Thermo Scientific

HAAKE Viscotester iQ

Reference Manual

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For Research Use Only. Not for use in diagnostic procedures.

Contents

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Preface

This manual describes the HAAKE Viscotester iQ touchscreen user interface and the HAAKE Viscotester iQ RheoApp software in detail. This manual also describes the HAAKE Viscotester iQ specific parts of the HAAKE RheoWin software, including the PC network setup that is needed for the HAAKE RheoWin software and the HAAKE Viscotester iQ to communicate which each other. Finally this manual gives detailed information about the properties of all the available standard measuring geometries.

Note In this manual the name HAAKE Viscotester iQ is used to describe both the HAAKE Viscotester iQ (with ball-bearing drive motor) and the HAAKE Viscotester iQ Air (with air-bearing drive motor) unless stated differently.

Related documentation

In addition to this manual, Thermo Fisher Scientific provides the following documents for use with the HAAKE Viscotester iQ:

- HAAKE Viscotester iQ Instruction Manual.
- HAAKE RheoWin Installation and 21 CFR Part 11 Configuration User Guide.
- HAAKE RheoWin Instruction Manual.

The following documents are provided for use with the HAAKE Viscotester iQ with Pressure Cell stand:

- HAAKE Pressure Cell Dxxx/yyy Instruction Manual.
- Instruction Manual UTMC Box.

Safety and special notices

Make sure that you follow the cautions and special notices presented in this manual. Cautions and special notices appear in boxes; those concerning safety or possible damage also have corresponding caution symbols.

This manual uses the following types of cautions and special notices.

CAUTION Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or may contain information that is critical for optimal performance of the system.

Note Highlights information of general interest.

Tip Highlights helpful information that can make a task easier.

Contacting us

Please always first address any questions to the local Thermo Fisher Scientific office or the general agent or partner company who delivered your instrument.

International Helpdesk

You can also contact our international helpdesk directly. In that case we kindly ask you to use the contact form to which a link is provided below.

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Application Support

For questions regarding your rheological application please use the following e-mail address to contact our application specialists. Do not use this e-mail address for any other questions.

❖ **To contact Application Support, Germany and International**

E-mail support.rheology@thermofisher.com

Software and Firmware downloads

The latest HAAKE RheoWin software version and firmware versions for all HAAKE rheometers and viscometers are available as downloads from our dedicated web-site.

❖ **To download software and firmware**

Internet www.rheowin.com

1

Instrument Description

The development of the HAAKE Viscotester iQ[1] rheometer was driven by customer demands from the quality control (QC) area. In the HAAKE Viscotester iQ we have combined our decades of experience in rheology and rheometry with new technical solutions, which are especially designed for highly dynamic working environments.

Our goal was to enable fast, reliable and precise rheological measurements with a maximum ease of operation. As an operator, please feel encouraged to challenge the HAAKE Viscotester iQ performance.

The HAAKE Viscotester iQ: individual, intuitive, intelligent

The completely new designed HAAKE Viscotester iQ is THE rheometer for quality control. In its class, the HAAKE Viscotester iQ sets new standards for modularity, ease of use and intelligent user guidance.

The HAAKE Viscotester iQ Air is the smallest (and most affordable) commercially available rheometer with an air-bearing in the world.

Figure 1. The HAAKE Viscotester iQ in four different configurations

Coaxial cylinder geometry | Parallel plate and cone and plate geometries | Vane geometry and universal container holder | Lab stand

The HAAKE Viscotester iQ is the instrument of choice for measuring single viscosity values or for investigating the more complex rheological properties of materials ranging from low viscous liquids to highly viscous pastes.

[1] Unless stated differently in this manual the name HAAKE Viscotester iQ is used to describe both the HAAKE Viscotester iQ and the HAAKE Viscotester iQ Air.

With its intuitive touchscreen panel user control interface the HAAKE Viscotester iQ can be comfortably used as a stand-alone unit. For more flexibility and/or for more demanding tasks the HAAKE Viscotester iQ can be controlled by the HAAKE RheoWin software.

With its small size and practical form factor the HAAKE Viscotester iQ is a (trans)portable instrument that can easily be moved between different labs (if needed).

Whatever your rheological challenges are, the HAAKE Viscotester iQ provides you with an intelligent solution.

The individual rheometer

Motto: "The rheometer that meets your demands in QC."

- A highly dynamic, powerful EC-motor[2] with CR-mode[3], CD-mode[4] and CS-mode[5] for enhanced measuring flexibility.
- A choice between two models:
  - The HAAKE Viscotester iQ with a ball-bearing drive motor.
  - The HAAKE Viscotester iQ Air with a robust air-bearing drive motor for enhanced sensitivity.
- Rotation and (optional, standard with Viscotester iQ Air) oscillation measurement mode.
- A broad scope of measuring geometries including coaxial cylinder, parallel plate and vane geometries.
- Five exchangeable temperature modules including two Peltier temperature modules.
- An adjustable universal holder for measurements in original containers and beaker glasses.
- Three different stands:
  - The "standard" stand (see Figure 1) suitable for most measurements.
  - The lab stand (see Figure 2) for measurements in large containers that do not fit in the "standard" stand.
  - The pressure cell stand (see Figure 2) for measurement in pressure cells.
- Three modes of operation:
  - Stand-alone mode using a touchscreen panel user interface, with manual control and job control.
  - Stand-alone mode with HAAKE Viscotester iQ RheoApp PC software and USB flash drive based job/data transfer.
  - Remote control with HAAKE RheoWin PC software.
- Up to 200 editable, internal measurement and evaluation routines.

[2] EC-motor: Electronically Commutated motor
[3] CR-mode: Controlled shear Rate mode
[4] CD-mode: Controlled Deformation mode
[5] CS-mode": Controlled shear Stress mode

- HAAKE RheoWin PC software for highly adaptable measurement and evaluation routines.

Figure 2. HAAKE Viscotester iQ with lab stand and ISO spindle (left) and HAAKE Viscotester iQ with pressure cell stand, pressure cell and UTMC box (right)

The intuitive rheometer.

Motto: "The rheometer that makes QC more convenient for you."

- An intuitive, easy to use, clearly structured touchscreen user interface for control and numerical and graphical visualization of measurement results.
- An easy to use lift function for convenient, accurate and reproducible gap setting.
- An easy and quick insertion and removal of rotors, cups and plates for optimized handling.

The intelligent rheometer

Motto: "The rheometer that guides your through your rheological challenges."

- Automatic measurement routines including data evaluation and operator guidance in stand-alone mode.
- "Connect Assist" quick coupling for measuring geometries and temperature modules with automatic recognition.
- "Temp Assist" sample temperature control using dynamic temperature modeling.
- "Fill Assist" sample volume measurement for coaxial cylinder measuring geometries using an ultra-sonic level gauge.

Main features of the HAAKE Viscotester iQ

The following list sums up the main features of the HAAKE Viscotester iQ and its optional accessories.

- Completely new developed drive motor with,
  - highly dynamic, powerful, synchronous, EC, direct drive motor with optical angle encoder and high precision ball-bearings or an unique, robust and patented air-bearing,
  - standard ROT mode (rotational rheometry), and optional (standard with Viscotester iQ Air) OSC mode (oscillation rheometry),
  - torque range 0.2 mNm to 100 mNm (ball-bearings),
  - torque range 0.01 mNm to 100 mNm (air-bearing),
  - rotational speed range 0.01 rpm to 1500 rpm,
  - frequency range from 0.1 Hz to 20 Hz (ball-bearings),
  - frequency range from 0.1 Hz to 50 Hz (air-bearing),
  - both CR-mode (Controlled shear Rate) and CS-mode (Controlled shear Stress) in ROT mode (rotational rheometry),
  - both CD-mode (Controlled Deformation) and CS-mode (Controlled shear Stress) in OSC mode (oscillation rheometry),
  - integrated high precision “Connect Assist” quick-coupling connector for measuring geometries,
  - integrated automatic recognition of measuring geometries including automatic transfer of the relevant geometry parameters.
- Easy and quick change between coaxial cylinder geometries, parallel plates geometries and vane geometries.
- Easy and quick insertion and removal of coaxial cylinder cups.
- Easy and quick determination *and* documentation of the correct sample volume (for almost all coaxial cylinder geometries) using the advanced “Fill Assist” tool.
- Easy and quick measurement of the correct sample volume (for all coaxial cylinder geometries) using simple level gauges.
- Easy and quick exchange of temperature modules.
- Automatic recognition of the temperature modules and external temperature sensors.
- Five different temperature modules for a wide temperature range from -20 °C to +180 °C and a wide range of measuring geometries. Table 1 explains the logic behind the TM-xx-x module names.
  - Temperature Module TM-PE-C
    - Peltier temperature control with a dedicated active heat-exchanger iQ (no circulator needed).
    - “Temp Assist” sample temperature control using dynamic temperature modeling.

  - For (smaller size) coaxial cylinder measuring geometries.
  - For parallel plate and cone and plate measuring geometries using the adapter for TMPxx lower measuring plates.
- Temperature Module TM-PE-P
  - Peltier temperature control with a dedicated active heat-exchanger iQ (no circulator needed).
  - "Temp Assist" sample temperature control using dynamic temperature modeling.
  - For parallel plate and cone and plate measuring geometries.
- Temperature Module TM-LI-C32
  - Temperature control using a separate external circulator.
  - For temperature control of (smaller size) coaxial cylinder measuring geometries.
- Temperature Module TM-LI-C48
  - Temperature control using a separate external circulator.
  - For temperature control of (larger size) coaxial cylinder measuring geometries.
- Temperature Module TM-LI-P
  - Temperature control using a separate external circulator.
  - For parallel plate and cone and plate measuring geometries.

Table 1. Abbreviations used in module names

Module	Type-1	Type-2	Type-3	Long name
TM				Temperature Module
	LI			Liquid
	PE			Peltier
		C		Cylinder
		P		Plate
			32	for cups with 32 mm outer diameter
			48	for cups with 48 mm outer diameter

- Easy to use, highly adaptable, holder for original sample containers or beaker glasses, for use with vane geometries or ISO 2555 spindle type geometries.
- External temperature sensor with holder, for measuring the sample temperature in an original sample container or beaker glass.
- Integrated, easy to use manual lift mechanism for (semi-) automatic, accurate and reproducible axial positioning of the measuring geometries (gap setting).
- Three modes of operation:
  - Stand-alone mode using a touchscreen panel user interface with,
    - manual control,
    - integrated, editable measuring and data evaluation routines (Jobs).

- Stand-alone mode using a touchscreen panel user interface *and* an USB flash drive based HAAKE Viscotester iQ RheoApp PC software for,
  - extended measuring routine (Job) editing,
  - extended instrument configuration,
  - data transfer to a PC,
  - user management.
- Remote control with the HAAKE RheoWin PC software for,
  - complex measuring and data evaluation routines (Jobs) and interactive data analysis,
  - automatic report export (PDF) and report printout,
  - 21 CFR part 11 compatibility.

• Colour touchscreen control panel with,

- an intuitive, easy to use, clearly structured graphical user interface,
- a multilingual user interface with the following 19 languages: Chinese, Czech, Dutch, English, Finnish, French, German, Hungarian, Indonesia, Italian, Japanese, Korean, Polish, Portuguese, Russian, Slovak, Spanish, Thai, Turkish. Other languages, apart from languages like Arabic and Hebrew which are written from right to left, can be added on request.
- numerical and graphical display of measurement results,
- direct manual control of shear rate, shear stress, rotational speed, torque, temperature using (editable) rows of set-values or manually entered set-values.
- automatic on-screen editable measurement routines (Jobs) with integrated data evaluation (up to 20 jobs per user) with the following measurement elements:

  ROT mode
  - Temperature set and equilibration element
  - Time curve element for ROT CR or ROT CS mode
  - Semi-continuous ramp element for ROT CR or ROT CS mode
  - Continuous temperature ramp element for ROT CR or ROT CS mode

  OSC mode (optional, standard with Viscotester iQ Air)
  - Time curve element for OSC CD or OSC CS mode
  - Amplitude sweep element for OSC CD or OSC CS mode
  - Frequency sweep element for OSC CD or OSC CS mode
  - Continuous temperature ramp element for OSC CD or ROT CS mode
- and the following evaluation elements
  - Curve fitting element
  - Mean value calculation element
  - Minimum/maximum value calculation element
  - Thixotropy area calculation element

  - Thixotropy index calculation element
  - Yield-stress calculation element
  - Cross-over calculation element (optional for OSC mode)
- integrated user management for up to 10 user with 3 different user levels,
- integrated optional “Fill Assist” routine for the measurement *and* documentation of the correct sample volume (for coaxial cylinder geometries),
- on-screen alphanumerical keyboard for entering sample information and parameters,
- 4 GByte of internal memory for virtually unlimited storage of Jobs and data,
- Easy Job and data transfer using the optional USB flash drive based HAAKE Viscotester iQ RheoApp PC software.

• Two USB ports for
  - data exchange with USB flash drive based HAAKE Viscotester iQ RheoApp PC software,
  - Fill Assist tool,
  - external keyboard,
  - external barcode reader.
• Ethernet TCP/IP interface for point-to-point communication with a PC on which HAAKE RheoWin is running or for integration in a company network.
• Small footprint for optimal use of lab space (width 270 mm, depth 340 mm to 500 mm).
• Trolley transport case for transporting a complete (i.e. including measuring geometries, temperature control, etc.) HAAKE Viscotester iQ measuring station.
• A set of four trolley transport cases for transporting a complete HAAKE Viscotester iQ with pressure cell stand measuring station (i.e. including a pressure cell and UTMC control box).

For a more detailed description of the functionality, installation, operation and specifications, etc. of the HAAKE Viscotester iQ and it accessories, see the following chapters of this manual.

2

Touchscreen User Interface

This chapter describes how to operate the touchscreen user interface of the instrument. That is, how to use the instrument in manual mode, how to run predefined measurements (Jobs), how to modify Jobs and how to configure the user interface.

The mechanical operation of the instrument is described in Chapter 5, “Operation,” of the HAAKE Viscotester iQ Instruction Manual, the operation of the PC software in Chapter 3, “HAAKE RheoApp Software,” and Chapter 5, “HAAKE RheoWin Software,” of this manual.

IMPORTANT Read the relevant parts of this chapter before operating the instrument for the first time.

Touchscreen

The touchscreen used in the Viscotester iQ is a standard modern capacitive touchscreen panel. The lightest touch of a finger tip is enough for executing a command. The touchscreen can be operated while wearing standard nitrile (laboratory) gloves without limitations.

Figure 3. Working with the touchscreen

CAUTION Do not operate the touchscreen when the glass of the touchscreen is broken.

Introduction

All functions of the HAAKE Viscotester iQ can be completely controlled using the build-in graphical user interface which is described in the following sections. For the configuration of some of the more enhanced functions the HAAKE Viscotester iQ RheoApp PC software is needed. The user interface is operated by tapping on the touchscreen, for entering alphanumerical information (that is numbers or text) an external USB keyboard, connected to the instrument head, can be used also.

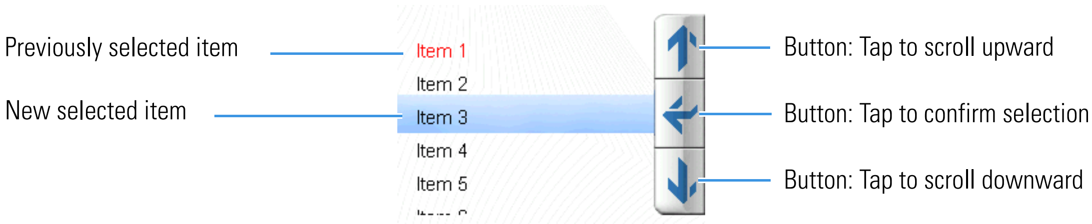
Common control elements

This section describes common control element like special button, scrollable lists, tabbed pages and the on-screen alphanumeric keyboard that are used in several menus throughout the touchscreen user interface.

Scrollable list

In all situations where the operator must choose one item from a list of items, these items are displayed in a scrollable list. See Figure 4 for a generic example.

Figure 4. Scrollable list, generic example



❖ **To select an item from a list**

1. Scroll through the list by tapping on the up or down button to move to the next item, or by wiping slowly upward or downward on the list itself.

   The item in the center of the list (directly in front of the Enter button) is the new selected item.
   The item in the red colour is the previously selected item.

2. To confirm the selection of the new selected item and go to the next or the previous menu (depending on the menu), tap on the **Enter** button.

   or

3. To go back to the previous menu without selecting a new item, tap the **Escape** Esc button (below the list, not shown in Figure 4).

In certain menus (for example in the Quantities/Units menu and the Job control menu) there is second button below the list. Tapping on that button will lead to a menu in which the selected item can be edited (for example the Unit for the selected quantity, or the Job definition).

General buttons

Certain buttons for general commands like, Enter, Esc, Edit, Start and Stop, are used in several menus and dialogs, see Table 2 for an overview of these buttons.

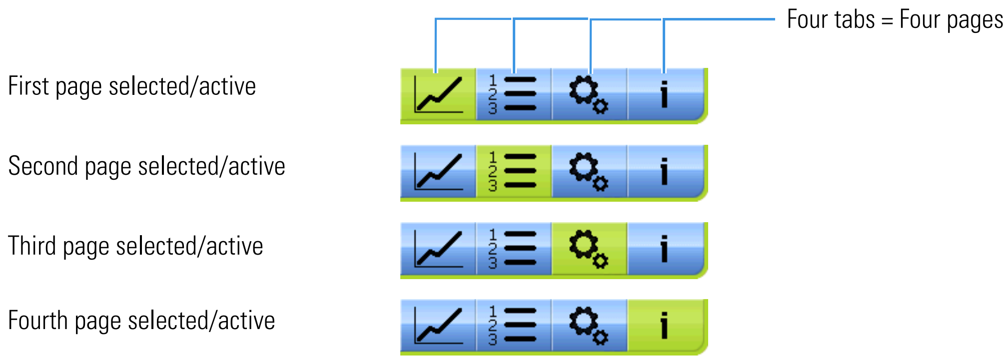
Table 2. Common buttons and their function

Button	Name	Function
	Enter	Close a menu or a popup dialog and confirm a selection or an (alpha)numeric entry
	Escape or back	Close a menu or a popup dialog and ignore a selection or an (alpha)numeric entry
	Edit	Open another menu to edit the properties of an item (for example a Job, a unit, etc.).
	Start	Start a manual measurement, a job or a data transfer action, etc.
	Stop	Stop a manual measurement or a job

Tabbed pages

The Job control, Job editor and the Manual control windows do not have a menu bar and a status bar a the top of the screen. Instead these two windows use tabbed pages for quick access to the different views and settings pages. See Figure 5 for an example of tabbed pages.

Figure 5. Example of tabbed pages (from the Manual control menu)



❖ To select a page

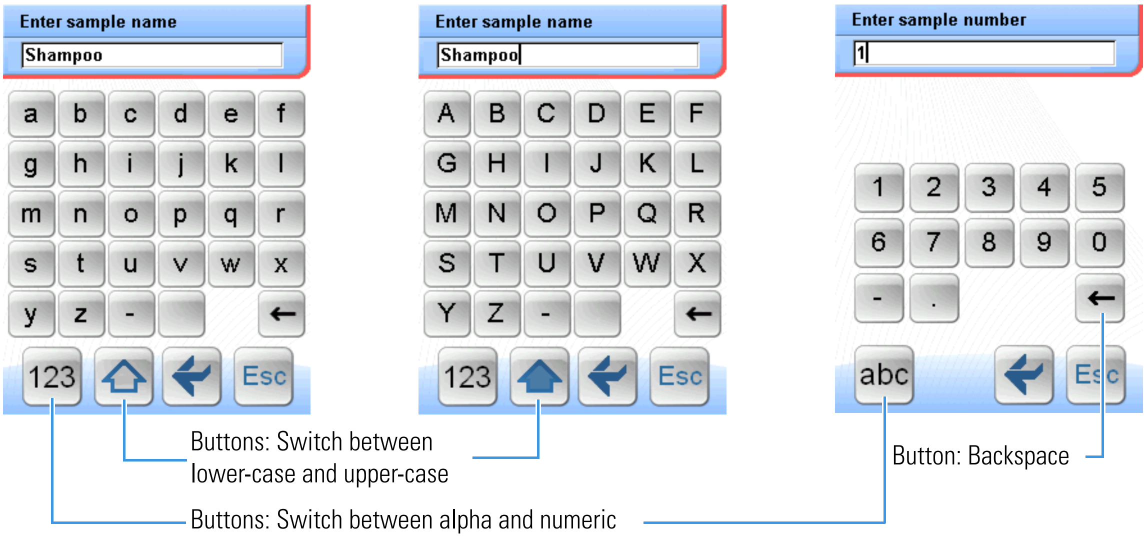
1. Tap on the tab of the page that is to be selected.

   The active page is highlighted in the colour of the line below the tabs. This colour is different for the different menus.

On-screen keyboard

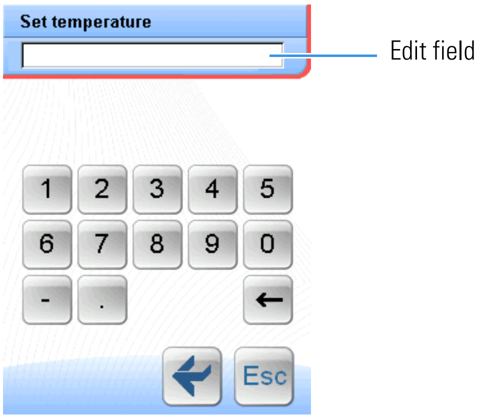
In all situations where an alphanumerical text (like the sample name) needs to be entered the on-screen alphanumerical keyboard, see Figure 6, will appear.

Figure 6. On-screen alphanumeric keyboard



In all situations where a numerical value (for job parameters and other set values) needs to be entered the on-screen numerical keyboard, see Figure 7, will appear.

Figure 7. On-screen numerical keyboard



Note To make entering alphanumerical information more comfortable, an USB keyboard can be connected to one of the two USB ports on the right hand side of the instruments head.

❖ To enter an alphanumerical text or a numerical value

1. Tap the button on the on-screen keyboard with the (first) character of the text or value to be entered.

   or

2. Hit the key on the USB keyboard with the (first) character of the text or value to be entered.
3. Repeat step 1 or step 2 until the complete text or value is entered.
4. Tap the **Enter**  button on the on-screen keyboard.

   or

5. Hit the Enter the key on the USB keyboard.

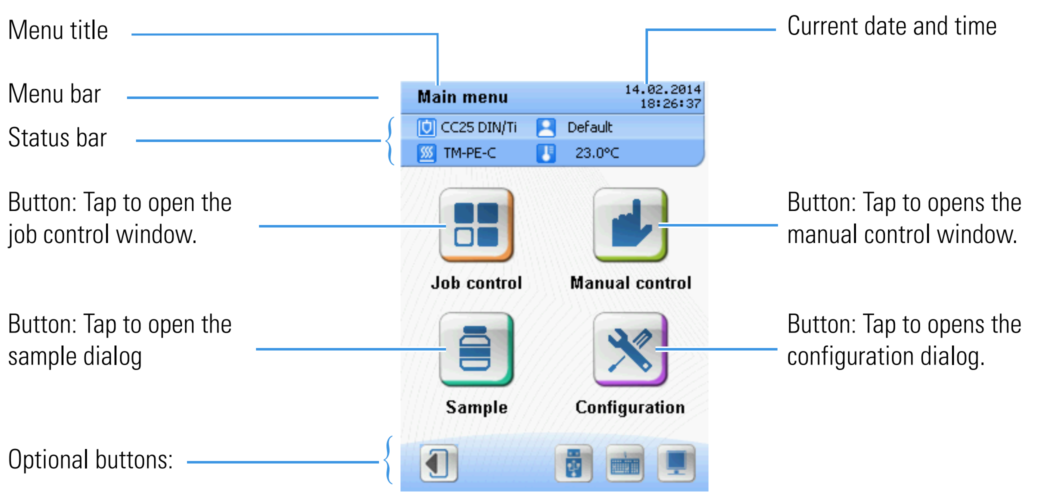
Main menu

The main menu, see Figure 8, consist of the following four main elements:

- The menu bar.
- The status bar.
- The buttons for the four main functions.
- The optional buttons at the bottom of the screen.

These four main elements are described in the following sections.

Figure 8. The Main menu



Menu bar

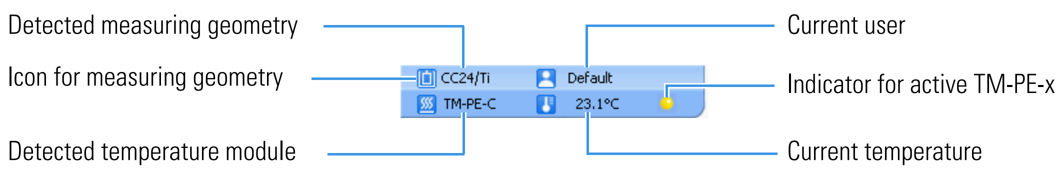
The menu bar (see Figure 8), which is also part of other menus, contains the menu title on the left hand side and the date and time on the right hand side. All the elements of the menu bar are display elements only, that means that tapping on the menu bar will have no effect.

Status bar

The status bar (see Figure 9), which is also part of some other menus, shows on the right hand side which measuring geometry (rotor) and which temperature module are detected as being mounted to the rheometer. On the left hand side the user name of the logged-in user and the current measured temperature are displayed.

The meaning of the display elements in the status bar is explained in Figure 9. All the elements of the status bar are display elements only, that means that tapping on the status bar will have no effect.

Figure 9. The status bar



Note When the HX iQ is not detected, that is not connected to the Viscotester iQ instrument head, the icon left of the text TM-PE-x will be displayed in red colour (instead of blue) and will blink. In this case temperature control will not work.

The icon displayed for the measuring geometry depends on the type of the detected measuring geometry (rotor), see Table 3.

Table 3. Icons for measuring geometries

Geometry icon	Detected measuring geometry
	Coaxial cylinder geometry according DIN 53019 / ISO 3219
	Coaxial cylinder geometry with recessed bottom
	Double gap coaxial cylinder geometry
	Parallel plate geometry
	Cone and plate geometry
	Vane geometry
	Universal adapter
	Pressure cell magnetic coupling
	Fill Assist tool
	None

Main buttons

The four main functions of the user interface, Job control, Manual control, Sample information and Configuration are accessed by tapping on one of the four large buttons.

Note The right and the lower edge of each of the four large buttons is colour coded. The same colour is used on the right and lower edges of the status bar or the tabbed pages in the corresponding window.

Optional buttons

The optional buttons at the bottom of the screen, see Figure 10, are only displayed under certain conditions, see Table 4. When a condition is not fulfilled, the corresponding button is not displayed.

Figure 10. Optional buttons at the bottom of the screen

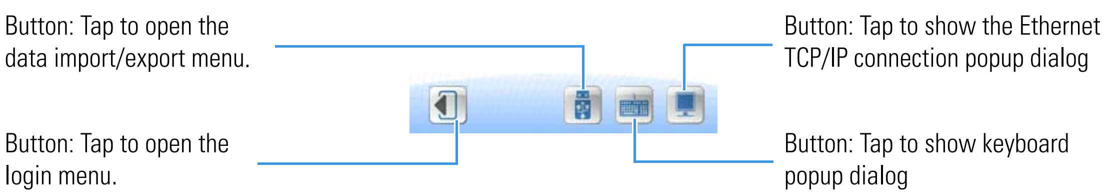


Table 4. Optional buttons at the bottom of the screen

Button	Meaning	Condition for the button to be displayed
	User login	The user management system must be active, that is when more than one user is defined.
	Fill Assist	The USB connector of the Fill Assist tool must be plugged into an USB socket on the right side of the instrument head.
	USB flash drive	The special HAAKE Viscotester iQ USB flash drive must be plugged into the correct USB socket on the right side of the instrument head.
	Keyboard	A USB keyboard must be plugged into an USB socket on the right side of the instrument head.
	Network	An Ethernet TCP/IP cable connected to a PC must be plugged into the RJ45 socket on the rear of the instrument head.

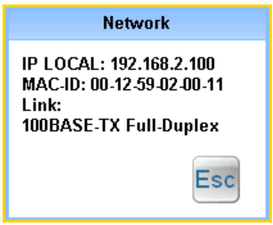
Tapping on one of the optional buttons will display another menu screen or a popup dialog:

- Tapping on the **User login** button will open the "Login menu," see page 59.
- Tapping on the **Fill Assist** button will *not* open another menu, the presence of this button just informs the operator that the Fill Assist USB plug is inserted in one of the USB sockets, see "Fill Assist tool" on page 126.
- Tapping the **USB flash drive** button will open the "Data copy menu," see page 60.
- Tapping on the **Keyboard** button will open the popup dialog shown inFigure 11. This dialog just informs the operator that the keyboard is really connected.

Figure 11. Keyboard popup dialog

- Tapping on the **Network** button will open the popup dialog shown in Figure 12, this dialog give information on the network connection, that is the Viscotester iQ's current IP address, its MAC-ID and the connection type.

Figure 12. Network popup dialog



Job control menu

The starting point for any Job related action is the Job control list menu (see Figure 13). From this list menu a Job can selected for either editing or viewing the Job or for running the Job.

❖ To edit or view a Job

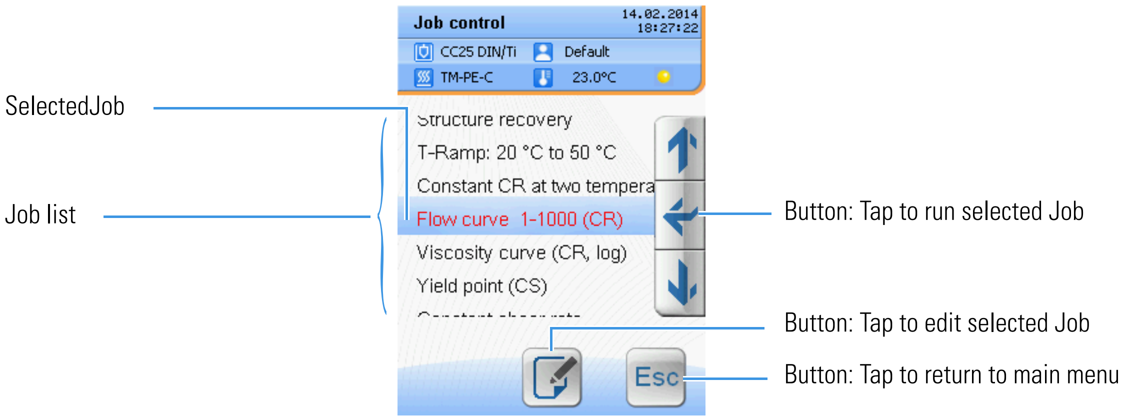
1. In the Job control menu (see Figure 13) select a Job from the list.
2. Tap the **Edit**  button below the list to open the selected Job in the "Job editor menu."

❖ To run a job

1. In the Job control menu (see Figure 13) select a Job from the list.
2. Tap the **Enter**  button in the list to open the selected Job in the "Job run menu."

For a more detailed description on how to run a job measurement see the section "Running a Job measurement."

Figure 13. Job control list menu



Job run menu

The Job run menu consist of four pages: The "Graph page," , the "Numeric page," the "Information page," page and the "Result page." The operator can switch forth and back between the four different pages at any time during a Job run.

The functionality of these pages is described in the following four sections.

Graph page

On this page one or two quantities are displayed in a graph as a function of a third quantity during the job run.

❖ To change the quantity and or unit for the left or the right axis

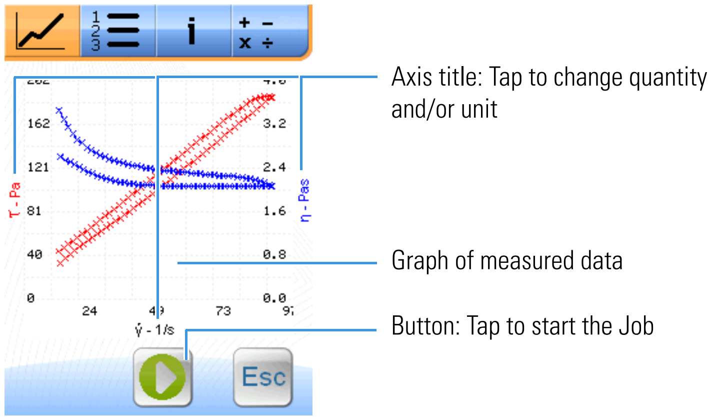
1. Tap on the axis title of the left, right or bottom axis to open the Quantity/Units menu.
2. Select the quantity and/or its unit that is to be displayed on the selected axis of the graph from the "Quantity/Units menu."
3. Close the Quantity/Units menu.

The quantities and/or units for an axis can be changed at any time during a job run.

The scaling for the axis is always automatic and can not be changed by the operator. The curve belonging to the left axis is always red (like the left axis title), the curve belonging to the right axis is always blue (like the right axis title). The line style of the curves is fixed and can not be modified.

The lower left corner of the graph page (as well as that of the numeric page and the information page) serves as status display for the running job. Here the (estimated) rest duration of the job, as well as the currently running element number in combination with total number of elements is displayed.

