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

Instruction Manual

Rheoplus Software

Volume 4 - Device driver
Physica MCR Series

Software Version: 3.0x
# Contents

1 Introduction ........................................................................................................................................ 6
2 Safety Instructions ............................................................................................................................. 7
3 Symbols in the Instruction Manual .................................................................................................. 8
4 Installation ........................................................................................................................................ 9
   4.1 Installing and Connecting a Device Driver ................................................................................. 9
   4.2 Setting up an Ethernet connection ............................................................................................ 10
   4.3 Removing a Device Driver ........................................................................................................ 11
5 Control Panel (Device Setup) .......................................................................................................... 12
   5.1 'Control Panel' ......................................................................................................................... 13
   5.2 'Configuration' ......................................................................................................................... 15
      5.2.1 Measuring system and Measuring Cell .............................................................................. 15
      5.2.2 Toolmaster options ............................................................................................................ 15
      5.2.3 Temperature Controller ..................................................................................................... 16
      5.2.4 Analog Output .................................................................................................................... 18
      5.2.5 Relay / Auxiliary ................................................................................................................. 19
   5.3 'Gapsetting' .............................................................................................................................. 19
      5.3.1 Profiles ............................................................................................................................. 19
      5.3.2 'Details' ............................................................................................................................. 20
      5.3.3 Settings (Measuring Position, Lift Position, NF Hysteresis for Measurement) .............. 21
      5.3.4 Zerogap ............................................................................................................................. 23
   5.4 'Controller' ............................................................................................................................... 24
      5.5 'Service' ................................................................................................................................ 25
         5.5.1 Inertia of measuring drive and measuring system .......................................................... 26
         5.5.2 Motor adjustment ............................................................................................................. 27
         5.5.3 Download ......................................................................................................................... 28
         5.5.4 Recovery mode ............................................................................................................... 29
         5.5.5 More Licenses ................................................................................................................. 29
   5.6 Info ............................................................................................................................................. 30
Index .................................................................................................................................................... 32
1 Introduction

This manual describes the installation of the device driver for the instruments of the Physica MCR xx1 and DSR xx1 series and the available settings for the instrument. The settings in the device setup influence the overall instrument behaviour, therefore read this manual carefully before you make any changes. The device setup further gives access to a number of calibration functions which will also be described. Please note that the figures in this manual are taken from the Physica MCR device driver.

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.

December 2006

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 Rheopius 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 in the Instruction Manual

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 Installation

The instruments of the Physica MCR and DSR series are connected to the computer via a serial interface. The installation procedure is identical for all instruments.

4.1 Installing and Connecting a Device Driver

1. To install a device driver go to 'Tools | Setup | Device and Accessories' in the main window.

2. In the list of installable devices select the MCRxxx or DSRxxx, where xxx is the number of your Physica MCR / DSR model, and click 'Add'. You will be prompted to enter a serial number.

3. Enter the serial number and click 'OK'. The MCRxxx or DSRxxx will be listed in the right-hand list about installed devices. You now need to set the parameters for the connection to the computer.

4. Click 'Connect' and either select the serial port (ComX) on the computer to which the instrument has been connected or connect an ethernet port (NetX).

**Important:**

Make sure the instrument is set to the communication type (serial or Ethernet) that you have selected in the software. Changing the communication settings on the instrument is described in the instrument manual for the Physica MCRxx1 series.

The correct communication settings for the serial port are selected automatically, they should not be changed unless communication errors occur frequently. Please note that the communication settings have to be changed on the instrument as well.

For reference, the default settings for the serial port are listed below:

- **Baudrate:** 38 400
- **Databits:** 8
- **Stopbits:** 1
- **Parity:** none
- **Handshake:** Xon/Xoff

The setup for an Ethernet connection is described in the following chapter.
4.2 Setting up an Ethernet connection

The instrument can either be connected to the network or directly to the computer’s network interface card. In case the computer is connected to the network as well, a second interface card has to be installed in the computer. Further, the TCP/IP protocol needs to be installed on the computer. If the instrument is connected to the company network, the assistance of the network administrator will be required.

For a direct connection between instrument and computer use the crossover patch cable, for a connection to the network use the standard patch cable. Both cables are delivered with the instrument.

