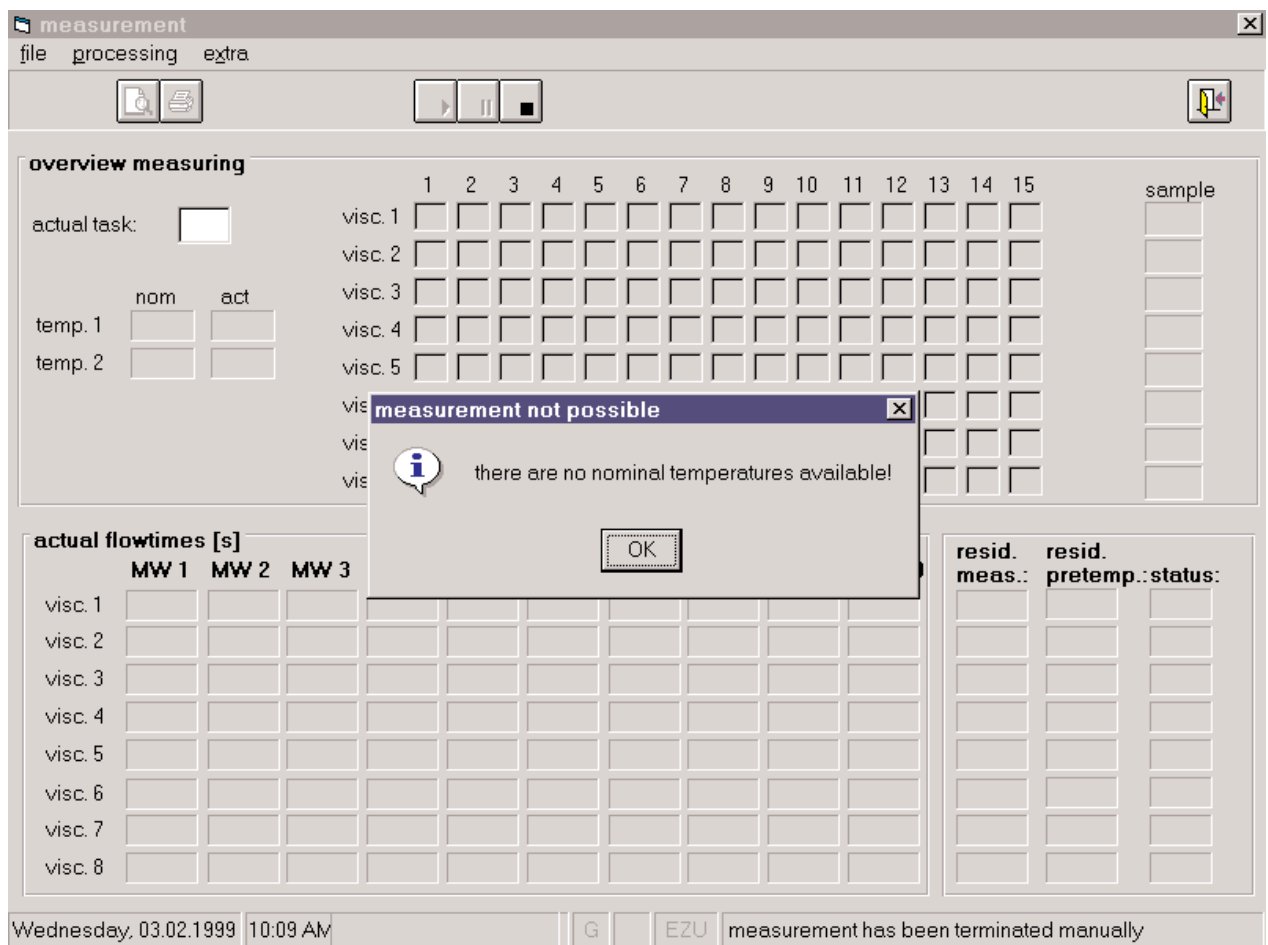


Fig. 69: "Measurement" overview screen, Message:
"No working temperature available"

The user is trying to start of the measurement and despite the thermostat/s is/are not yet programmed for a working temperature.

This has to be done at this point as is described in section 3.3, in order to proceed with the work.

4.8.4 The viscometer constants are missing

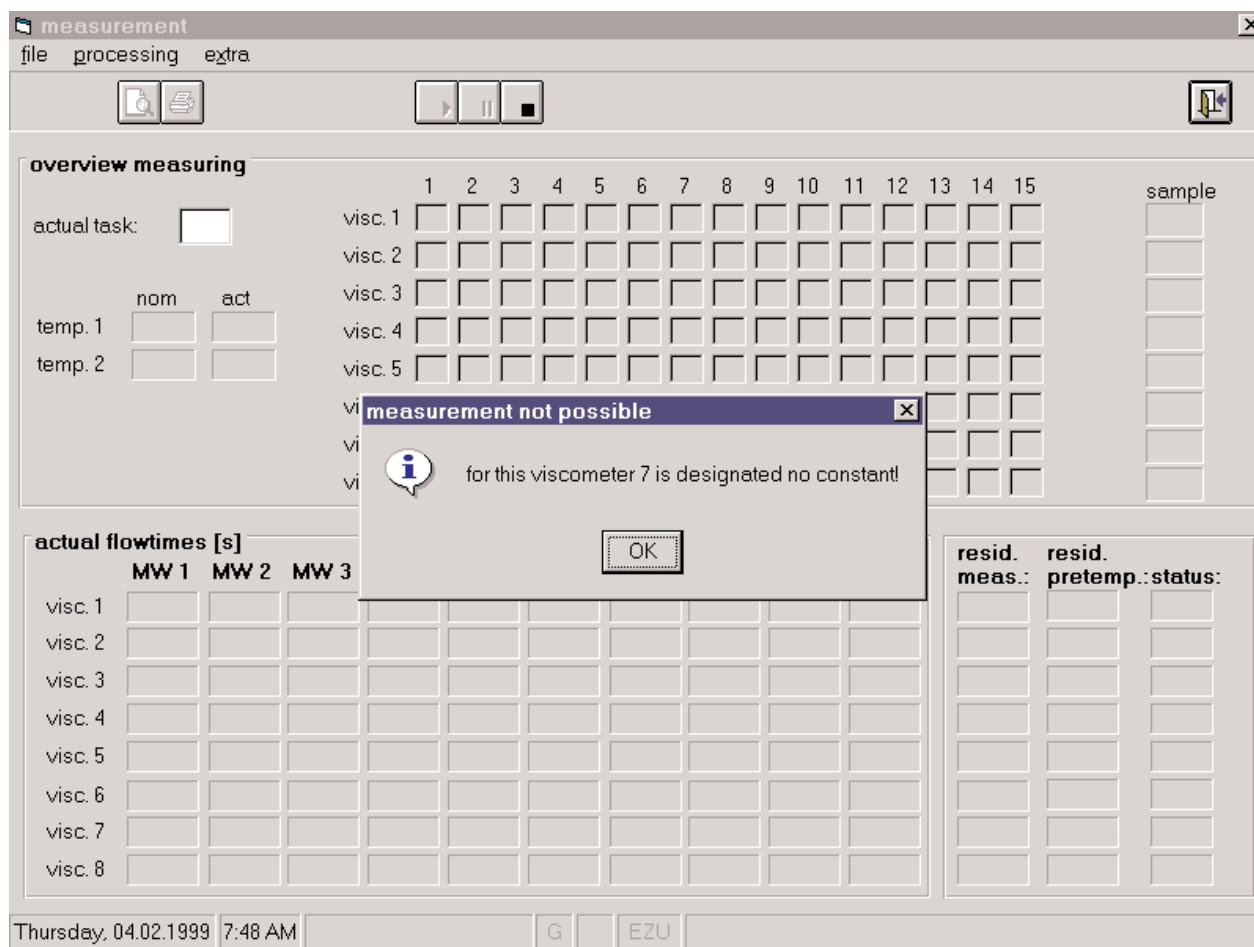


Fig. 70: "Measurement" overview screen, Message:
"No constant assigned to viscometer"

In the course of the start of the measurement it was found that no constant has been assigned to a viscometer (or to several viscometers, in the example: number 1).

The assignment has to be done now using the method selection (absolute: please refer to section 3.4., relative: please refer to section 3.4.2) and the input of the master data (please refer to section 3.6).

As was mentioned for method selection, care has to be taken to ensure that the methods which are assigned to the viscometer types are present with a suitable constant.