Figure 14. Graph page of job run menu



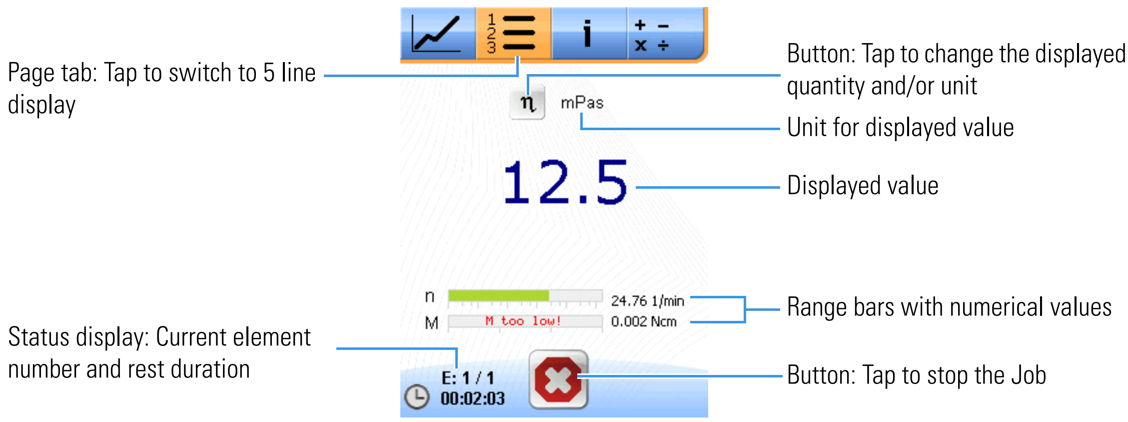
Tapping on the Start button will start the Job, the button will then be replaced by the Stop button, see Figure 15. As long as the Job is running the Esc button is disabled.

Numeric page

On this page either one or five quantities are displayed as numerical values during the job run.

The two range bars below the lines with the numeric value(s) show the current values of the two basic rheometrical quantities, angular velocity and torque, in two *logarithmically scaled* gauges, as well as their numerical values. The range bars give the operator a quick overview in which part of the total measurement the instrument is operating.

Figure 15. Numeric page of job run menu, 1 line display



❖ **To change the quantity or unit to be displayed as a numerical value**

1. Tap the **Quantity** button above or in front of the measured value to open the Quantity/Units menu.

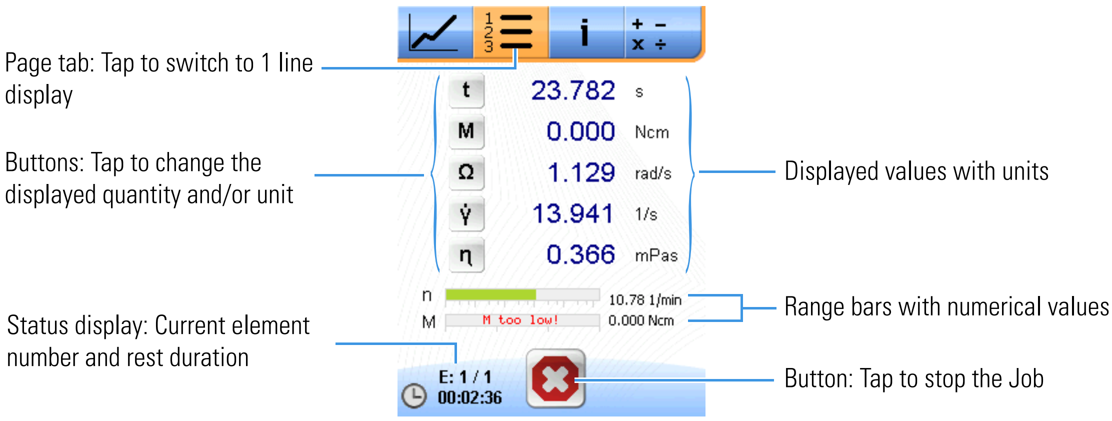
2. Select the quantity and/or its unit that is to be displayed on the selected line of the numerical display from the "Quantity/Units menu."

3. Close the Quantity/Units menu.

❖ To switch between the 1 line and the 5 line numerical display

1. Tap the **Numeric page** tab to switch the display between displaying 1 line in large characters (see Figure 15) or 5 lines with smaller characters (see Figure 16).

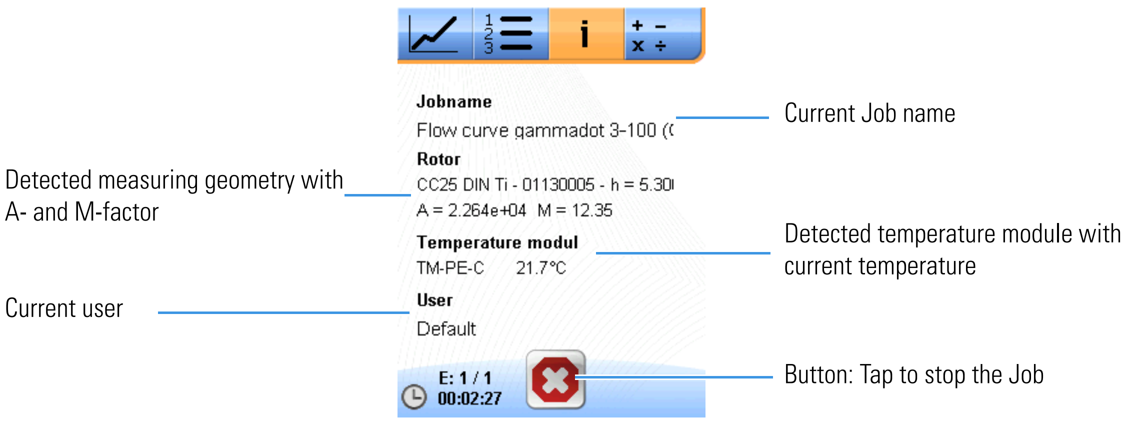
Figure 16. Numeric page of job run menu, 5 line display



Information page

The information page has no controls (apart from the page tabs and the Start/Stop button), it basically gives the same information as the status bar in the main menu and some other menus.

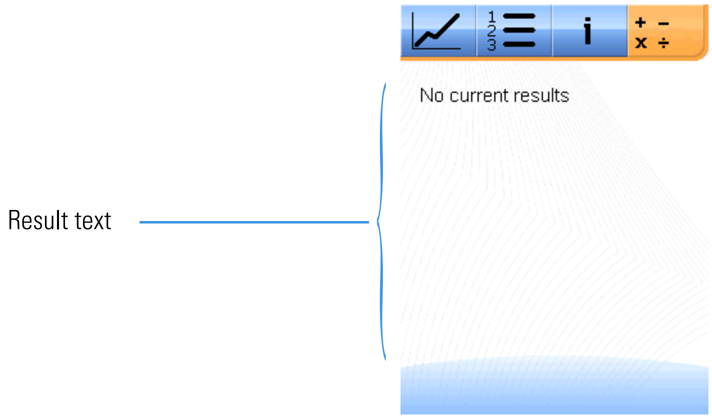
Figure 17. Information page of job run menu



Result page

At the end of a Job run the result page will display the calculated results of all the evaluation elements in a Job, see Figure 19. When the Job does not contains such elements or when the Job is not finished yet, this page will show the text No current results (see Figure 18).

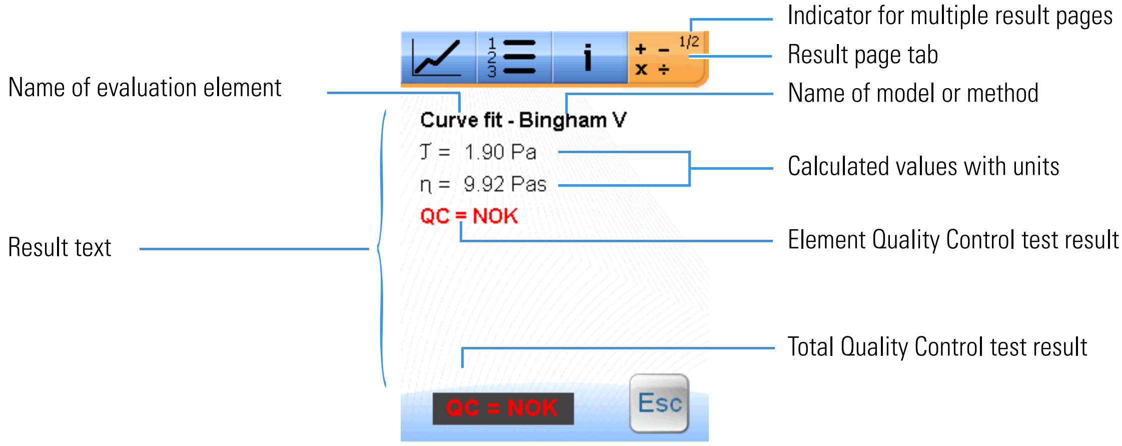
Figure 18. Result page of job run menu (with no results)



The result page does not only display the calculated result values, but also the result of a quality control (QC) test. For the QC test it is checked whether the calculated results values (of each element) are within a certain predefined range around a predefined reference value. When the test is positive the text QC = Ok is displayed below the result value(s), when the result is negative the text QC = Not Ok is displayed (see Figure 19).

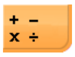
At the bottom of the result page the logical sum of all the QC test is displayed. Only when all QC tests are positive, the total QC result will be positive.

Figure 19. Result page of job run menu (with results)



When the result text (of multiple elements) does not completely fit on the result page, the result page will consist of multiple pages. In this case an indicator (see Figure 19) for multiple result pages is displayed in the Result page tab.

❖ **To switch between multiple result pages**

1. Tap the **Result page**  tab to switch the display between multiple result pages.

Running a Job measurement

To run a job measurement, starting from the Main menu, proceed as described below. When the touchscreen control is setup to show the Job control menu as the starting menu, the first step is not needed.

❖ To run a job measurement

1. In the Main menu tap the **Job control** button.
2. In the Job control menu (see Figure 13) select a Job from the list.
3. Tap the **Enter** button in the list to open the selected Job in the Job run menu.

> **Note** When the Show sample menu option is active, the Sample menu (see "Sample menu" on page 45) will be opened instead first. After the closing the Sample menu the Job run menu will be opened.

4. Tap the Start button to actually start the job.

Job editor menu

The Job editor menu consist of three pages: The "Editor page: General," the "Settings page," the "Information page."

The functionality of these pages is described in the following sections.

Editor page: General

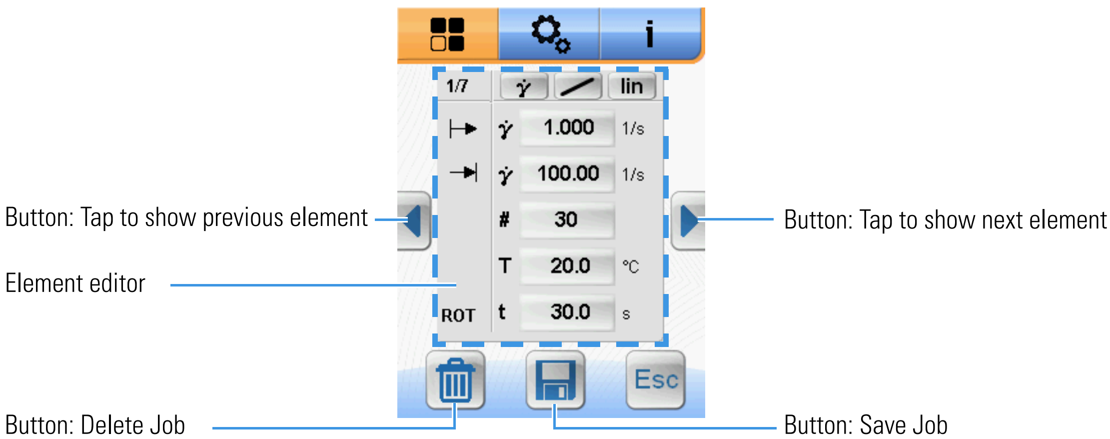
From the editor page (see Figure 20) a Job, that is the parameters of the individual Job elements that make up a Job, can be viewed and edited. Since the editor page can only show one Job element at a time, the operator must scroll through the list of elements to be able to view or edit all elements of a Job. From the editor page a Job can also be deleted and saved.

❖ To scroll through the list of Job elements

1. Tap the **Next** button to display the next element in the list.
2. Tap the **Previous** button to display the previous element in the list.

Figure 20 shows the Rotation Ramp Element in the editor page of the Job editor menu to explain the editor functionality which is more or less the same for all measurement elements. The editor functionality for the evaluation elements is quite different and described separately starting from page 30.

Figure 20. Editor page of Job editor menu

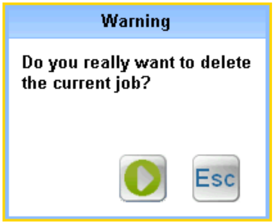


❖ To delete a Job

1. Tap the **Delete** button.

   A message (see Figure 21) will popup asking for confirmation to delete the Job.

   Figure 21. Warning popup message



2. Tap the **Start** button to confirm the deletion of the Job.

   After the Job is deleted the Job editor menu will be closed and the Job control menu will be displayed.

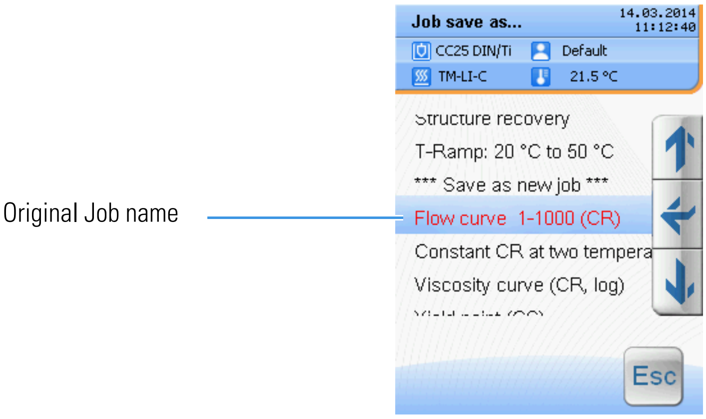
A (modified) Job can be saved using its original name, thereby overwriting the existing Job, or using a new name, which will leave the original Job intact.

❖ To save a Job using its original name

1. Tap the **Save** button to open the Save Job as... menu (see Figure 22).

   In the list with Job names the original Job name will be automatically selected.

   Figure 22. Save Job as... menu

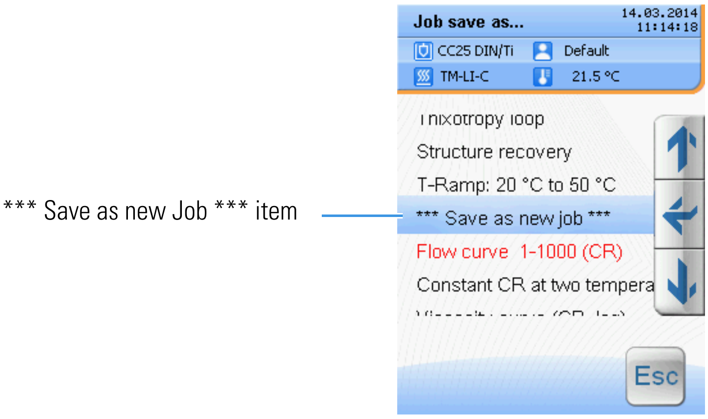


2. Tap the **Enter** button in the Save Job as... menu to save the Job using its original name.

❖ To save a Job using a new name

1. Tap the **Save** button to open the Save Job as... menu
2. Select the *** **Save as new Job** *** item from the list of Job names (see Figure 23).

Figure 23. Save Job as... menu



3. Tap the **Enter** button to open the on-screen alphanumerical keyboard menu.
4. Enter the new Job name.
5. Tap the **Enter** button in the on-screen alphanumerical keyboard menu to save the Job using the new name.

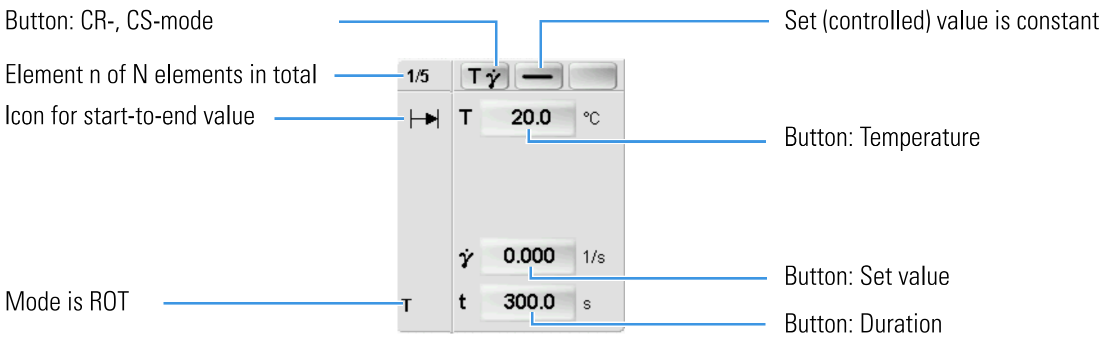
Editor page: Measurement elements Rotation

The element editors of the four rotation measurement elements are described in the following sections.

Editor for ROT temperature set element

The ROT temperature set element is a pre-measurement, sample conditioning element with no data acquisition. It is used to make sure that temperature equilibrium in the sample is achieved or to pre-shear the sample by applying a constant shear rate or shear stress during the duration of the element.

Figure 24. Element editor for temperature set element



❖ To switch between CR- and CS-mode

1. Tap the $T\dot{\gamma}$ or $T\tau$ button to switch between CR-mode (the shear rate $\dot{\gamma}$ is controlled) and CS-mode (the shear stress τ is controlled).

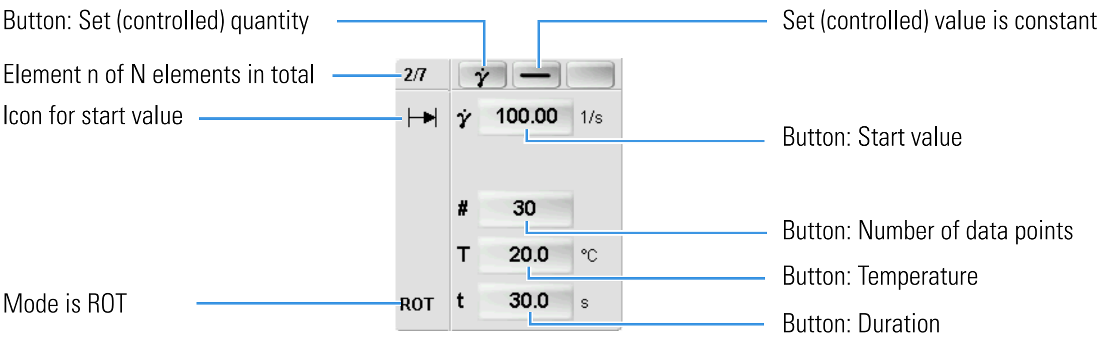
❖ To change the temperature, the set value or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the temperature, the set value or the duration in the numerical keyboard menu and close it.

Editor for ROT time element

With the ROT time element a constant value of the shear rate $\dot{\gamma}$ (CR-mode) or the shear stress τ (CS-Mode) is applied for a certain time (duration). When the TM-PE-C or TM-PE-P temperature module is used the sample temperature T can be controlled.

Figure 25. Element editor for ROT time element



❖ To switch between CR- and CS-mode

1. Tap the $\dot{\gamma}$ or τ button to switch between CR-mode (the shear rate $\dot{\gamma}$ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To change the set value, the number of data points, the temperature or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the set value, the number of data points, the temperature or the duration in the numerical keyboard menu and close it.

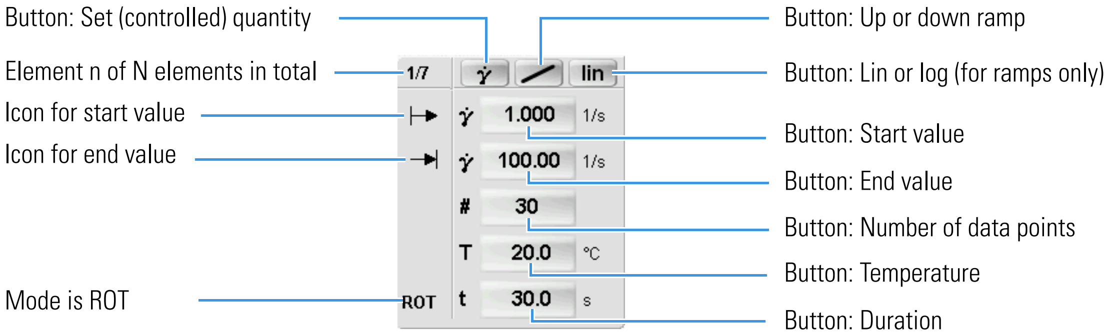
Editor for ROT ramp element

With the ROT ramp element a the applied shear rate $\dot{\gamma}$ (CR-mode) or the shear stress τ (CS-Mode) is changed from a certain start value to a certain end value during a certain time (duration). When the TM-PE-C or TM-PE-P temperature module is used the sample temperature T can be controlled.

The change in shear rate or shear stress can defined to be a linear ramping function of time (lin ramp) or an exponential ramping function of time (log ramp) which is traditionally called a logarithmic ramp because the resulting shear rate or shear stress values are logarithmically equidistant.

The ramp can be defined as an upward ramp (the value of the shear rate or shear stress is increasing as function of time) or a downward ramp (the value of the shear rate or shear stress is decreasing as a function of time).

Figure 26. Element editor for ROT ramp element



❖ To switch between CR- and CS-mode

1. Tap the $\dot{\gamma}$ or τ button to switch between CR-mode (the shear rate $\dot{\gamma}$ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To switch between ramp up and ramp down

1. Tap the  or  button to switch between upward and a downward ramp.

❖ To switch between lin and log ramp

1. Tap the lin or log button to switch between a linear ramp and a logarithmic ramp.

❖ To change the start value, the end value, the number of data points, the temperature or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the start value, the end value, the number of data points, the temperature or the duration in the numerical keyboard menu and close it.

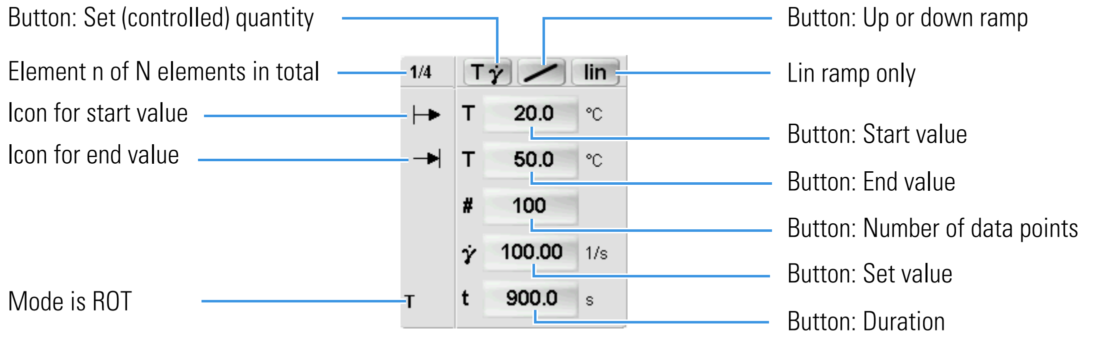
Editor for ROT temperature ramp element

With the ROT temperature ramp element a constant shear rate $\dot{\gamma}$ (CR-mode) or shear stress τ (CS-Mode) is applied while the sample temperature is changed from a certain start value to a certain end value during a certain time (duration). This element can only be used in combination with the TM-PE-C or TM-PE-P temperature module.

The change in temperature is always a linear ramping function of time (lin ramp).

The ramp can be defined as an upward ramp (the value of the temperature is increasing as function of time) or a downward ramp (the value of the temperature is decreasing as a function of time).

Figure 27. Element editor for ROT temperature ramp element



❖ To switch between CR- and CS-mode

1. Tap the T $\dot{\gamma}$ or T τ button to switch between CR-mode (the shear rate $\dot{\gamma}$ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To switch between ramp up and ramp down

1. Tap the ⁄ or ╲ button to switch between upward and a downward ramp.

❖ To change the start temperature, the end temperature, the number of data points, the set value or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the start temperature, the end temperature, the number of data points, the set value or the duration in the numerical keyboard menu and close it.

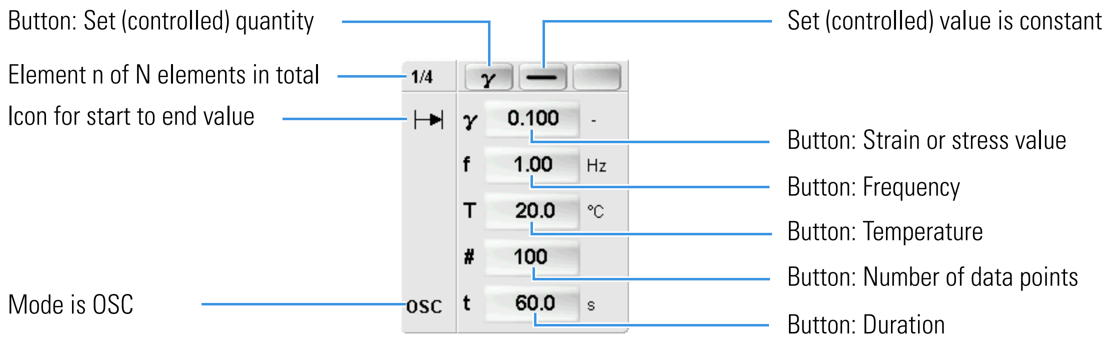
Editor page: Measurement elements Oscillation

The element editors of the four oscillation measurement elements are described in the following sections.

Editor for OSC time element

With the OSC time element a constant value of the strain γ (CD-mode) or the shear stress τ (CS-Mode) using a constant frequency f is applied for a certain time t (duration). When the TM-PE-C or TM-PE-P temperature module is used the sample temperature T can be controlled.

Figure 28. Element editor for OSC time element



❖ To switch between CD- and CS-mode

1. Tap the γ or τ button to switch between CD-mode (the strain γ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To change the strain or stress value, the frequency, the temperature, the number of data points or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the strain or stress value, the frequency, the temperature, the number of data points or the duration in the numerical keyboard menu and close it.

   The allowed value for the strain or stress amplitude depends on the used measuring geometry, see Appendix A, "Properties of Measuring Geometries."

   The frequency must be in the range of 0.1 Hz to 20 Hz.

   The temperature must be in the range defined by the specifications of the used temperature module, see Chapter 6, "Temperature Modules," in the HAAKE Viscotester iQ Instruction Manual.

   The number of data points must be in the range of 1 to 5000 (5000 is the maximum, total number of data points allowed for all elements in one job).

   The duration must be in the range of ??? s to ??? s.

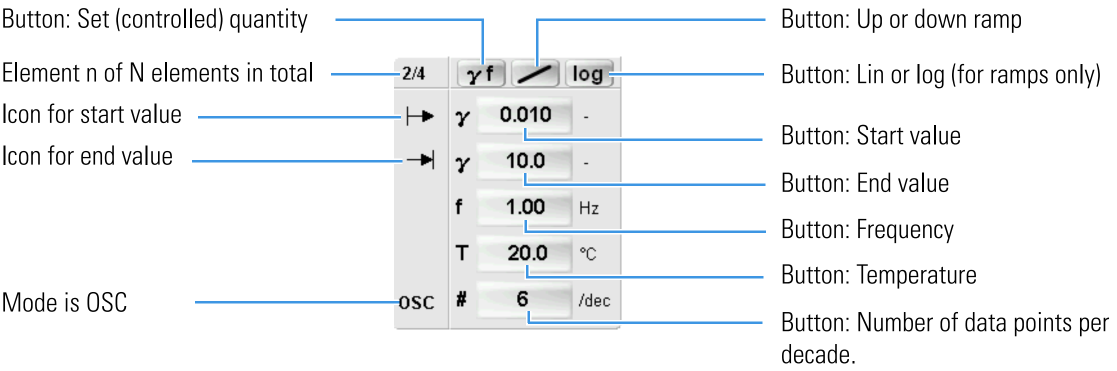
Editor for OSC amplitude sweep element

With the OSC amplitude sweep element the applied strain γ (CD-mode) or the shear stress τ (CS-Mode) is changed from a certain start value to a certain end value using a constant frequency f. The duration of the amplitude sweep depends on the frequency and the selected number of data points per decade. When the TM-PE-C or TM-PE-P temperature module is used the sample temperature T can be controlled.

The change in strain or shear stress can defined to be a linear ramping function of time (lin ramp) or an exponential ramping function of time (log ramp) which is traditionally called a logarithmic ramp because the resulting strain or shear stress values are logarithmically equidistant.

The ramp can be defined as an upward ramp (the value of the strain or shear stress is increasing as function of time) or a downward ramp (the value of the strain or shear stress is decreasing as a function of time).

Figure 29. Element editor for OSC amplitude sweep element



❖ To switch between CD- and CS-mode

1. Tap the γ**f** or τ**f** button to switch between CD-mode (the strain γ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To switch between ramp up and ramp down

1. Tap the  or  button to switch between upward and a downward ramp.

❖ To switch between lin and log ramp

1. Tap the **lin** or **log** button to switch between a linear ramp and a logarithmic ramp.

❖ To change the start value, the end value, the frequency, the temperature or the number of data points per decade

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the start value, the end value, the frequency, the temperature or the number of data points per decade in the numerical keyboard menu and close it.

   The allowed start and end values for the strain or stress amplitude depend on the used measuring geometry, see Appendix A, "Properties of Measuring Geometries."

   The frequency must be in the range of 0.1 Hz to 20 Hz.

   The temperature must be in the range defined by the specifications of the used temperature module, see Chapter 6, "Temperature Modules," in the HAAKE Viscotester iQ Instruction Manual.

   The number of data points per decade must be in the range of 2 to 25.

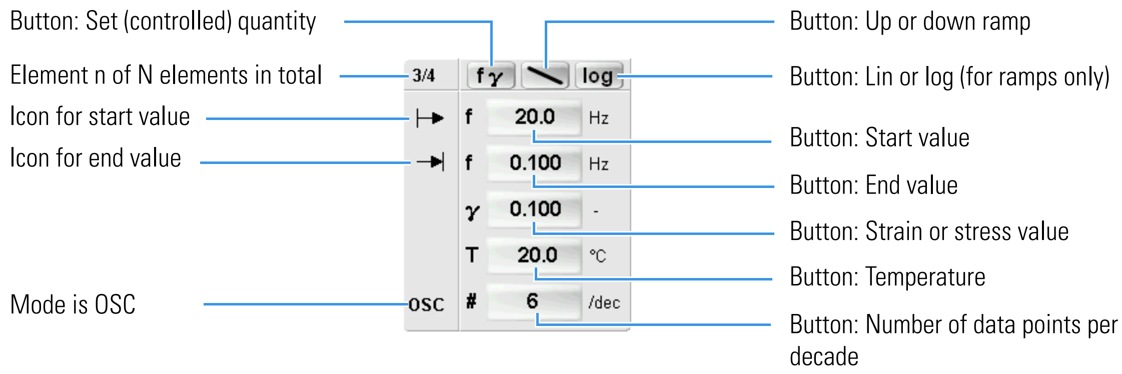
Editor for OSC frequency sweep element

With the OSC frequency sweep element the frequency f used while applying a constant strain γ (CD-mode) or shear stress τ (CS-Mode) is changed from a certain start value to a certain end value. The duration of a frequency sweep depends on the selected frequency range and the selected number of data points per decade. When the TM-PE-C or TM-PE-P temperature module is used the sample temperature T can be controlled.

The change in frequency can defined to be a linear ramping function of time (lin ramp) or an exponential ramping function of time (log ramp) which is traditionally called a logarithmic ramp because the resulting frequency values are logarithmically equidistant.

The ramp can be defined as an upward ramp (the value of the frequency is increasing as function of time) or a downward ramp (the value of the frequency is decreasing as a function of time).

Figure 30. Element editor for OSC frequency sweep element



❖ To switch between CD- and CS-mode

1. Tap the fγ or fτ button to switch between CD-mode (the strain γ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To switch between ramp up and ramp down

1. Tap the ／ or ＼ button to switch between upward and a downward ramp.

❖ To switch between lin and log ramp

1. Tap the lin or log button to switch between a linear ramp and a logarithmic ramp.

❖ To change the start value, the end value, the strain or stress value, the temperature or the number of data points per decade

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the start value, the end value, the strain or stress value, the temperature or the number of data points per decade in the numerical keyboard menu and close it.

   The start and end values for the frequency must be in the range of 0.1 Hz to 20 Hz.

   The allowed value for the strain or stress amplitude depends on the used measuring geometry, see Appendix A, "Properties of Measuring Geometries."

   The temperature must be in the range defined by the specifications of the used temperature module, see Chapter 6, "Temperature Modules," in the HAAKE Viscotester iQ Instruction Manual.

   The number of data points per decade must be in the range of 2 to 25.

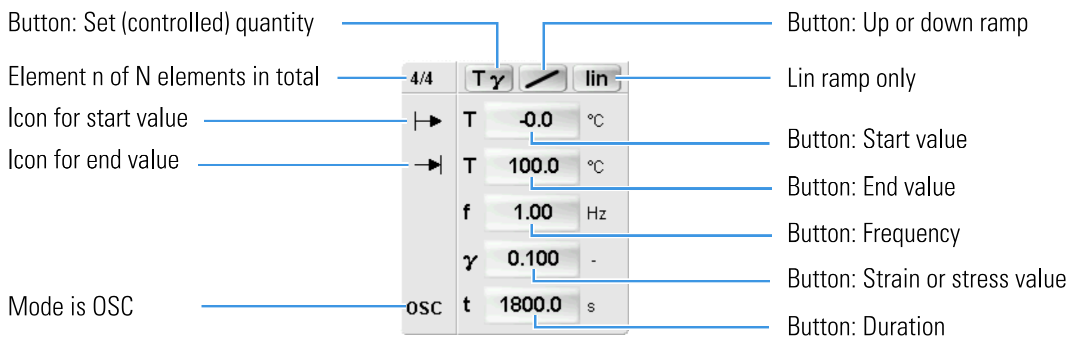
Editor for OSC temperature ramp element

With the OSC temperature ramp element a constant strain γ (CD-mode) or shear stress τ (CS-Mode) using a constant frequency f is applied while the sample temperature T is changed from a certain start value to a certain end value during a certain time t (duration). This element can only be used in combination with the TM-PE-C or TM-PE-P temperature module.

