



Anton Paar

Measure,
what is measurable,
and make measurable
that which is not.

Galileo Galilei (1564-1642)

Instruction Manual

Rheoplus Software

Volume 1 - Installation & Introduction

Software Version: 2.6x



Instruction Manual

Rheoplus Software
Volume 1 - Installation & Introduction

Software Version: 2.6x

While every precaution has been taken in the preparation of this document, **Anton Paar Germany GmbH** assumes no responsibility for technical or printing errors or omissions.

Nor is any liability assumed for damages resulting from the use of the information contained in this instruction manual.

Anton Paar Germany GmbH does not make a commitment to update the information in this manual. Specifications are subject to change without notice.

All rights reserved (including translation). No part of this document may be translated, reproduced or distributed in any form (print, photocopy, microfilm or any other process) without the prior written permission of **Anton Paar Germany GmbH**.

Trade marks may be used in this instruction manual without being marked as such. These are the property of their respective owners and are legally protected.

Published by **Anton Paar Germany GmbH**. Printed in Austria.

Copyright © 2005 **Anton Paar Germany GmbH**, Ostfildern, Germany.

Contact: **Anton Paar Germany GmbH**
Helmuth-Hirth-Str. 6
D-73760 Ostfildern / Germany
Tel: +49 711 720 91-0
Fax: +49 711 720 91-630

E-mail: info.de@anton-paar.com
Web: www.anton-paar.com

Date: October 2005

Document number: B64ib50-h

Contents

- 1 Introduction 11**
- 2 Safety Instructions..... 13**
- 3 Symbols 15**
- 4 System Requirements 17**
- 5 Software Installation and Update 18**
 - 5.1 Installation Package..... 18
 - 5.2 Installation 18
 - 5.3 Software Update..... 20
- 6 Finishing the Installation..... 21**
 - 6.1 Installing Accessories 21
 - 6.1.1 Installing New Accessories..... 21
 - 6.1.2 Importing Accessories from a Previous Software Version 22
 - 6.2 Installing Measuring Systems 23
 - 6.2.1 Installing New Measuring Systems 23
 - 6.2.2 Importing Measuring Systems from a Previous Software Version 24
 - 6.3 Installing Analysis Methods 24
 - 6.4 Installing Languages..... 25
 - 6.5 Installing a Printer..... 25
 - 6.6 Installing and Connecting a Measurement Device 26
- 7 Getting Started 27**
 - 7.1 Setting up a Workbook 27
 - 7.2 The Measurement Window..... 29
 - 7.3 The First Measurement..... 30
 - 7.4 Frequently Used Measurement Methods..... 32
- 8 Presentation of Measurement Results in Tables and Diagrams 35**
 - 8.1 Adding and Removing Data Series in Diagrams and Tables..... 35
 - 8.2 Changing the Table and Diagram Settings..... 36
- 9 Managing Templates and Configurations 37**
 - 9.1 Workbook Templates..... 37
 - 9.2 Configurations..... 38
- List of Figures 39**
- Index..... 41**



1 Introduction

Thank you for using the Rheoplus software.

This manual describes the installation and setup of the Rheoplus software. Further, it guides you through the first steps when starting to work with the program.

The complete documentation of the Rheoplus software consists of five volumes as listed below:

Volume 1 - Installation and Introduction

Volume 2 - Reference manual

The second volume goes into detail and describes all the functions of Rheoplus with the exception of the drivers and analysis. The driver functions can be found in the device driver manuals or in the instrument manuals.

Volume 3 - Analysis

The analysis of measurement data is described in this volume. There are a number of mathematical and rheological evaluations available for both rotational and oscillatory measurements. The manual describes the method of calculation as well as the necessary input and output data.

Volume 4 - Device drivers

This volume describes the installation of the instrument drivers, the general settings for the instrument and the selection of accessories and measuring systems. The drivers are specific for each instrument and need to be installed prior to the operation of any instrument:

Volume 5 - Software options

The Rheoplus software offers a number of options for special applications or requirements such as 'CFR 21 Part 11', 'LIM SAP' interface or the control of the automatic sample changer.

These manuals assume that you are familiar with Microsoft Windows. If you require more information on Microsoft Windows the tutorial or the Windows manual is recommended. Functions common to all Windows programs are not usually explained in these manuals, you are therefore referred to the documentation that came with your operating system.

If you require further assistance or would like to make any suggestions you are welcome to contact our local representative or Anton Paar Germany GmbH directly.

July 2004

Anton Paar Germany GmbH



2 Safety Instructions

Make sure you read and understand all the safety instructions given in this section and throughout the manuals before installing and operating the equipment. Follow the instructions in this manual at all times.

The manual contains important advice and warnings. Read them carefully and follow all instructions to avoid danger to yourself and others and / or damage to the equipment.