4.8.5

Measurement is being stopped

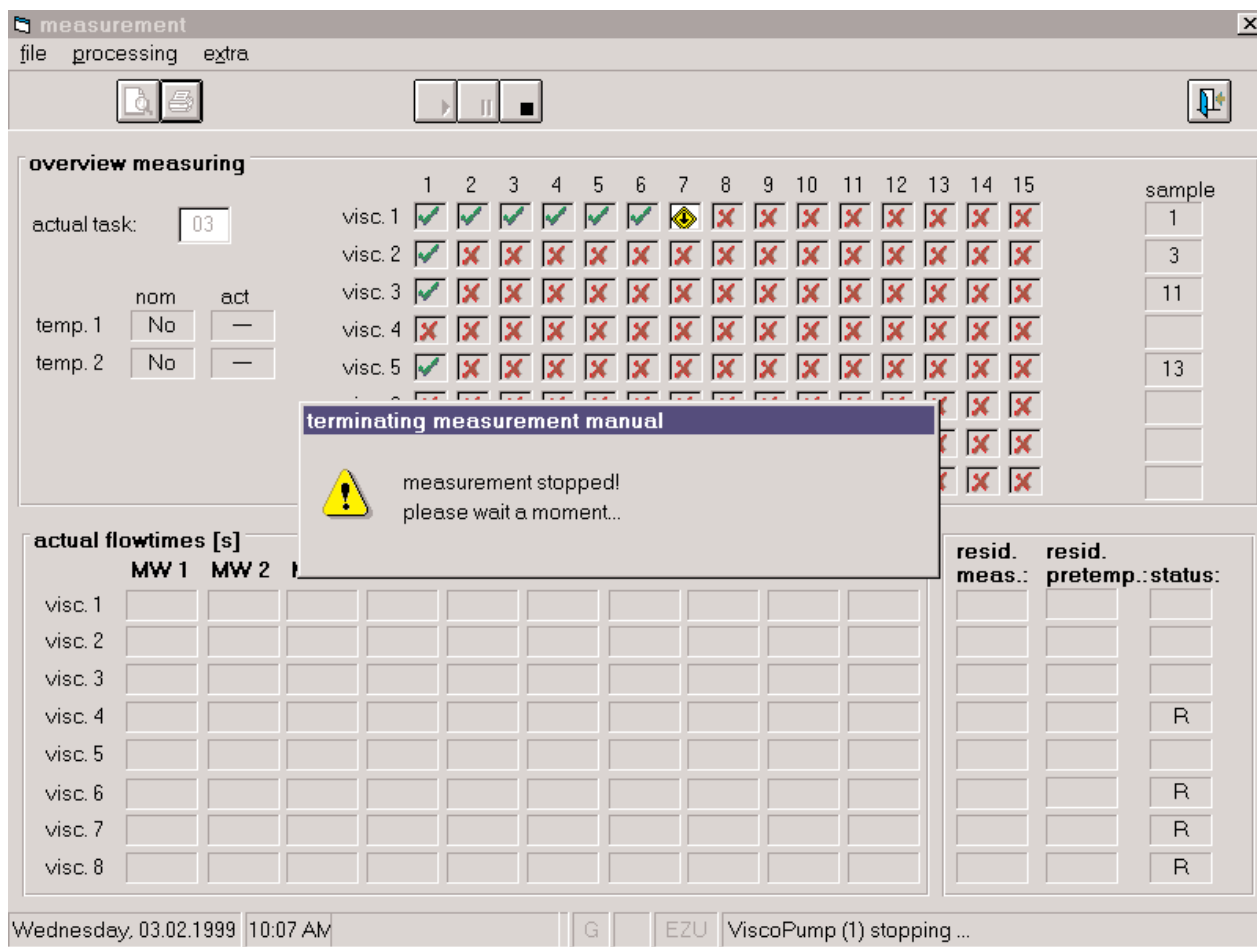


Fig. 71: "Measurement" overview screen, Message: "Measurement is being stopped"

This message will appear upon a measurement was stopped manually. The status line will show the corresponding action.

4.8.6 Sample-chamber flap was opened

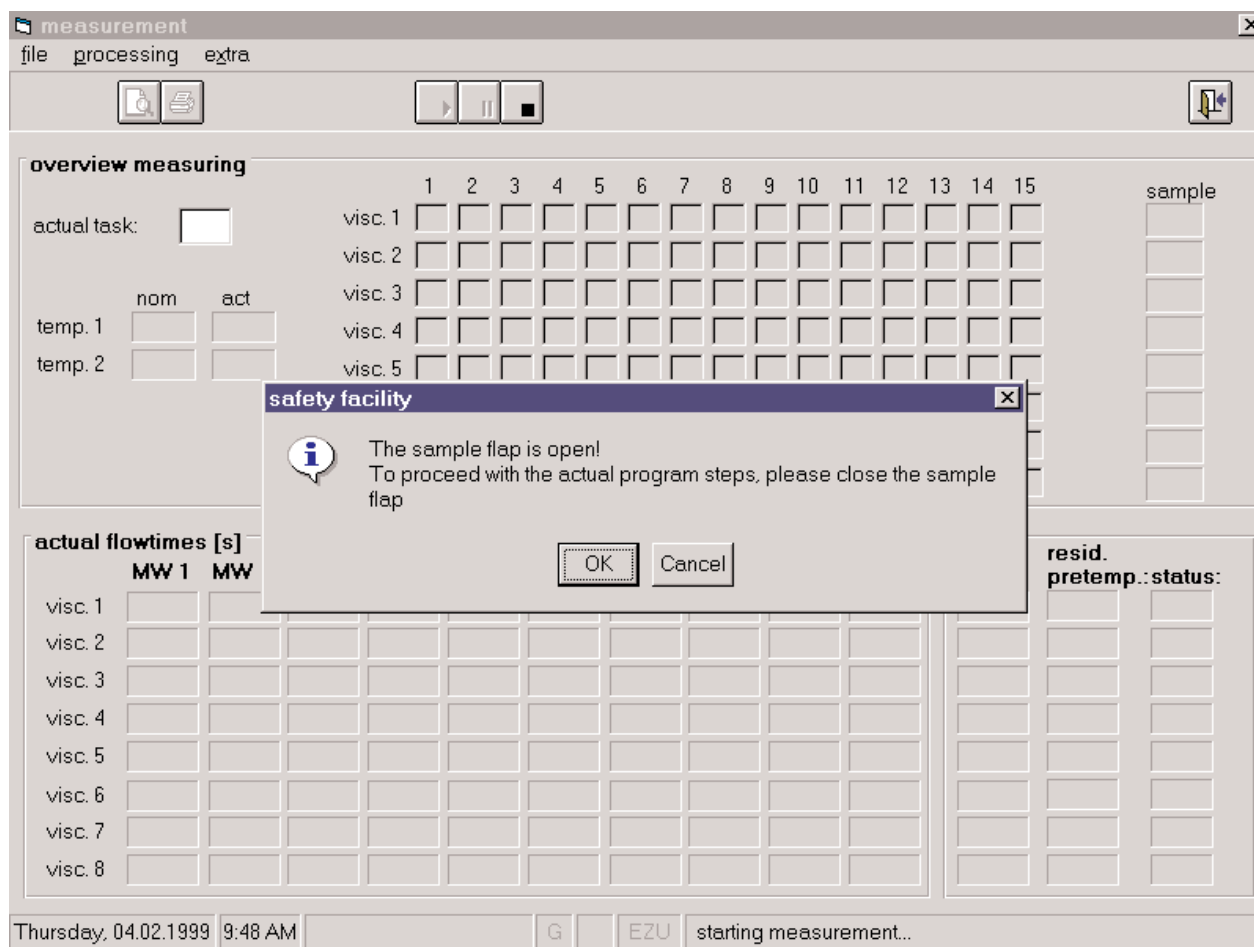


Fig. 72: "Measurement" overview screen, Message: "Sample-chamber flap opened"

The flap of the sample chamber (rack flap) was opened in the course of the measurement process. The system is stopped. Subsequently, you have several options to proceed. The system will first of all assume that the user wishes to add or remove

samples. (Please refer to section 4.8.9)

If the user opened the flap for the sole purpose of verifying the current number of samples, their position, etc., the suspended action will be resumed at the point where the program was

interrupted after closing the flap and pressing the "OK" button.

If the "cancel" button is pressed, the system will proceed with the actions described below.