The change in temperature is always a linear ramping function of time (lin ramp).

The ramp can be defined as an upward ramp (the value of the temperature is increasing as function of time) or a downward ramp (the value of the temperature is decreasing as a function of time).

Figure 31. Element editor for OSC temperature ramp element



❖ To switch between CD- and CS-mode

1. Tap the Tγ or Tτ button to switch between CD-mode (the strain γ is controlled) and CS-mode (the shear stress τ is controlled).

❖ To switch between ramp up and ramp down

1. Tap the or button to switch between upward and a downward ramp.

❖ To change the start temperature, the end temperature, the frequency, the strain or stress value or the duration

1. Tap the corresponding button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the start temperature, the end temperature, the frequency, the strain or stress value or the duration in the numerical keyboard menu and close it.

   The start and end values for the temperature must be in the range defined by the specifications of the used temperature module, see Chapter 6, "Temperature Modules," in the HAAKE Viscotester iQ Instruction Manual.

   The frequency must be in the range of 0.1 Hz to 20 Hz.

   The allowed value for the strain or stress amplitude depends on the used measuring geometry, see Appendix A, "Properties of Measuring Geometries."

   The duration should be in line with the maximum heating or cooling rate of the temperature module (circulator) used.

❖ To change the number of data points

1. The number of data points can be only changed by using the Job editor in the RheoApp software, see "JobEditor dialog" on page 73

Editor page: Evaluation elements

The element editors of the seven evaluation elements are described in the following corresponding sections. The editor controls that are common for all evaluation elements, for example those for setting the data range and setting the tolerance values, are described in "Common evaluation element controls" on page 35.

Editor for Curve fit element

With the Curve fit element a curve fit, according to a selectable model equation, can be performed on a selectable range of the measured data. There are 4 curve fit models available, each model is available for shear stress τ as a function of shear rate $\dot{\gamma}$ data $\tau = f(\dot{\gamma})$ as well as for viscosity η as a function of shear rate $\dot{\gamma}$ data $\eta = f(\dot{\gamma})$, see Table 5.

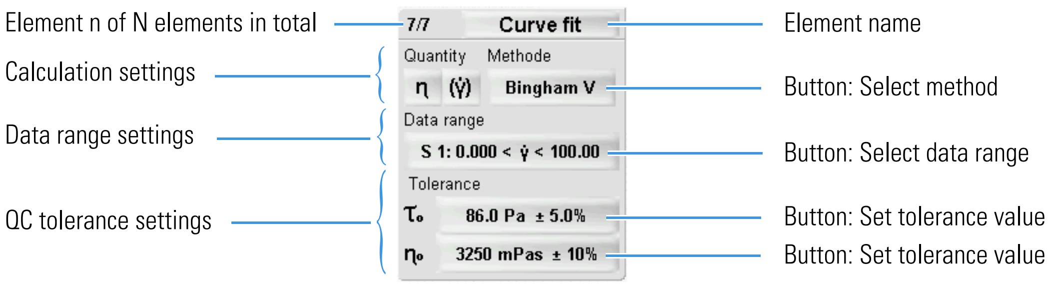
For quality control the Curve element can be set to check whether the resulting model parameters are within a certain absolute or relative tolerance with respect to a reference value for that model parameter.

Table 5. Curve fit models

Model name	Model equation for $\tau = f(\dot{\gamma})$	Model equation for $\eta = f(\dot{\gamma})$
Newton	$\tau = \eta \cdot \dot{\gamma}$	$\eta = \text{constant}$
Bingham	$\tau = \tau_0 + \eta_p \cdot \dot{\gamma}$	$\eta = \tau_0 / \dot{\gamma} + \eta_p$
Power law	$\tau = k \cdot \dot{\gamma}^n$	$\eta = k \cdot \dot{\gamma}^{n-1}$
Casson	$\tau = \sqrt{\tau_0^2 + (\eta_p \cdot \dot{\gamma})^2}$	$\eta = \sqrt{(\tau_0 / \dot{\gamma})^2 + \eta_p^2}$

From the element editor for the Curve element, see Figure 32, the curve fit model, the data range and the tolerance value(s) can be set.

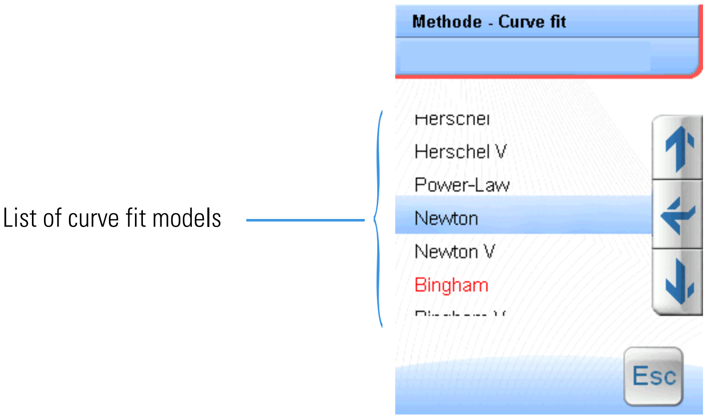
Figure 32. Element editor for Curve fit element



❖ To select a curve fit model equation

1. Tap the **Method** button to open the Method - Curve fit menu.
2. Select a **Model** from the list of models in the Method - Curve fit menu, see Figure 33.

Figure 33. Method - Curve fit menu



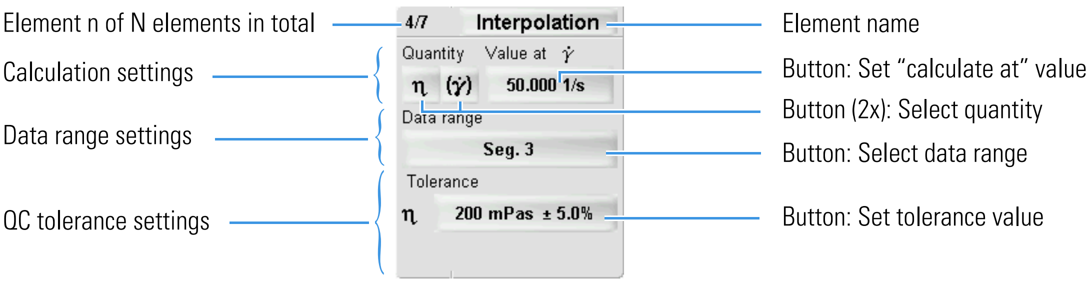
See “Common evaluation element controls” on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value(s). For the Curve fit element not only the data segment but also a specific range of shear rate values can be defined as the data range, see “To select the Data range for an evaluation element” on page 36.

Editor for Interpolation element

With the Interpolation element an interpolated value can be calculated for a one quantity as a function of another quantity. For example the value of the viscosity η at certain shear rate $\dot{\gamma}$ or at a certain temperature T.

For quality control the Interpolation element can be set to check whether the interpolated value is within a certain absolute or relative tolerance with respect to a reference value for the interpolated value.

Figure 34. Element editor for Interpolation element



❖ To select the quantities for the interpolation

1. Tap the left **Quantity** button (η in the example) to open the Select quantity menu.
2. Select the quantity that is to be interpolated from the Select quantity menu, see “Quantity/Units menu” on page 48.

1. Tap the right **Quantity** button ($(\dot{\gamma})$ in the example) to open the Select quantity menu.
2. Select the quantity, at which the interpolated quantity is to be calculated, from the Select quantity menu.

❖ To set the “calculate at” value

1. Tap the **Set “calculate at” value** button in the element editor to open the numerical keyboard menu.
2. Enter the desired value at which the interpolated quantity is to be calculated in the numerical keyboard menu and close it.

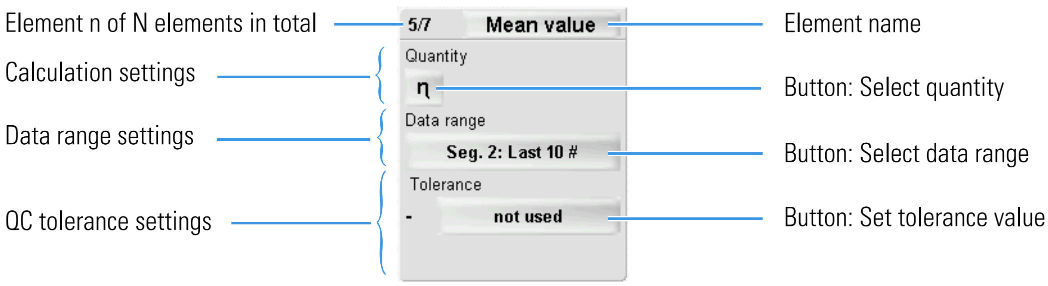
See “Common evaluation element controls” on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value.

Editor for Mean Value element

With the Mean value element the mean value of a (measured) quantity over a certain range can be calculated. For example the mean value of the last 10 measured viscosity η data points in a certain data segment.

For quality control the Mean value element can be set to check whether the calculated mean value is within a certain absolute or relative tolerance with respect to a reference value for the mean value.

Figure 35. Element editor for Mean Value element



❖ To select the quantity for the mean value calculation

1. Tap the **Quantity** button (η in the example) to open the Select quantity menu.
2. Select the quantity for which the mean value is to be interpolated from the Select quantity menu, see “Quantity/Units menu” on page 48.

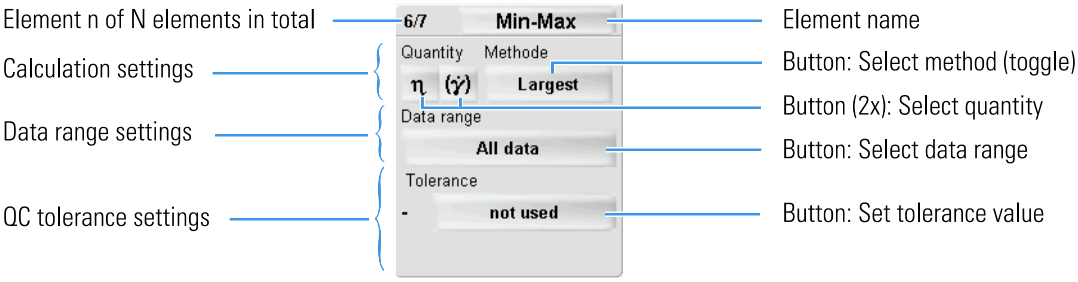
See “Common evaluation element controls” on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value. For the Mean value element not only the data segment but also the last n values of a segment can be defined as the data range, see “To select the Data range for an evaluation element” on page 36.

Editor for Min-Max element

With the Min-Max element, the minimum, the maximum, the smallest or the largest value of a (measured) quantity over a certain range can be calculated. For example the maximum of the measured viscosity η as a function of the time, or the maximum of the shear stress τ as a function of time in a certain data segment.

For quality control the Min-Max element can be set to check whether the calculated value is within a certain absolute or relative tolerance with respect to a reference value for the calculated value.

Figure 36. Element editor for Min-Max element



❖ To select the quantities for the min-max calculation

1. Tap the left **Quantity** button (η in the example) to open the Select quantity menu.
2. Select the quantity that is to be interpolated from the Select quantity menu, see "Quantity/Units menu" on page 48.
3. Tap the right **Quantity** button ((γ̇) in the example) to open the Select quantity menu.
4. Select the quantity, at which the interpolated quantity is to be calculated, from the Select quantity menu.

❖ To select the method

1. Tap the **Method** button (Largest in the example) one or multiple times until the desired method is displayed on the button.

See "Common evaluation element controls" on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value.

Editor for Thixotropy Area element

With the Thixotropy area element the difference of the area A_{upward} under a $\tau=f(\dot{\gamma})$ upward curve and the area $A_{downward}$ under a $\tau=f(\dot{\gamma})$ downward curve can be calculated. The result can be displayed as an absolute difference or a relative difference, see Table 6.

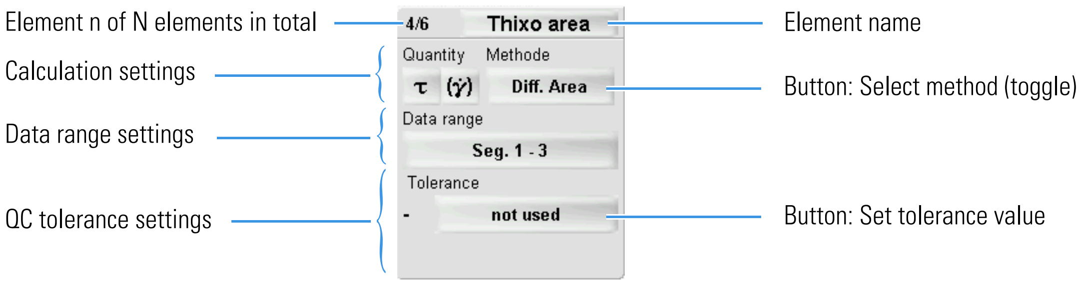
Table 6. Thixotropy area element calculation result

Method	Result
Diff. Area	$A_{upward} - A_{downward}$
Diff. Area %	$100 \times (A_{upward} - A_{downward})/A_{upward}$

In order for this element to work the Job must contain either a upward ROT Ramp element + a downward ROT Ramp element, or an upward ROT Ramp Up element + a ROT Time element + a downward ROT Ramp element, in that order.

For quality control the Thixotropy area element can be set to check whether the Thixotropy area value is within a certain absolute or relative tolerance with respect to a reference Thixotropy area value.

Figure 37. Element editor for Thixotropy area element



❖ To select the method

1. Tap the **Method** button (Diff. Area in the example) to switch between the Diff. Area and the Diff. Area % methods.

See "Common evaluation element controls" on page 35 on how to activate/deactivate the tolerance check and how to set the tolerance value. The data range for the calculation always consists of the complete data of the two ROT Ramp elements and can not be modified.

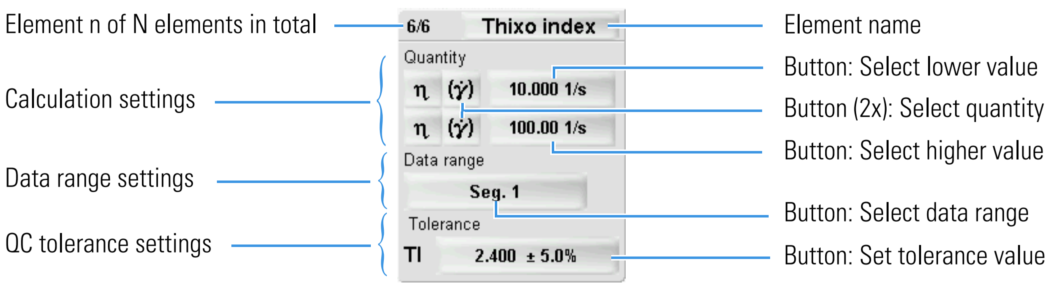
Editor for Thixotropy Index element

With the Thixotropy index element the so-called thixotropy index, which is defined at the quotient of the viscosity value η_1 measured at a lower shear rate $\dot{\gamma}_1$ (or angular speed n_1) and the viscosity value η_2 measured at a higher shear rate $\dot{\gamma}_2$ (or angular speed n_2).

Thixotropy Index TI = $\eta_1(\dot{\gamma}_1)/\eta_2(\dot{\gamma}_2)$ or TI = $\eta_1(n_1)/\eta_2(n_2)$ with $\dot{\gamma}_1 < \dot{\gamma}_2$ and $n_1 < n_2$

For quality control the Thixotropy index element can be set to check whether the calculated Thixotropy index is within a certain absolute or relative tolerance with respect to a reference Thixotropy index value.

Figure 38. Element editor for Thixotropy index element



❖ To select the quantity

1. Tap either the upper or the lower (right) **Quantity** button ($(\dot{\gamma})$ in the example) to switch between the shear rate $\dot{\gamma}$ and the rotational speed n.

❖ To select the two shear rate or rotational speed values

1. Tap the **Select lower value** button or the **Select higher value** button in the element editor to open the numerical keyboard menu.
2. Enter the desired value for the lower or the higher value in the numerical keyboard menu and close it.

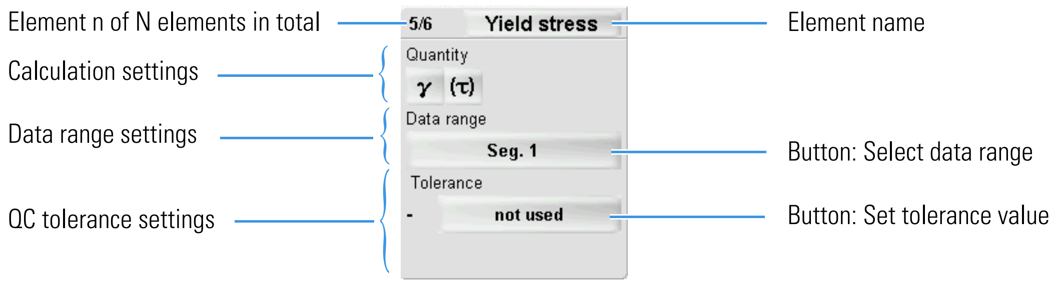
See “Common evaluation element controls” on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value.

Editor for Yield Stress element

With the Yield stress element the yield stress value can be calculated from the data measured with a controlled stress ramp during which the stress is increased as linear function of time.

For quality control the Yield stress area element can be set to check whether the yield stress value is within a certain absolute or relative tolerance with respect to a reference yield stress value.

Figure 39. Element editor for Yield stress element

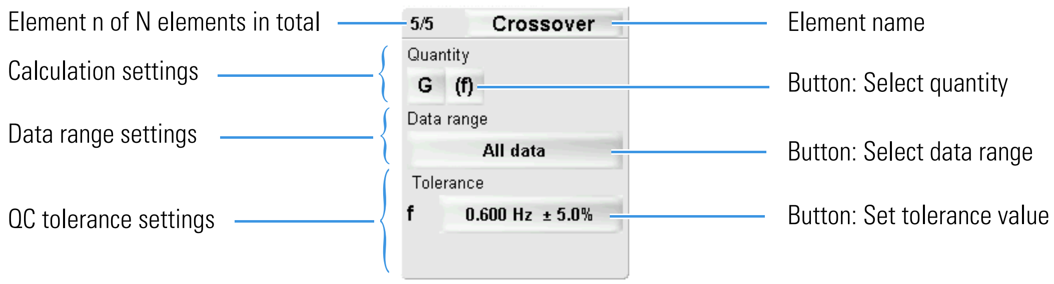


See “Common evaluation element controls” on page 35 on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value. The data range for the Yield stress calculation must always consists of the data of one ROT Ramp element.

Editor for Cross-over element

With the Cross-over element the cross-over point, that is the point at which G’ = G”, can be calculated from the data measured with one of the four oscillation measurement elements.

Figure 40. Element editor for Cross-over element



❖ To select the quantity

1. Tap the **Quantity** button ((f) in the example) to switch between the frequency f, the strain γ, the shear stress τ, the time t and the temperature T.

See “Common evaluation element controls” on page 35 on how to set the on how to set the data range, how to activate/deactivate the tolerance check and how to set the tolerance value.

Common evaluation element controls

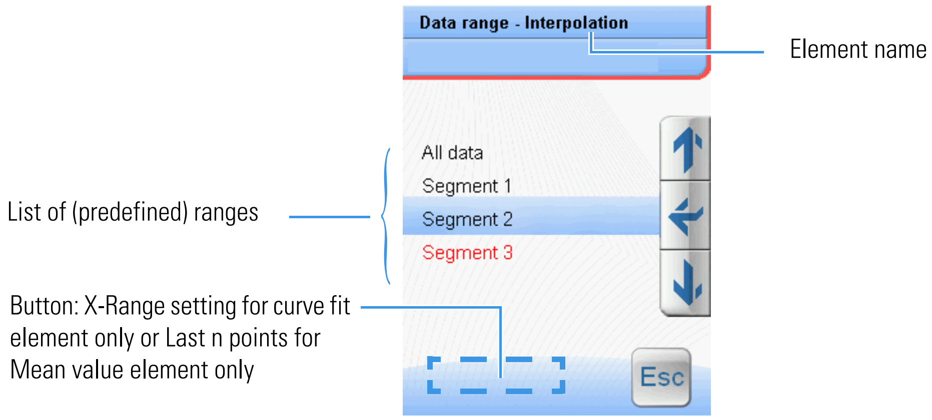
Certain controls in the evaluation element editors are (almost) the same for all evaluation elements. These common controls are described in this section.

❖ To select the Data range for an evaluation element

1. Tap the **Select data range** button to open the Data range menu.
2. Select the desired data segment from the list of ranges (see Figure 41).

   The list of ranges always includes the All data item and the Segment 1 item. More Segment x items are included when the Job contains more than one measurement element. A (data) segment stands for the data acquired by a measurement element.

Figure 41. Select Data range menu

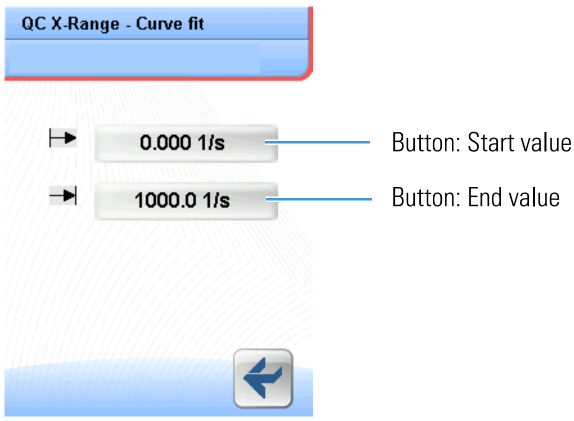


The Data range menu for the Curve fit element and the Mean value element are both equipped with a special button in the lower left part of the menu (see Figure 41).

For the Curve fit element only:

3. Tap the **X-Range** X-Range button to open the X-Range menu, see Figure 42.

Figure 42. X-Range menu (for Curve fit element only)



4. Tap the **Start value** or the **End value** button to open the numerical keyboard menu.
5. Enter the desired value for the Start value or the End value in the numerical keyboard menu and close it.

   For the Mean value element only:

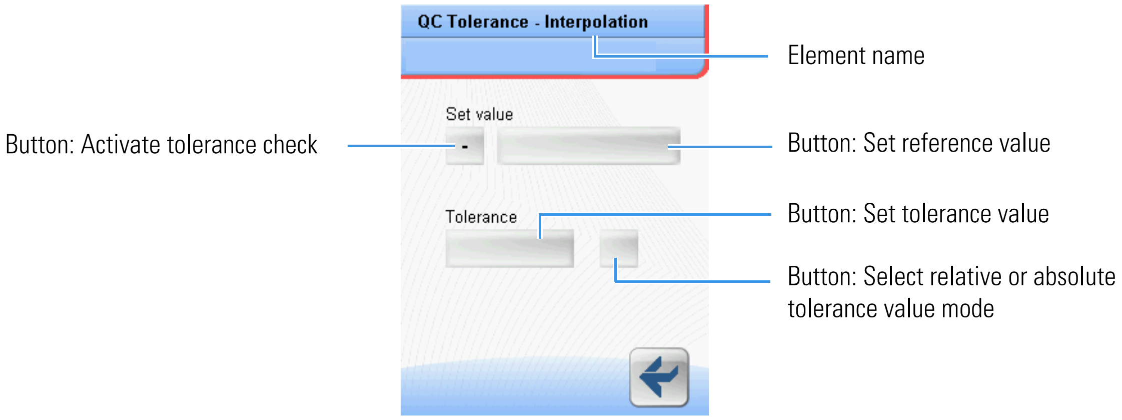
6. Tap the **Last n points** Last 10 points button to open the numerical keyboard menu.
7. Enter the desired value for the Last n points in the numerical keyboard menu and close it.

❖ To activate the QC tolerance check

1. Tap the **Set tolerance value** button in an evaluation element editor to open the QC Tolerance menu.
2. Tap the **Activate tolerance check** [-] button, see Figure 43.

   The Activate tolerance check button, the Set reference value button, the Set tolerance value button and the Mode switch button will now be populated with values and text, see Figure 44.

Figure 43. Set Tolerance values menu



❖ To deactivate the QC tolerance check

1. Tap the **Set tolerance value** button in an evaluation element editor to open the QC Tolerance menu.
2. Tap the **Activate tolerance check** [η] button, see Figure 44.

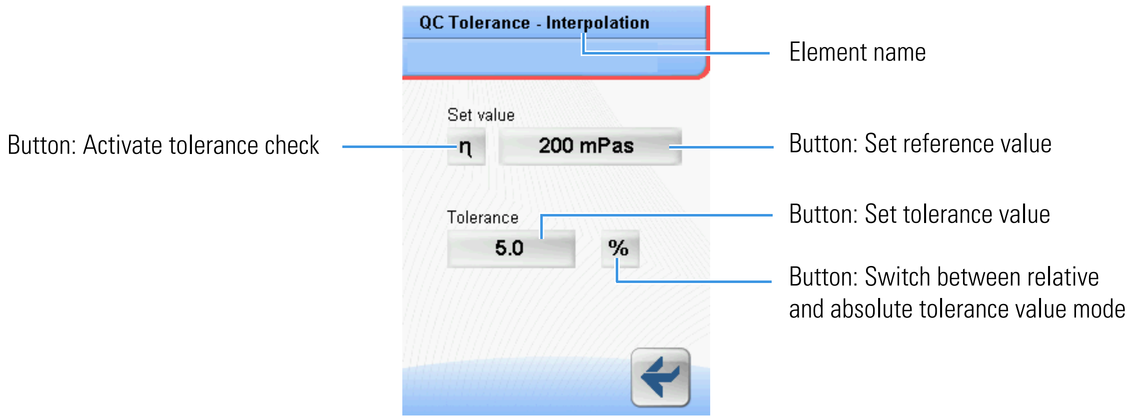
   The values and texts on the Activate tolerance check button, the Set reference value button, the Set tolerance value button and the Mode switch button will now be removed, see Figure 43.

> **Note** Which symbol (η in the example) is displayed on the Activate tolerance check button depends on the settings of the evaluation element.

❖ To set the tolerance values

1. Tap the **Set tolerance value** button in an evaluation element editor to open the QC Tolerance menu.
2. Activate the QC tolerance check if needed, see "To activate the QC tolerance check."
3. Tap the **Set reference value** button to open the numerical keyboard menu
4. Enter the desired value for the Reference value in the numerical keyboard menu and close it.
5. Tap the **Mode** button to select the relative or absolute tolerance mode.
6. Tap the **Set tolerance value** button to open the numerical keyboard menu
7. Enter the desired value for the Tolerance value in the numerical keyboard menu and close it.

Figure 44. Set Tolerance values menu

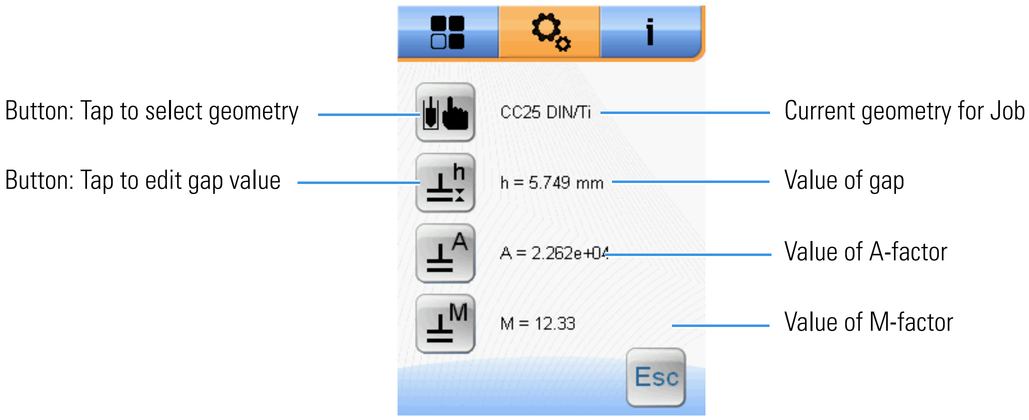


8. Tap the **Enter** button to return to the element editor.

Settings page

From the Settings page of the Job editor menu the operator can view which geometry is currently defined to be used for the Job and select another geometry if desired. For certain types of geometries certain geometry properties can be edited.

Figure 45. Settings page of Job editor menu



❖ To select another geometry for the Job

1. Tap the **Geometry** button to open the Geometry selection menu.
2. Select the desired geometry from the list of geometries in the Geometry selection menu, see Figure 46.

> **Note** The list of geometries only lists geometries that have been mounted to the Viscotester iQ drive motor shaft at least once (and have not been deleted from the list afterwards). The same list of geometries is accessible from the **Configuration > Geometries** menu, see "Geometries menu" on page 58.

Figure 46. Geometry selection menu

3. Close the on-screen Geometry selection menu.

   The selected geometry is now displayed right of the Geometry button on the Settings page.

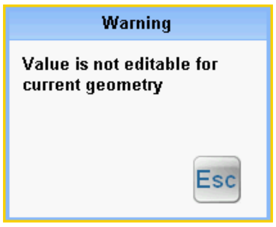
❖ To edit the gap for a parallel plate geometry

1. Tap the **Gap**  button to open the on-screen numerical keyboard menu.
2. Enter the desired gap value.
3. Close the on-screen numerical keyboard menu.

   The gap value is now displayed right of the Gap button on the Settings page.

The gap value can only be edited for a parallel plate geometry. When the current selected geometry is not a parallel plate geometry a tap on the Gap button will cause a warning message to popup, see Figure 47.

Figure 47. Value not editable

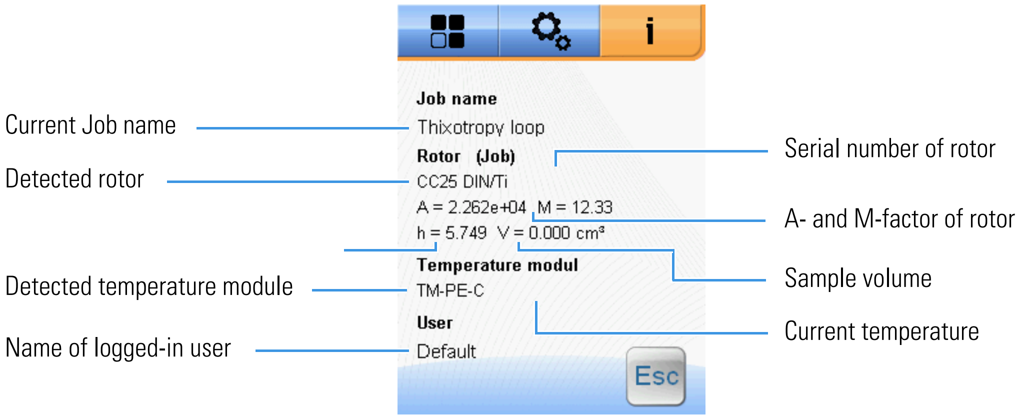


The A- and M-factor of a geometry can only be edited when an Adapter U1, U2, P1, P2, P3 or ISO is detected as the geometry. The functionality for editing geometry factors is available on the **Configuration > Geometries** menu, see "Geometries menu" on page 58.

Information page

The information page basically gives the operator the same information as the status bar of the main menu. That is information on which measuring geometry (rotor) and which temperature module are detected as being mounted to the rheometer, as well as the currently measured temperature and the user name of the logged-in user, plus some additional information, see Figure 48.

Figure 48. Information page of Job editor menu



Manual control menu

The manual control menu consists of four pages: The "Graph page," , the "Numeric page," , the "Settings page," and the "Information page," page. The operator can switch forth and back between the different pages at any time, that is also during a manual control measurement.

The functionality of these pages is described in the following four sections.

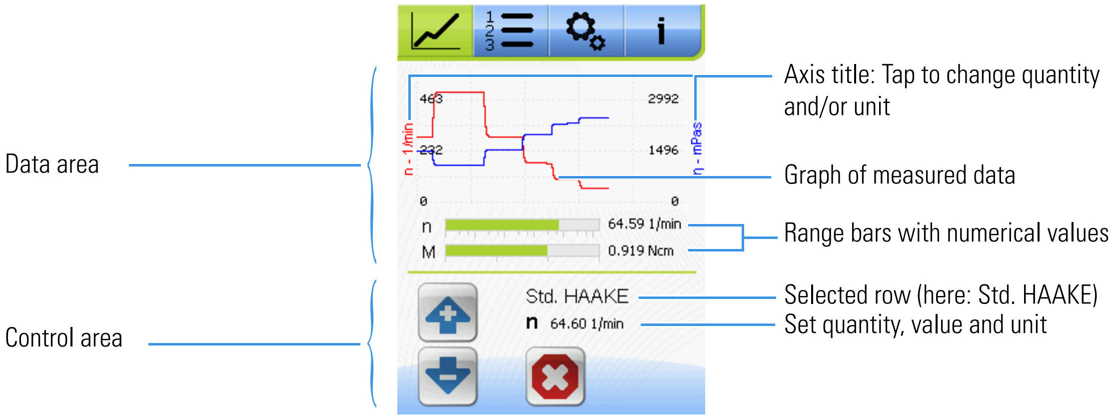
How to setup and run a manual measurement is described in the section "Running a manual control measurement."