General Information

- The Rheoplus software by Anton Paar Germany GmbH has been developed for controlling Anton Paar and Physica rheometers and viscometers. It is used for the recording, evaluation and presentation of measurement data.
- All measurement data obtained with this equipment should be checked for plausibility before consequential actions are taken based on this data.
- Before using the software read all safety instructions and information regarding the use of the equipment. Follow the instructions at all times.
- Anton Paar Germany GmbH and its suppliers shall not be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising from the use or inability to use this product, even if Anton Paar Germany GmbH has been advised of the possibility of such damages. In any case, Anton Paar Germany GmbH's liability shall be limited to the amount actually paid by you for this product. This limitation does not apply to damages which were caused by Anton Paar Germany GmbH with intent or due to gross negligence. Likewise, claims which are based on mandatory legal rules regarding product liability remain unaffected.



3 Symbols

The following symbols will be used in this manual:

**Warning:**

A section marked with this sign contains important information. Read the section carefully and follow all instructions. Disregarding the information may lead to injuries and / or damage to the equipment.

**Important:**

A section marked with this symbol contains important information on how to handle the equipment and ensure the reliability of the measurement results. Disregarding this information may cause damage to the equipment.

**Hint:**

A section marked with this symbol contains additional information.



4 System Requirements

To use the Rheoplus software we recommend the following computer configuration (minimum requirements are given in parenthesis). These data are given for the Rheoplus software only, please also check the requirements for your computer's operating system.

- Processor: Pentium II or higher

(Pentium 166 MHz. It is not recommended to use a slower computer as this may result in disruptions and communication problems.)
- Memory (RAM): see the specifications for your operating system
- Free hard disk space: 30 MB

(30 MB; in addition to this you need space to store your measurement data)
- Monitor / graphics card: 17" color monitor; 1024x768 resolution

(Any monitor on the Windows compatibility list.)
- Operating system: Windows 2000 and Windows XP
- Mouse: required, see Windows compatibility list
- Keyboard: required, see Windows compatibility list
- Interfaces: All instruments - except the UDS 200 and the instruments of the Physica MCR xx1 series - require a free serial port. In some cases a further serial interface for a temperature controller might be necessary. The UDS 200 requires a GPIB interface which is delivered with the instrument. The instruments of the Physica MCR xx1 series can be connected via Ethernet or via a serial port.
To use the Ethernet connection of the Physica MCR xx1 series a network interface card or a network connection is required. Further, the TCP/IP protocol needs to be available.
If you want to run several instruments from one computer, additional interfaces are required. Please note that all serial ports must use different interrupts. This requires a change of the Windows default settings (by default Com1 / Com3 and Com2 / Com4 share an interrupt).
- Printer: A printer is not necessary for the operation of the software but it is recommended for effective use of the Rheoplus software. Any printer on the Windows compatibility list is suitable. Networked printers can also be used with the Rheoplus software.

5 Software Installation and Update

5.1 Installation Package

The Rheoplus software installation package includes the following:

- Installation CD with software installation files and manuals. The software manuals can be read using Acrobat Reader (also available on the CD).
- Certificate containing the software license and installation code (serial number) for the software, installation codes for device driver(s), analysis methods and software options. The number and type of these depend on your order.

These certificates are the proof of your ownership of the software. Therefore, store these documents in a safe place. The software serial number is required when ordering updates.

Please read the license agreement before opening the envelope with the installation CD. By opening the envelope you are accepting the software licence.

5.2 Installation

This chapter gives a detailed description of the installation procedure of the Rheoplus software. Information about updating an existing version can be found at the end of the chapter.

1. Start the computer and the operating system and insert the CD.
2. The installation CD will start automatically and display a dialog box in which you can choose your language. Select the language and click 'OK' to proceed or 'Cancel' to abort the installation.
If the autorun feature is disabled on your computer go to 'Start | Run', type `x:\cdinst.exe` (where x is the drive letter for your CD drive) and click 'OK' to start the installation.



Hint:

It is recommended to close all other applications before you start the installation.

3. Select 'Install Rheoplus Software' to start the installation.
4. Select the language for the software installation and click 'Next'.
5. Carefully read the license agreement and click 'Yes' to proceed with the installation. 'No' will cancel the installation procedure.
6. Select the directory in which you want the software to be installed. It is recommended to use the default directory.
If you are updating your software and would like to keep both versions you should select a different directory for the installation of the new software. Please note that Rheoplus software data files will always be associated with the newest version. The older version can only be started with the program icon.
Click 'Next' to proceed with the installation.
7. Enter the software installation code provided with the installation package.
It is possible to install a demonstration version without the installation code. Please note that the demonstration version has a limited number of functions; measurements or and analysis methods cannot be run and it is not possible to store data.
Click 'Next' to proceed with the installation.
8. You will be prompted to install the new version with the previously entered serial number. If you are doing an update of an older version you are asked to confirm that you want to overwrite the existing installation.
Click 'Next' and confirm overwriting when prompted.
9. Select the program folder or use the default, then click 'Next' to continue. In the next dialog you can check the selected settings. 'Next' will start the installation, 'Back' returns to the previous dialog box and 'Cancel' aborts the installation.
10. After the installation files have been copied, the installation program will prompt you to install the device driver. Select your instrument from the list on the left-hand side of the dialog box and click 'Add'.
11. Enter the device driver code (extended serial number) and click 'OK'.
12. Select the port or other suitable connection when prompted and click 'OK'.
Then click 'Quit'.
13. Click 'Finish' to complete the installation.