4.8.7

Sample-chamber flap is open, measurement will be stopped

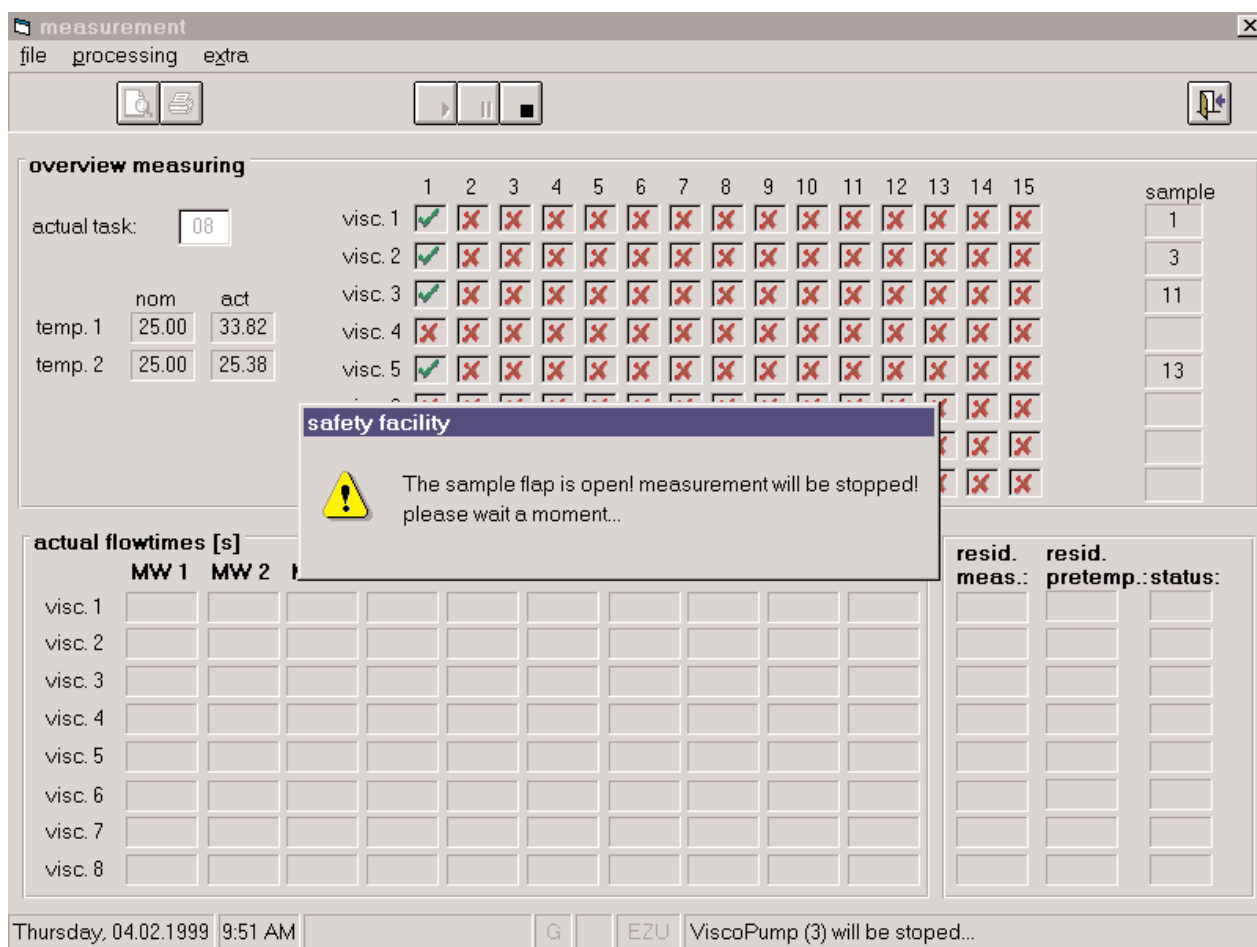


Fig. 73: "Measurement" overview screen, Message:
"Sample-chamber flap open, measurement will be stopped"

If the "cancel" button is pressed according to the description in section 4.8.6, this screen message will appear shortly. As soon as the operation is completed, the system will proceed according to 4.8.8.

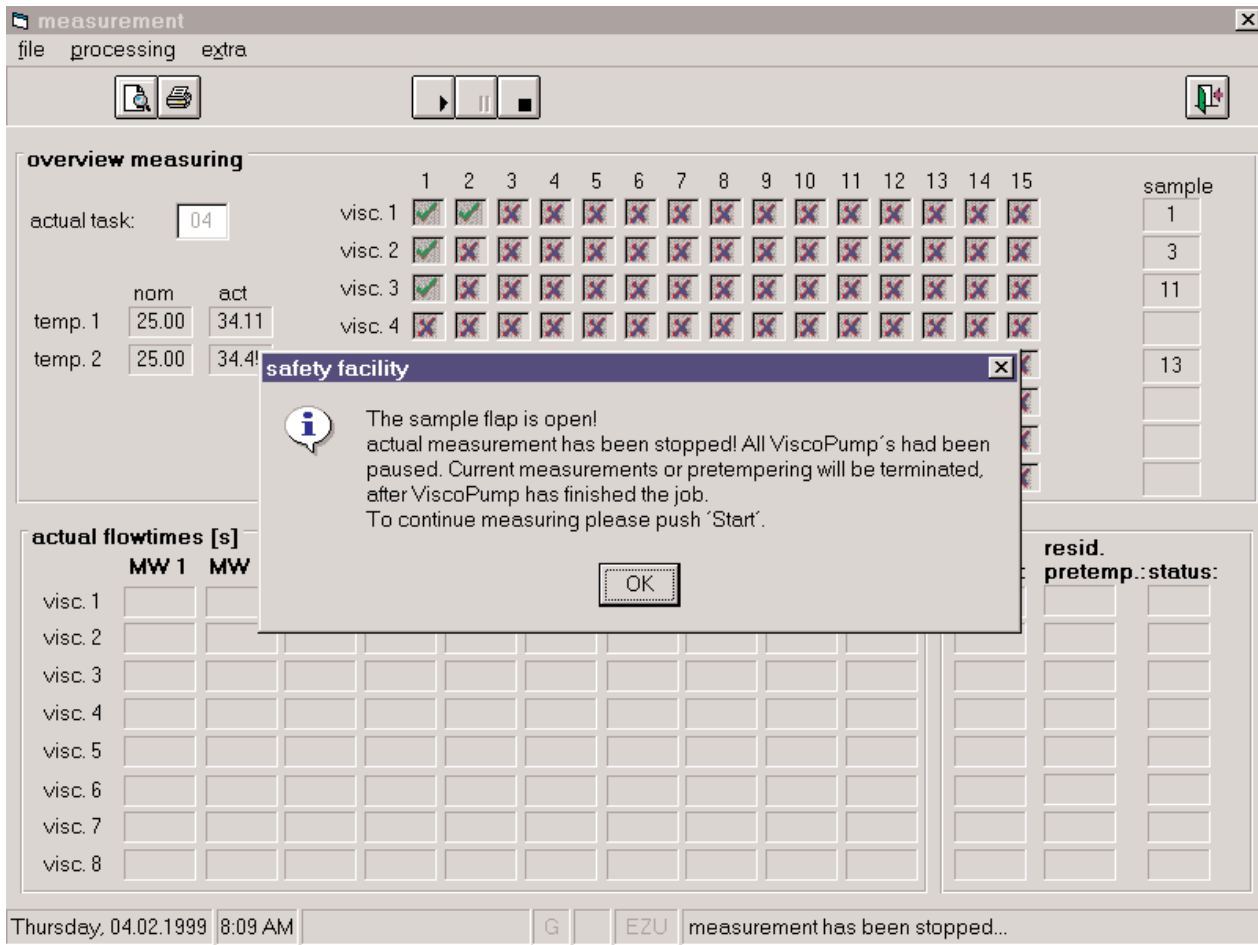


Fig. 74: "Measurement" overview screen, Message:
"Sample-chamber flap open, measurement was stopped"

As soon as the above operation has been completed, and this message will appear.

If you press the "OK" button, you will get to the input screen described below.