Graph page

The graph page is split up in two areas which are optically separated by a green line. In the upper, data area (see Figure 49), one or two measured values are displayed in an automatically scaled graph as a function of time. In the lower, control area, the controls for starting/stopping the measurement and increasing/decreasing the set value are located.

The two range bars below the graph show the current values of the two basic rheometrical quantities, angular velocity and torque, in two *logarithmically scaled* gauges, as well as their numerical values. The range bars give the operator a quick overview in which part of the total measurement the instrument is operating.

Figure 49. Graph page of manual control menu



❖ To change the quantity and or unit for the left or the right axis

1. Tap on the **Axis title** of the left or right axis to open the Quantity/Units menu.
2. Select the quantity and/or its unit that is to be displayed on the selected axis of the graph from the "Quantity/Units menu."
3. Close the Quantity/Units menu.

The set value can be changed before starting the measurement as well as while the measurement is already running.

❖ To increase or decrease the set value

1. Tap the **Up(+)** or the **Down(-)** arrow button on the left hand side of the control area.

   When a row of set values is selected, tapping the arrow buttons will select the next or previous value in the row.

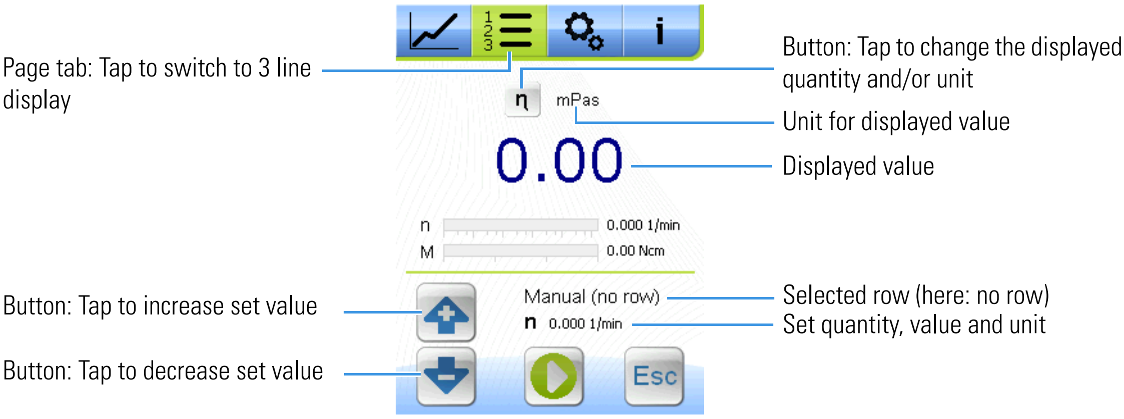
   When manual (no row) is selected from the list of rows, tapping the arrow buttons will increase/decrease the set value with a certain step size.

The currently selected row as well as the current set value are displayed above the start/stop button.

Numeric page

The numeric page is split up in two areas which are optically separated by a green line. In the upper data area (see Figure 50 and Figure 51), the numerical values of either one or three measured values are displayed. The lower control area is identical to that of the "Graph page."

Figure 50. Numeric page of manual control menu, 1 line display



❖ To change the quantity or unit to be displayed as a numerical value

1. Tap the **Quantity** button above or in front of the measured value to open the Quantity/Units menu.
2. Select the quantity and/or its unit that is to be displayed on the selected line of the numerical display from the "Quantity/Units menu."
3. Close the Quantity/Units menu.

❖ To switch between the 1 line and the 3 line numerical display

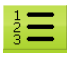
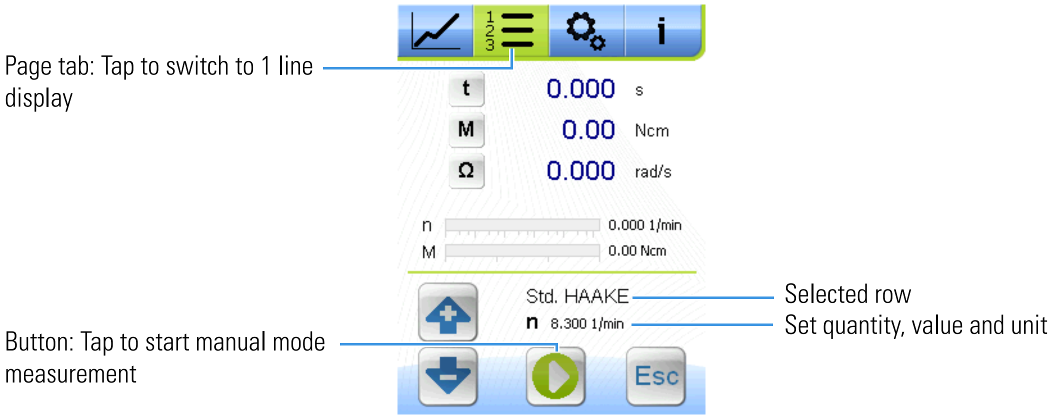
1. Tap the **Numeric page**  tab to switch the display between displaying 1 line in large characters or 3 lines with smaller characters.

Figure 51. Numeric page of manual control menu, 3 line display

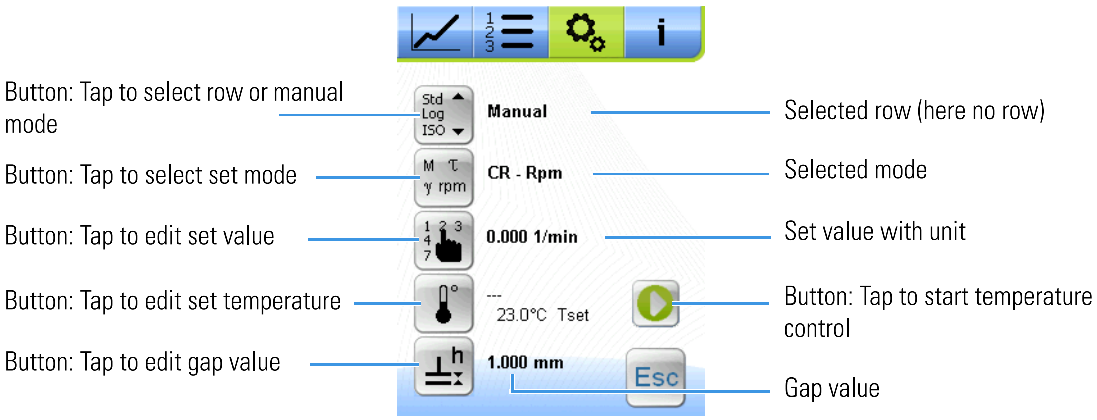


Settings page

From the Settings page the operator can define the following settings for a manual control measurement:

- Select whether the set value, is selected from a row of values or by manually entering a value.
- Select the set control quantity, that is either the angular velocity, shear-rate, torque or stress.
- Set a temperature value and start the TM-PE-C or TM-PE-P temperature control.
- Set the gap value for a parallel plate geometry.

Figure 52. Settings page of manual control menu



❖ To a select a row of set values

1. Tap the **Row**  button to open the Row selection menu.
2. Select the desired row from the list of rows in the Row selection menu, see Figure 53.

Figure 53. Row selection menu

3. Close the Row selection menu.

   The name of the selected Row is now displayed right of the Row button on the Setting page.

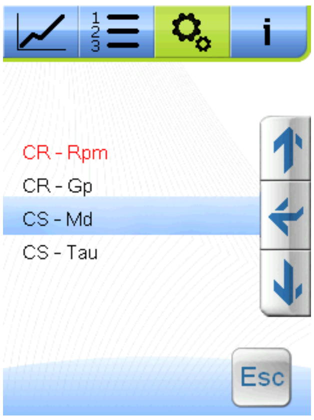
❖ To manually enter a set value

1. Tap the **Row** button to open the Row selection menu.
2. Select the Manual (no row) item from the list of rows, see Figure 53.

   The text Manual is now displayed right of the Row button on the Setting page.
3. Tap the **Mode selection** button to open the Mode selection menu.
4. Select the desired Mode from the list of modes, see Figure 54.

   CR-Rpm stands for angular velocity control
   CR-Gp stands for shear-rate control
   CS-Md stands for torque control
   CS-Tau stands for shear-stress control

Figure 54. Mode selection



5. Tap the **Set value** button to open the on-screen numerical keyboard menu.
6. Enter the desired set value.
7. Close the on-screen numerical keyboard menu.

❖ To edit a set temperature value and start the TM-PE-C or TM-PE-P temperature control

1. Tap the **Temperature** button to open the on-screen numerical keyboard menu.
2. Enter the desired set temperature value.
3. Close the on-screen numerical keyboard menu.

   The set temperature value is now displayed right of the Temperature button on the Settings page.

   Optionally perform step 4.
4. Tap the **Start** button to start the TM-PE-C or TM-PE-P temperature control.

   The current measured temperature value is now displayed above the set temperature, right of the Set temperature button on the Settings page.

❖ To edit the gap for a parallel plate geometry

1. Tap the **Gap** button to open the on-screen numerical keyboard menu.
2. Enter the desired gap value.
3. Close the on-screen numerical keyboard menu.

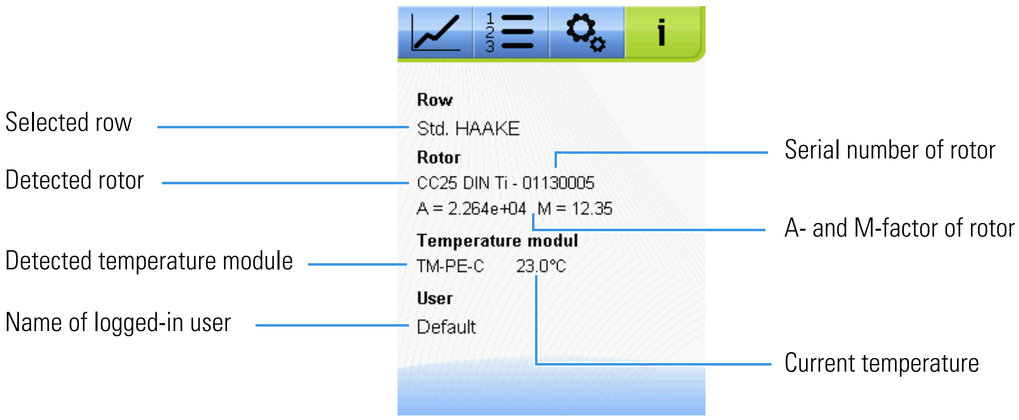
   The gap value is now displayed right of the Gap value button on the Settings page.

> **IMPORTANT** Make sure that the entered value for the gap and the actual physical gap value (see “To set the measuring gap” on page 36 of the HAAKE Viscotester iQ Instruction Manual) are identical. In case they are not, the measurement results will not be correct. The HAAKE Viscotester iQ firmware has no means of setting/checking the actual physical gap value.

Information page

The information page basically gives the operator the same information as the status bar of the main menu. That is information on which measuring geometry (rotor) and which temperature module are detected as being mounted to the rheometer, as well as the currently measured temperature and the user name of the logged-in user, plus some additional information, see Figure 55.

Figure 55. Info page of manual control menu



Running a manual control measurement

❖ To run a manual control measurement

1. Select a Row with set values from the Row selection menu on the Settings page, see "To a select a row of set values."
2. Continue with step 6.

   or

3. Select **Manual (no row)** from the Row selection menu on the Settings page.
4. Select the set control quantity from the Mode selection menu on the Settings page.
5. Enter the Set value from the Settings page.

   For more details on step step 2 to step 5 see "To manually enter a set value."

6. Tap the **Graph page** tab or the **Numeric page** tab to switch to the Graph or Numeric page.
7. Tap the **Up(+)** or the **Down(-)** arrow button to select the desired set value from the selected Row.
8. Tap the **Start** button to start the measurement.

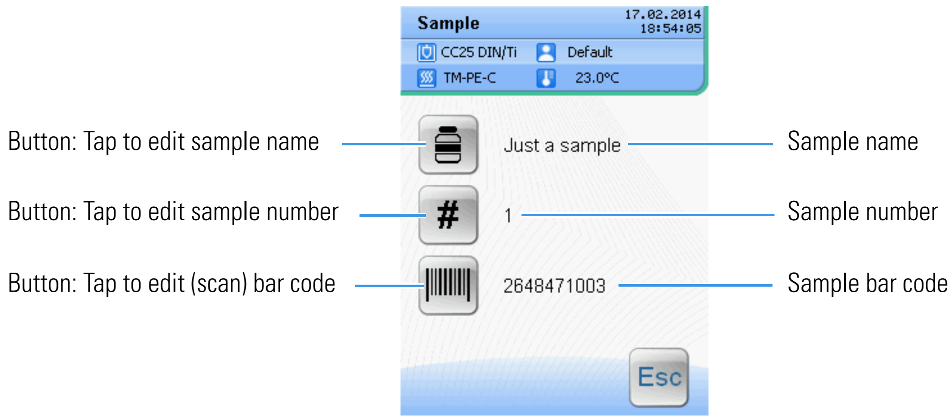
Note The set value can also be changed using the Up(+) or the Down(-) arrow button when the measurement is already running, both when a Row or Manual (no row) is selected. In the last case the set value will be increased/decreased with increasing size steps the longer Up(+) or the Down(-) arrow button is tapped.

Sample menu

From the Sample menu the operator can enter the sample name and the sample number of the sample that is to be measured. Using a USB bar code scanner a bar code related to the sample can be scanned. All sample information is saved together with the other measurement data in a data file.

By activating the corresponding option the sample menu will appear automatically at the start of any Job. See "Job settings menu" on page 56 for how to activate this option.

Figure 56. Sample menu



❖ To edit the sample name or sample number

1. Tap the **Sample name** button or the **Sample number** button to open the alpha numerical keyboard menu.
2. Edit the Sample name or Sample number in the numerical keyboard menu (see Figure 7) and close it.

❖ To edit (scan) the sample bar code

1. Tap the **Sample bar code** button to open the numerical keyboard menu.
2. Aim the bar code scanner head to the bar code that is to be scanned and click the scanner button.

   The bar code number will appear in the edit field character by character as if it was slowly entered on the keyboard.

> **Note** The sample bar code can also be entered manually using the on-screen keyboard or a USB keyboard since for the HAAKE Viscotester iQ a keyboard and bar code scanner are the same. In fact a bar code scanner can be used in any alphanumerical edit field to enter a number.

The maximum text length of the sample name, sample number and sample bar code is 50 characters each.

Configuration menu

From the Configuration menu the configuration the settings listed in Table 7 can be accessed. Certain configuration settings can also be made using the HAAKE Viscotester iQ RheoApp software, see Chapter 3, "HAAKE RheoApp Software," for more information.

Figure 57. Configuration menu

Table 7. Configuration menu list items

Entry in list	Function
Language	Select the language for the touchscreen panel user interface
Device info	Shows device information like firmware versions, internal parameters, etc.
Quantities/Units	Select the default units for the physical quantities
Temperature offsets	Edit the temperature offset values for the temperature modules

Table 7. Configuration menu list items

Entry in list	Function
Date	Set the current date for the internal clock/calendar
Time	Set the current time for the internal clock/calendar
Touch panel calibration	Calibrate the touchscreen
Factory reset	Reset all configuration settings to the default factory setting
Calibration	Run one or more internal drive motor calibration routines
Network	Edit the (local) network IP address and show network settings
Start menu	Select which menu is displayed after the instrument initialization
Job settings	Edit general Job setting
Device settings	Edit general device setting
Set measuring gap	Assistance for setting parallel plate measuring gap
Geometries	Edit geometry properties

Language menu

From the Language menu the operator can select the language for the touchscreen panel user interface. Currently the following 19 language are available: Chinese, Czech, Dutch, English, Finnish, French, German, Hungarian, Indonesia, Italian, Japanese, Korean, Polish, Portuguese, Russian, Slovak, Spanish, Thai and Turkish. Other languages, apart from languages like Arabic and Hebrew which are written from right to left, can be added on request.

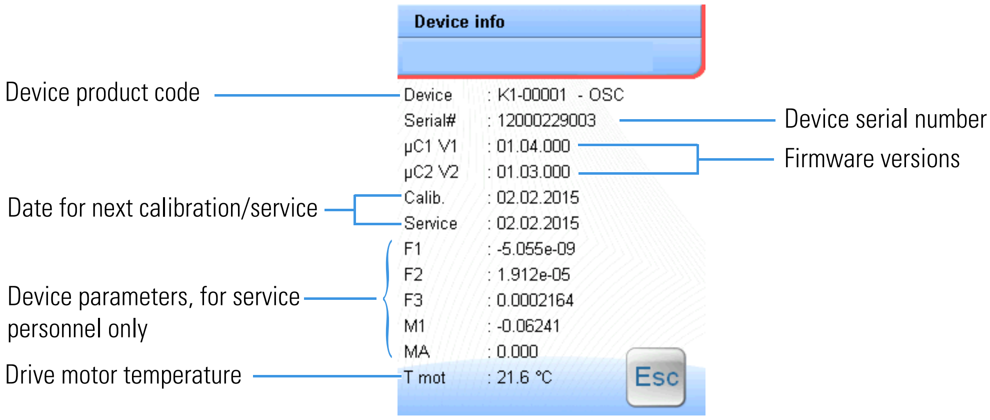
Figure 58. Language menu

Since the Language item is the default item in the Configuration menu and since the Language item is always displayed in both the current language and in English, finding back to the correct language is never a problem.

Device info menu

The Device info menu shows internal device information like the device serial number, the firmware versions and certain device parameters. Knowledge of this information is not needed for normal instrument operation. The device serial number is needed when starting the HAAKE Viscotester iQ RheoApp software for the first time, see the HAAKE Viscotester iQ RheoApp Start Guide. The firmware versions can be checked and the information on the www.rheowin.com/firmware.htm web page. In case of service issues the operator may be asked to supply the value of other device parameters.

Figure 59. Device info



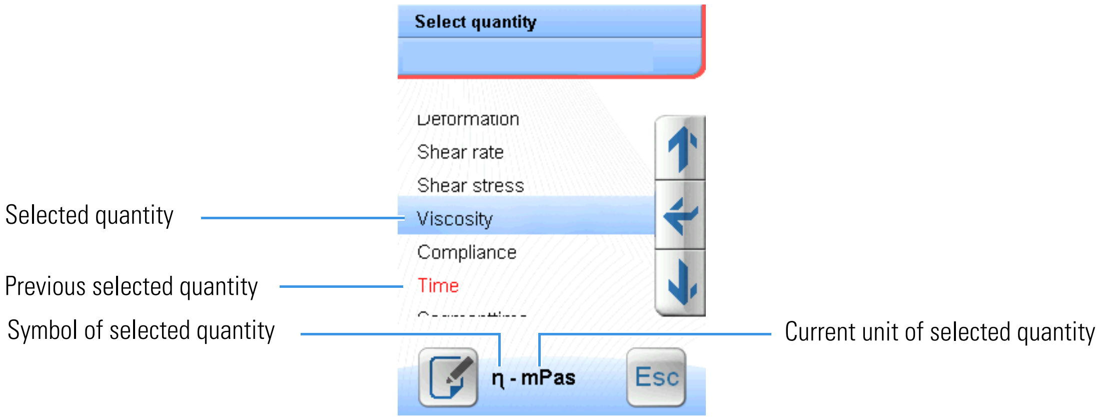
Quantity/Units menu

From the Quantity/Units menu the operator can select the default unit for any available physical quantity. This selection can also be made using the HAAKE Viscotester iQ RheoApp software, see Chapter 3, "HAAKE RheoApp Software," for more information.

❖ To select the default unit for a physical quantity

1. Select the physical quantity (Viscosity η in this example) from the list of quantities, see Figure 60.

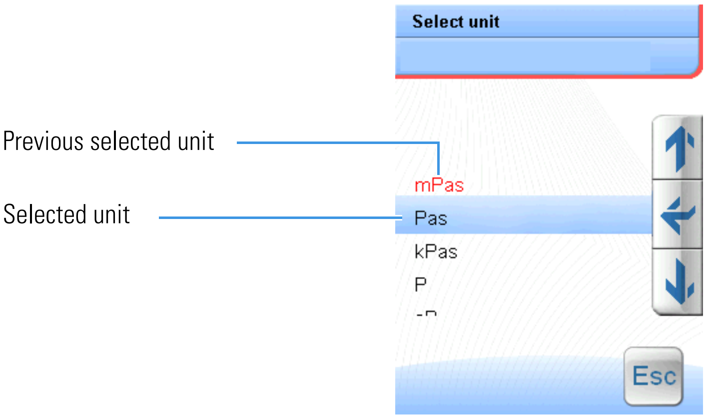
Figure 60. Select quantity menu



2. Tap the **Edit**  button on the left side of the bottom of the screen to open the Select unit menu.

3. Select the desired unit (Pa.s in this example) from the list of units, see Figure 61.

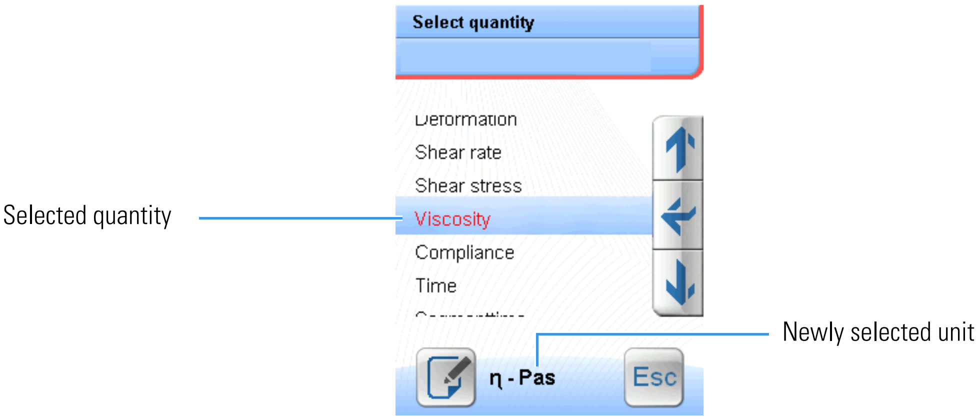
Figure 61. Select unit menu



4. Tap the **Escape**  button to close the select quantity menu.

   The quantity is now displayed with the newly selected unit, see Figure 62.

Figure 62. Select quantity menu



Temperature offsets menu

Temperature offset tables are used for correcting (small) differences between the temperature value measured by the instrument and the actual temperature in the sample. These values may show (small) temperature dependent differences (or offsets) for various reasons. By defining temperature offset values, in the form of a table for a few (up to five) temperature values, the instruments firmware can calculate a corrected temperature value, by linear interpolation between to adjacent temperatures in the table, for any temperature value within the range of the table. For temperatures for which no interpolated offset can be calculated the offset of the nearest value in the list is used.

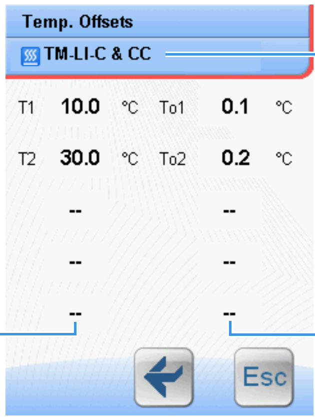
To be able to determine the differences between the temperature value measured by the instrument and the actual temperature in the sample, a separate calibrated digital thermometer with a special probe that can be inserted in the gap of the measuring geometry is needed. The use of an especially designed calibration kit (order number 222-2206) which includes PC software for a fully automatic determination of the offset values is highly recommended.

The firmware of the HAAKE Viscotester iQ is equipped with 16 temperature offset tables, one for every possible combination of a temperature module (TM-PE-C, TM-PE-P, TM-LI-Cxx) and a certain type (CC = concentric cylinder or PP = parallel plates) of measuring geometry and one for the external Pt100 temperature sensor.

It is not possible to manually select one of the temperature offset tables in the temperature offset menu; the menu always displays the table corresponding to the currently connected (detected) temperature module and measuring geometry.

Each temperature offset table can consist of up to 5 temperature values and the offset values for those temperatures, see Figure 63.

Figure 63. Temperature offset menu



❖ To edit a temperature offset table

1. Make sure that the correct table is edited. See the Temp. Offsets menu status bar for which combination of a temperature module type and a measuring geometry type the table is displayed.
2. Tap on a **Temperature value** (in the left column in the menu, see Figure 63), or the -- characters in an empty row, to open the numerical keyboard menu.
3. Enter the temperature value in the numerical keyboard menu (see Figure 7) and close it.
4. Tap on a **Temperature offset value** (in the right column in the menu, see Figure 63), or the -- characters in previously empty row, to open the numerical keyboard menu.
5. Enter the temperature offset value in the numerical keyboard menu (see Figure 7) and close it.
6. Repeat step 2 to step 5 for up to four different temperature values.

   The temperature values must be sorted by increasing value from top to bottom.

> **IMPORTANT** Any temperature offset table must contain at least two temperature values plus the corresponding offset values.

Date menu

From the Set date menu the operator can set the current date for the internal calendar/clock. Under normal circumstances this only has to done be once as part of the instrument installation.

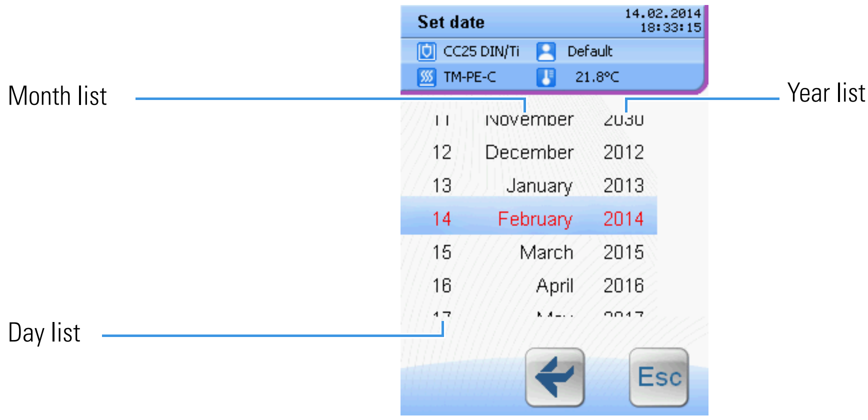
The Set date menu consists of three independent scrolling lists.

❖ To set the date

1. Scroll through the day list to select the current day.
2. Scroll through the month list to select the current month.

3. Scroll through the year list to select the current year.
4. Tap the **Enter** button  to set the new date.

Figure 64. Set date menu



Time menu

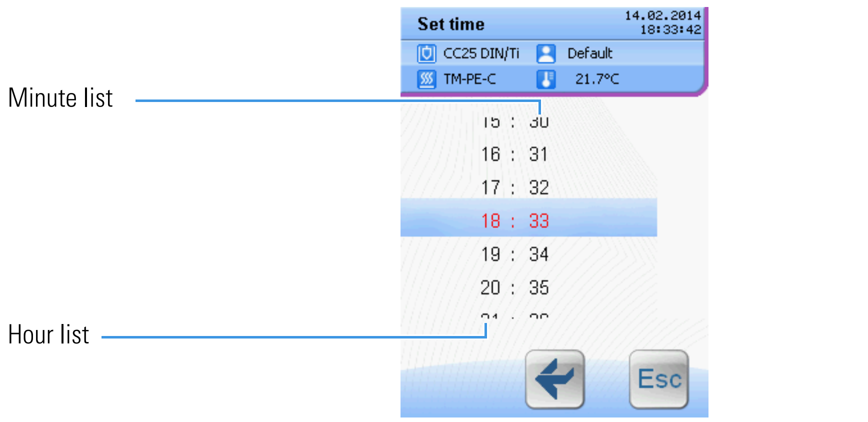
From the Set time menu the operator can set the current time for the internal calendar/clock. Under normal circumstances this only has to done be once as part of the instrument installation.

The Set time menu consists of two independent scrolling lists.

❖ To set the time

1. Scroll through the hour list to select the current hour.
2. Scroll through the minute list to select the current minute.
3. Tap the **Enter** button  to set the new time.

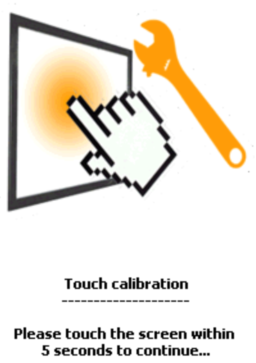
Figure 65. Set time menu



Touch panel calibration menu

From the Touch panel calibration menu, see Figure 66, the operator can recalibrate the touchscreen position detection by following the sequence of instructions that appear on the touchscreen panel. There is no end or escape function for the touchscreen calibration, but without operator action the menu will automatically close after approximately 5 seconds.

Figure 66. Touchscreen calibration start screen



Factory reset menu

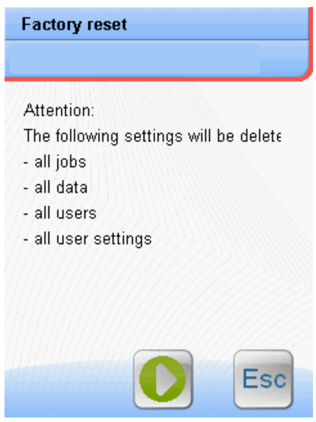
From the Factory reset menu the operator can reset all configuration setting to the default factory settings. Under normal circumstances this function is never needed.

WARNING Reseting the configuration settings to the default factory settings will delete all Jobs, all Data, and all Users.

❖ To reset all configuration settings to the default factory settings

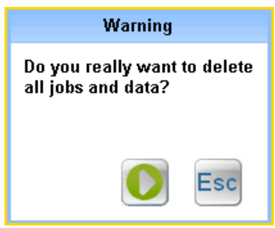
1. Tap the **Start** button in the Factory reset menu to start the reset process, see Figure 67.

   Figure 67. Factory reset menu

2. Tap the **Start** button in the Warning popup menu to confirm the start of the reset process, see Figure 68.

   Figure 68. Warning popup menu

During the Factory reset process the text `Data will be deleted, please wait...` will displayed in the lower half of the Factory reset menu. When the process is finished the menu will be closed automatically.

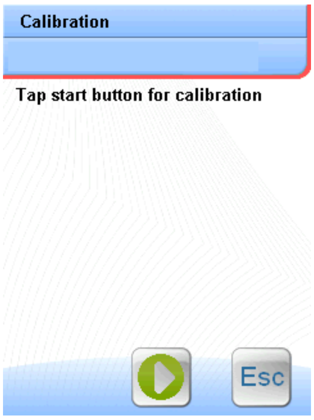
Calibration menu

From the calibration menu the operator can re-calibrate the bearing and motor properties of the drive motor. The same calibration is performed during the initialization of the instrument after switching it on. The calibration of standard Viscotester iQ (without Oscillation option) takes 3 minutes. The calibration of a Viscotester iQ with Oscillation option takes 4 minutes and 40 seconds.

❖ To run the calibration routine

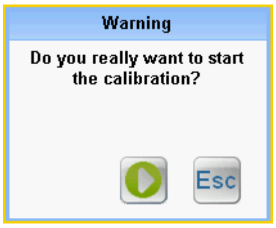
1. Tap the **Start**  button in the Calibration menu to start the calibration process, see Figure 69.

Figure 69. Calibration menu



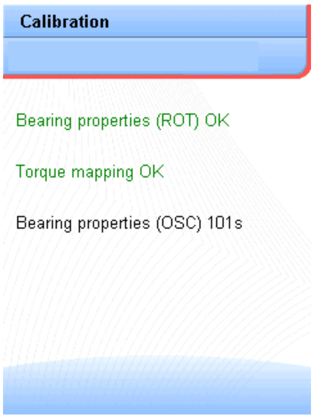
2. Tap the **Start**  button in the Warning popup menu to confirm the start of the calibration process, see Figure 70.

Figure 70. Warning popup menu



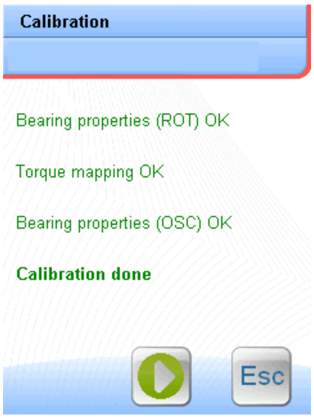
During the calibration process the progress is displayed, the duration of each of the two or three step is counted down, see Figure 71.

Figure 71. Calibration progress



Wen the calibration process is finished the calibration menu should look like in Figure 72.

Figure 72. Calibration finished



3. Tap the **Esc** Esc button to close the Calibration menu.

Network menu

From the upper half of the Network menu the default IP address (192.168.2.100) can be changed to another value. This can be necessary when two HAAKE Viscotester iQ are used in one network which is not equipped with a DHCP server. The lower half of the Network menu supplies the same network status information as the Network popup dialog, see Figure 103 on page 90.