You can now start the software. Before you can work with the software, some basic settings have to be made. The installation of accessories, measuring systems and additional analysis methods is carried out in the Rheoplus software. Please continue with chapter 6.

5.3 Software Update

When installing an update in the same directory, the existing analysis methods and device drivers remain installed.

When updating software version 1.90 or lower please note that these versions did not use serial numbers and are therefore not recognized by the setup program for the current version.

We recommend renaming the directory in which the old version has been installed and installing the new version in the default directory. Start the Windows Explorer, go to your current install directory and rename it c:\usold. After that you can start the installation of the new version; you should use the default directory for installation.

After the installation you can import your measuring system settings from the old version as follows. Start the Rheoplus software, go to 'Tools | Setup | Device and Accessories' and select the tab 'Meas. Systems'. Then click 'Import'. Select the installation directory for the old version and select the file mesystem.pms in the sub-directory \Data. Click 'Merge' ('Open') to import the file. Now the new installation is set up to use the previous measuring system settings. This procedure is usually only necessary if you have special measuring systems. All standard systems are included in the setup of every new software version.

6 Finishing the Installation

Depending on the software configuration that you have bought and the instrument you are using, some additional settings have to be made in the Rheoplus software after the installation. The settings described in this chapter have to be selected to be able to use the software. If you are using an instrument of the Physica MCR xx1 series with accessories and measuring systems delivered with the instrument, you can skip chapters 6.1 and 6.2.

6.1 Installing Accessories

Accessories are e.g. measuring cells, temperature control systems and water baths. Please check which accessories you will use (delivery note, type label). The installation is not necessary for instruments of the Physica MCR xx1 series as these recognize accessories delivered with the instrument automatically.

6.1.1 Installing New Accessories

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Device and Accessories'.
2. Select the tab 'Accessories' and click 'Install'.
3. Highlight the appropriate accessory group. A list can be found below. If you are not sure which group to select, refer to the relevant accessory manual where you will find detailed information.
 - *Circulator / Thermostaten: Physica VTxxxx, ...*
includes fluid circulators, both from Anton Paar Germany GmbH and from some other manufacturers
 - *Controller - TCxx, PS-DC, Switchbox, Relay, HVS, MKTxxx, Sensors*
includes analog devices such as fluid circulators and temperature controllers. Power supply units for special accessories and special sensors can also be found here.
 - *Meas.Cells / Messzellen: MCR Series, DSR Series*
includes all measuring cells for the Physica MCR Series, e.g. Peltier lower plates or cylinder systems
 - *Meas.Cells / Messzellen: MCRxx1 Series*
includes all measuring cells for the Physica MCR xx1 Series

-
- *Meas.Cells / Messzellen: UDS200, RheoLab, LS100 - TEK/Zxxx*
includes all measuring cells for all other Physica rotational rheometers such as the UDS 200, the MC 1 or the MC 20
4. Highlight your accessory in the list of predefined accessories and add them by clicking the arrow button (or use a double-click). It is possible to highlight several accessories by using <Ctrl> or <Shift>.
 5. Repeat steps 3 and 4 for each accessory (group) as necessary. If you install an accessory by mistake, highlight it in the list of installed accessories and click 'Delete'.
 6. After all accessories have been installed, click 'OK' to close the dialog box.
 7. If you are going to proceed with the installation of measuring systems, leave the configuration dialog box open, otherwise close it with 'OK'.

6.1.2 Importing Accessories from a Previous Software Version

If you are updating the software but have installed the update in a directory different from that of the previous version, you can import all accessory settings from the previous version.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Device and Accessories'.
2. Select the tab 'Accessories' and click 'Import'. Choose the sub-directory \data in the installation directory of the previous software installation.
3. Select the file 'zusatz.pzg' and open it. All accessories defined in the previous version will be installed in the new version.
4. Click 'OK' to close the configuration dialog box.

6.2 Installing Measuring Systems

Please check which measuring systems you will use. The name of the measuring systems can be found on the measuring system box or the measuring system itself. The installation is not necessary for instruments of the MCR xx1 series as these recognize measuring systems delivered with the instrument automatically.

6.2.1 Installing New Measuring Systems

**Warning:**

If you edit the measuring system settings, take the utmost care to enter the values as given on the measuring system data sheet. Always make sure that the correct constants are entered in all fields, especially the CSS factor and the CSR factor. If these factors are not correct all your measurement data will show the wrong values.