4.8.9

Change in the number of samples

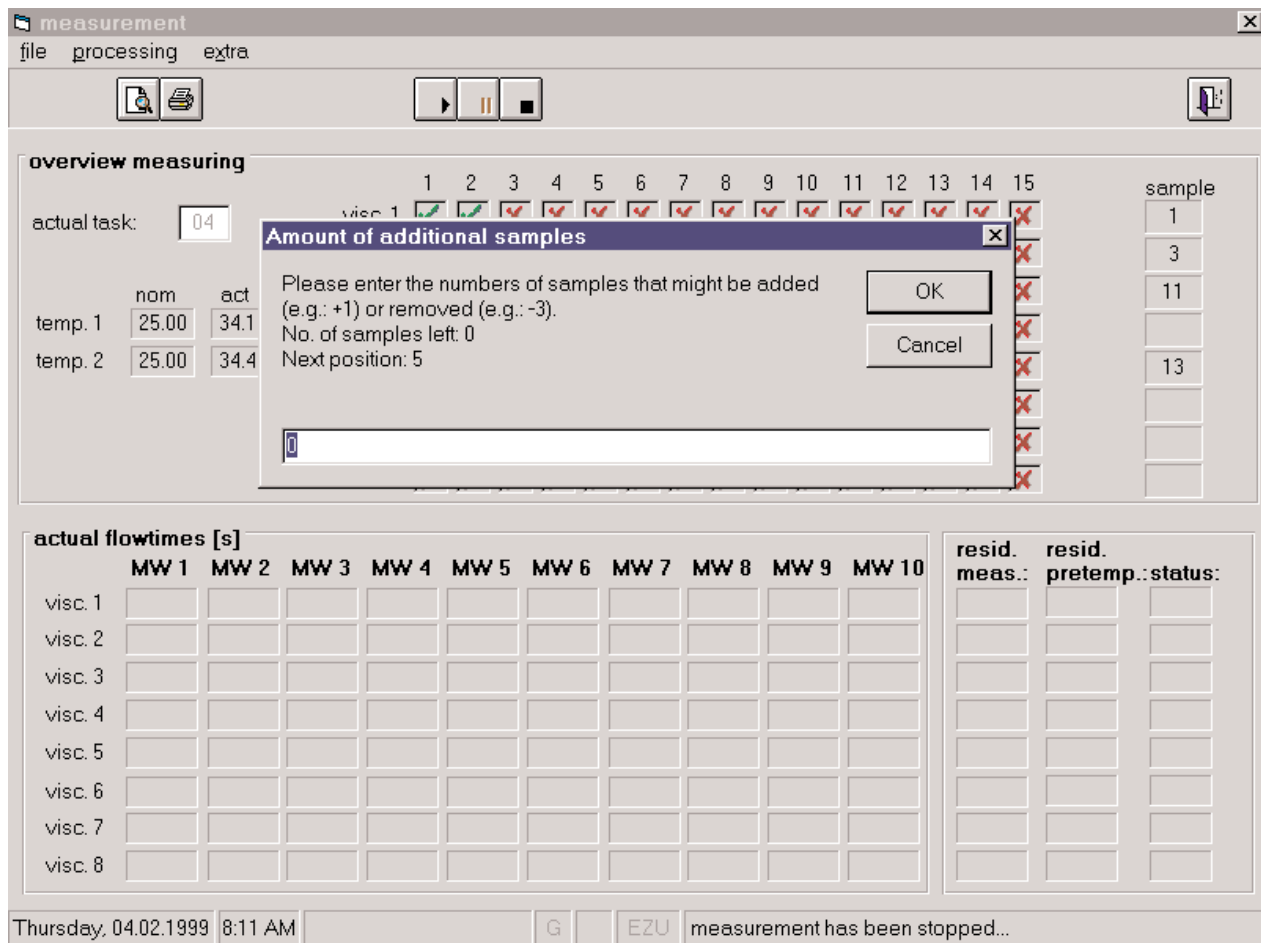


Fig. 75: "Measurement" overview screen, Message: Change number of samples

After the measurement was stopped according to the description in section 4.8.6 to 4.8.8, you can now change the number of samples by removing or adding samples. This is particularly intended for editing so-called priority samples.

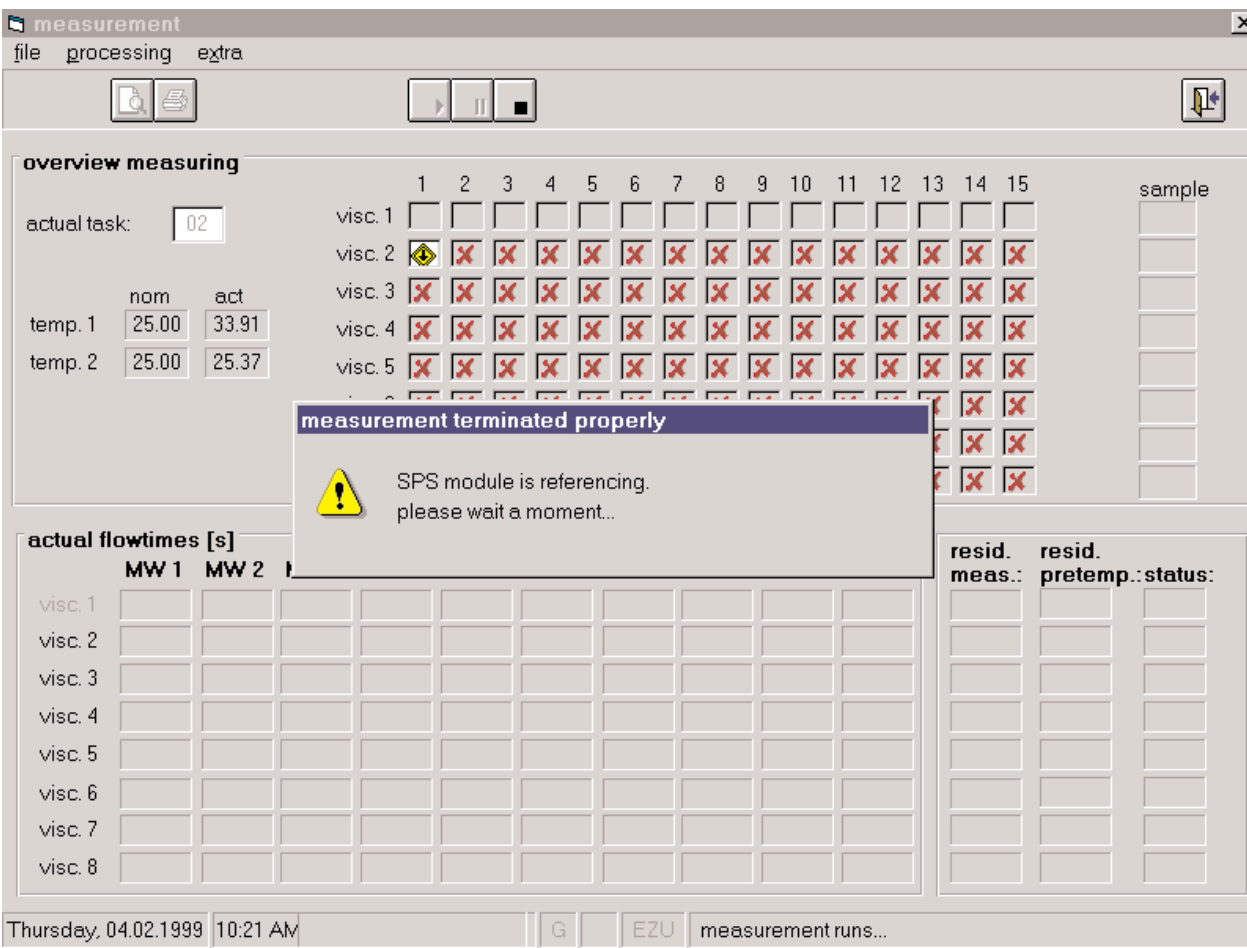


Fig. 76: "Measurement" overview screen, Message:
Measurement terminated, reference cycle will be initiated

Upon termination of the processes described in sections 4.8.6 through 4.8.9,1 reference cycle will be carried out.