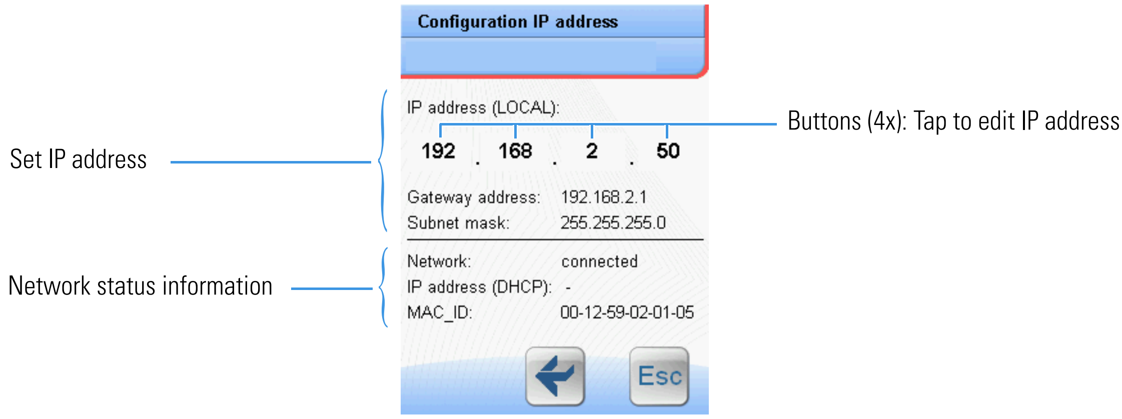
❖ To change the local IP address

An IP address always consist of 4 decimal numbers, each ranging from 0 to 255, separated by dots. To change the IP address from the Network menu each of the 4 numbers must be edited separately.

1. Tap on the first number of the IP address to open the numerical keyboard menu.
2. Enter the first number in the numerical keyboard menu (see Figure 7) and close it.
3. Repeat step 1 and step 2 for the other 3 numbers of the IP address.

> **IMPORTANT** After changing the IP address of a HAAKE Viscotester iQ the corresponding IP address must also be changed in the RheoWin Device Manager.

Figure 73. Network menu

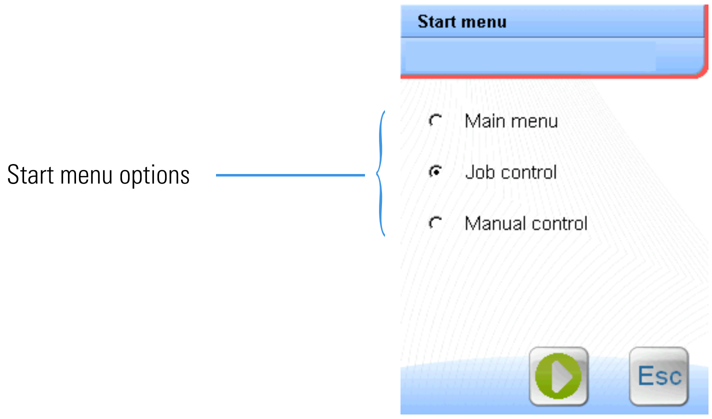


Note The fact that the text **connected** is displayed behind Network in the Network menu means that physical network connection is working, but not necessarily that the communication between the HAAKE Viscotester iQ and the HAAKE RheoWin software is setup properly and working. See "Setting up a HAAKE Viscotester iQ using a point-to-point network" on page 90 and "Setting up a HAAKE Viscotester iQ in a company network" on page 95 for more information on setting up the network connection.

Start menu selection menu

From the Start menu selection menu, the menu that will displayed as the initial menu, after the initialization of the instrument is finished, can be selected. There are three different menus that can be selected as the Start menu, see Figure 74.

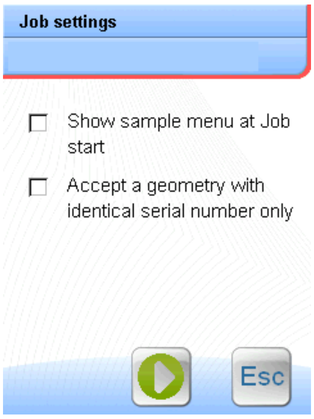
Figure 74. Start menu selection menu



Job settings menu

From the Job settings menu two settings that apply to the Job control measuring mode can be made.

Figure 75. Job settings menu



Show sample menu at Job start

When the **Show sample menu at Job start** check box is selected, the Sample menu (see Figure on page 45) will be automatically displayed directly after starting a Job and before starting the actual measurement, this prompts the operator to enter the sample name etc.

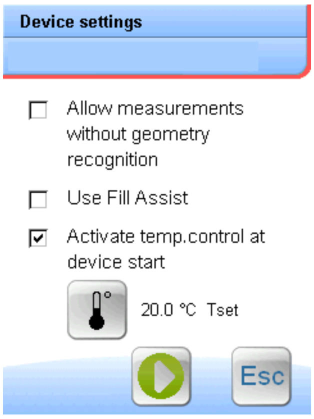
Accept a geometry with identical serial number only

When the **Accept a geometry with identical serial number only** check box is selected, only one unique rotor (of a the defined type with the specified serial number) is accepted for use with a Job. When the check box is *not* selected any rotor of the same type is accepted.

Device settings menu

From the Device settings menu two settings that apply to both the Job control and the manual control measuring mode can be made, the third setting applies to the instrument start-up behaviour.

Figure 76. Device settings menu



Allow measurements without geometry recognition

When the **Allow measurements without geometry recognition** check box is selected, the geometry recognition at the start of a measurement is disabled and it is the responsibility of the operator to make sure that the correct geometry is mounted to instrument.

In the case of a Job controlled measurement the properties of the geometry that was defined to be used with the job (see the Job editors "Settings page" on page 38) are used.

In the case of a manual controlled measurement the properties of the geometry that set as the default geometry are used.

Use Fill Assist

When the **Use Fill Assist** check box is selected, the operator will automatically be prompted to use the "Fill Assist" tool at the start of *every* Job when using Job controlled measurements.

See "Fill Assist tool" on page 126 in Chapter 6, "Measuring Geometries," on how to use the "Fill Assist" tool as part of a Job controlled measurement or a Manual controlled measurement.

Activate temp. control at device start

When the **Activate temp. control at device start** check box is selected, the Viscotester iQ will automatically start a connected Peltier temperature control module (TM-PE-P or TM-PE-C), with the set temperature value, when the device is switched on.

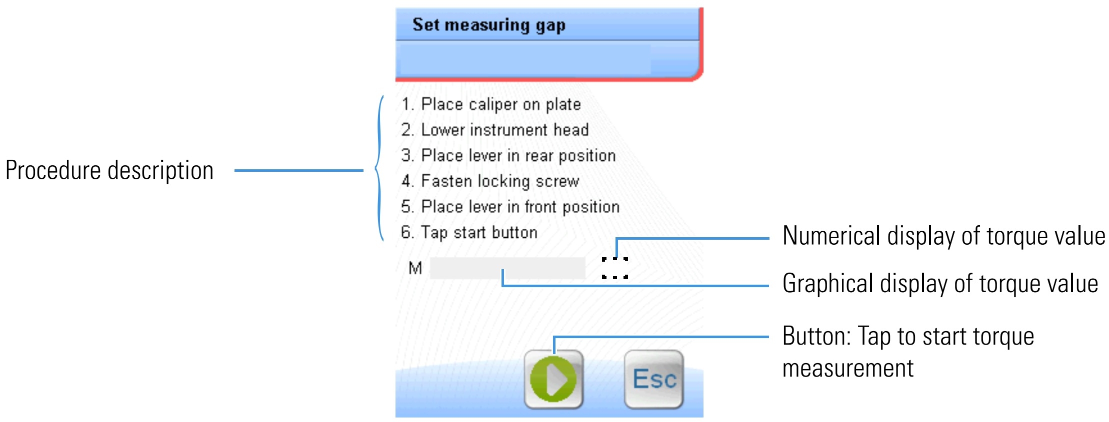
❖ To set a temperature value

1. Tap the **Set value**  button to open the on-screen numerical keyboard menu.
2. Enter the desired set value.
3. Close the on-screen numerical keyboard menu.

Set measuring gap menu

The Set measuring gap menu offers the operator assistance for an accurate gap setting for parallel plate geometries. The use of this menu is explained in "Lift control" on page 32 of the HAAKE Viscotester iQ Instruction Manual.

Figure 77. Set measuring gap menu

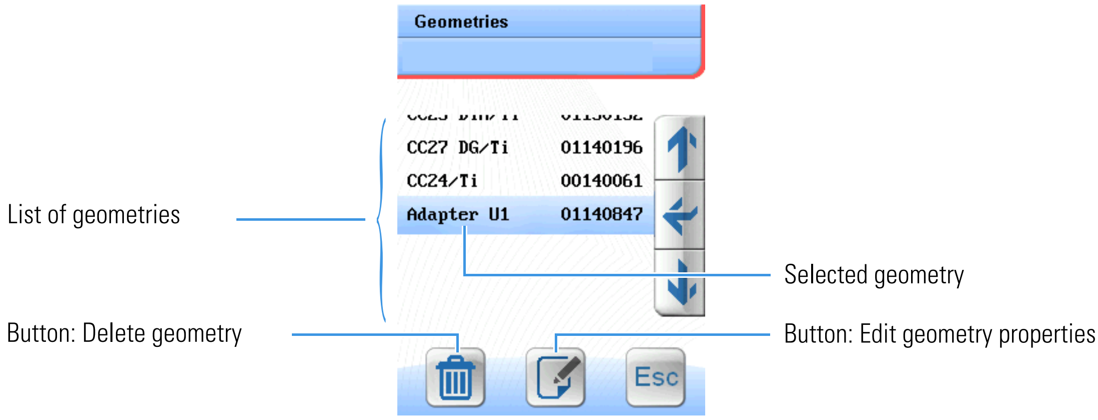


Geometries menu

The Geometries menu lists all the geometries (rotors) that have been mounted to the Viscotester iQ drive motor shaft at least once (and have not been deleted from the list afterwards). The same list of geometries is accessible from the Settings page in a Job editor, see "Settings page" on page 38, and from the Settings page in the Manual control menu, see "Settings page" on page 42.

Note Upon delivery of the instrument the geometry list is empty. That means that before running a measurement, at least one geometry must be have been added to the list of geometries, see "To add a geometry to the list" on page 59.

Figure 78. Geometries menu



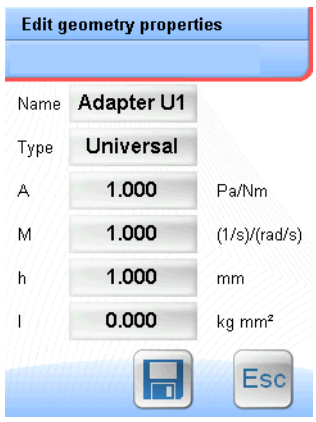
Certain properties (see Figure 79) of the adapter geometries Adapter U1, Adapter U2 and Adapter P1 can be edited to match the adapter with the attached rotor, disposable plate or spindle (see "Connect Assist adapters" on page 135 in Chapter 6, "Measuring Geometries," for more information on the Connect Assist adapters).

Note The properties of any standard geometry can *not* be edited.

❖ To edit the properties of a geometry

1. Select the desired geometry from the list of geometries in the Geometries menu (see Figure 78).
2. Tap the **Edit** button to open the Edit geometry properties menu (see Figure 79).

Figure 79. Edit geometry properties menu (default adapter properties)



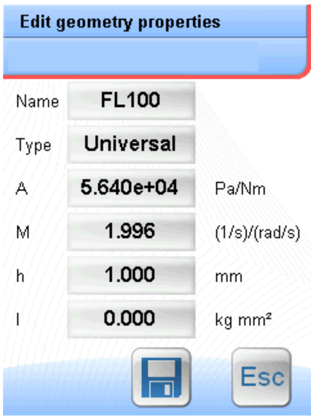
3. Tap the **Name** button to open the alpha numerical keyboard menu to edit the name of the geometry.

4. Tap the **Type** button to select the geometry type from the three possible types **Universal**, **Plate** and **Cylinder.**

5. Tap the **A**, **M**, **h** or **I** button to open the numerical keyboard menu (see Figure 7) to edit the corresponding numerical value.

6. Tap the **Save** button to save the edited geometry properties (see Figure 80).

Figure 80. Edit geometry properties menu (edited properties)



CAUTION After tapping the Save button wait at least 3 seconds before continuing to operate the instrument. Do *not* dismount the geometry from the coupling during this time.

❖ To delete a geometry from the list

1. Select the desired geometry from the list of geometries in the Geometries menu (see Figure 78).

2. Tap the **Delete** button to delete the selected geometry from the list.

❖ To add a geometry to the list

1. Mount the desired geometry to the Viscotester iQ drive motor shaft.

   When the geometry is *not* a Connect Assist adapter the geometry is automatically added to the geometry list as soon as it is recognized it.

   When the geometry is a Connect Assist adapter the Edit geometry properties menu (see Figure 79) will open automatically. After editing the properties values make sure to tap the **Save** button for the geometry to be edited to the list.

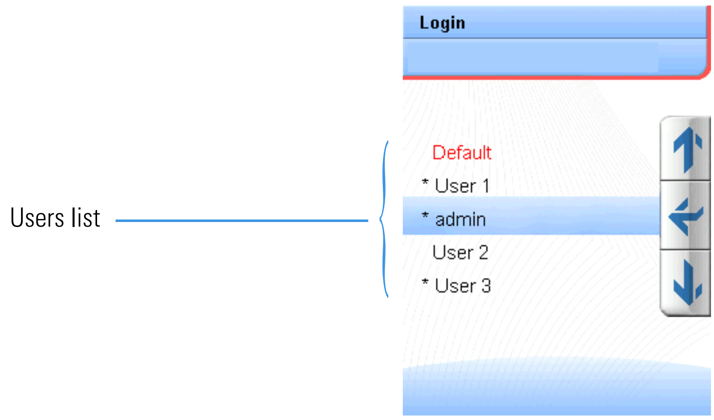
CAUTION It is *not* possible to manually add a geometry to the geometry list.

Login menu

The login menu can be accessed from the main menu only when the default user is deactivated and at least one user is setup in the user management system using the HAAKE Viscotester iQ RheoApp PC configuration software.

Users with a * in front of the name in the Users list need to enter their password to login.

Figure 81. Login menu



❖ To login

1. Select a User name from the list of users in the Login menu.

   For users without a password:

2. Tap the **Enter** button to proceed to the selected Start menu.

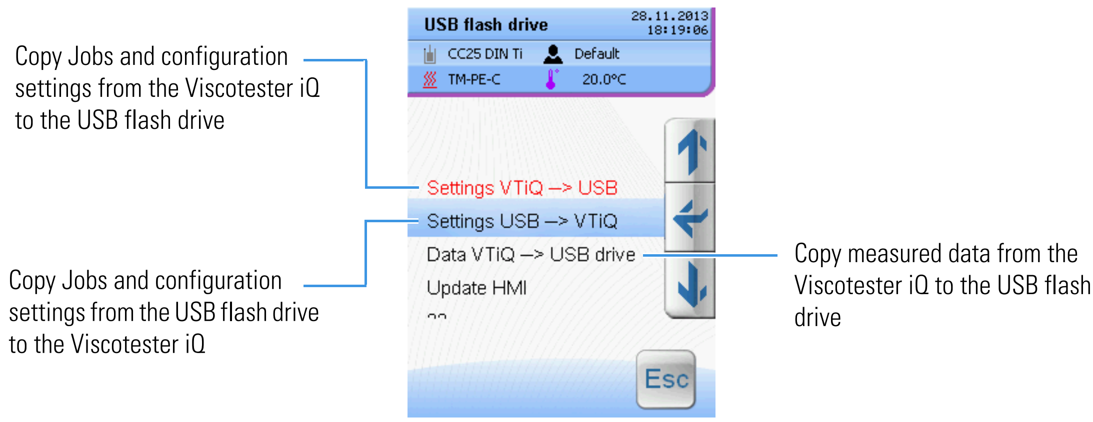
   Step 3 to step 5 are only applicable to users with a password:

3. Tap the **Enter** button to proceed to the alphanumerical keyboard menu.
4. In the alphanumerical keyboard enter the password
5. Tap the **Enter** button to proceed to the selected Start menu.

Data copy menu

From the Data copy menu Jobs and configurations settings can be copied from the special USB flash drive to the HAAKE Viscotester iQ internal memory and vice-versa. Also measured data files can be copied from the HAAKE Viscotester iQ internal memory to the special USB flash drive.

Figure 82. Data copy menu



❖ To copy Jobs and configuration settings from the Viscotester iQ to the USB flash drive

1. Select the item Settings VTiQ --> USB from the list.
2. Tap the **Enter** button.

❖ To copy Jobs and configuration settings from the USB flash drive to the Viscotester iQ

1. Select the item Settings USB --> VTiQ from the list.
2. Tap the **Enter** button.

❖ To copy measured data from the Viscotester iQ to the USB flash drive

1. Select the item Data VTiQ --> VTiQ from the list.
2. Tap the **Enter** button.

3

HAAKE RheoApp Software

This chapter describes how to operate the HAAKE Viscotester iQ RheoApp software. That is how to use the software to edit (internal) Jobs, how to set up the (internal) User Management system and how to edit the configuration of the HAAKE Viscotester iQ user interface, as well as how to handle the HAAKE Viscotester iQ USB flash drive to transfer Jobs and configuration settings to the rheometer and measured data from the rheometer.

The mechanical operation of the instrument is described in Chapter 5, “Operation,” of the HAAKE Viscotester iQ Instruction Manual, the operation of the touchscreen control panel user interface is described in Chapter 2, “Touchscreen User Interface,” the operation of the HAAKE RheoWin PC software is described in Chapter 5, “HAAKE RheoWin Software,” of this manual.

IMPORTANT Read the relevant parts of this chapter before using the HAAKE Viscotester iQ RheoApp software for the first time.

Introduction

The HAAKE Viscotester iQ RheoApp software is a USB flash drive based PC software for the extended and convenient configuration of the HAAKE Viscotester iQ touchscreen panel user interface.

With the RheoApp software and the special HAAKE Viscotester iQ USB flash drive the following tasks, can be performed:

- Create and edit (add and remove elements) Job routines for the Job control mode.
- Edit rows of set values for the Manual control mode.
- Edit certain configuration settings that can not be set using the touchscreen panel user interface.
- Set up the user management system (add users and assign privileges).
- Transfer Jobs and configuration setting between the HAAKE Viscotester iQ internal memory and USB flash drive.
- Transfer measured data from the HAAKE Viscotester iQ internal memory to the USB flash drive.

Note All of the above task can not be performed from the HAAKE Viscotester iQ touchscreen panel user interface.

The HAAKE Viscotester iQ USB flash drive is equipped with a special directory and file structure for transferring Jobs, configuration settings and data files from and to the HAAKE Viscotester iQ. The RheoApp software must be considered as the front end or user interface for this directory and file structure.

WARNING The HAAKE Viscotester iQ USB flash drive directory and file structure should never be handled manually using the Windows Explorer or similar tools. All directories and files have numerically coded names that do not reveal information on their use and contents.

The RheoApp software does not need to be installed on a PC, but can be launched directly from the special USB flash drive on any PC.

❖ To launch the HAAKE Viscotester iQ RheoApp software

1. Mount the special HAAKE Viscotester iQ RheoApp USB flash drive in an USB slot of any PC running Windows XP or newer.

   In case the Windows AutoPlay dialog automatically pops up (depending on the operating system settings, this happens or not) proceed to step 2 otherwise proceed to step 3.

2. In the Windows AutoPlay dialog click the **Open folder to view files** item to open the root directory of the USB flash drive in the Windows Explorer.

   Proceed to step step 4.

3. Open the Windows Explorer and browse to the root of the HAAKE Viscotester iQ RheoApp USB flash drive.

4. In the Windows Explorer dialog double click the **Run Viscotester iQ RheoApp** shortcut.

   The HAAKE Viscotester iQ RheoApp software will start.

Note On certain PCs a Windows security alert dialog, issued by the Windows Firewall, may popup before or while the RheoApp software is started. This dialog can be closed without risk.

Main window

The HAAKE Viscotester iQ RheoApp software main window (see Figure 83) consist of the menu bar, the tool bar, the area in which either the USB flash drive explorer or the Elements for Jobs icons are displayed and the area on the right in which the JobEditor dialog, Data dialog and the Configuration dialog are displayed.

USB flash drive explorer

The USB flash drive explorer consists of a hierarchical list from which the Configuration settings, the Data files and the Jobs which are stored on the USB flash drive (from which the HAAKE Viscotester iQ RheoApp software was launched) can be selected, edited and viewed.

The starting point of the hierarchical list is the drive letter of the USB stick, that is `J:\` in Figure 83.

The first level of the list consists of the different users that are available on the HAAKE Viscotester iQ touchscreen panel user interface.

Note Only when the currently logged on user has administrator privileges more then one user will be visible. This means that in general just one user will be visible.

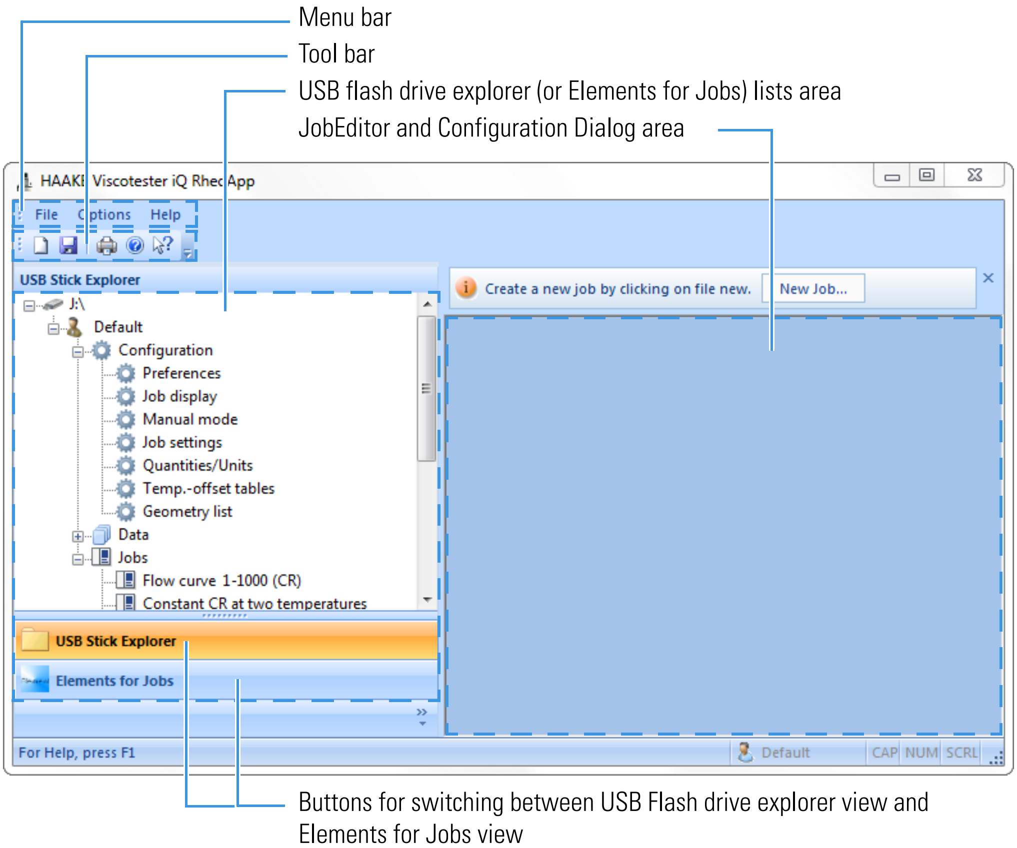
As long as no users are defined the so-called Default user is always displayed.

The three second level items of the list are always Configuration, Data and Jobs for each user.

The third level items below the Configuration level consist of the 7 pages of the Configuration dialog. The third level items below the Data level consist of all the Data files measured using a Job from the touchscreen panel user interface. The third level items below the Job level consist of the up to 20 Jobs (for each user) that can be selected and started from the touchscreen panel user interface.

The different levels of the hierarchical list can be expanded and collapsed by clicking on the plus and minus buttons respectively.

Figure 83. RheoApp main window (with USB flash drive explorer view active)



❖ To display to the USB flash drive explorer list

1. Click on the **USB flash driver explorer** button.

Elements for Jobs icons

In the same area as the USB flash drive explorer the Elements for Jobs can displayed (see Figure 92 on page 75). The Job elements are used for composing a Job, this is described in “JobEditor dialog” on page 73.

❖ To display the Elements for Jobs icons

1. Click on the **Elements for Jobs** button.

Menu bar

The menu bar contains the four items File, Options, Window and Help and the corresponding drop-down menus, which commands are described in the following sections.

File menu

The File menu contains the standard Microsoft Windows file and print menu items. The contents of the file menu partly depends on which dialog window (JobEditor dialog, Data dialog or Configuration dialog) is currently opened and active.

New Job

With the New Job command an empty JobEditor dialog window is opened. See "JobEditor dialog" on page 73 on how to use the JobEditor.

Save Job

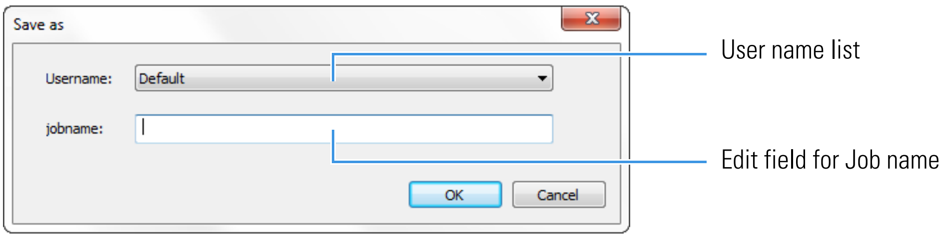
With the Save Job command a Job is saved using its current name. This command is only available when at least one JobEditor dialog window is open. The command always applies to the active JobEditor dialog window only.

Save Job as

With the Save Job command a Job can be saved using a new name. This command can also be used for for saving a Job for another user, the currently logged in user must have administrator privileges for this to work. This command is only available when at least one JobEditor dialog window is open. The command always applies to the active JobEditor dialog window only.

Saving a Job for a another user can be used to create Jobs for a another user or to copy existing Jobs to the Job list of that user.

Figure 84. Save Job as dialog



❖ **To save a Job using a new name and/or for another user**

1. Choose **File > Save Job as** to open the Save as dialog.
2. Enter the new Job name in the **Job name** edit field.
3. Optionally, select the **User name,** for which the Job is to be saved, from the user name list.

   The new Job will now be displayed in the Job list of the selected user in the USB flash drive explorer.

Close

With the Close command the currently active JobEditor dialog window or Data view window is closed.

Preview report

With the Preview report command the contents of the Job or the Data file in the currently active JobEditor or Data view dialog window can be previewed as a report.

❖ To preview a Job report

1. Open a Job in a JobEditor dialog by double clicking on the Job in the USB flash driver explorer Job list.
2. Choose **File > Preview report** to preview the Job report.

❖ To preview a Data report

1. Open a data file in a Data view window by double clicking on the data file in the USB flash driver explorer Data list.
2. Choose **File > Preview report** to preview the Data file report.

Print report

With the Print report command the contents of the Job or the Data file in the currently active JobEditor or Data view dialog window can be printed as a report.

❖ To print a Job report

1. Open a Job in a JobEditor dialog by double clicking on the Job in the USB flash driver explorer Job list.
2. Choose **File > Print report** to preview the Job report.

❖ To print a Data report

1. Open a data file in a Data view window by double clicking on the data file in the USB flash driver explorer Data list.
2. Choose **File > Print report** to preview the Data file report.

Print setup

With the Print setup command the standard Windows Print setup dialog window is opened. The printer selected and set up in this dialog is used for printing the Job and Data reports.

Backup, Restore

With the Backup and Restore commands, all the Jobs and data files as well as all configuration settings (of all users) stored on the HAAKE Viscotester iQ RheoApp USB flash drive, can be backed up in and restored from a single file anywhere on a PC or network drive.

Exit

With the Exit command the RheoApp program is closed.

Options menu

The Options menu contains commands to configure the HAAKE Viscotester iQ RheoApp software and to define users for both the RheoApp software and the HAAKE Viscotester iQ user interface.

Language

Note The language selected from the Language menu applies to the RheoApp software only, that is not to HAAKE Viscotester iQ touchscreen panel user interface.

❖ To change the language

1. Choose **Options > Language** to open the language menu.
2. Choose the desired language from the menu.

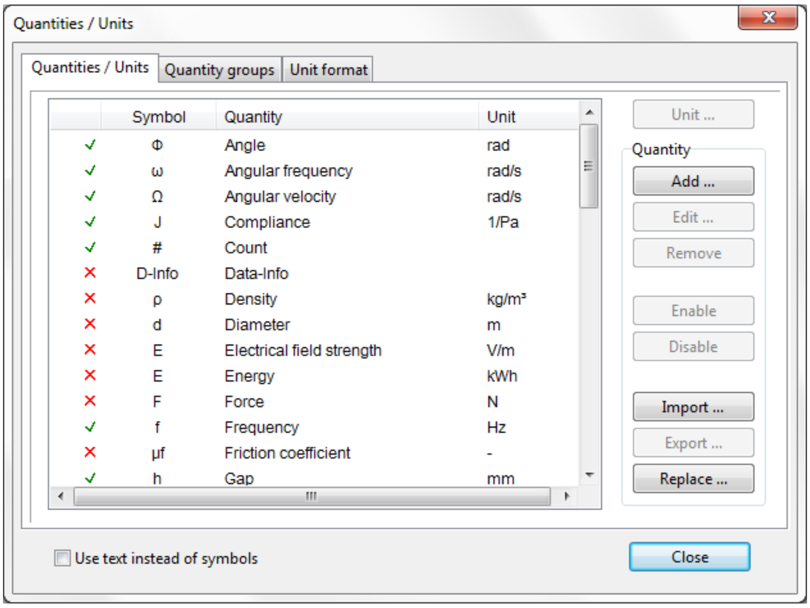
   The RheoApp user interface language will change immediately.

Quantities/Units

From the Quantities/Units dialog (see Figure 85) the units used in the RheoApp software, that is in the JobEditor dialog, the Data dialog and the Configuration dialog, can be selected.

Note The settings made in this dialog do not relate to the units displayed on the HAAKE Viscotester iQ touchscreen panel user interface.

Figure 85. Quantities/Units dialog



❖ To change a unit for a quantity

1. Choose **Options > Quantities/Units** to open the Quantities/Units dialog.
2. Select the row in the Quantities/Units table that contains the quantity.

3. Click the **Unit** button to open a dialog with a list of units.

   or

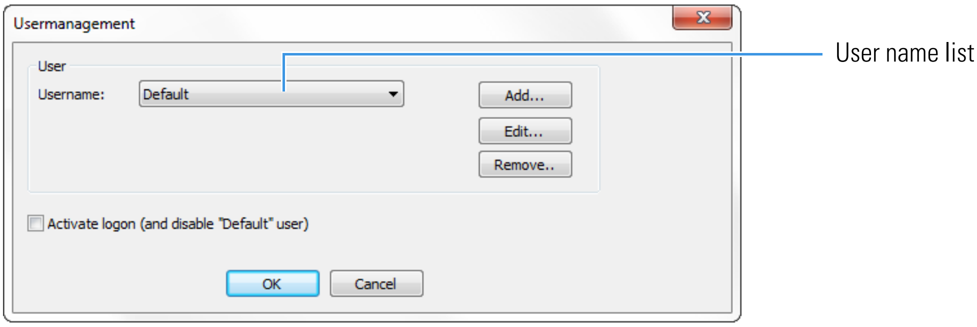
4. Right click on the row in the Quantities/Units table that contains the quantity to open a dialog with a list of units.
5. Select the desired unit from the list.

User management

From the User management dialog the RheoApp login dialog can be activated and users can be added, edited and removed (see Figure 86).

Note Users are always defined for both the HAAKE Viscotester iQ touchscreen user interface *and* the HAAKE Viscotester iQ RheoApp software at the same time.

Figure 86. User management dialog



Up to 10 users can be defined. Each user must be assigned an user level. Users can optionally have administrator privileges. The Administrator privileges are additional to the level 1, level 2 or level 3 privileges.

The main differences between the different user levels are described in Table 8. For a more detailed list of the privileges of the three user levels and an administrator see Appendix C, "User Privileges."

Table 8. Main differences between the user levels.

<table>
<tr><th>Level</th><th>Privileges in RheoApp</th><th>Privileges in user interface</th></tr>
<tr><td>Level 1</td><td>Create, edit and view Jobs</td><td rowspan="2">Edit, view and run Jobs [a]</td></tr>
<tr><td>Level 2</td><td>Edit Job element parameters and view Jobs</td></tr>
<tr><td>Level 3</td><td>View Jobs</td><td>View and run Jobs</td></tr>
<tr><td>Administrator</td><td>Edit users
Edit Jobs and configuration settings of other users
Copy Jobs between users</td><td>--- [b]</td></tr>
</table>

[a] Level 1 and level 2 are identical in the HAAKE Viscotester iQ user interface.

[b] There is no administrator functionality in the HAAKE Viscotester iQ user interface.

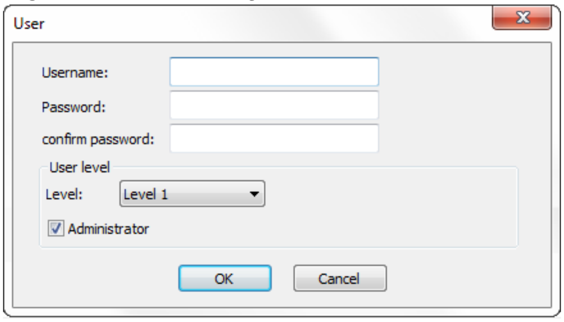
❖ To add or edit an user

1. Choose **Options > User management** to open the User management dialog.

   Step 2 is only needed when editing an existing user.