It is extremely important to enter the correct lengths for the measuring system. Incorrectly entered values can result in damage to the instrument and measuring system.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Device and Accessories'.
2. Select the tab 'Meas. Systems' and click 'Install'.
3. Highlight the appropriate measuring device group.
4. Highlight your measuring system in the list of predefined measuring systems and add it by clicking the arrow button (or use a double-click). It is possible to highlight several measuring systems by using <Ctrl> or <Shift>.
5. Repeat steps 3 and 4 for each measuring system (group) as necessary. If you install a measuring system by mistake, highlight it in the list of installed measuring systems and click 'Delete'.
6. In the configuration dialog box, highlight the installed measuring system and click 'Edit'.
7. Check the values against those given on the measuring system data sheet and change the software values according to the data sheet, if necessary. Then click 'OK'.
8. Repeat steps 6 and 7 for each installed measuring system.
9. After all measuring systems have been installed and checked, click 'OK' to close the dialog box.

6.2.2 Importing Measuring Systems from a Previous Software Version

If you are updating the software but have installed the update in a directory different from that of the previous version, you can import all measuring system settings from the previous version.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Device and Accessories'.
2. Select the tab 'Meas. Systems' and click 'Import'. Choose the sub-directory \data in the installation directory of the previous software installation.
3. Select the file 'mesystem.pms' and open it. All measuring systems defined in the previous version will be installed in the new version.
4. Click 'OK' to close the configuration dialog box.

6.3 Installing Analysis Methods

All standard analysis methods are installed automatically. The procedure described in this section has to be carried out only if you have ordered additional analysis methods protected by a serial number. The serial numbers and the names of the analysis methods can be found on your software certificate.

Analysis methods protected by a serial number are marked with < * > in the list of installable methods; all other methods are installed by default.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Install Analysis Modules'.
2. Highlight the analysis module you wish to install and click 'Add'.
3. Enter the serial number as given on your software certificate and click 'OK'.
4. If the selected module includes several methods, you can select the required methods in the dialog box which opens after you click 'OK'.
5. Select the methods you wish to install and click 'Install'.
6. Repeat steps 2 to 5 until all additional analysis methods have been installed, then click 'Quit' to close the installation dialog box.

6.4 Installing Languages

Every standard installation of the Rheoplus software can be run in English or in German; the language selection is dependent on the regional settings in your operating system. Additional languages can be installed in the software. The software uses the language corresponding to the regional settings, if the language is available, otherwise English will be used. Please ask our local distributor if a required language is not available.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Install Language Libraries'.
2. Highlight the required language in the list and click 'Add'. Use the button 'Path' to choose the location of the language files if they have been delivered separately from the main installation CD.
To change the default font, click on the corresponding button and select font, size, style and so on. The variable font is e.g. used for dialog boxes, diagrams and tables. For languages that do not use Latin letters, the appropriate font has to be selected here to make sure that the dialog boxes contain the correct font. For the 'Font in Dialogs' the user selected font is the default setting. If 'System font' is selected, the settings from the operating system are used. If 'Dialog Resource' is selected, the programmed font will be used.
3. Click 'OK' to close the dialog box.

6.5 Installing a Printer

The Rheoplus software allows you to install and set up different printers for tables, graphics and applications (report sheets). The printer installation requires that a printer (or printers) has already been installed on the operating system.

1. Start the Rheoplus software, if it is not running already, and go to 'File | Printer Setup'.
2. Select the entry ('Text', 'Graphics' or 'Application') for which you want to install the printer.
3. Select the required printer from the list and make the necessary settings. Please note that the values for the margin are added to those defined in the Windows printer setup. The 'Setup' button gives access to the Windows printer setup.
4. Click 'OK'.
5. Repeat steps 2 to 4 for all printers that you want to install.

6.6 Installing and Connecting a Measurement Device

This step is only necessary if you have not installed the measurement device during the software installation or if you want to install additional instruments.

1. Start the Rheoplus software, if it is not running already, and go to 'Tools | Setup | Device and Accessories'. Click 'Install'.
2. Highlight the device in the list on the left hand side of the dialog box and click 'Add'.
3. Enter the extended serial number when prompted and click 'OK'.
4. Select the port when prompted and click 'OK'.
5. Click 'Quit' to close the dialog box, then click 'OK' to close the configuration dialog box.

7 Getting Started

In this chapter, it is assumed that all necessary settings have been made in the software, as described in the previous chapters. It is further assumed that the measuring device and all accessories have been installed and started.

The descriptions in this chapter are rather general. Many settings depend on the instrument, accessories and measuring systems. For an introduction to rheology and to the measurement of rheological properties, the 'Rheology Handbook' by Thomas Mezger (ISBN 3-87870-745-2) is recommended.

7.1 Setting up a Workbook

A workbook is a file, similar to an Excel™ worksheet, that contains the settings for the measurement device, the presentation windows, the measurement parameters and the settings for the data evaluation. It can also contain measurement and analysis results.

Workbook templates are available for all standard types of rheological measurements and for a large number of applications. These templates contain parameters and presentation windows suitable for the selected measurement.

1. Go to 'File | New' or click the 'Create Workbook' button.
2. In the RheoManager, select the tab for your application or for the measurement type you want to use.