4.8.11

Measurement terminated

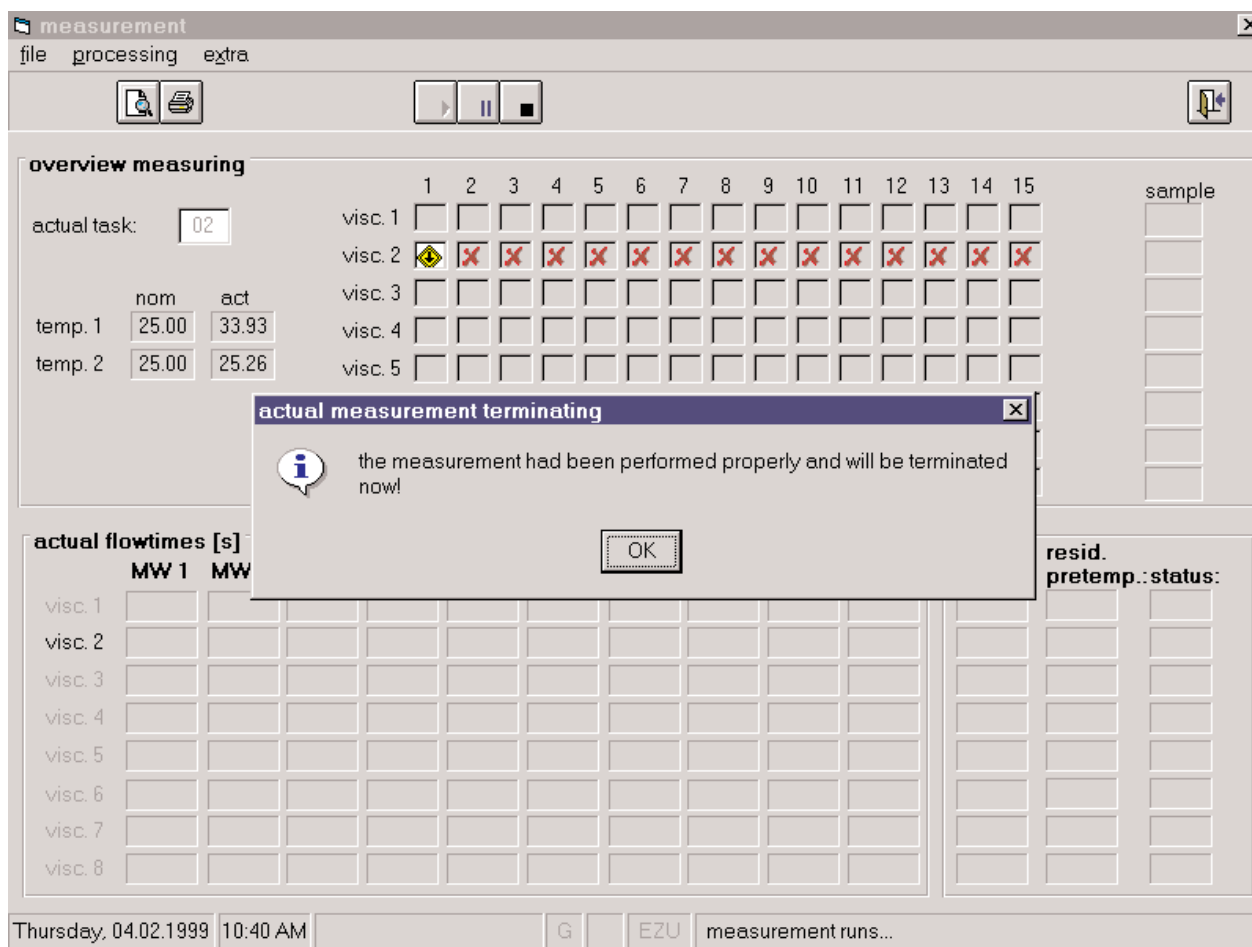


Fig. 77: "Measurement" overview screen, Message:
"Measurement terminated after manual interruption"

If measurement was interrupted manually and the process is terminated, the following message will appear on the screen.

Aktuelle Messwerte 05.02.1999

date:
time:
method:
no. of meas.:
pretemp. time: min.
bath 1
temperature: °C
tolerance: %
min. temp.: °C
max. temp.: °C
viscometer type:
t0- flowtime: s
viscosity solvent:
barcode:
Sample ID:
average: s H.C.- correction: s
delta t: % standarddev.: %
concentration:
relative viscosity:

1 of 2 [Navigation icons] [Close] of Total: 100%

Fig. 78: Example of an own log page

This preview of a log page is initiated by pressing the overview button (please refer to section 4.1, overview).

You can scroll through the page using the arrows located on the bottom bar of the screen.

Pressing the other pictograms will initiate an enlargement/reduction of the representation, a printout of the log in the form shown, or the filing or forwarding in the form of a document. "Cancel" or "close" are self-explanatory.

5.2

Program: DokuAVSPro II

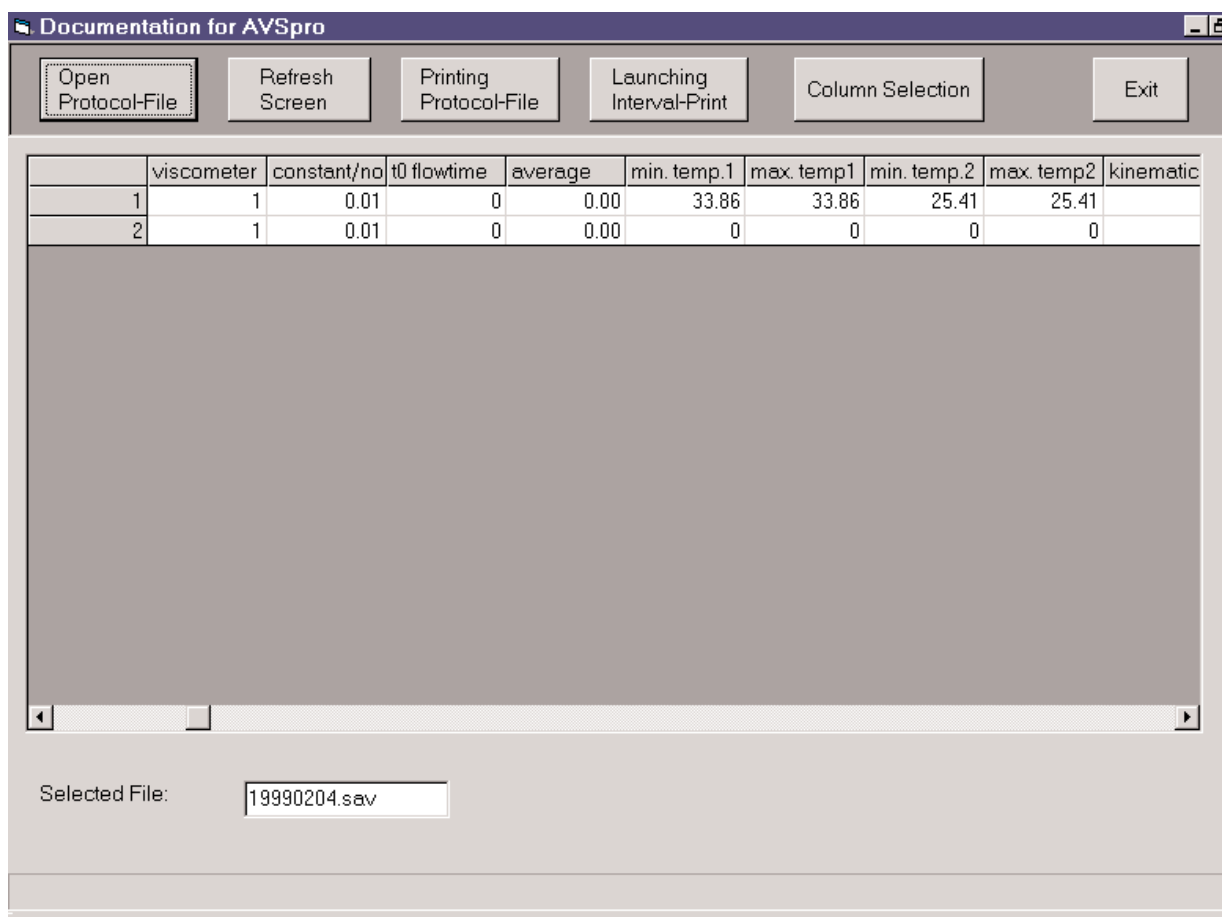


Fig. 79: View of the screen of the documentation program

The DokuAVSPro II program is used for the documentation of measurement data from the log files of the AVSPro II measurement system.

The log files with any columns can be output on a printer or on the screen. In addition, a file can be output at intervals on continuous form paper.

During the start of the program, some of the buttons are not yet active; they become only fully available upon the loading of a file.

- „Open log file“:

A dialogue box for selecting a log file is offered to the user. With a double click on the desired file name or by clicking on the file name, followed by a click on OK, the contents of the file is shown in the table underneath. During the first start of the program, all columns of a log file are displayed by way of default. The name of the selected file appears in a text field.

- „Update screen“:

If you click on this key, the contents of the table below will be updated. For instance, if the user has selected new columns.