1. Go to the network settings of your computer and check the properties of the TCP/IP protocol. Make a note of the IP number, the subnet mask and the IP number of the standard gateway. If these are not set, you may use the following settings, unless the computer is connected to a network:

   IP number: 192.168.21.5
   Subnet mask: 255.255.255.0
   Standard gateway: 192.168.21.10

   If the computer is connected to a network, ask the administrator for information on the available settings.

2. In the Rheoplus software go to 'Measuring Device' and highlight the instrument in the list. Then click 'Connect'.

3. Highlight an Ethernet connection, e.g. 'Net1', in the list and click 'Setup'.

4. Click 'Scan' and wait for the software to display the dialog box shown below.

   ![Fig. 4 - 1 Scanning for instruments](image-url)
5. If the network the computer is connected to uses DHCP (ask your administrator for the necessary information), enable the option 'DHCP' in the dialog box. Otherwise leave it unchecked and enter the same subnet and gateway as on the computer in the appropriate text boxes.

6. For the IP number use the same numbers as on the computer for the first three groups of digits. The last one needs to be different. If the computer is connected to a network, ask your administrator which number can be used. For a direct connection, you can use any number as long as it is different from the setting on the computer. Note: the numbers 0, 1 and 2 should not be used.

7. To the left of the IP settings the dialog box displays the name, serial number and type of the instrument. This information is read from the instrument during the check and cannot be changed. For 'Location' you can enter e.g. the laboratory's name or the user.

8. Click 'OK' to close the dialog box, then click 'OK' for all the remaining dialog boxes.

### 4.3 Removing a Device Driver

1. Go to 'Tools I Setup I Device and Accessories'.

2. On the tab 'Meas. Device' click 'Install' and select the device you would like to remove in the list of installed devices.

3. Click 'Delete' and confirm with 'OK' when prompted. The device is no longer listed.

4. Click 'Quit' to leave the dialog and 'OK' to close the first dialog box.
5 Control Panel (Device Setup)

The device setup can be accessed with 'Measuring Device I Control Panel' in the workbook, the device setup button in the toolbar or by double-clicking the device field in the measurement window. This section includes a description of the device setup dialog and the sub-dialogs through the tabs.

The figure above shows the device driver dialog of the Physica MCR 301 as an example. Please note that all normal force settings are only available on those Physica MCR instruments that have an air bearing. The gap setting functions are not available for the instruments of the DSR series.

The status field shows the current values of the available physical variables.
5.1 ‘Control Panel’

The control panel tab shows the current gap, temperature and normal force from the instrument (if available) and the selected measuring system and accessories. It contains the functions that are used most frequently during the operation of the instrument. For most of the functions, you need to select the measuring system and accessory first; this is done under ‘Configuration’. Once the configuration has been selected, it is stored and changes are only necessary if e.g. an accessory or measuring system is changed. The buttons of the control panel tab are described below.

• Initialization
  When the instrument is switched on, the top right button shows ‘Initialization’. Click this button after the instrument has booted and wait for the instrument to finish the initialization process. Afterwards, the button changes to ‘Zero Gap’ which is enabled if a measuring system with zerogap function is selected.

• Zero gap
  Setting zero gap is necessary for e.g. cone-plate and plate-plate systems. The zero gap is used as a reference for all gap settings; further, it is not possible to move the measuring head downwards until zero gap has been set. The zero gap procedure needs to be carried out at a constant temperature, preferably the measurement temperature. Therefore, set the temperature and wait for thermal equilibrium before you click ‘Zero gap’. The procedure is carried out automatically by the instrument.
  For air bearing instruments, there are two methods of zero gap setting available (see ‘Gapsetting’).

• NF Reset
  Clicking this button sets the normal force value to zero. Only use this function when the measuring system is not in contact with the sample.

• List of Profiles
  In this list you select the profile for the movement of the measuring head to the lift or measuring position. A profile contains a set of speed and normal force values dependent on the position of the measuring head.

• Lift Pos.
  Moves to the maximum position as given in the text field next to the button. The speed and normal force settings for the movement can be changed by the user under ‘Gapsetting’.