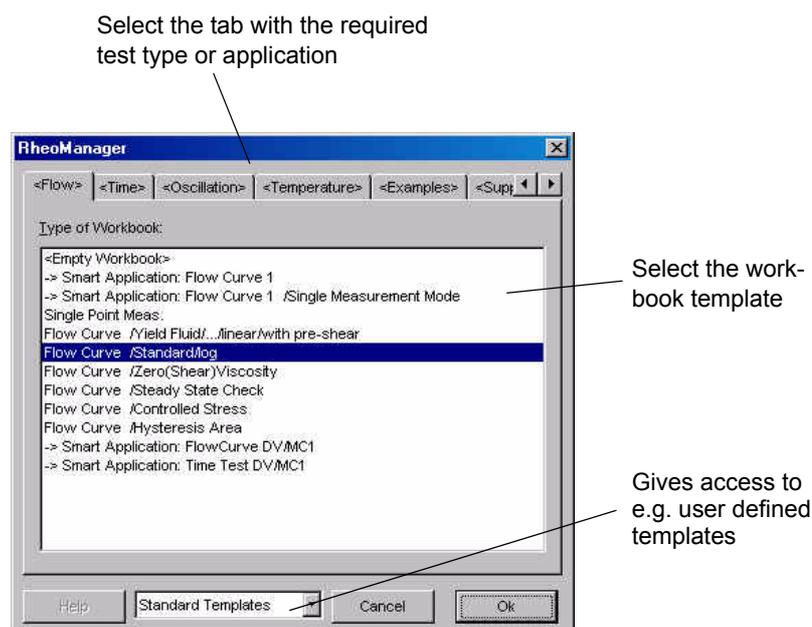


Fig. 7 - 1 RheoManager (selection of workbook templates)

3. Select the measurement that you want to carry out from the list and click 'OK'. A workbook containing appropriate measurement parameters, diagram and table windows will be created.
4. When prompted to select a configuration, select the default file (rheoplus.hcf) and click 'Open'. If you have selected a measurement type not suitable for your device, an error message is shown.
5. Each template contains a workbook assistant that can guide you step-by-step through the setup procedure. You can either use this guide or edit the settings (measurement parameters, analysis, presentation windows) by yourself. The measurement window is described in chapter 7.2; for information on the other window types please see volume 2 of the software manual.
6. Save the workbook after you have made all settings. A detailed description of the different sub-windows (measurement window, table, diagram...) can be found in volume 2 of the software manual. A description of the device driver (where the selection of measuring system and accessory is made, for example) can be found in volume 4 of the software manual. Please refer to the section relevant for your measuring device.

7.2 The Measurement Window

The measurement window contains all parameters that are necessary to carry out a measurement e.g. shear rate or shear stress, temperature and time settings. You can define any type of test and change the number of intervals. The intervals will be carried out one after the other when the measurement is started.

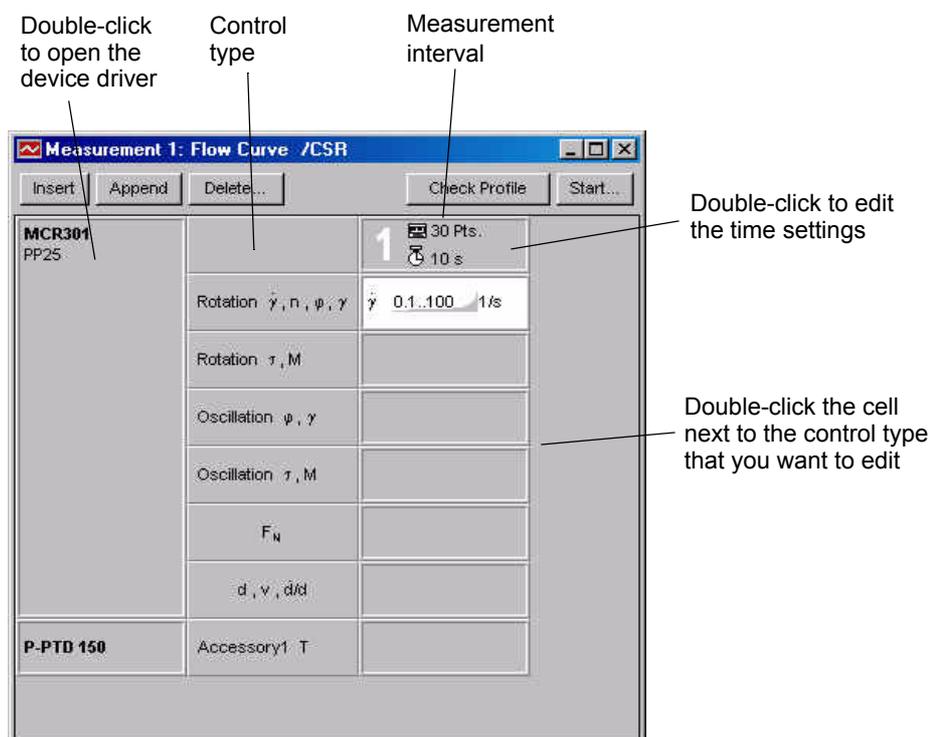


Fig. 7 - 2 Measurement window - Example

If you double-click the cell where the device name or accessory name is shown, the device driver will be opened.