2. Select an user from the User name list.
3. Click the **Add** button to open the User dialog, see Figure 87

Figure 87. User dialog



4. Enter or edit the **User name**.
5. Enter or edit the **Password** and **Confirm** it.

   The password can be left empty.
6. Select an user level from the **Level** list.
7. Optionally, give the user administrator privileges by selecting the **Administrator** option.

Note By removing a user from the list, all Jobs, Data files and configuration settings of that user will be removed (that is deleted from the HAAKE Viscotester iQ, Reference Manual RheoApp USB flash drive) as well.

❖ To remove a user

1. Choose **Options > User management** to open the User management dialog.
2. Select an user from the **User name** list.
3. Click the **Remove** button.

Note The Default user can not be removed.

Users can be forced to log in to the RheoApp program by activating the login dialog. When this option is activated the HAAKE Viscotester iQ RheoApp - Login dialog (see Figure 88) will appear directly after starting the RheoApp program. After selecting a user name and entering the password (if needed), the main RheoApp program window will appear.

❖ To activate the login dialog

1. Select the **Activate login (and disable "Default" user)** option.

Note The Activate login (and disable "Default" user) option can only be activated when at least one user with administrator privileges has been defined.

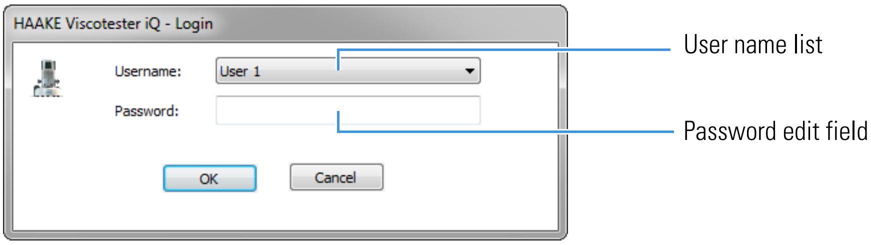
Change user

With the Change user command another user can log in to the RheoApp program without closing and restarting the program.

❖ To login another user

1. Choose **Options > Change user** to open the Login dialog.

Figure 88. Login dialog



2. Select an user from the **User name** list.
3. Enter the user's **Password**.
4. Click **Ok**.

   The USB flash drive explorer list will now display the Configuration settings, Data files and Jobs of the newly logged-in user.
   In case the logged-in user has administrator privileges, the USB flash drive explorer will display the Configuration settings, Data files and Jobs of *all* users.

View

From the View menu the visual appearance of the RheoApp program can be modified.

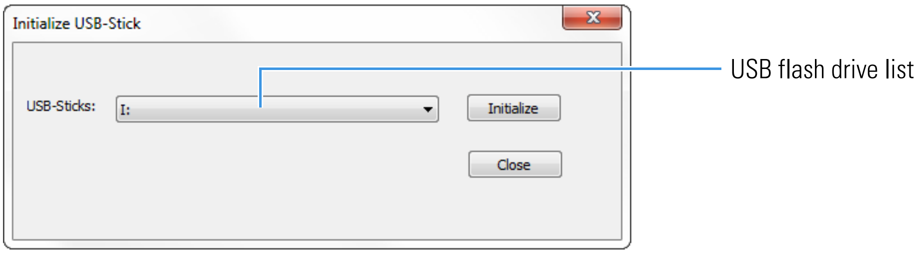
Recycle bin for Job elements

The Recycler dialog displays the contents of the JobEditor's recycle bin. From the Recycler dialog, elements removed from Jobs can be dragged & dropped back into JobEditor dialog.

Init USB flash drive

Using the Init USB flash drive Dialog (see Figure 89) the special directory and file structure of the HAAKE Viscotester iQ RheoApp USB flash drive can be transferred to another (empty) USB flash drive. This new RheoApp USB flash drive will *not* contain any Jobs and data files and the configuration settings will be the factory default settings.

Figure 89. Init USB flash drive dialog



❖ To create a new HAAKE Viscotester iQ RheoApp USB flash drive

1. Select the USB flash drive to which the special directory and file structure of the HAAKE Viscotester iQ RheoApp USB flash drive is to be transferred.

In the USB flash drive list only USB flash drives (and USB hard disks), that do not contain the HAAKE Viscotester iQ RheoApp program yet, are displayed. The use of an empty, fast, 4 Gb, USB flash drive is recommended.

2. Click the **Initialize** button to start the transfer process.
3. Click the **Close** button when the transfer process has finished.

Edit report template

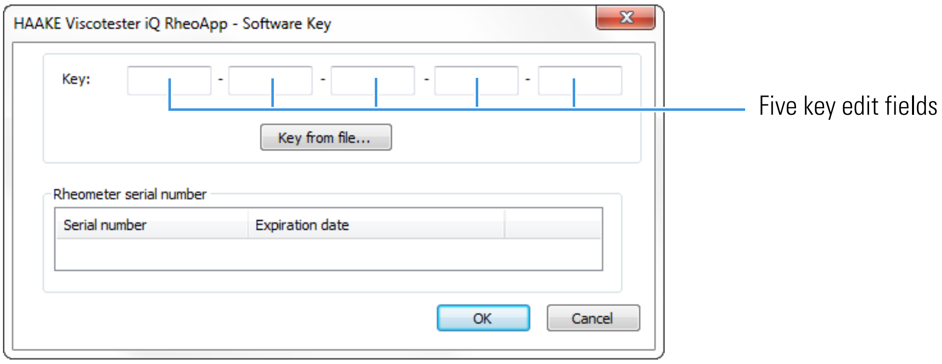
By choosing **Options > Edit report template** the List&Label report template editor program will be launched. For more information on how to edit report templates see the List&Label manual.

This command is only available when at least one JobEditor dialog window or one Data view window is open. The command always applies to the active window. That means that when a JobEditor dialog window is the active window, the Job report template is opened for editing. When a Data view window is the active window, the Data report template is opened for editing.

Add key

On the Add key dialog additional HAAKE Viscotester iQ serial number keys can be entered to make one HAAKE Viscotester iQ RheoApp USB flash drive usable with more than one HAAKE Viscotester iQ instruments.

Figure 90. Add key dialog



❖ To enter a key

1. From the sticker on the HAAKE Viscotester iQ RheoApp Start Guide document read the key and enter it in the five key edit fields.

   or

2. Click the **Key from file** button and select a special *.txt key file using the Windows file **Open** dialog.

   The information contained in the key will appear in the list in the **Rheometer serial number** area.

Windows menu

The Windows menu contains the standard Microsoft Windows menu items and functionality to arrange the program dialog windows.

Help menu

The Help menu contains the standard Microsoft Windows menu items.

Help topics

From the Help topics menu the HAAKE Viscotester iQ on-line help window is opened. Currently there is no on-line help available.

About HAAKE Viscotester iQ RheoApp

The About dialog displays information on the serial number(s) of the HAAKE Viscotester iQ instrument(s) with which the current copy of the HAAKE Viscotester iQ RheoApp software can be used as well the version number of the HAAKE Viscotester iQ RheoApp software.

JobEditor dialog

With the JobEditor new Jobs can be created and existing Jobs can be modified.

All Job parameters in the two blue areas of the JobEditor dialog (see Figure 92), that is the Geometry area and the upper left part of the Element editor area can also be edited in the Job editor menu in the HAAKE Viscotester iQ user interface (see“Job editor menu” on page 20). For consistency, the items located in the blue area of the Element editor, are positioned in the same way as in the element editor in the HAAKE Viscotester iQ user interface (see Figure 20 on page 20).

In the area right of the blue Element editor area, the values of the rotational speed or the torque, which correspond with the values of the shear rate or the shear stress in the Element editor, are displayed. This allows for a quick check against the instruments measurement range. The rotational speed and torque values can also be edited directly.

In the Data acquisition area, the number of data points for the element can be defined.

❖ To create a new (empty) Job

1. Choose **File > New** from the menu bar to open an JobEditor dialog.

   The USB flash drive explorer list is now automatically replaced by the Elements for Jobs list.

2. Continue with step 6.

   or

3. In the USB flash drive explorer list right click on **Jobs** to open a menu.
4. In the menu choose **New Job** to open an JobEditor dialog.
5. Click on the **Elements for Jobs** button to display the Elements for Jobs list.
6. Edit the new Job, see “To edit a Job.”

Editing a Job consist of selecting the desired the measuring geometry, populating the Elements sequence area with elements, editing the element parameters and editing certain other Job properties.

❖ To edit a Job

1. Create a new (empty) Job, see "To create a new (empty) Job."

   or

2. Open an existing Job by double clicking on a **Job** name in the USB flash drive explorer list.
3. Select the desired measuring geometry from the **Geometry** list.
4. Add elements to the Job by dragging & dropping the desired elements from the **Elements for Jobs** list to the **Element sequence** area of the JobEditor.

   and/or

5. Remove elements from the Job by dragging & dropping the desired elements from the **Element sequence** area to the **Recycle** bin in the JobEditor.

> **Note** The maximum number of element in one Job is: 10 measurement elements plus 4 evaluation elements.
> **Note** Evaluation elements can only be positioned at the end of Job, i.e. after the measurement elements.

6. Click on any element icon in the Elements sequence area to select that Job element and to display the parameters of that element in the Element editor area.

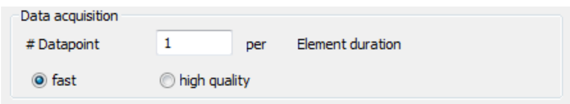
   or

7. Use the Previous element and Next element buttons (see Figure 92) to select a Job element.
8. Edit the parameters of the individual elements.

   The different measurement and evaluation elements (editors) and their parameters are described in detail in the sections "Editor page: Measurement elements Rotation" on page 22, "Editor page: Measurement elements Oscillation" on page 25 and "Editor page: Evaluation elements" on page 29 of Chapter 2, "Touchscreen User Interface." Since the elements editors in the RheoApp software and the HAAKE Viscotester iQ touch screen panel user interface are more or less identical, the description in Chapter 2 applies to the RheoApp software as well, apart from the exception mentioned below.

   For all oscillation elements the data acquisition quality can only be set in the RheoApp Job editor, see Figure 91.

   Figure 91. Data acquisition quality settings in OSC elements

   The operator can select between Fast data acquisition, which means that each data point is measured during 6 oscillation periods, and High quality data acquisition which means that each data point is measured during 12 oscillation periods.

9. Edit the Job settings (data save options, accoustic signal options, options for temperature control at the end of the job) by right clicking in the **Element sequence** area and selecting **Job settings** from the context menu (see Figure 92).

   For more information on the Job settings see "Job settings page" on page 83.

❖ To save a Job

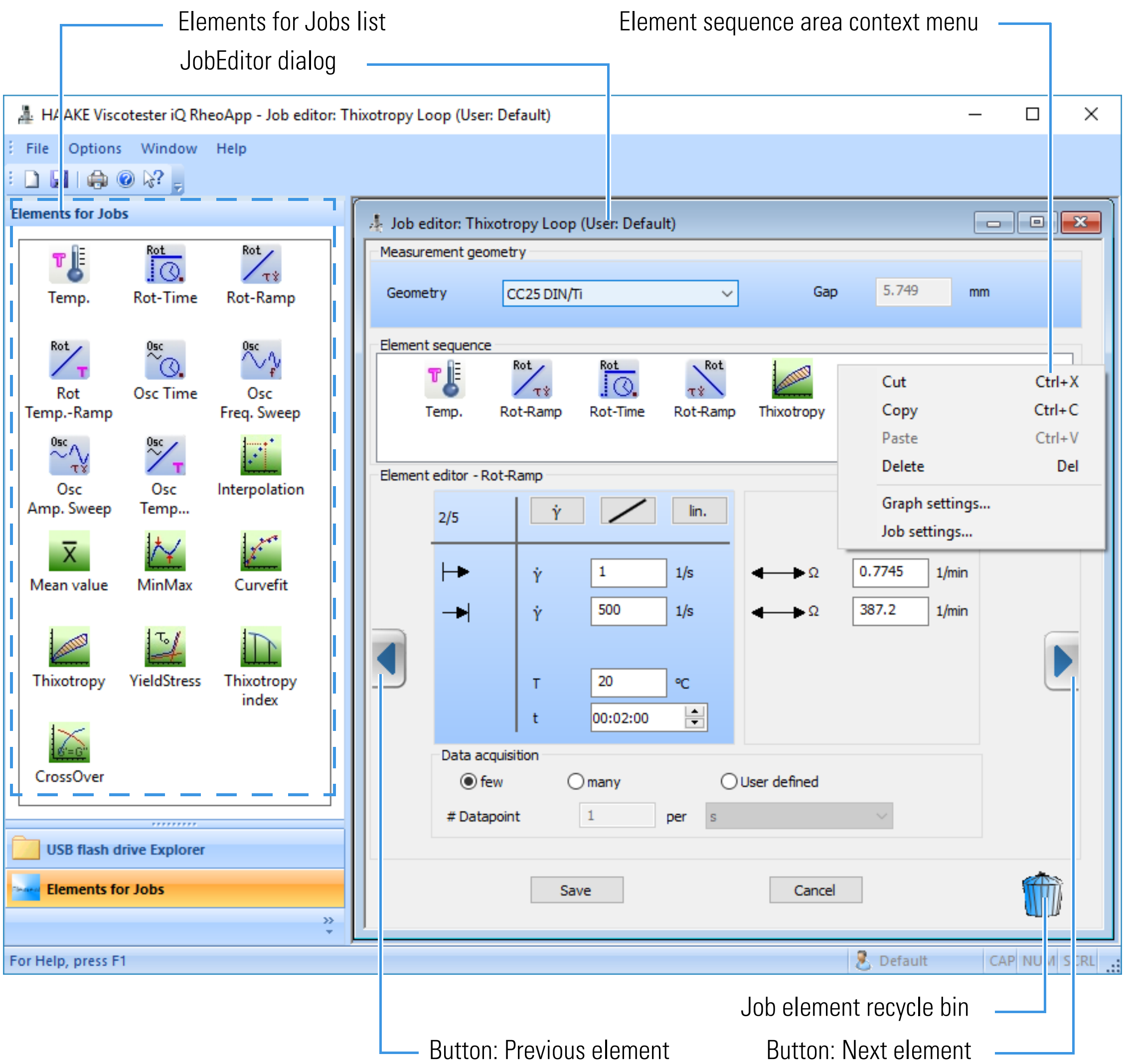
1. Click the Save button at the bottom of the JobEditor dialog

   or

2. Use the **Save Job** or **Save Job as** commands from the file menu, see “File menu” on page 66.

> **Note** The maximum text length of a Job name is 300 byte of Unicode characters. One Unicode character can have a size between 1 byte and 12 byte, that means that the maximum text length of a Job name is between 25 and (theoretically) 300 characters.

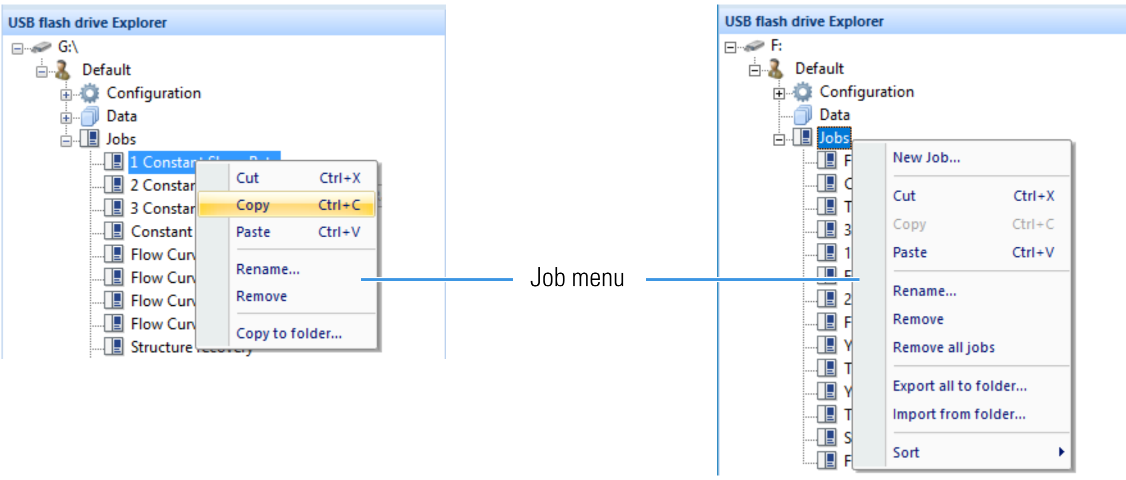
Figure 92. JobEditor dialog and Elements for Job (in Main window)



Handling Jobs

From the USB flash drive explorer, Jobs can be copied, copied to another user, copied to a folder on a PC or network drive, renamed, removed (deleted) and sorted.

Figure 93. USB flash drive explorer Job menu (left for Job name item, right for Jobs item)



❖ To copy a Job

1. Right click on a Job name in the USB flash driver explorer Job list to open the Job menu.
2. Select **Copy** from the menu (see Figure 93).
3. Right click in the USB flash driver explorer Job list to open the Job menu.
4. Select **Paste** from the menu.

   A new Job with the same name as the original Job plus the text `- Copy` will be added to the list.
5. Rename the copied Job, see "To rename a Job."

In order to make existing Jobs available for other users, Jobs can be copied to another user's Job list. This is especially useful after defining new users, because the Job list of a newly created user is always empty. The predefined (factory) Job are only available in the Default user's Job list.

❖ To copy a Job to another user

1. Right click on a Job name in the USB flash driver explorer Job list to open the Job menu.
2. Select **Copy** from the menu (see Figure 93).
3. Right click in the USB flash driver explorer Job list of another user to open the Job menu.
4. Select **Paste** from the menu.

   The Job will be added to the other user's Job list using the same Job name.

Note It is only possible to copy Jobs from one user to another when the currently logged on user has Administrator privileges.

For example for creating a backup copy, a Job can be copied to Job file in a folder on a PC or network drive.

❖ To copy a Job to folder on a PC or network drive

1. Right click on a Job name in the USB flash driver explorer Job list to open the Job menu.
2. Select **Copy to folder** from the menu (see Figure 93) to open the Windows file dialog.

3. In the Windows file dialog select a folder and click **Ok**.

   The Job will be copied to a file with the same name as the Job and with the extension *.rwj, in the selected folder.

Note The saved Job file is *not* compatible with the HAAKE RheoWin software.

Rename Jobs to make it easier for operators to choose the correct Job for a certain application.

❖ To rename a Job

1. Right click on a Job name in the USB flash driver explorer Job list to open the Job menu.
2. Select **Rename** from the menu (see Figure 93).
3. Edit the Job name (directly in the list).

Removing Jobs from the Job list that are not needed makes selecting a Job in the HAAKE Viscotester iQ touch screen panel user interface more convenient.

❖ To remove a Job

1. Right click on a Job name in the USB flash driver explorer Job list to open the Job menu.
2. Select **Remove** from the menu (see Figure 93).

Per default the Job list in the USB flash driver explorer is not sorted according to any criteria, that is the Jobs are listed in an arbitrary order. This can be changed by sorting the Job list.

❖ To remove all Jobs

1. Right click on Jobs (the root of the Job tree) in the USB flash driver explorer Job list to open the Job menu.
2. Select **Remove all jobs** from the menu (see Figure 93).

❖ To export all Jobs to any folder on a PC

1. Right click on Jobs (the root of the Job tree) in the USB flash driver explorer Job list to open the Job menu.
2. Select **Remove all to folder** from the menu (see Figure 93).

❖ To import a Job from any folder on PC

1. Right click on Jobs (the root of the Job tree) in the USB flash driver explorer Job list to open the Job menu.
2. Select **Import from folder** from the menu (see Figure 93).

❖ To sort the Job list

1. Right click on **Jobs** in the USB flash driver explorer Job list to open the Job menu.
2. Select **Sort** from the menu (see Figure 93).
3. Select **Alphabetical** or **Date** from the sub-menu to sort the Job list.

Data view window

The Data view window consist of 4 pages (Graph, Table, Evaluation results, Job), three pages each offer a different view on the data, the fourth page shows the Job used to generate the data.

❖ To open a data file in the Data view window

1. Select a Data file from the USB flash driver explorer **Data** list.
2. Double click on the data file name to open the file in the Data view window.

Graph page

The graphical display uses the settings from the Graphical display area in the **Configuration > Job** display dialog.

Table page

The settings for the columns for the table currently can not be modified.

Evaluation result page

The result page displays the calculated parameters of the evaluation elements in the Job.

Job page

The Job page, which is identical to the Job editor but with all editing functions disabled, shows the Job that was used for generating the data.

Configuration dialog

The Configuration dialog consist of 7 pages (Preferences, Job display, Manual mode, Job settings, Quantities/Units, Temp.-Offset tables and Geometry list) see Figure 94) which are described in the following sections.

All configuration settings are stored on the special HAAKE Viscotester iQ USB flash drive from which the RheoApp software is launched.

Note All settings made in the Configuration dialog relate to the HAAKE Viscotester iQ touchscreen user interface only, that is *not* to the RheoApp software.

Note All settings made in the Configuration dialog are user specific, that is every user has its own set of configuration settings.

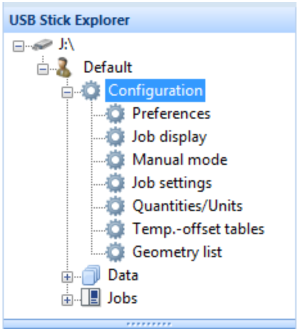
❖ To open a page of the Configuration dialog

1. In the USB flash drive explorer tree double click the **Configuration** item, then click the tab of the desired page.

   or

2. In the USB flash drive explorer tree double click any of the 7 page name items below the Configuration item to open the corresponding page of the Configuration dialog directly.

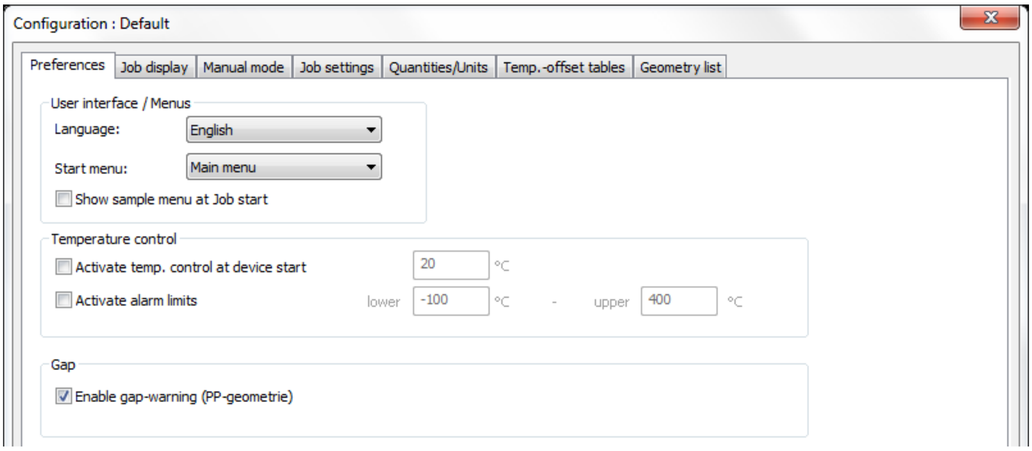
Figure 94. USB flash drive explorer tree



Preferences page

On the Preferences page of the Configuration dialog some more general settings for the HAAKE Viscotester iQ touchscreen panel user interface can be made.

Figure 95. Preferences page of Configuration dialog



User interface/Menus

In the User interface/Menus area of the Preferences page, the Language and the Start menu for the HAAKE Viscotester iQ touchscreen user interface as well as the option to display the Sample menu, directly after starting a Job and before starting the actual measurement, can be selected.

❖ To select a touchscreen user interface language

1. Click on the **Language** drop-down button to open a drop-down list with languages.
2. Select the desired language from the drop-down list.

❖ To select the start menu

1. Click on the **Start menu** drop-down button to open a drop-down list with menus.
2. Select the desired menu from the drop-down list.

❖ To show the Sample menu at Job start

1. Select the **Show sample menu at Job start** check box.

Note The settings in the User interface/Menus area can also be changed using the HAAKE Viscotester iQ user interface.

Temperature control

In the Temperature control area of the Preferences page the TM-PE-C or TM-PE-P temperature control can be set to automatically start controlling a certain temperature at instrument setup. The lower and upper temperature alarm values below respectively above which the temperature control will automatically stop and display a message, can be edited and the alarm limit control can be enabled.

❖ To activate the TM-PE-C or TM-PE-P temperature control at instrument start up

1. Enter a value for the temperature.
2. Select the **Activate temp. control at device start** check box.

❖ To activate the temperature alarm

1. Enter values for both the **lower** and the **upper** alarm temperatures.
2. Select the **Activate alarm limits** check box.

Note The settings in the Temperature control area can only be changed using the RheoApp software, that is not from the HAAKE Viscotester iQ user interface.

Gap

In the Gap area of the Preferences page the optional gap-warning message can be activated. When this is done a popup message on the HAAKE Viscotester iQ user interface will remind the operator to set the correct gap (for parallel-plate geometries only) before a Job is actually started.

❖ To activate the gap-warning

1. Select the **Enable gap-warning (PP-geometry)** check box.

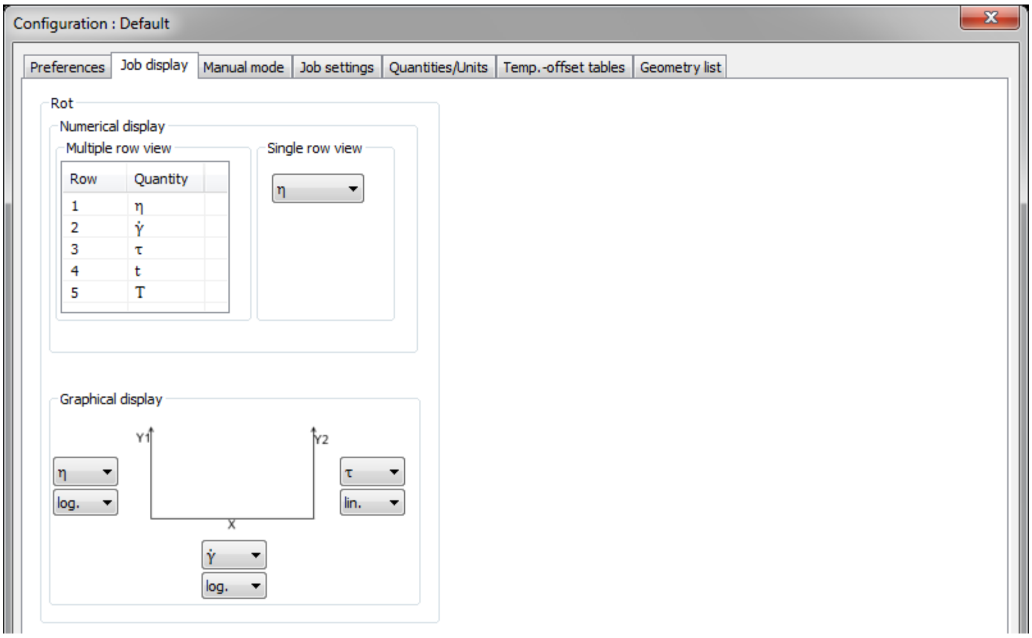
Note The settings in the Gap area can only be changed using the RheoApp software, that is not from the HAAKE Viscotester iQ user interface.

Job display page

On the Job settings page of the Configuration dialog, the quantities that are displayed in the Job control menu of the HAAKE Viscotester iQ touchscreen user interface can be selected.

In the Rot area, the quantities for the bottom, the right and the left axes of the graph on the "Graph page," (see page 16) and the quantities for the 1-line and 5-line numerical display on the "Numeric page," (see page 17) of the HAAKE Viscotester iQ touchscreen user interface can be selected. For the graph axes the scaling mode can be set to either lin or log.

Figure 96. Job display page of Configuration dialog



❖ **To select the quantity for an axis of the graphical display or a line of the numerical display**

Step 1 is for the multiple row view only.

1. Click on the current quantity in the table to display a quantity drop-down button.
2. Click on the quantity drop-down button to open a drop-down list of quantities.
3. Select the desired quantity from the drop-down list.

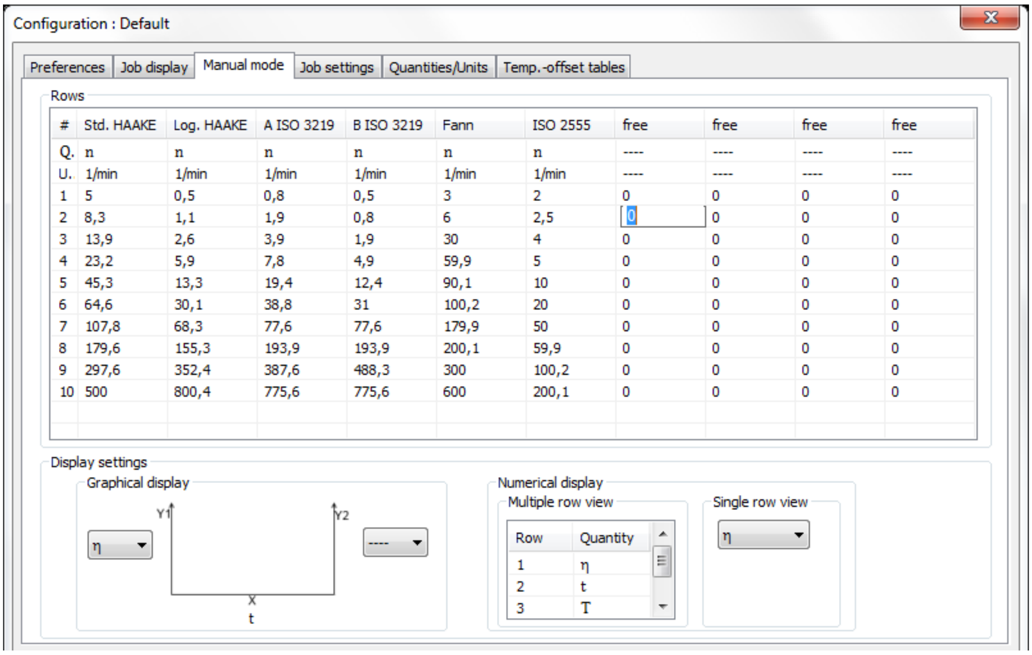
❖ **To set the scaling mode of an axis**

1. Click the **lin.** or **log.** drop-down button to open a drop-down list.
2. Select the desired scaling mode, lin. or log. for the axis from the drop-down list.

Manual mode page

On the Manual mode page of the Configuration dialog, the set value rows can be viewed and edited, and the quantities that are displayed in the Manual mode menu of the HAAKE Viscotester iQ touchscreen user interface can be selected.

Figure 97. Manual mode page of Configuration dialog



Rows

In the Rows area of the Manual mode page the row values of the 6 predefined rows can be viewed and the name, the set quantity as well as the up to 10 row values for the 4 user defined rows can be edited.

❖ To edit a row of set values

1. Click on the header of the column of the row of set values that is to be edited and enter a name for that row of set values.
2. Click on the **Q.** row to display a quantity drop-down button.
3. Click on the drop down button to open a drop-down list of quantities.
4. Selection the desired set quantity torque M, shear rate $\dot{\gamma}$, shear stress τ or angular speed n from the drop-down list.

   The currently defined default unit for that quantity is displayed in the **U.** row.
5. Click on the first value row and enter the first value of the row of set values.
6. Repeat step 5 for up to 9 subsequent row values as desired.
7. Click the **OK** button of the Configuration dialog to save the new row.

Note Row values can only be edited using the RheoApp software, that is not from the HAAKE Viscotester iQ user interface.

Display settings

In the Display settings area of the Manual mode page, the quantities for the right and the left axes of the graph on the "Graph page," (see page 40) and the quantities for the 1-line and 3-line numerical display on the "Numeric page," (see page 41), of the HAAKE Viscotester iQ touchscreen user interface can be selected.

❖ **To select the quantity for an axis of the graphical display or a line of the numerical display**

Step 1 is for the multiple row view only.

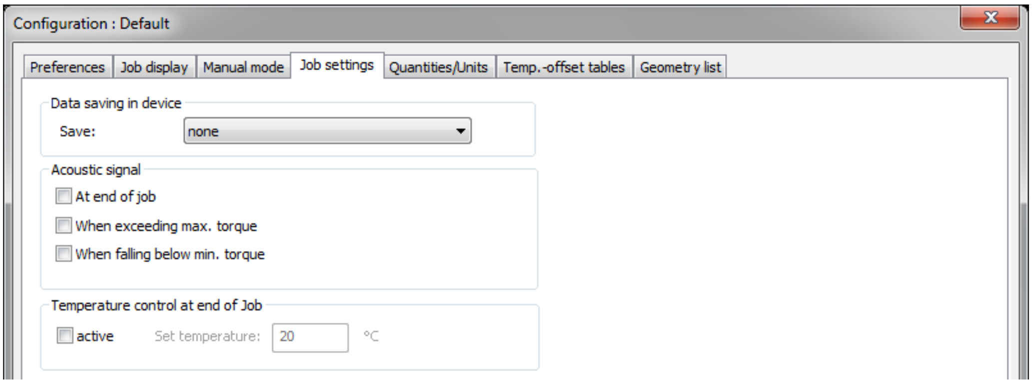
1. Click on the current quantity in the table to display a quantity drop-down button.
2. Click on the quantity drop-down button to open a drop-down list of quantities.
3. Select the desired quantity from the drop-down list.

Note The manual control display settings can also be changed from the he HAAKE Viscotester iQ user interface, see the "Manual control menu" on page 40.