• Meas. Pos.
  Moves to the measuring position as given in the text field next to the button. The speed and normal force settings for the movement can be changed by the user under ‘Gapsetting’.
• **Stop**
  Sends a stop command to the instrument, to stop the lift motor; only enabled while the motor is working.

• **Arrow buttons**
  moves up or down with stepwise increasing speed as long as the button is pressed. The movement stops once the button is released.

• **Temperature**
  Click the ‘Set’ button to send the temperature value given in the text field next to the button to the instrument or temperature controller. If more than one temperature control unit is connected, the unit can be selected with the radio buttons ‘Peltier’ and ‘Dev-COM’. Select ‘Peltier’ to send the temperature to a Peltier system connected to the instrument; ‘Dev-COM’ is used for a temperature controller connected to the serial port of the instrument. If you are using a waterbath for counter-cooling and a Peltier system, select the ‘Dev-COM’ first, send the counter-cooling temperature to start the waterbath. Then select ‘Peltier’ and set the measurement temperature.

• **Set Value Mx (Analog Outputs)**
  These input boxes and buttons are visible, if an accessory has been selected for the M1/M2 in the ‘Configuration’ tab. To set a value for the connected accessory, enter the value in the corresponding input box and click the ‘Set value Mx’ button.

• **Switch (Relais)**
  The button and text are visible, if the relais has been selected in the ‘Configuration’ tab. Clicking this button switches the internal relay of the Physica MCRxx1.
5.2 ‘Configuration’

In the configuration tab you select the measuring system and accessories connected to the instrument. If the required measuring system or cell is not available, it has to be installed under ‘Tools I Setup I Device and Accessories’.

5.2.1 Measuring system and Measuring Cell

The measuring system and measuring cell are detected automatically by the Toolmaster™ unless the detecting type ‘Without Toolmaster’ has been selected.

For manual selection of measuring system choose it from the drop-down list 'Meas. System'. The measuring position (on the control panel tab) will be changed automatically to the selected system’s default setting. This is usually not changed except for plate-plate systems. The maximum shear rate and shear stress for the selected system are shown in the control panel tab. Please observe that the maximum shear rate also depends on your sample.

For manual selection of the accessory choose it from the list 'Meas. cell'. Depending on the selected unit you will also have to select a temperature controller. A temperature controller is e.g. a waterbath such as the VT2 or a TC20/TC30.

The option ‘Switch off Meas. Cell after Test’ switches off the heater of the connected measuring cell after a test has been finished. Activating the option for the Peltier system can avoid damage in case the countercooling is disconnected by mistake.

5.2.2 Toolmaster options

The recommended (and default) setting for the detecting type is ‘Toolmaster, Check Name & SN’. With this setting, the instrument reads the name of the measuring system or accessory and its serial number; as these data are stored with the measuring results, the data become traceable. The following options are available:

- Toolmaster, Check Name & SN / Mixed Mode, Check Name & SN
  Both the name and the serial number are read from the system when it is connected to the instrument. If the system has not been used before, the software displays the edit dialog box which shows all available information about the system. This set of data is unique and is used every time this system is detected by the instrument. The Toolmaster™ includes e.g. the exact geometry factors, the inertia, the serial number and the description for the system. The detected system is then selected in the device driver.
  With the first option, a system with Toolmaster™ has to be used. For using
measuring systems or accessories that are not equipped with Toolmaster™
one of the mixed modes has to be used or the Toolmaster has to be switched
off.
If the mixed mode has been selected, you can use systems with and without
Toolmaster™.

- **Toolmaster, Check Name / Mixed Mode, Check Name**
  With this option, the instrument only reads the name from the connected
  system although the exact data are read and used for the measurement. This
  option is useful, if an administrator sets up workbooks and wants to ensure
  that a certain system type is used. It is still possible to use several different
  systems, e.g. two different CC27 bobs, with the workbook although the low
  level users cannot change the selected system in the device driver. For this
  option to work properly, the administrator has to install a default system (from
  the list of installable systems) in the software and also select it in the device
  driver.
  With the first option, a system with Toolmaster™ has to be used. For using
  measuring systems or accessories that are not equipped with Toolmaster™
one of the mixed modes has to be used or the function has to be switched off.
  If the mixed mode has been selected, you can use systems with and without
  Toolmaster™.