If you have selected one of the predefined measurement types the software will already have selected the measurement type for you and entered some default values. Please note that these values are not necessarily the right ones for your sample and may have to be adapted to your sample.

- Double-click the cell for the control type you would like to use and edit the parameters, e.g. shear rate, and select whether to use constant values or a range. Make sure that 'Active' is checked.
- Double-click the time setting field and enter the number of measurement points you would like to be recorded. If you have selected a fixed measurement point duration you also need to set up the measuring time for each point. The interval duration gives the total length of the measurement.

If you are using variable measurement point duration, enter the initial and final value. In most cases, a logarithmic setting is recommended.

- In the time setting dialog ('Data generation') you can also set the adjusting time and the number of raw values that will be used for data point generation. In most cases, these settings do not need to be changed as the automatic setting provides good results.

If you decide to use manual settings, make sure that the sum of the adjusting time and mean value does not exceed the measurement duration for each point.

The *adjusting time* is the time the instrument takes to reach the selected value of the control quantity, e.g. shear rate. You can use the automatic setting or set a value yourself. The adjusting time depends on your sample and should be at least a few seconds.

The *number of mean values* decides how many raw values are used by the software to calculate the presented result. The instrument is capable of reporting 500 points per second (2 ms per point). The mean value time is usually longer than the adjusting time and should be increased if the results show a lot of noise. The more raw data points for the calculation, the better the presented data. Also, make sure that the number of raw values is selected in a way that always the last part of the measurement point duration is used; this is to prevent transient effects at the start-up of the measurement influencing the results.

Please note that for oscillatory measurements one raw value corresponds to one sine wave. The automatic setting usually gives good results and can always be used for oscillatory measurements.

7.3 The First Measurement

This chapter describes the general procedure for a measurement. For the handling of special accessories, refer to the relevant accessory manual.

1. For instruments of the Physica MCR or MCR xx1 series, go to the device driver (button with the instrument symbol) and click the button 'Initialization'. For other instruments, this step is not necessary.
2. Open the device driver, if the dialog box is not open yet.
3. Select the measuring system and measuring cell. For instruments that use a serial device, select this as well. The location of the settings depends on the instrument you are using. For detailed information, please refer to the relevant device driver manual and, possibly, the accessory manual.
4. Enter a temperature value and click 'Set' unless you are operating the temperature control unit manually.

5.
 - A. If you are using a plate-plate or cone-plate system, mount it and start the zerogap procedure. For the instruments of the Physica MCR and MCRxx1 series, this procedure is carried out by the software. For these instruments click 'Zerogap' in the device driver. For other instruments set zero gap manually. Then move to the measuring position.
 - B. If you are using a concentric cylinder system, insert the cup into the measuring cell and mount the measuring system. Then move to the measuring position.
6. Wait for thermal equilibrium.
7. Move up the measuring system and load the sample. The required amount of sample depends on the measuring system, it can be found in the dialog box for editing measuring systems ('Tools | Setup | Device and Accessories'). The cup of the cylinder systems has a marker for the filling height. For a plate-plate or cone-plate system always use a slightly higher amount than the nominal value.
8.
 - A. With a plate-plate or cone-plate system, move to the measuring position. If the instrument has automatic gapsetting, it will stop at the trimming position automatically. With the other instruments, stop 50 μm above the measuring position. Trim the sample and move to the measuring position.
 - B. With a concentric cylinder system, insert the cup and move to the measuring position.
9. Close the measuring cell (if applicable) and wait for thermal equilibrium.
10. Start the measurement using the start button in the measurement window or the arrow button in the toolbar. Enter the information into the start dialog box and click 'Start'. It is possible to define a thermal equilibrium time in the start dialog box instead of waiting for the equilibrium.
11. Wait for the measurement to finish. The workbook is stored periodically during the measurement and after the measurement has been finished. The measured data can be analyzed using the method suggested in the workbook or a user-selected method. A detailed description of the analysis window and the analysis methods can be found in volume 3 of the software manual. For an introduction on how to change the presentation windows (table, diagram) please refer to chapter 8.
12. Release the measuring system, move up the instrument head (if applicable) and remove the sample.

7.4 Frequently Used Measurement Methods

In the following section you will find a list of some frequently used measurement types and their area of application.

In general, you have to choose between rotational and oscillatory tests. Rotational tests give information about the behavior at large deformations such as pumping, stirring or brushing; oscillatory tests allow you to analyze the structure of the material at rest and can thus give information about e.g. storage stability, elasticity or behavior over long time scales.