- „Print log file“:

By pressing this key a logfile can be output on printer paper. The file has to be opened before. The columns column headings of the table will be taken over for the printout. The printer has to be ready for operation. As an alternative, it is possible to obtain a printout of a certain range of data records only. In this case the user selects one or several data records using the mouse (press the left mouse key and move the mouse curse of upwards or downwards). Selected data records are highlighted in blue. Subsequently, you will be prompted to know whether all data records or just the selected range are to be printed out.

- “Start interval printing”:

When clicking on this key, a dialogue box will appear at first, in which the user is asked to enter the path for the current log file. A specific path is defaulted in a text field. If required, however, it can be modified by clicking on the drive and the corresponding directory. Subsequently, the program will search the specified directory for the current log file. A corresponding message will appear at the bottom on the status line. The program will continue to search until the log file has been found. Subsequently, interval printing will begin. The file will be read at intervals of 10 S. If a new data record is found, it will be output on the printer. The interval printout can be cancelled by pressing the key again. In this case, a security prompt will be made. If interval printing is interrupted prematurely, and if the program is restarted subsequently, are newed pressing of this key will cause a dialogue box to be displayed, which will prompt the user to know whether he wishes to continue the cancelled interval printout. If “yes” is pressed, interval printing will be continued at the place at which it was cancelled. If “no” is clicked, interval printing will resume with the first data record.

- “Columns selection”:

This key is used to view or print certain columns of a file. Another window will appear containing the column names of the log files including the pertinent check boxes. Columns supposed to appear in the table or on the print out will be marked by a check in the check box. During the first start of the program the check boxes will contain checks.

- “Exit”:

This key can be used to end the program. Prior to the program end, a dialogue box will appear which asks the user whether or not he wishes to exit the program. If you click on “yes” the program will be terminated immediately.

5.2

Program: DokuAVSPro II / Functions

Special Notes:

If log files are to be output on the printer or on the screen without any columns being selected, a corresponding message will be issued.

If the program is exited, the last column configuration will be stored in the init.txt file, which will be displayed at the renewed start in the column selection window. In the course of the printout of a log file (total printout or interval printout) the user can initiate the output of any file in the table. During interval printing, however, it may happen that the user wishes to have the file which is just being printed displayed on the screen. In this context, errors may occur when accessing the corresponding log file. An acoustic alarm will sound, and a dialogue box will appear. A renewed attempt will in most cases be successful. Within the table, you can scroll vertically or horizontally. You can change the size of the individual columns.

Caution, important note:

Please do not use HP printers, since they do not support single-line printing.

“init.txt” initialisation file:

The init.txt file is an ASCII file used to store various parameters (including the details of the columns selection). It is located in the same directory as the above-mentioned files. At the first start this file is not yet present.

Important note:

This file must not be modified, since otherwise program errors will occur. Some examples of measurement logs are described below. An additional program: DokuAVSPro II enables the specific sorting of the measurement results and the processing using other programmes, such as Excel®.

As described in chapter 5, the data of the measurement device are available for external use.

Each measurement is stored in the "TagesprotokollAVSProtddmm-
jjjj.SAV" daily-log file.

The following parameters are contained in this file (typical example):

Parameter	Value
Date;	01.07.1999;
Time;	00:08:55;
Measurement method;	ABS;
Sample ID;	31;
Viscometer;	8;
Constants/Recommended constants;	1.0000;
Blank value;	0;
Measurement value1;	167.78;
Measurement value2;	167.8
Measurement value3;	167.81
Measurement value4;	167.77
Measurement value5;	0;
Measurement value6;	0;
Measurement value7;	0;
Measurement value8;	0;
Measurement value9;	0;
Measurement value 10;	0;
Command number of measurements;	4;
Mean value;	167.78;
Command temperature 1;	40.00;
Minimum temperature 1;	40;
Maximum temperature 1;	40;
Command temperature 2;	100.00;
Command temperature 2;	99.98;
Maximum temperature 2;	100.02;
Temperature tolerance;	1;
Hagenbach Correction;	NO;
Kinematic viscosity;	167.78;
Dynamic viscosity;	167.78;
Viscosity index;	0;
SUS;	0;
SFS;	0;
Relative viscosity;	0.0000;
Specific viscosity;	0.0000;
Viscosity number;	0.00;
Reduced viscosity;	0.00;
Inherent viscosity;	0.00;
K value;	0.00;
Density	1.00;
Measurement i. o.;	0;
Remark;	NO;

The above parameter list is located at the head of the file. The corresponding values follow line by line.

The above sample can be read horizontally line by line within the stored file.

Notes

General safety information:

With the present analysis device the user can work with substances presenting a health hazard. As a principle, as with any work involving the handling of matters presenting a health hazard, the relevant regulations of the Employer's Liability Insurance companies off he Hazardous-Matters Decree etc. have to be observed.

The staff involved must be suitably qualified and use the required personal safety equipment! The warnings and application notes contained in the preceding chapters are listed here once again: Section 3.1 (page 16)

Please note:

There may be additional problems, for instance, if a data record which was created using the German version of Windows® XP was taken over to a system on which the English version of Windows® XP is running, since there may be differences in the decimal-separation sign (German: “,” comma”, English: “. decimal point”). This may result in errors while reading the database which can only be eliminated by in-linking a correct country-specific version.

Section the 3.4.1 (page22):

Please note:

If any viscometer in any thermostat fails for whatever reason, the corresponding viscometer in the other bath will be put out of operation as well.

Section 3.6.1.2 (page 45):

Operating note/Warning:

Please note that this runtime corresponds to the theoretical value and is not suited to take into account any individual variations of the Hagenbach-Couette Correction which are caused by the real constructional shape! If corrections of a value of more than 1% of the resulting runtime are to be expected, errors may occur in the determination of the relative viscosity. This applies in particular to short runtimes and high relative viscosities (greater than approx. 2.0) in the viscometers with a small capillary diameters (size 0 to I).

Section 3.7 (page 50):

Important note:

If a ViscoPump is deactivated during running operation, the entire measurement process will be stopped after this moment, i.e. the sample will be sucked off after reactivation of the pump and will then be lost! For program-technical and safety reasons it is not possible to resume work at the process-control point at which deactivation occurred. This way of action is only suggested in cases in which an unpredictable event might cause a hazard. If required, it is recommended to stop the running of the program only (please refer to figure 61, "measurement" screen, "edit" menu).

Connected devices:

Please note that for process-technical reasons no viscometers of different makes must be used in the respective measurement positions.

If a viscometer including the corresponding ViscoPump have been deactivated from the side of the program for reason of a TC error or another error detected by the system, the viscometer can be dismantled, replaced, or cleaned after stopping the measurement process. If required, this screen can be used to input the new constant so that the measurement process can resume again. This is particularly recommended in "absolute" mode in the VI determination mode, since otherwise two viscometers belonging together would have to be deactivated.

Warning and application information

Section 3.9.4 (page 60):
ViscoPump parameters Warning:
If this pressure is too high, it
may happen that the sample is
pressed through the venting line
into the ViscoPump, and with
aggressive solvents it may
cause irreversible damage there.

Section 4.3 (page 46):
Measurement overview, extras
ViscoPump active rinsing: In this
process the rinsing liquid is

blown out under pressure after
pumping up by way of a reversi-
on of the running direction of the
rotary pump.

Please note the operating war-
ning on page 43. Section 4.8.2
(page 70): No thermostat type
identified

Please note: If an incorrect ther-
mostat type is input here, this
may lead to malfunction, since
the positions for transfer will not

match the so-called “taught-in”
positions. (Also refer to section
3.9.1.1 ff., learning function)

The system makes a basic distinction between various error types:

Fatal errors:

These will cause a termination of the program; as a rule, these are so-called runtime errors which may come with the indication of an error number. It is urgently recommended to communicate such errors including the error number, the wording of the message and, if possible, the circumstances leading to this error to SI Analytics GmbH.

Input errors:

As a rule, the program will detect such input errors which can be corrected if the information given is adhered to. In most cases, the text belonging to the possible input contains a piece of information telling which errors are possible. Input errors which may, for instance, have occurred by simply confusing digit strings (twisted figures etc.) cannot be detected

or corrected by the system as long as they stay within the plausibility limits. Likewise, erroneous settings of the parameters for the ViscoPumps or for the filling and air parameters for the viscometers cannot be detected as errors by the system as long as they stay within the limit values. It is up to the user to ensure that his input does not cause any harm in context with his specific application, or otherwise he should use the so-called default values (if such defaults are offered).