- **Without Toolmaster**
  The instrument does not check whether a system with Toolmaster™ is
  connected to the instrument. All selections have to be made manually.

### 5.2.3 Temperature Controller

Serial devices such as the temperature controllers TCxx or fluid circulators VTx
can be controlled directly from the Physica MCR when connected to the Com1
serial port on the left hand panel of the instrument. Select the temperature
controller, if required, from the drop-down list. The serial port and the
communication parameters are selected by the software automatically. The
parameters can be viewed and changed under 'Connect'. Changes are not
normally necessary..

<table>
<thead>
<tr>
<th>Device</th>
<th>Viscotherm VT 2/20/200</th>
<th>Viscotherm TC 10/20/30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud</td>
<td>4800</td>
<td>9600</td>
</tr>
<tr>
<td>Parity</td>
<td>even</td>
<td>even</td>
</tr>
<tr>
<td>Data bits</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Handshake</td>
<td>Xon/Xoff</td>
<td>none</td>
</tr>
</tbody>
</table>

If the controller is not shown in the list, it needs to be installed under 'Tools I Setup
I Device and Accessories'. Detailed information about installing accessories can
be found in volume 1 of the Rheoplu software manual.
When a temperature controller is connected to the serial port of the instrument it is possible to display either the temperature of the controller (option 'Using values from temp. Controller' activated) or the temperature value measured by the sensor in the accessory. In case of the waterbath the bath temperature would be displayed if this option is selected; this value is of limited use. Generally, the temperature is read from the accessory sensor. The table below shows which settings should be used.

<table>
<thead>
<tr>
<th>Temp. controller</th>
<th>Using values from temp. controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT 2/20/200</td>
<td>no</td>
</tr>
<tr>
<td>TC 20</td>
<td>yes</td>
</tr>
<tr>
<td>TC 30</td>
<td>yes</td>
</tr>
</tbody>
</table>

The option 'Switch off Temp. Controller after Test' switches off the power of the temperature controller after a test has been finished.
5.2.4 Analog Output

The Physica MCR has two multi-purpose connectors, M1 and M2, with an analog output of ±10 V (with 16 bit resolution). The time interval of the data output is 100 ms. They can be used to control analog accessories or to connect e.g. an oscilloscope to read raw data from the instrument.

You can select either an accessory (for control of an analog device) from the list or a DSP variable (for data output). Once you have made a selection in either of the lists the other will be disabled. The accessory list contains the installed accessories; if the device you would like to use is not available you need to install it under ‘Tools I Setup I Device and Accessories’.

The following values are available for data output (DSP Variable):

- Abs.displacement: 0...2PI, displacement in [rad]
- Speed: rotational speed in [1/s]
- El. Torque: electrical torque in [Nm]
- Torque: sample torque in [Nm]
- Inertia Torque: for service only
- Normal force: axial force
- Encoder signal A: track 1 of the optical encoder
- Encoder signal B: track 2
- AV1: for service only
- AV2: for service only
- Rel.Displacement: relative displacement in [rad]
- Trg.Value Out: the voltage is triggered when the instrument receives a new set value.
- Trg.Mp.Generate: the voltage is triggered when a measuring point is generated and sent to the software
- Trg.Part Change: the voltage is triggered when either the next interval is started or the measurement is started/ends

The values send from the instrument are available in the units listed above. If you want to display different units e.g. mNm instead of Nm you can change the factor accordingly. For the other values you should choose the factor as listed below:

- Normal force Offset = 32768
  Factor = -3,0524e-4
- Encoder signal A and B: 1.0

The output voltage is calculated as:

\[ U_{BNC} = \text{Offset} + \text{Factor} \times \text{DSP Size value} \times (10 \text{ V} / 10000) \]
5.2.5 Relay / Auxiliary

- Relay 1
  For switching the relay, an accessory can be selected that uses logical values as the physical variable. If the value is set to zero, the relais is open; every value different from zero closes the relais.

- AUX Input
  The AUX connector can be used to read a voltage value from an accessory. The value is shown in the 'Control Panel' tab. The AUX Input has to be calibrated unless calibration values have been delivered with the accessory. The calibration is described in the appendix 'Temperature Calibration' in volume 2 of the software manual.