Rotation with shear rate or strain control ($\dot{\gamma}$, n , ϕ , γ)

- **Flow curve**
A flow curve is used to measure the flow properties of a material. These properties are of interest e.g. for pumping, stirring, swallowing or coating. The selected shear rate range should correspond to the application. A typical setting is a logarithmic shear rate ramp at a constant temperature. The measuring point duration can be estimated using the reciprocal value of the shear rate.
- **Temperature ramp**
The sample is measured at a constant shear rate in a temperature interval that is of interest for the application. The result describes the influence of the temperature on the flow properties of the material.
- **Time test**
The sample is measured at a constant shear rate and constant temperature. With this type of test, time-dependent changes in the material can be measured, e.g. gelling or curing.
- **Stress relaxation**
In this test, a constant deformation is applied to the sample over a certain period of time; the stress necessary to sustain this deformation is measured. The results give information about the viscoelastic behavior of a material. They can also be used for the calculation of the relaxation time spectrum which in turn may be used to calculate the molar mass distribution.

Rotation with stress control (τ , M)

- **Stress ramp**
An increasing stress is applied to the sample at a constant temperature. The results may be used for the calculation of the yield stress using the yield stress analysis methods. At stresses above the yield point, the flow behavior is measured.

- **Creep or Creep recovery**
In a creep test, a constant stress is applied to the sample and the resulting strain is measured. In a creep recovery test, a second interval is added in which the stress is set to zero and the change of the strain is measured. The stress should be set so that the maximum strain reached during the creep phase is inside the linear viscoelastic range.
The creep recovery test gives information about the viscoelastic behavior. It is rarely used because the same information can be gained in oscillatory tests. Previously, the creep test was used to be able to measure at very low shear rates.

Oscillatory tests with strain control (ϕ, γ) or stress control (τ, M)

- **Amplitude sweep**
The sample is measured at a constant frequency (usually $\omega = 10$ 1/s) with increasing strain or stress. The temperature is kept constant. The resulting values are storage modulus (G'), loss modulus (G'') and phase shift ($\tan\delta$). The data give information about the viscoelastic properties, e.g. whether a material is mainly elastic or mainly viscous and its structural strength. Further, the strain range for the linear viscoelastic range (LVE) can be determined. Inside this range, the material properties are independent of the applied strain which means that the sample structure is not influenced by the measurement. Therefore, information about the sample structure can be obtained with measurements inside this range. All test types that are used to gain information about the structure of a material at rest should be carried out inside this strain range.
- **Frequency sweep**
In a frequency sweep, the sample is measured at a constant deformation and constant temperature in a range of frequencies. The results give information about the behavior of a material over different time scales (high frequencies - short times, low frequencies - long times). These data can also be used to calculate the relaxation time spectrum and the molar mass distribution.
- **Temperature ramp**
The sample is measured at a constant frequency and deformation (inside the LVE) in a temperature interval that is of interest for the application. The result describes the influence of the temperature on the sample structure.
- **Time test**
The sample is measured at a constant frequency, deformation (inside the LVE) and constant temperature. With this type of test, time-dependent changes in the material can be measured, e.g. gelling or curing.

Mixed test types

- Three Interval Thixotropy Test (3ITT)

The 3ITT test consists of three intervals:

- 1st interval: low shear rate or strain inside LVE at a constant frequency
- 2nd interval: high shear rate (corresponding to application)
- 3rd interval: as in first interval

The first interval is used as a reference because here the material is measured at rest. In the second interval the structure of the material is destroyed. In the third interval the material is measured at rest again and the degree and speed of the structural recovery can be measured. If possible, the combination oscillation-rotation-oscillation should be used because the available information in the measurement data allows a more precise explanation of phenomena observed in the application. For a coating application, for example, the material is mainly viscous, it can flow, during and directly after the shearing. For a high quality coating, the properties need to change from mainly viscous to mainly elastic after a certain time. This time as well as the degree of recovery can be determined using this type of test.

8 Presentation of Measurement Results in Tables and Diagrams

The default templates include table and diagram windows suitable for the selected test type. You can create additional windows to show different information, add data to existing windows and edit the properties of the windows. In this chapter you will find a description of the most common tasks; detailed information can be found in the relevant chapter in volume 2 of the software manual.

8.1 Adding and Removing Data Series in Diagrams and Tables

Diagrams and tables show, by default, the current measurement and current analysis. Whenever you start a new measurement, the displayed data will change to the new measurement. Data series that are shown in a presentation window (diagram or table) are marked with a check mark '✓' in the datapool.

To **add a data series** to a presentation window, check the box next to the data series in the datapool. The data series will be shown in the currently active diagram or table. To **remove a data series** from a presentation window, uncheck the data series in the datapool.

To display only parts of a data series, right-click on the presentation window and click 'Select Viewing Data' or click the toolbar button for the data selection to open the dialog box shown below.