Timeout errors:

Errors of this type will be reported by the system, for instance, if the data communication between peripheral devices such as PLC, ViscoPump or similar devices did not occur within a fixed timely frame. In this case you should first check whether the corresponding peripheral device is correctly connected to the system or whether it is switched on at all (e.g. thermostat etc.).

Transmission error:

Sometimes the data transmission between the peripheral devices is disturbed; this may result in a message requesting the repetition of the corresponding command. In normal cases it is possible to continue to work.

Miscellaneous errors:

Under certain circumstances it may happen that you receive error messages which cannot be assigned to any of the above categories. In this case it is of major importance to communicate the exact wording, the error number if possible, and the circumstances leading to the error under concern to SI Analytics.

Below please find some examples.

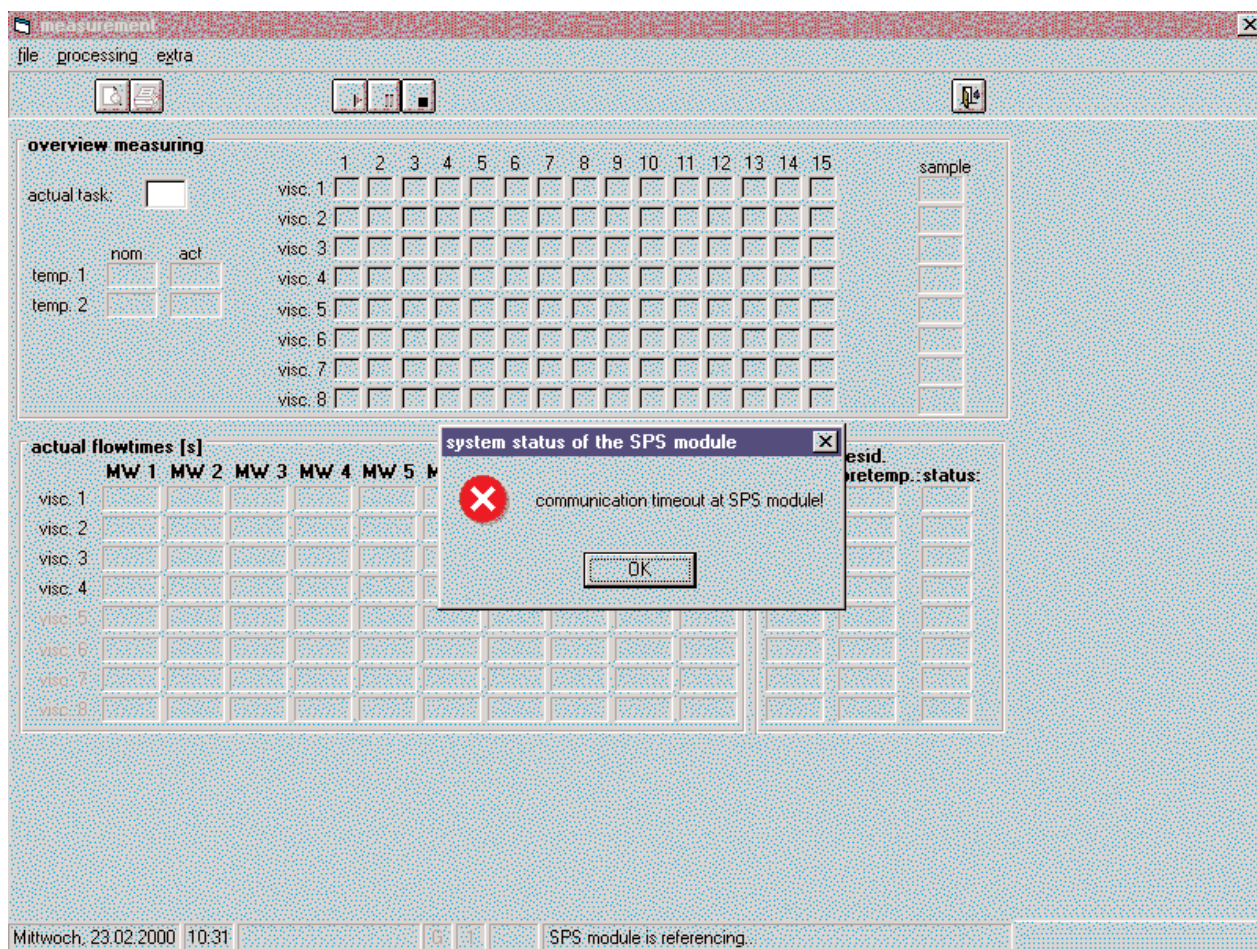


Fig. 81: Communication timeout

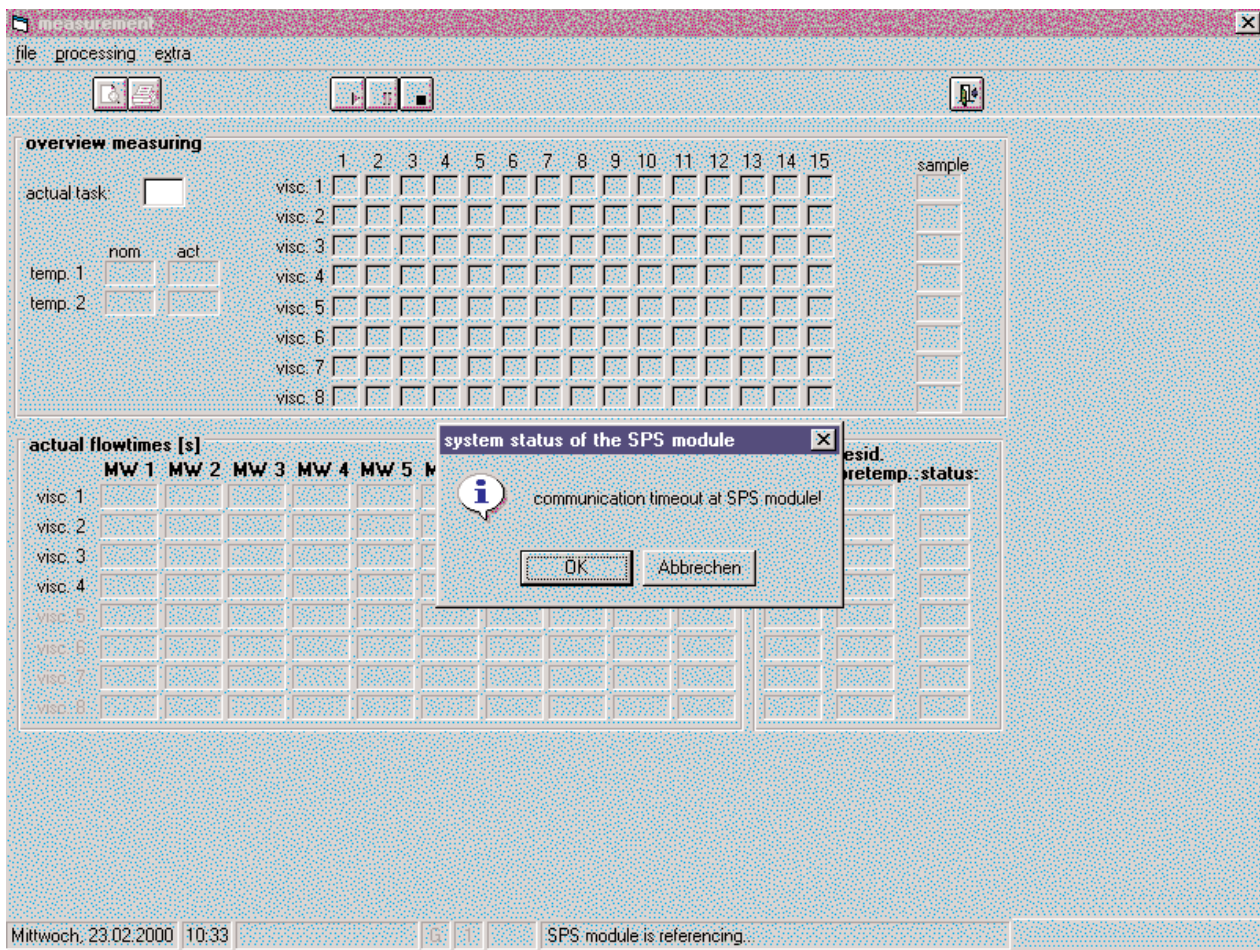


Fig. 82: Communication timeout: "Repeat transmission?"

A communication timeout may have several causes, a listing of which would not make sense here. As a principle, the question should be answered with "yes", since this will provide you with the possibility of resuming the program at the point where the error occurred.