5.3 'Gapsetting'

Under 'Gapsetting' you select which type of speed and normal force (only air bearing instruments) profile to use for going to the respective position. A profile defines which speed and normal force to use at which position.

Enable the option 'TruGap' to use the TruGap™ function. This function is available only if a TruGap measuring system and accessory are used. The TruGap function is included in the MCR501, it is optional for the MCR301.

The measuring system will move to the measuring position when a measurement is started or will move to the maximum position after a test has been finished (this should only be used for low viscous samples and slow gap speeds), if the option 'Measuring Position at Test Start' or 'Lift Position after Test' (MCR only) is activated. The option 'Measuring Position at Test Start' must not be used for solid samples.

5.3.1 Profiles

Select the profile from the list 'Active Profile' depending on the sample you are going to measure. The settings of the selected profile can be shown by clicking 'Details'.

To create your own profile you can either select 'Manual Settings' from the list or click 'Change' for the selected profile (the settings of the last active profile are kept). The settings can now be edited under 'Details'. After you have made all changes, you can use the new profile directly. It is stored with the workbook. To store the new settings as a separate profile to be able to apply it to other workbooks, click 'Save as....' replace one of the user profiles listed in that dialog box. Up to three user profiles can be stored.
5.3.2 ‘Details’

If ‘Speed Control’ is selected the speed profile is a standard profile, the normal force limit is the maximum possible value for the instrument. With ‘Speed Ctrl + NF limit’ both speed profile and normal force limit are taken from the details chosen under ‘Settings’. With these first two options, the measuring head always goes to the measuring position set by the user. The speed is set according to the detail settings or reduced to stay within the set normal force limit.

If the third option, ‘NF Control, Stop by NF’, is selected, the speed profile from the ‘Settings’ are used but the movement is stopped as soon as the normal force limit is reached. This option can only be selected with plate-plate systems when chose for the ‘Measuring Position’; for all other measuring system the gap will be incorrect.

Dependent on the instrument type there are two types of zero gap available: ‘Speed controlled’ and ‘Normal force controlled’. If speed control is selected, the measuring system moves down while rotating until the rotation is stopped because of the contact with the lower measuring system. Then the lift motor moves upwards until the measuring system again can rotate freely. This is the zero gap position which is used as a reference for all gap settings.

If normal force control is selected the measuring system moves down until a normal force value of about 20 N is read. Then the lift motor moves upwards until the set normal force value has been reached. This option is only available for instruments with an air bearing.
5.3.3 Settings (Measuring Position, Lift Position, NF Hysteresis for Measurement)

The "Settings..." dialog contains the settings that define the speed and normal force control during movement of the lift motor. Further, it is possible to define settings for the instrument motor (measuring drive) that are active while the lift motor is working. They allow e. g. to lock the measuring system during sample loading (movement to the measuring position) and trimming or to rotate at a set speed while moving up of the sample. The figure below shows the settings for the measuring position as an example.

Please note, that the normal force settings are only available for instruments with an air bearing.

If the option 'Gap control active after positioning' is enabled, the settings for the respective profile are used even after the measurement system has reached the measurement or lift position. This can e. g. be used to control the normal force on a sample during the temperature equilibrium without running a measurement which is useful for samples that have to be loaded at a temperature that is far from the measurement temperature.
A profile defines which speed and normal force to use at which position, where position is the vertical position of the measuring head. The applicability of the test profile limits depend on the selected variable. If normal force or speed are selected as set variables in the measurement profile the values set in the profile will override the values set in this dialog; the limit values are only applied to the variables that are not set.

All settings which are described in the following can be set separately for each profile type. Select the profile for which you want to define the speed and normal force settings and enter the required values.

The minimum and maximum position are the gap range at which the normal force control is active. The lower limit is important to avoid that the sample is squeezed out until the upper measuring system touches the lower. The normal force control will be switched off at the limit positions and the gap will remain constant, even if the measured normal force value no longer is inside the defined range.

The 'NF Hysteresis' defines the allowable deviation of the normal force value from the required set value before the normal force is adjusted again. Usually, this value is set to 0.2 to 0.5 N.