Job settings page

On the Job settings page of the Configuration dialog certain settings, which will be used for *newly created Jobs* (of the selected user) *only*, can be made.

Figure 98. Job settings page of Configuration dialog



Note For changing the Job settings of any *existing* Job see Step 9 of "To edit a Job" on page 74.

Data saving in device

Regarding the saving of the data generated during a Job run the Job control can be setup

1. to save no data at all, or
2. to save the results of the evaluation elements in a job only, or
3. to save both the measured data and the evaluation results.

The first option, that is not to save any data, is the default setting for all predefined Jobs that are part of the HAAKE Viscotester iQ standard delivery. The reason for this is, that it can not be assumed that the RheoApp software (and therefore the special USB flash drive) is available for every HAAKE Viscotester iQ. Without the special USB flash drive the measured data files can not be transfered from the HAAKE Viscotester iQ internal memory to the USB flash drive and thus not be viewed and processed by the RheoApp software.
Since the data saving option is valid for all Jobs (of the current user), changing this option to saving all data or just the evaluation data, is quickly done.

When the second data save option is selected, only the results calculated by the evaluation elements that are part of the job are saved in the resulting data file. This is useful to save space in the internal memory, to save time when transferring the data from the internal memory to the USB flash drive and in all case the measured data itself is not needed anyway.

When the third data save option is selected, all data points measured by the Job plus the results calculated by the evaluation elements that are part of the job are saved in the resulting data file.

❖ **To setup the data saving**

1. Click on the **Save** drop-down button to open a drop-down list of data save options.
2. Select the desired option from the drop-down list.

Accoustic signal

The Job control can be setup to give an acoustic signal at the end of every Job, this is useful for warning the operator when the Job is finished, for example when he or she has to operate multiple instruments in parallel.

The Job control can also give an acoustic signal when the maximum torque is exceeded and when the torque falls below the minimum torque, this is useful for warning the operator for running a measurement outside of the instruments specified torque range.

❖ **To activate an acoustic signal**

1. Select the acoustic signal option that is to be activated.

Temperature control at end of Job

The Job control can be setup to set the temperature (of the TM-PE-C or TM-PE-P) to a certain value at the end of a Job, instead of switching off the temperature control at the end of a Job.

❖ **To activate the temperature control at the end of a Job**

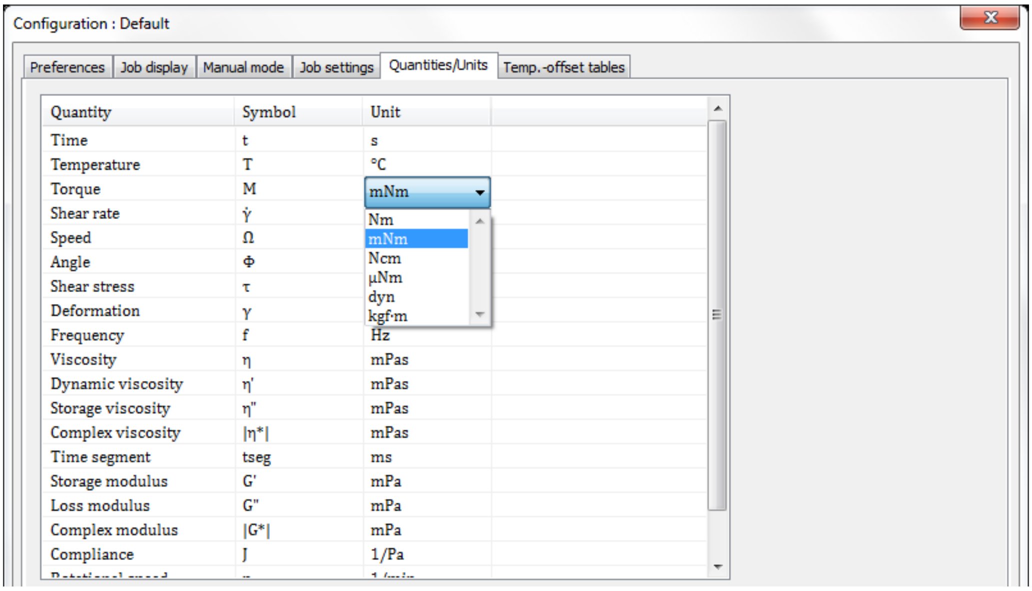
1. Select the **Active** option.
2. Enter a value for the **Set temperature**.

Note The settings on this page can only be changed using the RheoApp software, that is not from the HAAKE Viscotester iQ user interface.

Quantities/Units page

On the Quantities/Units page of the Configuration dialog the default units for the quantities, that are displayed on the HAAKE Viscotester iQ touchscreen user interface, can be defined.

Figure 99. Quantities/Units page of Configuration dialog



❖ **To select a default unit for a quantity**

1. Click on the current unit in the **Units** column of the quantity to display a units drop-down button.
2. Click on the units drop-down button to open a drop-down list of units.
3. Select the desired unit from the drop-down list.

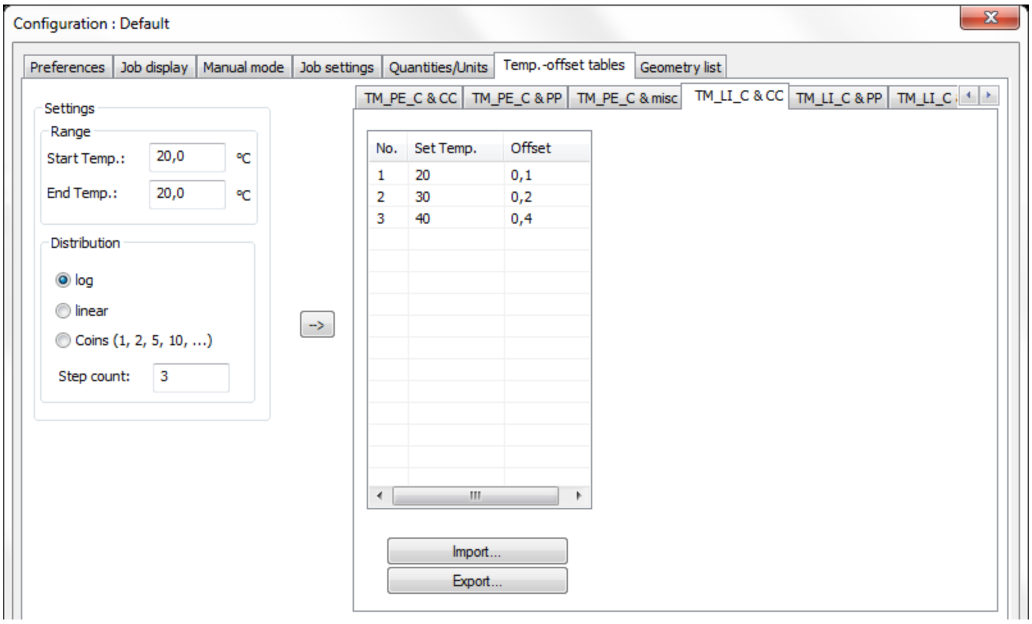
Note The default unit for a quantity can also be changed from the he HAAKE Viscotester iQ user interface, see the “Quantity/Units menu” on page 48.

Temp.-Offset tables page

On the Temp.-Offset table page of the Configuration dialog all 8 temperature offset tables that are stored and used in the HAAKE Viscotester iQ firmware for controlling and measuring the temperature can be viewed and edited. See “Temperature offsets menu” on page 49.

Using the Import and Export buttons the selected temperature offset table can be imported from and exported to a *.tot file which is compatible with the HAAKE RheoWin software (see “The Temperature page” on page 109).

Figure 100. Temp.-Offset table page of Configuration dialog



Geometry list

The functionality on this page is not finally implemented yet, more information will be available in a future version of this manual.

Using the USB flash drive for Job and configuration transfer

See the “Data copy menu” on page 60.

4

Network setup

The communication between the HAAKE Viscotester iQ and the HAAKE RheoWin rheometer control software uses the TCP and UDP protocols on an IP network connection. This chapter describes how to setup this network connection.

Note It is assumed that any hardware network interface used for the communication between the Viscotester iQ and the PC (with HAAKE RheoWin) has been properly setup as part of the PC and operating system installation. This manual does not deal with PC hardware installations and/or network problems. In case of problems with the PC hardware or with the network a local IT specialist should be consulted

Note The mini USB socket on the rear of the HAAKE Viscotester iQ instrument head is only intended for service purposes, that is not for controlling the instrument.

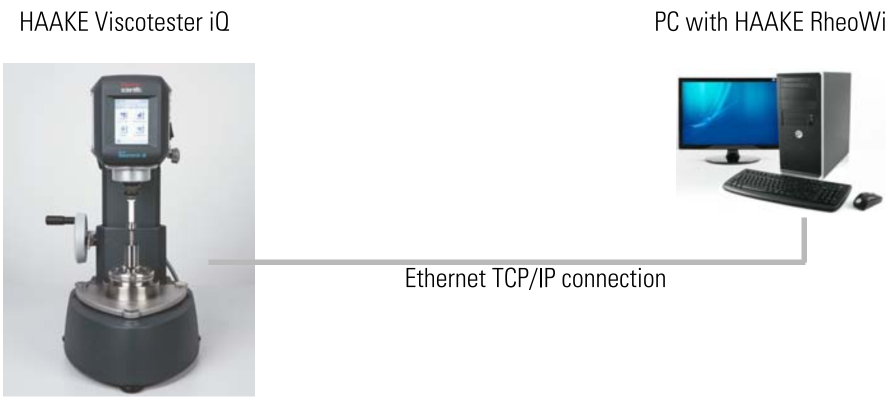
IMPORTANT Read this chapter completely before starting the network setup.

Network considerations

There are two different ways to make the connection between a HAAKE Viscotester iQ and a PC (with HAAKE RheoWin):

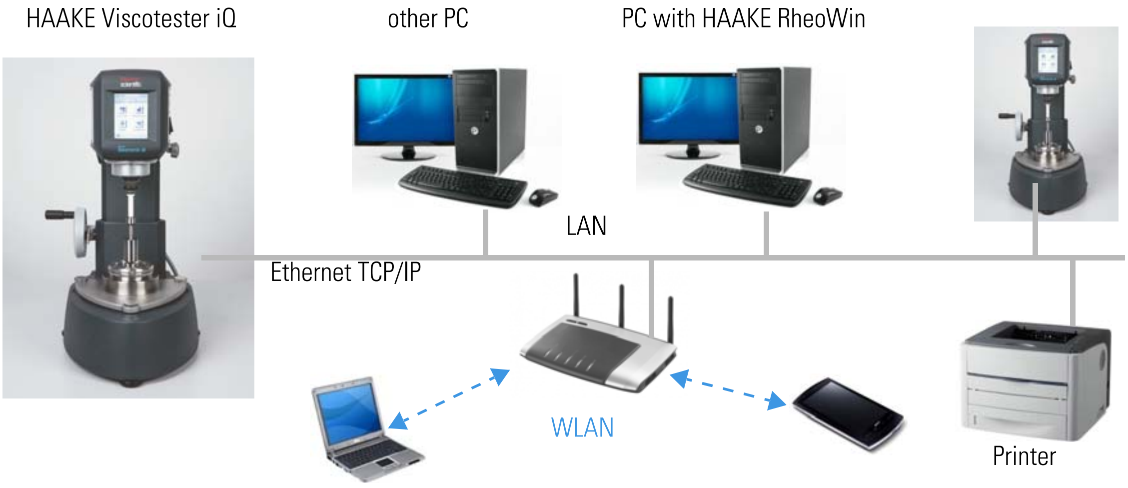
- Point-to-point network
  The HAAKE Viscotester iQ can be directly connected to a PC (with HAAKE RheoWin) using a so-called point-to-point network. In such a network there are only two clients and the network connection is only used for the communication between the HAAKE Viscotester iQ and HAAKE RheoWin.

Figure 101. HAAKE Viscotester iQ and PC (with HAAKE RheoWin) in point-to-point network



- Company or local network (LAN, WAN, Internet)
  The HAAKE Viscotester iQ can be connect to a network of any size, for example a small dedicated network, a company network (LAN) or a local network with a few or many clients of which the HAAKE Viscotester iQ and the PC (with HAAKE RheoWin) are just two clients. The connection between the Viscotester iQ and the PC (with HAAKE RheoWin) is just one of many connections in the network.

Figure 102. HAAKE Viscotester iQ and PC (with HAAKE RheoWin) in LAN



Point-to-point network

Using a point-to-point network has the following advantages and disadvantages:

- A point-to-point network is easy to setup. An IT network specialist is normally not needed.
- In a point-to-point network the network connection is only used by the communication between the HAAKE Viscotester iQ and HAAKE RheoWin. Because of this and also due to the intelligent data buffering in the HAAKE Viscotester iQ firmware the communication can not be interrupted and a stable connection is guaranteed.
- The HAAKE Viscotester iQ can only be accessed from the PC (with HAAKE RheoWin) to which it is connected to by the point-to-point network.
- When the PC (with HAAKE RheoWin) needs to be connected to a company network (and/or the internet), to be able to access network directories for exchanging data files etc., the PC needs two hardware network interfaces. One for the HAAKE Viscotester iQ point-to-point network and the other for the company network (and/or internet).
  Many PCs only come with one hardware network interface, however it almost always possible to add a second internal or external hardware network interface. Under order number 222-1760 Thermo offers such an USB to Ethernet adapter. For detailed installation instructions and more information on this adapter see the documentation on the CD that comes with the adapter.

Company or local network

Using a company or local network has the following advantages and disadvantages:

- Integrating the HAAKE Viscotester iQ and the PC (with HAAKE RheoWin) into a company network normally needs an IT network specialist.

- In a company or local network the network is used by many different services at the same time (accessing network drives, printing, internet connections etc.). Because of that, and even with intelligent data buffering in the HAAKE Viscotester iQ firmware, it is not possible to guarantee a certain continuous data acquisition-rate for the communication between the HAAKE Viscotester iQ and HAAKE RheoWin. As a result measurement data may (but certainly must not) show missing data points.
- The HAAKE Viscotester iQ can be accessed from any PC in the network on which HAAKE RheoWin or a browser is installed. Any HAAKE Viscotester iQ can of course only be controlled from one instance of HAAKE RheoWin at a time.
- Only one hardware network interface in the PC (with HAAKE RheoWin) is needed.

Multiple HAAKE rheometers connected to one PC

One instance of RheoWin running on one PC can *control multiple* HAAKE rheometer (that is multiple Viscotester iQ (Air) and/or MARS iQ (Air) and/or MARS 40/60) *at the same the time*. In this case separate RheoWin Jobs are running at the same time, each Job controlling a different rheometer.

For this each rheometer can be connected to the PC using an individual point-to-point network, or all rheometers can be connected to a company or local network.

TCP/IP connection

The TCP/IP connection requirements for the HAAKE Viscotester iQ are listed in the following sections.

Note The Ethernet TCP/IP connection requirements are all standard specifications and should be fulfilled by any PC network interface.

Firewall, TCP/IP ports, UDP protocol

IMPORTANT Any Firewall (Windows Defender, Symantec, Norton, etc.) installed on the PC on which HAAKE RheoWin is running must be configured in such a way that the TCP ports listed in Table 9 and the UDP protocol are not blocked for RheoWin.

The UDP protocol is used for sending “ConnectAssist” messages (automatic rotor recognition) from the Viscotester iQ to RheoWin. This functions will not work when the UDP protocol is blocked.

Table 9. TCP/IP ports used by the HAAKE Viscotester iQ and HAAKE RheoWin

Port	Used for
2010	THMP service protocol for instrument control
2000	HAAKE RheoWin network scan function

IP and MAC adress

The IP address of the HAAKE Viscotester iQ can either be set manually (local IP address) or assigned by a DHCP server.

Local IP adress

The local IP address of a HAAKE Viscotester iQ is used when the instrument is connected to a network without a DHCP server. The default value of the local IP address is 192.168.2.100.

The local IP address can be viewed and modified using the Network menu of the touchscreen user interface, see "Network menu" on page 54.

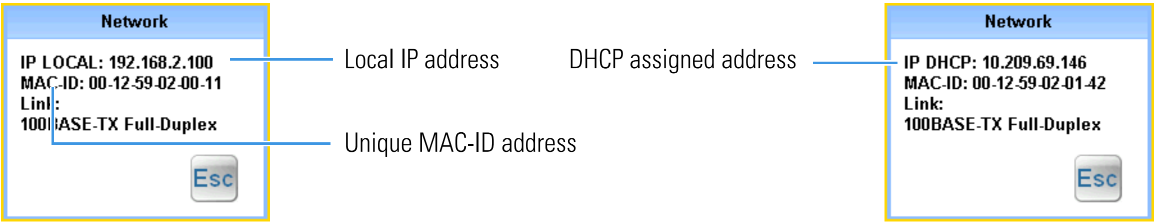
DHCP client

The HAAKE Viscotester iQ network interface is equipped with an automatic DHCP client functionality (conforming to RFC-2131). When the HAAKE Viscotester iQ is (physically) connected to a network with a DHCP server, the DHCP client in the instrument will automatically be assigned an IP address. There is no need to switch the instrument off/on for the new IP address to take effect. The new address is displayed in the Network status information popup dialog, see Figure 103.

Network status information

When the HAAKE Viscotester iQ is physically connected to an active network, the IP address that is currently used by the instrument can be viewed in the Network popup dialog which is accessed from the touchscreen user interface Main menu, by tapping the (optional) Network button at the bottom of the screen, see "Optional buttons" on page 14.

Figure 103. Network status information popup dialog with IP address



Note The fact that the Network popup dialog is accessible from the Main menu does not necessarily mean that the communication between the HAAKE Viscotester iQ and the HAAKE RheoWin software is setup properly and working.
See "Setting up a HAAKE Viscotester iQ using a point-to-point network" on page 90 and "Setting up a HAAKE Viscotester iQ in a company network" on page 95 for more information on setting up the network connection.

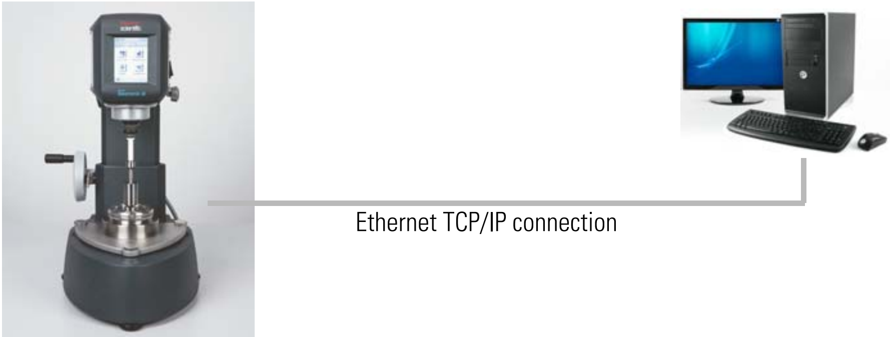
MAC address

Each HAAKE Viscotester iQ instrument is equipped with a unique MAC address which can be found in the Network popup dialog, see Figure 103 and also in the Configuration->Network menu, Figure 73 on page 55.

Setting up a HAAKE Viscotester iQ using a point-to-point network

As described above a free hardware network interface socket on the PC is needed for setting up a point-to-point network between the HAAKE Viscotester iQ and the PC (with HAAKE RheoWin).

Figure 104. HAAKE Viscotester iQ and PC (with HAAKE RheoWin) in point-to-point network



Making a hardware connection

❖ **To make a hardware network connection**

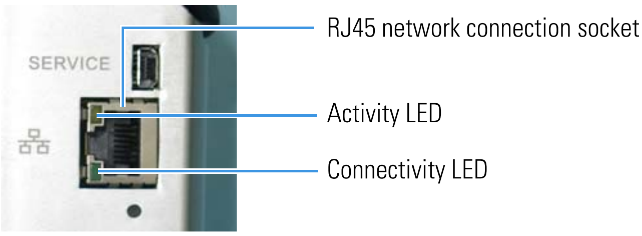
1. Plug one end of the network patch cable (order number 082-2526), which is part of the HAAKE Viscotester iQ standard delivery, into the RJ45 network socket on the back of the instrument head, see Figure 3 on page 4 in Chapter 2, “Functional Elements,” of the HAAKE Viscotester iQ Instruction Manual and Figure 105.

2. Plug the other end of the network patch cable into the RJ45 network socket of the PC on which HAAKE RheoWin is or will be installed.

When both the HAAKE Viscotester iQ and the PC are switched on, the (lower) connectivity LED of the network socket on the back of the instrument head should light up. The connectivity LED on the PC network socket should light up as well.

Note When the connectivity LEDs do not light up, check whether both ends of the network cable are plugged into the network sockets correctly.

Figure 105. Network connection socket on the back of HAAKE Viscotester iQ instrument head.



PC network interface configuration

❖ **To configure the PC network interface**

1. Make sure the Viscotester iQ is switched and initialized and that the hardware network connection is properly setup, see “Making a hardware connection.”

2. From the Windows Start menu select **Control panel** to open the Control panel dialog

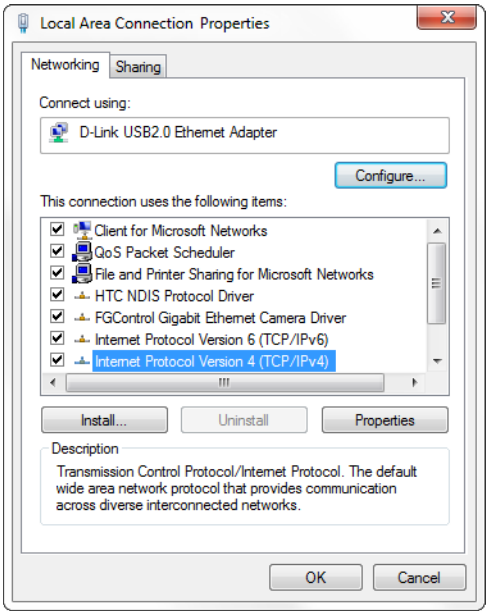
3. In the Control panel dialog click on the **View Network status and task** entry (under Network and Internet).

4. In the Network and Sharing Center dialog, from the View your active networks list, select the network connection that will be used for the HAAKE Viscotester iQ.

   In most cases this network connection is listed as an unidentified network with the name Local Area Connection x, where x stands for a numeric value.

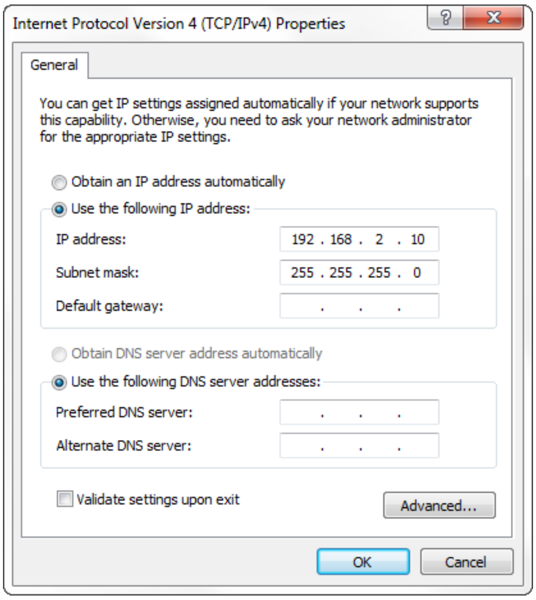
5. Click on that network entry in the list to open the **Local Area Connection x Status** dialog.
6. In the Local Area Connection x Status dialog click the **Properties** button.
7. In the Local Area Connection x Properties dialog select **Internet Protocol Version 4 (TCP/IPv4)** from the list and then click the **Properties** button.

Figure 106. Local area connection x properties dialog



8. In the Internet Protocol Version 4 (TCP/IPv4) Properties dialog select **Use the following IP address**
9. Enter the values **192.168.2.10** for the IP address and **255.255.255.0** for the Subnet mask.

Figure 107. Internet protocol (TCP/IP) properties



The last number of the IP address (here 10) does not have to be 10, it can be in the range of 0 to 255, but *must be different* from the last number (100) of the IP address of the HAAKE Viscotester iQ (the default IP address is 192.168.2.100).

The IP address of the network card in the PC and the IP address of the HAAKE Viscotester iQ must be different from each other but they must be in the same subnet range. This means that the first three numbers of the IP addresses (in dotted-decimal notation) must be the same but the last number must be different. For local area network connections it is customary to use IP addresses in the range of 192.168.xx.xx.

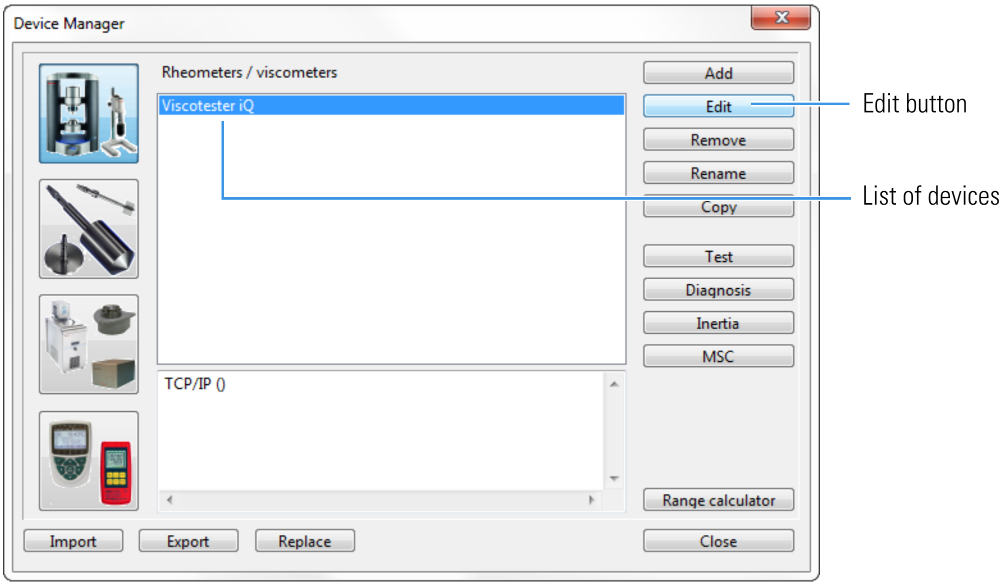
If necessary the local IP address can be viewed and modified using the Network menu of the touchscreen user interface, see “Network menu” on page 54.

HAAKE Viscotester iQ configuration in HAAKE RheoWin

❖ To configure the settings for the HAAKE Viscotester iQ in HAAKE RheoWin

1. Start the **RheoWin JobManager.**
2. Select the **DeviceManager** command from the Configuration menu.
3. In the DeviceManager dialog select the **Viscotester iQ** from the list of Rheometers / viscometers.

Figure 108. Device Manager dialog

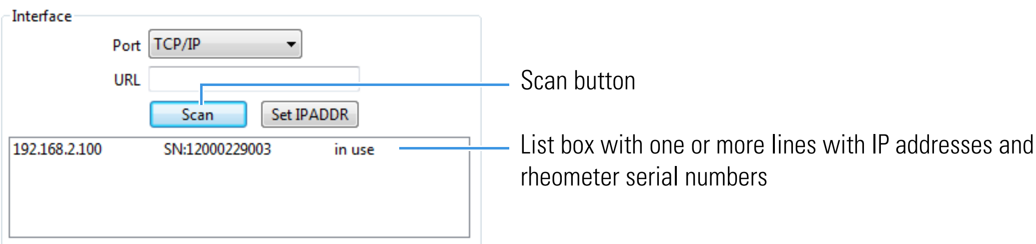


4. Click the **Edit** button on the right hand side of the list of devices to open the Properties of 'Viscotester iQ' dialog (see Figure 127 on page 105).

5. In the Interface area in the Properties of 'Viscotester iQ' dialog click the **Scan** button.

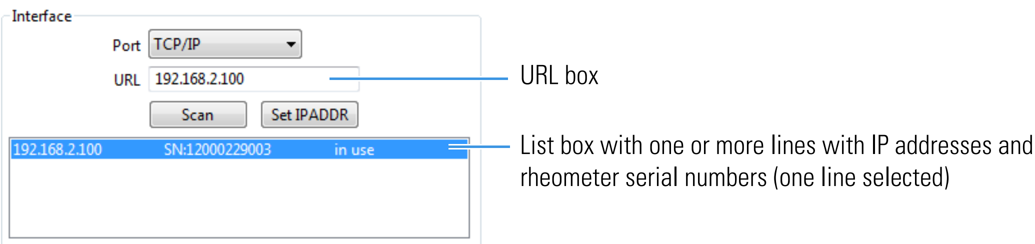
   HAAKE RheoWin will then scan (query) the network for any available HAAKE Viscotester iQ instruments. After a short time a list of IP addresses with the corresponding serial numbers of the HAAKE Viscotester iQ rheometers will appear in the list box below the Scan button.

Figure 109. Scan for IP address of the HAAKE Viscotester iQ



6. Double click the line containing the serial number of the HAAKE Viscotester iQ to transfer the IP address of the HAAKE Viscotester iQ to the URL box. (The IP address can also be entered manually in that box).

Figure 110. Transfer the IP address of the HAAKE Viscotester iQ



or (instead of step 5 and step 6)

7. Manually enter the IP address in the URL box.

8. Click the **Ok** button to close the Properties of 'Viscotester iQ' dialog.

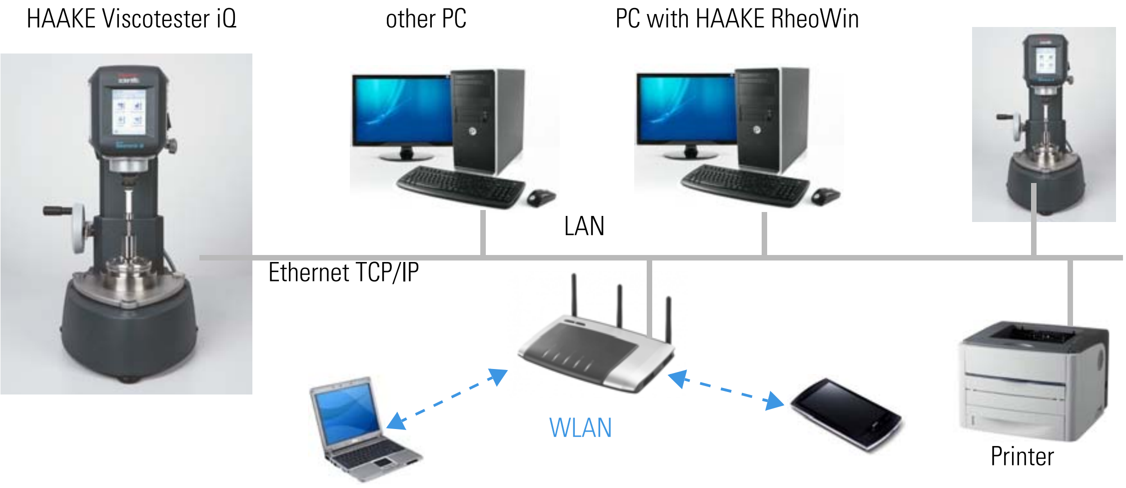
9. In the Properties of 'Viscotester iQ' dialog click the **Test** or **Diagnosis** button on the right hand side of the list to test the communication between the HAAKE RheoWin software and the HAAKE Viscotester iQ.

The HAAKE RheoWin software and the HAAKE Viscotester iQ are now ready to be used.

Setting up a HAAKE Viscotester iQ in a company network

In this case the PC (with HAAKE RheoWin) must already be connected to an existing company network.

Figure 111. HAAKE Viscotester iQ in company LAN



Making a hardware connection

❖ **To make a hardware network connection**

1. Plug one end of the network patch cable (order number 082-2526), which is part of the HAAKE Viscotester iQ standard delivery, into the RJ45 network socket on the back of the instrument head, see Figure 3 on page 4 in Chapter 2, "Functional Elements," in the HAAKE Viscotester iQ Instruction Manual and Figure 105 on page 91.

2. Plug the other end of the network patch cable into a RJ45 network wall socket (or network hub/switch) of a network to which the PC on which HAAKE RheoWin is (or will be installed) connected also.

When the HAAKE Viscotester iQ is switched on, the (lower) connectivity LED of the network socket on the back of the instrument head should light up. The connectivity LED on the network wall socket or hub/switch should light up as well. When the connectivity LEDs do not light up, check whether the network cable is plugged into the network sockets correctly.

Network without DHCP server

When the network uses the default range of 192.168.xx.xx IP addresses, make sure that the default HAAKE Viscotester iQ IP address 192.168.2.100 is not already used in the network. Otherwise change the HAAKE Viscotester iQ IP address.

When the network uses IP addresses in a range different from 192.168.xx.xx the IP address of the HAAKE Viscotester iQ must be changed.

When multiple HAAKE Viscotester iQ instruments are connected to one network the IP address of at least one HAAKE Viscotester iQ must be changed, since all network clients must have different IP addresses.

For instructions on how to change the HAAKE Viscotester iQ IP address, see “Network menu” on page 54.

Network with DHCP server

When the network is equipped with a DHCP server the IP address of any client in the network is not set by the client itself but assigned to the client by the DHCP server.

The HAAKE Viscotester iQ network interface is equipped with an automatic DHCP client functionality (conforming to RFC-2131). When the HAAKE Viscotester iQ is (physically) connected to a network with a DHCP server, the DHCP client in the instrument will automatically be assigned an IP address. There is no need to switch the instrument off/on for the new IP address to take effect.

See “Network status information” on page 90 on how to view the assigned IP address.