The PLC is able to detect a series of errors and visualize them by using the LED panel U0 to U6 as a digital coding.

If an error does not disappear after repeated resetting the system or after eliminating an obvious error, e.g.: wrong positioning, stiffness of an axle etc. one have to inform the Servicedept.

of SCHOTT Instruments by naming the error code (error number), describing the circumstances it's appearance and the actions taken to eliminate this error.

u6	u5	u4	u3	u2	u1	u0	decimal	meaning
64	32	16	8	4	2	1		decimal value
					x		1	unknown P-code
					x		2	data range exceeded
					x	x	3	stack overflow
				x			4	unknown library function
				x		x	5	unknown operator
				x	x		6	overflow at type casting
				x	x	x	7	P-code not implemented
			x				8	array dimension konflikt
			x			x	9	array field range exceeded
			x		x		10	library function not implemented
			x		x	x	11	string length exceeded
			x	x			12	less memory for data range
			x	x		x	13	less memory for stack range
			x	x	x		14	less memory for Pcode
			x	x	x	x	15	MCM command error
	x						16	timeout on flashing
	x					x	17	error while deleting flash sector
	x				x		18	flash write protected
	x				x	x	19	check sum error in Pcode
	x		x				20	signatur at Pcode invalid
	x		x			x	21	less memory for eeprom range
	x		x	x			22	eeprom write protected
	x		x	x	x		23	timeout while eeprom programming
	x	x					24	exchange of variables: no response of target module
	x	x				x	25	exchange of variables: no valid target program loaded
	x	x			x		26	exchange of variables: invalid variable indicator
	x	x			x	x	27	exchange of variables: type mismatch
	x	x	x				28	exchange of variables: checksum error
	x	x	x			x	29	constant assignment not possible
	x	x	x	x			30	task already activ
	x	x	x	x	x		31	invalid signatur in eeprom
x							32	wrong memory assignment in eeprom
x						x	33	checksum error in eeprom
x					x		34	invalid motor number
x					x	x	35	not in use
x				x			36	error in module: assigning logical axis
x				x		x	37	error while movement of dosing unit
x				x	x		38	error while moving an axis
x				x	x	x	39	error while moving two axes simultaneously
x		x					40	FIFO overflow
x		x				x	41	not in use
x		x					42	not in use
x		x			x	x	43	not in use
x		x	x				44	not in use
x		x	x			x	45	not in use
x		x	x	x			46	not in use
x		x	x	x	x		47	not in use
x	x						48	not in use
x	x					x	49	not in use
x	x				x		50	not in use
x	x				x	x	51	function not present
x	x			x			52	wrong parameter
x	x			x		x	53	data range of function exceeded
x	x			x	x		54	limits of machine exceeded
x	x			x	x	x	55	reserved
x	x	x					56	limit switch approached
x	x	x				x	57	command ignored
x	x	x			x		58	polygon memory exceeded
x	x	x			x	x	59	write protected
x	x	x	x				60	not enough eeprom
x	x	x	x			x	61	program stack overflow
x	x	x	x	x			62	program not defined
x	x	x	x	x	x		63	invalid register index
x							64	transcription error
x						x	65	reply overflow
x					x		66	internal error
x					x	x	67	control deviation at Z-axis
x					x		68	reserved
x					x		69	reserved
x					x	x	70	commando SETADR not allowed
x					x	x	71	reserved
x			x				72	checksum error in program memory
x			x			x	73	checksum error in a register
x			x		x		74	checksum error at modul address
x			x		x	x	75	reserved
x			x	x			76	load circuit shutdown because of MCM overload

view of the LED panel of the PLC

u0	0	0	u1
u2	0	0	u3
u4	0	0	u5
u6	0	0	u7

Trouble shooting

Malfunction resulting from electrical or mechanical causes are not covered by the present operating instructions. Operational disturbances caused by the operating system of the AVSPro II device can be classified roughly in two categories.

9.1

Unrecoverable malfunction

System and runtime errors:

In these cases the user has to put down and tell the service department as accurately as possible the wording of the message appearing on the screen as well as the circumstances leading to this error message.

It can, however, not be excluded that some of these errors can be avoided by way of careful parameterisation, or by a reset, respectively.

Applicable to several timeout errors:

If the repetition of the transmission remains without success, an unrecoverable error is present in this case, too; please compare to section 8, "error messages".

9.2

Recoverable malfunction

Most of the recoverable operational disturbances can be attributed to erroneous input or incorrect parameterisation in of the ViscoPumps, the thermostats, or to an error in the positioning of the transfer station and erroneous viscometer data.

In most cases, erroneous input will not directly lead to operational malfunction, but will become obvious only during or after the measurement process.

Erroneous numerical input for: The major part of erroneous input leading to improper processes is prevented by a plausibility verification (for instance, input of 0 for a constant etc.). If, however, erroneous input is e.g. caused by a

shift of the decimal point, the program is, of course, unable to verify the admissibility of the value as long as the numerical value is within the plausibility limits.

Other known erroneous input includes the quantity details applicable to the rinsing of the viscometer. Since the absolute quantity of the sample is not known to the system, a too high number of rinsing processes

(with the next sample) may cause that an inadequate quantity of sample remains for the measurement, with the result that the ViscoPump will be excluded from the measurement process after a pre-programmed number of attempts.

In such cases it is up to the user to ensure the consistency of the numerical values.

9.2.2

Incorrect ViscoPump parameters

The input of incorrect parameters is critical with regard to the operation of the ViscoPumps. Below please find some examples:

• **ViscoPump parameters:**

Ramp value too high

• Viscometers size 0c, solvents dichloromethane:

Set ramp value

Ramp value 100%

• Error:

After a short time, the solvent will splash upward inside the capillary and trigger the upper optoelectric barrier, a condition which will frequently lead to error messages.

• Elimination:

Set the ramp value to the smallest value possible, then adapt it stepwise.

• **ViscoPumpparameters:**

Discharge time too short

• High toughness of the substance under test (for instance < 100 mm²/s) Evacuation time 30%

In this case, a part of the substance under test remains within the viscometer. After multiple filling processes, it may happen that the viscometer is over-filled, and the substance under test may reach into the thermostat bath; as a result, the measurement stations is removed from the process control for reason of automatic error detection.

In this case, error elimination can be made on-line.

• Elimination:

Set evacuation time to 150%, then adapt stepwise.

• **ViscoPumpparameters:**

Come off performance for the rinsing

In this context, please refer to the warning information contained in section 3.9.4

• **ViscoPump parameters:**

Sucking process over N1 too short

For all viscometers and substances under test

The standard methods, e.g. for Ubbelohde viscometers, require that the substance under test is sucked up at least up to half of the so-called fore-running ball. If this requirement is not met, there may be an incorrectness in the measurement results which may lead to noticeable deviations in the case of high-precision measurements.

• Elimination:

Extend the time in an adapted manner.

In principle, such an incorrect positioning is only possible if the “teach-in” function (please refer to section 3.9.1.1) was not run carefully enough. Such an incorrect positioning, however, may result from a series of prompts to be answered in the course of programming during operation without involvement of a viscometer.

Please compare to section 4.8.2, and figure 68:

At this point you are asked for the type of the thermostat used. Depending on the answer to this question (yes or no) the thermostat and thus the positioning to be used will be determined!

So if an incorrect thermostat type is input here, the mis-positioning-described below including a series of other malfunctions will occur as well:

The sample needle does not hit the docking station properly. Since the force used to perform this motion is set to a minimum by a limitation of current, no mechanical damage will occur, but the motion itself will be stopped. Since no feedback of the

positioning will occur, a wrong position will be assumed as a reference at the end of the positioning travel.

As a result, the backward movement will inevitably lead to the operation of the end-position switch. This will signal to the control that a malfunction is present, and all other motional processes will be stopped. This may lead to messages such as “Z reference travel impossible” appearing on the screen, and in the worst case no message at all will be generated, with the result that the system stops.

Please refer item 8.2: Error messages of the PLC

Elimination: The state of the end-position switch of the Z (vertical) axis can be read from the light-emitting diode of the respective end-position switch. In this case it is most likely that the upper (visible) end-position switch was operated, which can be seen from the fact that the light-emitting diode is off!

In this case, the axis under concern has to be moved out of this

position; preferably, all axes should be moved away from the position of the end-position switches. It requires then a certain mechanical force to move the axes against the power of motor and its holding moment.

As soon as the activation of the end-position switch is reset, the program can be started again without any problems.

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