The 'Position [mm]', 'Velocity [mm/s]' and 'NF [N]' settings define a detailed speed and normal force profile for the selected profile option. To add values to the list or change the existing settings enter the required values and click 'Insert'.

An example of a speed profile is given below.

<table>
<thead>
<tr>
<th>Position</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>167</td>
<td>12</td>
</tr>
<tr>
<td>278</td>
<td>17</td>
</tr>
<tr>
<td>464</td>
<td>31</td>
</tr>
<tr>
<td>774</td>
<td>69</td>
</tr>
<tr>
<td>1290</td>
<td>175</td>
</tr>
<tr>
<td>2150</td>
<td>471</td>
</tr>
<tr>
<td>3590</td>
<td>1297</td>
</tr>
<tr>
<td>5590</td>
<td>3594</td>
</tr>
<tr>
<td>10000</td>
<td>10000</td>
</tr>
</tbody>
</table>

For instruments without an air bearing only the speed profile can be defined, the normal force settings are not available.
The options under ‘Output meas. drive’ can be used to define the behaviour of the
measuring drive while the lift motor is moving and after the target position has
been reached.

The figure below shows the available options. Select the option you wish to use
and enter the set value respectively the limit value. If ‘output speed’ is selected,
the torque value will be used as a limit; if ‘output torque’ is selected, the speed
value will be used as a limit. The value 0 means that the maximum available value
will be used.

![Settings for the measuring drive (under ‘Gapsetting’)](image)

If the option ‘go to user start angle’ is selected the measurement system will be
moved to the position that has been defined as the start angle. A default value is
stored on the instrument, the user start angle can be changed in the ‘Service’ tab
(see there). The advantage of a defined start angle is that all measurements will
start in the exact same position which further increases repeatability of the
results.

With the option ‘lock meas. system’ the measuring system is kept at the current
position which allows e. g. easy sample trimming.

If the option ‘meas. drive active after positioning’ is activated the selected
measuring drive control option will be applied even after the measuring head has
reached the final gap position. This is recommended for the options ‘lock
measuring system’ and ‘go to user start angle’.

5.3.4 Zerogap...

‘Temperature Time’ can be used to repeat the zero gap setting for the time interval
entered in this text box. This is useful to ensure that zero gap is set at a stable
temperature. Make sure to choose a sufficiently high value. It is recommended
though, only to start the zero gap procedure at a constant temperature, preferably
the measurement temperature.

The velocity settings (‘High Velocity’ and ‘Low Velocity’) give the speed of the lift
motor in mm per second above the switch point and below. The height of the
switch point (‘USH’) can be set by the user. The default value is 10 000 mm.
5.4 'Controller'

- Dynamic Shear Rate CSR / Dynamic Deformation CSD
  The setting of the dynamic value influences the speed and accuracy of the controller for the speed and angle in rotational measurements. The available settings depend on the instrument type. In most cases, the setting 'Auto' is recommended (Physica MCR301 and 501 only); with this setting, the instrument will adjust the controller strength by itself. The selected value is given in the status column of the table.
  The manual setting allows to adjust the controller strength between 0 % and 100 %, with 0 % as the default setting. The default value is used for the measurement of flow curves with a measurement point duration longer than second. For flow curves with a shorter measurement point duration and especially for relaxation tests the dynamic speed controller should be set to 80 % to 100 %. In case the automatic setting does not give good results for highly elastic or very high viscou materials, you can also choose the setting 'Heavy load'.
  For the MCR 101 and MCR51 you can choose between 'Fast' and 'Accurate'. The first option is used for high viscous materials; it is fast but not necessarily very accurate. The setting 'Accurate' ensures that the set shear rate or deformation is reached exactly, but it may be too slow for fast changes in the measuring profile, e.g. shear rate jumps.

- Dynamic Shear Stress CSS
  This setting influences the controller strength for stress controlled rotational measurements. To use the compensation, check the option below the drop-down list.
  A manual adjustment (option 'Manual') is only available for the Physica MCR301 and 501. It allows to adjust the controller strength dependent on the sample properties. If the option 'Off' is selected, there is no compensation.
  The inertia compensation is only meaningful for the measurement of low viscous materials in stress controlled rotation. For shear rate controlled rotation, the controller is different, the inertia is taken into account automatically. Because of this, rate controlled measurements are to be preferred.