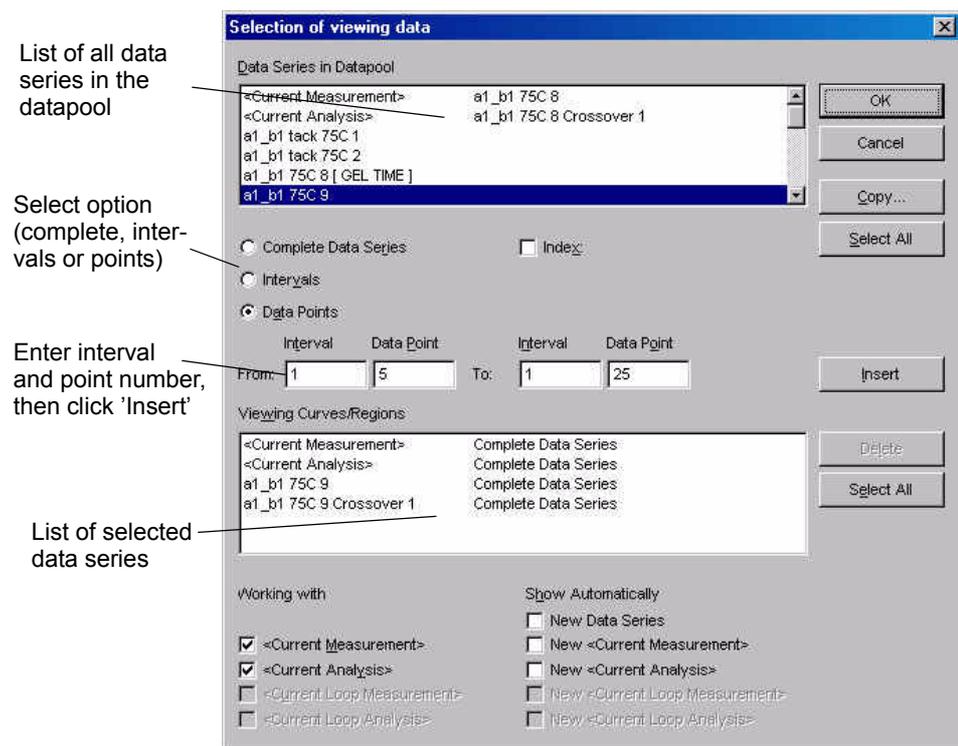


Fig. 8 - 3 Selection of data series for presentation in tables and diagrams

8.2 Changing the Table and Diagram Settings

The tables and diagrams in the default templates contain settings suitable for the selected method. Additional windows can be created using 'Insert | Diagram Window' or 'Insert | Table Window'. The new window can be selected from a list of templates.

To change e.g. the variables shown in a table, double-click on the table. In the dialog box you can select additional variables from the list and add them to the displayed variables. The amount of information in the table header can also be changed by checking the appropriate settings in this dialog box.

In a diagram, you can change the axis settings (adding an axis, changing the variables) by double-clicking on any axis in the diagram.

To edit the marker and color for a curve, double-click on the curve. The dialog box that is opened allows you to choose these settings separately for each curve.

Detailed information on the available settings in the presentation windows can be found in volume 2 of the software manual.

9 Managing Templates and Configurations

In general, a workbook template contains the device with a suitable configuration as well as the settings for measurement, analysis and presentation windows. The default templates have been stored without a device to make sure that they can be used for any device. It is possible to define user templates and have them shown in the RheoManager.

A 'configuration' (file extension *.hcf) is a file that contains all information about the setup of a measuring device, e.g. measuring system, accessory or parameter settings. This setup can be exported from a workbook, stored as a separate file and applied to another workbook or workbook template.

9.1 Workbook Templates

The purpose of a template is to protect e.g. the measurement method and the evaluation and display of measurement data. When a template is opened, a new workbook containing all the settings from the template is generated.

1. To create your own workbook templates, set up the workbook including the settings for the instrument, the measurement parameters, the analysis window (if any) and the presentation window.
2. Go to 'Tools | Options | Default Paths', select a path for templates and click 'OK'. This setting has to be chosen only once.
3. Go to 'File | Save as Template' and enter a filename. The software will automatically choose the default directory for the templates.
4. Click 'OK' to save the new template.

Next time you start the RheoManager ('File | New') select 'User Templates' from the listbox to display the newly created template(s).

To sort the templates, create sub-directories in the default directory. Each sub-directory that contains at least one template will be shown as a separate tab in the RheoManager.

9.2 Configurations

In many cases, a complete device setup contains a lot of different settings that have to be made in various places in the device driver. Recreating these settings manually in a new workbook can be time consuming. It is therefore recommended to set up the instrument once and save the configuration.

1. If no device has been selected in the workbook yet, go to 'Measuring Device | Select Device'.
2. Highlight the device in the list and click 'OK'.
3. Go to 'Measuring Device | Edit Setup' and make all required settings. Click 'OK'.
4. Go to 'Measuring Device | Save Setup', select the path or keep the default path, enter a filename and click 'Save'.
5. To apply the configuration to a new workbook, go to 'Measuring Device | Load Setup' in that workbook. Select the configuration file and click 'Open'.

List of Figures

Fig. 7 - 1	RheoManager (selection of workbook templates)	27
Fig. 7 - 2	Measurement window - Example	29
Fig. 8 - 3	Selection of data series for presentation in tables and diagrams	36

Index

I

- installation
 - analysis method 24
 - languages 25
 - measuring device (software installation) 26
 - measuring system 23
 - printer 25
 - software 18

R

- requirements 17

S

- Safety instructions 13

U

- update 20