- Position Control (DSO)
  Direct Strain Oscillation allows oscillatory measurements with very low torques and small deformations. Low viscous samples can be measured with good quality. Direct strain oscillation is included in the MCR 500, for the MCR300 it is available as an option. The other instruments of the MCR series cannot use Direct Strain Oscillation.
• Dynamic Normal Force NF
The setting for the normal force dynamic defines how fast the gap motor is moving when adjusting the normal force. The default setting is 0%, it does not need to be changed very often. With this setting, the normal force control is accurate but may be too slow for samples that change very quickly. To increase the adjusting speed drag the slide using the mouse. An increase will result in a faster but less accurate normal force control.

• Torque Booster
The torque booster (Physica MCR301 and 501) increases the maximum torque of the instrument for short times during a measurement. With the ‘Auto’ setting, the maximum is set by the instrument; with the ‘Manual’ setting the maximum value can be limited by the user.

5.5 ‘Service’

The ‘Service’ tab contains settings that influence the general behaviour of the instrument.

• Inertia Meas. System / Inertia Drive
This button opens the dialog for the determination of the inertia of the measuring system or the measuring drive (see 5.5.1).

• Compliance Rheometer
This value is the compliance of the rheometer to normal forces. The factory value should not be changed unless you are instructed to do so.

• Motor Adjustment
This opens a dialog where the motor adjustment can be started and stored. The motor adjustment should be carried out for all measuring systems that you are using; it is especially required for the measurement of low viscous materials (see 5.5.2).

• Download
With this button you can download the firmware e.g. an update (see 5.5.3).

• PT100 AB Koeff.
The Physica MCR allows to connect a Pt100 sensor for automatic calibration of a temperature cell. This sensor is calibrated; the values for offset and span can be set in the dialog opened by this button.

• User Start Angle
Click this button to open a dialog where the user start angle can be changed. If set to zero, which is the standard setting, the default start angle stored on the instrument will be used. The start angle is the position on the circumference of the instrument’s position sensor to which the measuring
system will be turned when the option 'go to user start angle' has been selected in the 'Gapsetting...' dialog. The advantage of a defined start angle is that all measurements will start in the exact same position which further increases repeatability of the results.

- **Service**
  For service purposes only.

- **Communicate with Electronic in Recovery Mode**
  If this option is enabled, a low level communication to the computer is possible. The option should not be activated unless necessary. It further requires, that the instrument is set to recovery mode as well (see 5.5.4).

- **Info...**
  Displays the info dialog with information on the instrument and components (serial number, version number).

- **Test Types...**
  The test type dialog shows which measurement modes are enabled (instrument dependend). You can deselect modes that you do not use to simplify the measurement window.

- **More Licences**
  This button opens a dialog box for the import of additional instrument licences. These instruments can receive measuring profiles from the software and export results, but can be operated in manual mode only (see also 5.5.5).

### 5.5.1 Inertia of measuring drive and measuring system

If the inertia of the drive is known, you can determine the inertia values for the measuring systems you are using. The inertia value has to be available in order to be able to use the measuring system. Insert the measuring system and move it to measuring position (set zero gap before, if required). For cone-plate systems or other systems with a small gap, go to a gap of about 0.5 to 1 mm. Then click the 'Meas. System' button and enter the values given in the example. It is recommended to save the results automatically with the measuring system. Click
Start' to start the procedure. Wait for the instrument to finish the measurement, then click 'OK' to leave the dialog.

Important:
Make sure that no measurement system is connected and that the rotor can move freely.

5.5.2 Motor adjustment

In the motor adjustment dialog, an automatic compensation procedure can be started. This procedure calibrates for variations of the air bearing properties at different positions of the rotor. These variations are inherent to every air bearing and though they are very small they may become noticeable in measurements at very small torques.

The instrument is delivered with a default motor adjustment value. To measure very exact data, especially at low torque values, you can carry out and save the motor adjustment for each measurement system you are using. If a measuring system or measuring system type is used frequently, the motor adjustment for this system can be set as the default by clicking 'Define as Standard'. The default
adjust is used for all measuring systems for which no motor adjust data are stored.

Fig. 5 - 5  Motor adjustment dialog box

A warning to repeat the adjust is shown after x days at the start of a measurement.

Mount the measuring system and move to a position of 1 or 2 mm. To start the motor adjustment click ‘Start’. The adjustment takes about 3 min and should only be carried out in a quiet, vibration-free location. The adjustment data are saved automatically for the measurement system once the procedure is finished.

The instruments of the Physica MCR series can store up to 10 motor adjustments. If no adjustment is available for this system the default adjust (marked with ‘x’) is used.

Important:
The motor adjustment is very sensitive to draft and vibration in the instrument environment. Provide a vibration- and draft-free environment.

5.5.3 Download

The download procedure is used to send firmware updates or other data to the instrument.

Click the ‘Download’ button and select the drive and directory, then select file you wish to send to the instrument. The firmware files have the extension *.dlf and usually a name of the form m301xxxx.dlf. Click ‘Download’ to start the download
procedure. The software will indicate the progress of the download in %. After the download has been finished, click 'Finished' to return to the configuration dialog, or 'Next Download' to send more data.

The instrument is re-booted automatically once the download dialog is closed. Wait for the instrument to finish booting and close the configuration dialog with 'OK'. The instrument needs to be initialized after the re-booting.

5.5.4 Recovery mode

The recovery mode allows communication with the instrument without loading the firmware. It can be used to download files to the instrument if it does not boot normally, e.g. because the firmware file has been damaged.

The recovery mode has to be enabled both in the software and on the instrument. First, activate the recovery mode option and close both the configuration dialog and the device driver with 'OK'. Then switch on the instrument while repeatedly pressing the button 'Menu' on the front panel of the Physica MCR. The instrument display should show version number, date, time and 'Boot Firmware Active'. Go to the 'Service' tab again and download the firmware. Please make sure that the instrument does not try to boot when the device driver is opened.

After the download has been finished remember to uncheck the recovery mode option.

5.5.5 More Licenses

Additional licences allow to store measuring profiles on instruments that are otherwise used in manual operation only. The instrument cannot be controlled directly by the software but measuring data can be imported to a workbook or stored as a datapool file using the import function for offline data.

The additional licence(s) have to be ordered for a software and an instrument serial number.

To install an additional licence, click 'Import'. Then click 'Import' in the dialog box opened by the first click and select the licence file you have receied from Anton Paar Germany. Then click 'Add'.

To delete an installed licence highlight it in the list and click 'Delete'.
5.6 Info

The info button displays a dialog that shows information about the connected instrument such as serial number, communication settings, version number and firmware versions.

![Dialog box 'Info'](image)

**Fig. 5 - 6 Dialog box 'Info'**

You can use the button 'Service Report' to access templates for a service request. If you should experience problems with the Rheoplus software such as a conflict with Windows or other applications you can generate a service report from within the software which can be used when you report the problem to our distributor's or our own customer support.

Proceed as follows:

- Click the 'Service Report' button and select 'Software and System Report'.
- Select the output device and format type (default 'Windows Text Format') and click 'Export'.
Index

A
analog output 18
aux 19

C
compliance (Physica MCRxx1 / DSRxx1) 25
configuration (tab) 15
connecting a device driver 9
control panel 12
control panel (tab) 13
controller (tab) 24

D
download 28
DSO 24
Dynamic CSD 24
Dynamic CSR 24
Dynamic CSS 24
Dynamic NF 25

E
Ethernet 10

G
gapsetting (tab) 19

I
inertia 26
info 30
initialization 13
Initialize 13
installing a device driver 9

L
Licenses 29
Lift Pos. (lift position) 13

M
Meas. Pos. (measuring position) 13
measuring cell 15
measuring system 15
More Licences 26
motor adjustment 27

P
Position Control 24

R
recovery mode 29
relay 19
removing a device driver 11

S
Safety instructions 7
service (tab) 25

T
temperature controller 16
temperature, set 14
Toolmaster 15
Torque Booster 25
TruGap 19

Z
Zero gap 13