HAAKE Viscotester iQ configuration in HAAKE RheoWin

❖ **To configure the settings for the HAAKE Viscotester iQ in HAAKE RheoWin**

1. Open the **Properties of ’Viscotester iQ’** dialog in RheoWin JobManager as described in chapter “HAAKE Viscotester iQ configuration in HAAKE RheoWin” on page 93.
2. Click the **Scan** button to find the HAAKE Viscotester iQ in the network.
3. From the list of found HAAKE Viscotester iQ devices (more than one HAAKE Viscotester iQ can be connected to the network), select the proper HAAKE Viscotester iQ by checking the serial number, see Figure 110 on page 94.

The limitations of the HAAKE RheoWin scan function are:

- The Scan function can not search beyond the boundaries of the network which are set by the nearest network router in the network.

This nearest router restriction only applies to the Scan function, that is not to the ability of HAAKE RheoWin to communicate with a HAAKE Viscotester iQ which is located behind the nearest router. In this case the IP address of the HAAKE Viscotester iQ can be manually entered in the URL edit field.

5

HAAKE RheoWin Software

This chapter describes how to operate the part of the HAAKE RheoWin PC software which is specific to Viscotester iQ. That is, how to use the automatic measuring geometry recognition in the JobEditor and how to use the HAAKE Viscotester iQ, Reference Manual device drivers in the DeviceManager.

The mechanical operation of the instrument is described in Chapter 5, “Operation,” of the HAAKE Viscotester iQ Instruction Manual, the operation of the touchscreen control panel user interface is described in Chapter 2, “Touchscreen User Interface,” the operation of the HAAKE Viscotester iQ RheoApp PC software is described in Chapter 3, “HAAKE RheoApp Software,” of this manual.

IMPORTANT Read the relevant parts of this chapter before using the HAAKE RheoWin PC software for the first time.

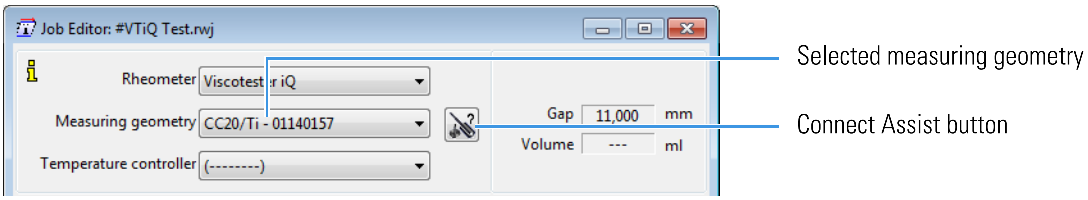
Software Version

HAAKE RheoWin version 4.88.0001 or higher is needed for operating the HAAKE Viscotester iQ and the HAAKE Viscotester iQ Air.

Connect Assist in JobEditor and Jobs

The JobEditor contains special functionality to conveniently work with the Connect Assist automatic measuring (rotor) recognition.

Figure 112. JobEditor with Connect Assist button



The JobEditor continuously scans the selected HAAKE Viscotester iQ for an attached rotor. When a rotor is attached to the instruments drive motor shaft coupling it will be automatically detected by the instrument and consequently by the JobEditor. Within 6 seconds after attaching the rotor to the instrument a Connect Assist message will popup in HAAKE RheoWin, see Figure 113, Figure 114 and Figure 115. The same message will popup immediately after clicking the Connect Assist button, see Figure 112.

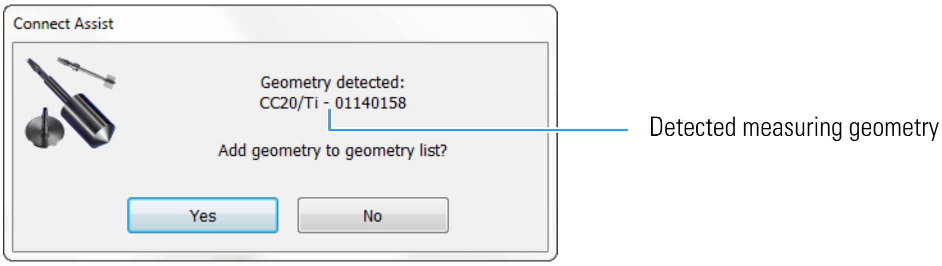
❖ To handle an attached measuring geometry

In case the measuring geometry (rotor) is attached to the instrument for the *first* time, the message in Figure 113 will appear.

1. Click **Yes** to add this individual measuring geometry to the list of measuring geometries which is stored in the RheoWin DeviceManager.

   All the measuring geometry parameters (like the A- and M-factor, etc.) are automatically transfered to and stored in the measuring geometry list in the RheoWin DeviceManager.

Figure 113. Connect Assist detection message dialog



In case the attached measuring geometry (rotor) is already contained in the list and *not* identical with the measuring geometry selected in the Job, the message in Figure 114 will appear.

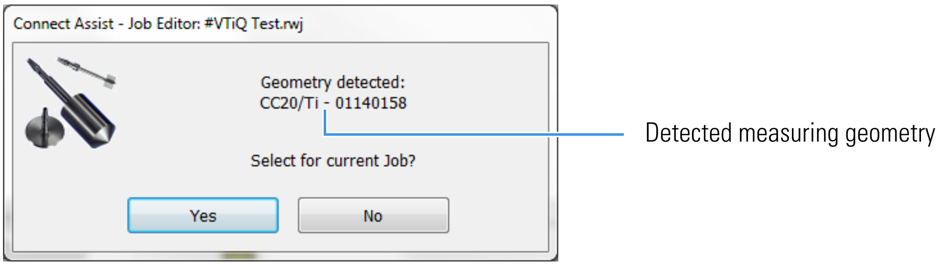
> **Note** Identical means that both the geometry type and the geometry serial number must be the same for both the detected and the selected measuring geometry (rotor).

2. Click **Yes** to select to use the attached and detected measuring geometry to the current Job.

   or

3. Click **No** to keep the selected the measuring geometry in the Job.

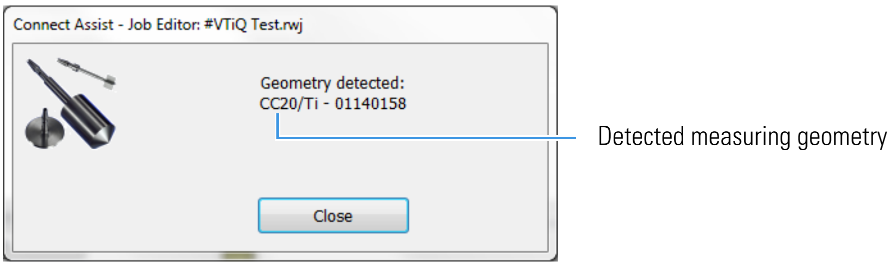
Figure 114. Connect Assist detection message dialog



In case the attached measuring geometry (rotor) is already contained in the measuring geometry list and identical with the measuring geometry selected in the Job, the message in Figure 115 will appear, and automatically disappear after a few second.

4. Click **Close** to close the message box

Figure 115. Connect Assist detection message dialog



Connect Assist and Connect Assist Adapters

When a Connect Assist adapter (see "Connect Assist adapters" on page 135) is attached to the drive motor shaft for the first time the Edit geometries properties menu will popup on the Viscotester iQ touch screen user interface. The operator must edit the geometry properties and tap the Save button first (see "Geometries menu" on page 58) before the adapter will be recognized by RheoWin.

For all subsequent use a Connect Assist adapter is treated the same as any other Connect Assist rotor.

Note With a Viscotester iQ it is *not* possible to edit the geometry properties of a Connect Assist rotor using RheoWin.

Connect Assist and Pressure Cells

Although the magnetic coupling adapters PC1, PC2 and PC3, which are used in combination with the Viscotester iQ with pressure cell stand and a pressure cell, are recognized by the Viscotester iQ itself, the are deliberately not recognized by RheoWin. This because the measuring geometry itself, which is mounted in the pressure cell, can not be detected.
Also, although the adapters PCx are called adapters, just like the adapters U1, U2, etc. (see "Connect Assist adapters" on page 135), the adapters PCx do *not* contain any editable parameters.

The above means that, when setting up a Job for a measurement with a Viscotester iQ with pressure cell stand and a pressure cell, the correct measuring geometry must be selected manually.

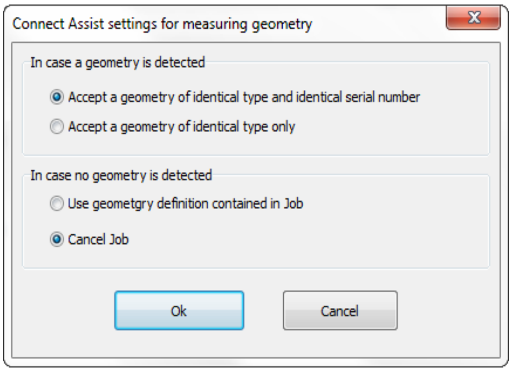
Connect Assist at Job start

When a Job is started Connect Assist is used to check whether the correct measuring geometry is attached to the instrument.

❖ To define how a Job handles the detected measuring geometry when the Job is started

1. Right click on the selected measuring geometry in the JobEditor (see Figure 112) and select the item **Connect Assist setting for measuring geometry** from the context menu to open the corresponding dialog, see Figure 116.

   Figure 116. Connect Assist settings dialog

   A selection must be made both for the case a measuring geometry is detected and for the case no geometry is detected.

2. Select the option **Accept a geometry of identical type and identical serial number only**, when it is desired that the Job must be run using a unique measuring geometry.

or

3. Select the option **Accept a geometry of identical type,** when the Job can be run with any measuring geometry of a certain type, for example a P35/Ti or CC20/Ti, etc.

Note To run the Job with a geometry type which is different from the currently selected measuring geometry, attach that geometry to the instrument, click the **Connect Assist** button in the JobEditor and select **Yes** in the Connect Assist detection message dialog, see Figure 114.

The default setting for the case no measuring geometry is detected, is to cancel the Job because under normal circumstances this can only happen when no measuring geometry is attached to instrument.

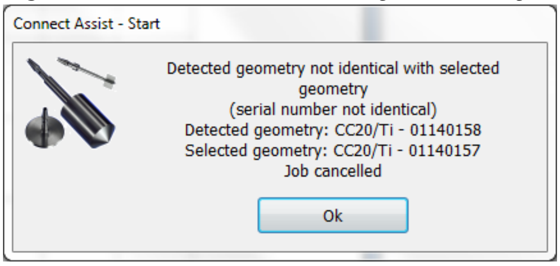
4. Select the option **Use geometry definition contained in the Job**, for the rare case the tag in the measuring geometry is damaged and is not detected, to be able to run the Job anyway.

Note This option should be used as an emergency solution only.

Depending on the Connect Assist settings one of the following messages may appear after starting a Job:

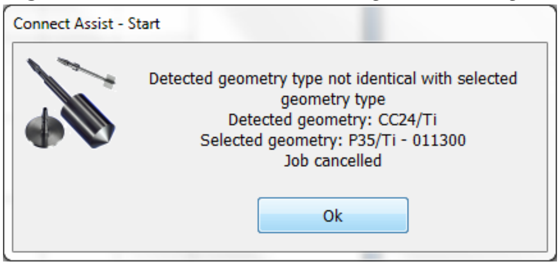
- In case the option **Accept a geometry of identical type and identical serial number only** was selected in the Connect Assist settings dialog (see Figure 116) and this geometry was not detected.

Figure 117. IConnect Assist message: Identical geometry not detected



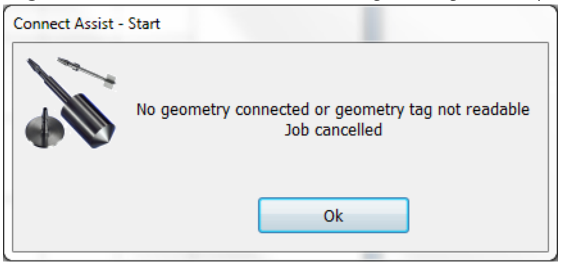
- In case the option **Accept a geometry of identical type** was selected in the Connect Assist settings dialog (see Figure 116) and this geometry type was not detected.

Figure 118. Connect Assist message: Identical geometry type not detected



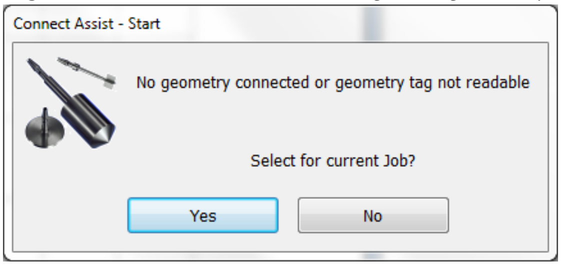
- In case no geometry was detected, that is no geometry is attached to the drive motor shaft or the geometry tag is not detected and the option **Cancel Job** was selected in the Connect Assist settings dialog (see Figure 116).

Figure 119. Connect Assist message: No geometry detected



- In case no geometry was detected, that is no geometry is attached to the drive motor shaft or the geometry tag is not detected and the option **Use geometry definition contained in the Job** was selected in the Connect Assist settings dialog (see Figure 116)

Figure 120. Connect Assist message: No geometry detected, use geometry definition contained in Job



Connect Assist in a company network

Note The properties of any standard geometry can *not* be edited.

Whenever a rotor is mounted to the Viscotester iQ drive motor shaft, the instrument actively informs RheoWin that a rotor was detected by sending a so-called broadcast message into the network it is connected to. *Any* instance of RheoWin, which at that moment is running on *any* PC which is connected to that network, will receive and detect this broadcast message and display the corresponding Connect Assist message (see Figure 113, Figure 114 and Figure 115).

Note For the broadcast message to be received by RheoWin and the Connect Assist message to be displayed, no JobEditor window needs to be open, and not even the network address of the VTiQ in RheoWin needs to be setup up correctly.

To prevent that an instance of RheoWin will display Connect Assist messages, received over a company network connection, from a HAAKE rheometer (a HAAKE Viscotester iQ or a HAAKE MARS 40 or a HAAKE MARS 60) that is not controlled by that instance of RheoWin, RheoWin can be setup to ignore Connect Assist broadcast messages from that network connection (Lan adapter).

Note Modifying this setting is only needed when RheoWin can receive Connect Assist broadcast messages from more then one HAAKE rheometer.
That means that in the case of a standard installation, where RheoWin communicates with just one HAAKE rheometer using a point-to-point network connection (with a separate lan network adapter in the PC) and where there are no other HAAKE rheometers connected directly to a company network or to another point-to-point network connection (with another separate Lan network adapter), there is no need for modifying this setting.

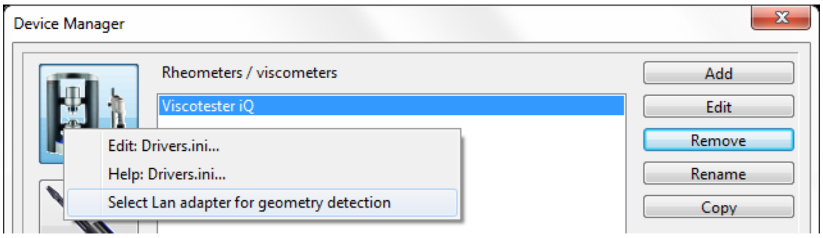
❖ **To setup RheoWin to ignore Connect Assist broadcast messages from a network connection**

1. In RheoWin JobManager open the **DeviceManager**.

2. Right-click on the **rheometer** icon on the left hand side of the list of Rheometers/Viscometers.

3. From the popup menu select the command **Select Lan adapter for geometry detection**, see Figure 121, to open the Select Lan adapter dialog.

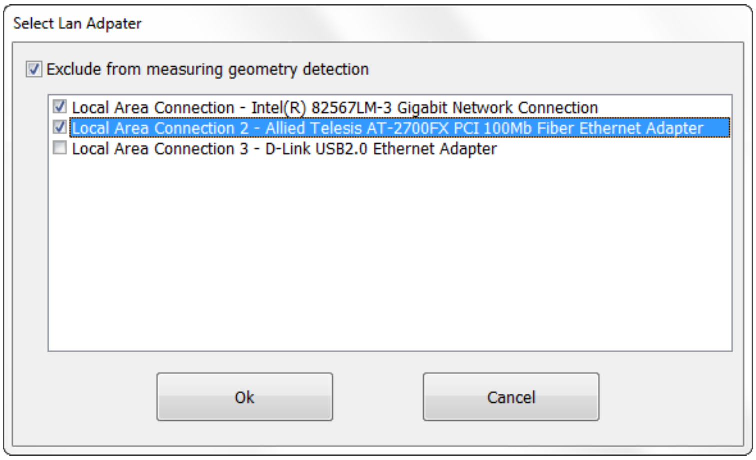
Figure 121. DeviceManager



4. In the Select Lan adapter dialog first select the **Exclude from measuring geometry detection** checkbox, then select the checkbox in front of any **Local Area Connection** that should be *ignored* when listening to Connect Assist broadcast messages, see Figure 122.

5. Click the **Ok** button to save the settings and to close the Select Lan adapter dialog.

Figure 122. Network selection



Fill Assist in JobEditor and Jobs

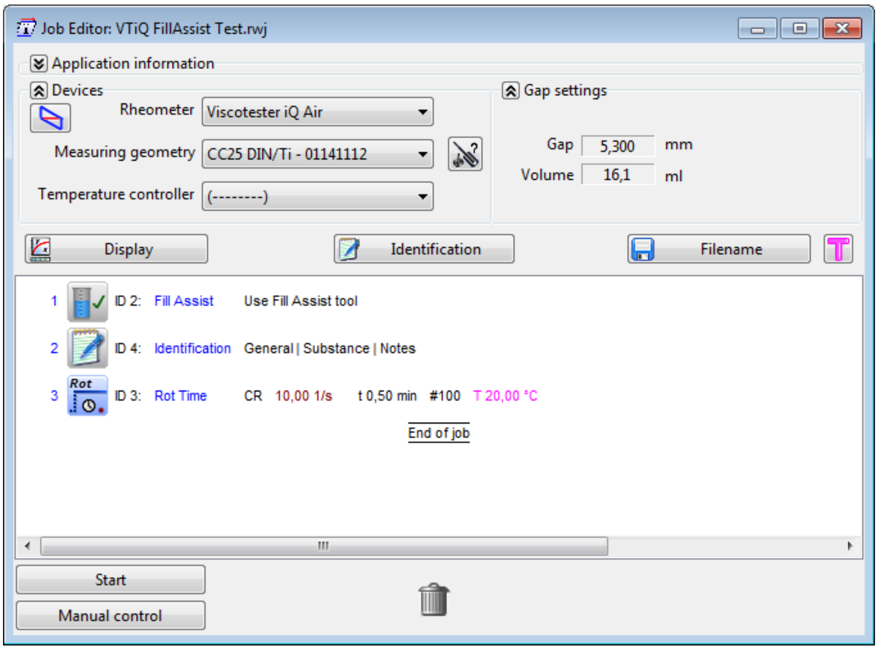
By adding the Fill Assist element to a Job the Fill Assist tool can also be used as part of a RheoWin job.

IMPORTANT To use the Fill Assist tool in a RheoWin Job, the Configuration > Device settings > Use Fill Assist check box must be activated, see "Use Fill Assist" on page 57 in Chapter 2, "Touchscreen User Interface."

❖ To activate the Fill Assist tool in a RheoWin Job

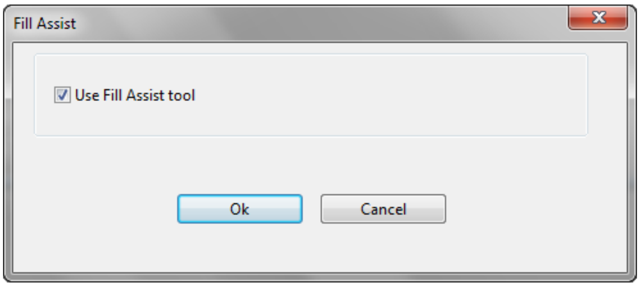
1. Add the Fill Assist element to the Job, preferably as the first element in the Job (see Figure 123).

Figure 123. Fill Assist element in JobEditor



2. Open the Fill Assist element editor and select the **Use Fill Assist tool** check box (see Figure 124).

Figure 124. Fill Assist element editor



3. Close the Fill Assist element editor by clicking the **Ok** button.

4. Save the Job.

Fill Assist during Job run

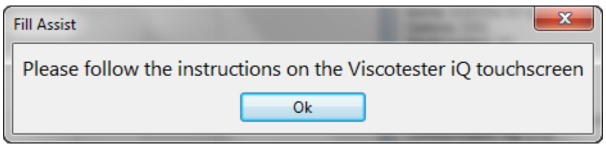
When running a RheoWin Job in which Fill Assist is activated the "Fill Assist measuring routine," which is integrated in the instruments touch screen user interface, is used.

❖ To use the Fill Assist tool in a RheoWin Job controlled measurement

1. Start a Job (in which Fill Assist is activated).

   When the Fill Assist element in the Job is executed a message will appear to prompt the operator to follow the instructions on the Viscotester iQ touchscreen, see Figure 125.

Figure 125. RheoWin Fill Assist message



2. Follow the procedure "To use the Fill Assist tool in a Job controlled measurement" on page 127 in Chapter 6, "Measuring Geometries."

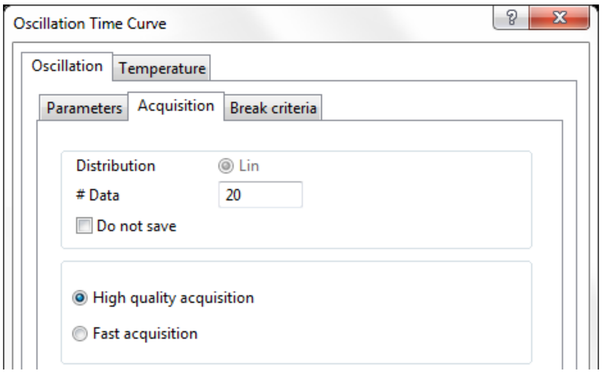
3. When the Fill Assist measuring routine is finished click the **Ok** button in the Fill Assist message box (see Figure 125) to close the message box.

   The RheoWin Job will then be continued.

JobEditor and data acquisition for OSC mode

On the Acquisition page of the editor of every oscillation element, the operator can choose between High quality acquisition and Fast acquisition mode (see Figure 126). In High quality acquisition mode 12 oscillation periods are used for every data point. In Fast acquisition mode 6 oscillation periods are used for every data point. These values are used for all oscillation frequencies.

Figure 126. Data acquisition mode in OSC element editors



DeviceManager and device drivers

To be able to communicate with any rheometer, viscometer, temperature control unit, circulator or auxillary instrument (i.e any device) the HAAKE RheoWin software needs a so-called driver for that device. Such a driver consists of a file with the extension .dll which is stored in the \RheoWin\Drivers directory. The necessary device drivers are installed automatically during the HAAKE RheoWin software installation process.

In the **DeviceManager** the devices are sorted into four separate lists, one for the rheometers and viscometers, one for the measuring geometries, one for the temperature control units and circulators and one for the auxillary devices (e.g. pressure sensor, humidity sensor).

❖ To select a device list

1. Click on one of the four buttons on the left side of the list. The selected list will appear.

Each device driver has a user-interface (editor) which can be accessed from the DeviceManager.

❖ To open the editor for a device

1. Choose the device from the list of devices.

2. Click the **Edit** button on the right side of the device list.

The properties of all the devices are stored in one (large) file, the drivers.flp file, which is stored in the HAAKE RheoWin “application data directory”, for more information on this see the HAAKE RheoWin manual.

For both the HAAKE Viscotester iQ and the HAAKE Viscotester iQ Air two device drivers are installed; the VTiQ.dll or VTiQAir.dll driver for the HAAKE Viscotester iQ itself and the VTiQT.dll driver for the HAAKE Viscotester iQ Peltier controller which is integrated in the HAAKE Viscotester iQ electronics.

Note The VTiQ.dll driver is needed to control a Viscotester iQ, the VTiQAir.dll driver is needed to control a Viscotester iQ Air. The VTiQT.dll driver is common to both Viscotester iQ versions.

Viscotester iQ driver

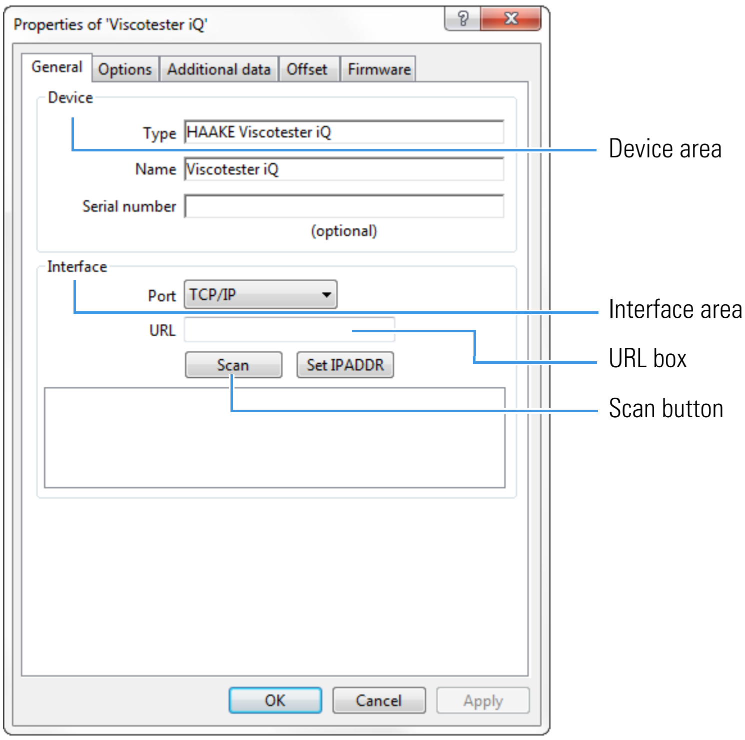
Both the Properties of 'Viscotester iQ' and the Properties of 'Viscotester iQ Air' dialog consists of 5 pages (General, Options, Additional data, Offset and Firmware, see Figure 127) which are described in the following sections. The functionality of the dialog is identical for the two Viscotester iQ versions.

The General page

In the Device area the device type, which is either HAAKE Viscotester iQ or HAAKE Viscotester iQ Air, is shown. This property can not be modified.

In the Interface area the user can set the properties of the interface for the communication between the HAAKE RheoWin and the HAAKE Viscotester iQ.

Figure 127. The General page of the Properties of 'Viscotester iQ' dialog



The value for the Port is TCP/IP, this property can not be modified, the HAAKE Viscotester iQ can only be controlled by HAAKE RheoWin using an Ethernet TCP/IP connection (The USB port on the back of the HAAKE Viscotester iQ instrument head is for service issues only).

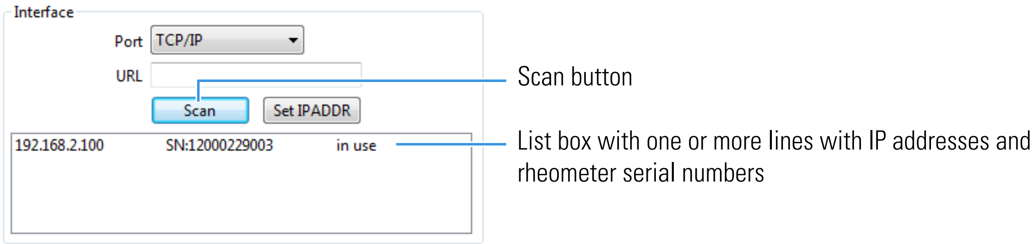
A valid URL value must be selected/entered for the HAAKE Viscotester iQ to be able to communicate with the HAAKE RheoWin software.

❖ To select/enter the URL value

1. In the Interface area in the Properties of 'Viscotester iQ' dialog click the **Scan** button.

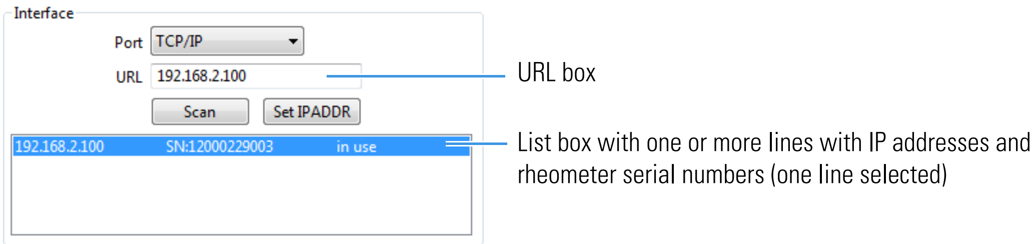
   HAAKE RheoWin will then scan (query) the network for any available HAAKE Viscotester iQ instruments. After a short time a list of IP addresses with the corresponding serial numbers of the HAAKE Viscotester iQ rheometers will appear in the list box below the Scan button.

   Figure 128. Scan for IP address of the HAAKE Viscotester iQ

2. Double click the line containing the serial number of the HAAKE Viscotester iQ to transfer the IP address of the HAAKE Viscotester iQ to the URL box.

   Figure 129. Transfer the IP address of the HAAKE Viscotester iQ

   or (instead of step 1 and step 2)

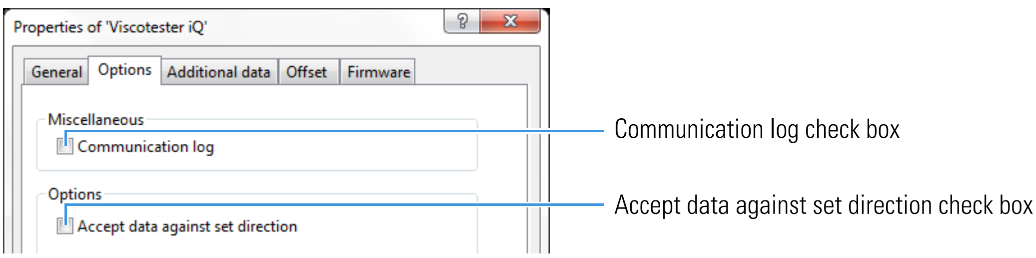
3. Manually enter the IP address in the URL box.

A HAAKE Viscotester iQ configured this way is now ready to be used in the HAAKE RheoWin JobManager. Normally setting up the interface for the HAAKE Viscotester iQ is only done once during the initial installation of the instrument (also see "HAAKE Viscotester iQ configuration in HAAKE RheoWin" on page 93).

The Options page

On the Options page (see Figure 130) several options which influence the data-acquisition and the communication between HAAKE RheoWin and the HAAKE Viscotester iQ can be set.

Figure 130. The Options page of the Properties of 'Viscotester iQ' dialog



Under certain circumstances the measured shear rate can be negative when the set shear stress is positive or vice versa. This can be caused by residual stresses in the sample caused by sampling loading, etc. When the Accept data against set direction check box is selected, such measured values are accepted and saved, when the check box is cleared these values are set to zero. By default this check box is selected.

When the Communication log check box is selected, the HAAKE Viscotester iQ device driver will create a log file (in ASCII format) which contains all the commands send to the device and all the answers received from the device. This log file has the file name VTIQ.log and is stored in the `..\Thermo\RheoWin\Drivers` directory in the Windows `All Users Application Data` folder.

❖ To view the VTIQ.log file

1. Start the HAAKE RheoWin JobManager software.
2. Choose **Help > Show log file...** to open the RheoWin Log-Files dialog.
3. In the RheoWin Log-Files dialog select the VTIQ.log file from the list.

   The VTIQ.log file will now be displayed.

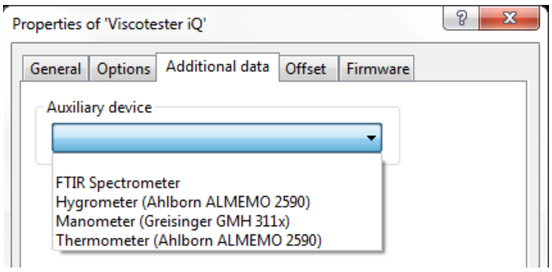
When the Communication log check box is selected HAAKE RheoWin will show a warning message every time the communication with the device is started, this because the logging may influence the timing of the communication in a negative way.

Note The Communication log check box should always be *cleared* unless it is needed for service issues, trouble shooting, debugging, etc.

The Additional data page

On the Additional data page (see Figure 131) settings for the acquisition of data from external instruments or sensors, auxiliary devices and cameras can be made.

Figure 131. The Additional data page of the Properties of 'Viscotester iQ' dialog



RheoWin can acquire data from the following auxiliary devices:

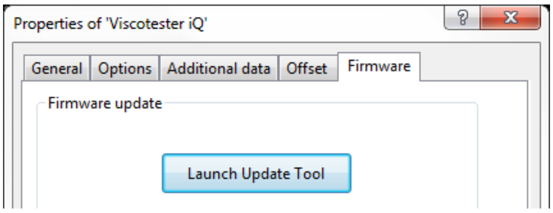
- A hygrometer, that is the Ahlborn ALMEMO 2590 (and compatible models) universal measuring device equipped with a special sensor to measure humidity.
- A thermometer, that is the Ahlborn ALMEMO 2590 (and compatible models) universal measuring device equipped with a temperature sensor.
- A manometer, the Greisinger GMH 3110 and GMH 3111 pressure measuring devices. This device can be used with the pressure cells that are available for the HAAKE Viscotester iQ.

These devices can be connected to a RS232 port or an USB port (using the appropriate special adapter cable or a general USB to RS232 adapter) on the PC on which HAAKE RheoWin is running. The properties of these auxiliary devices must be set in the editors of these devices in the DeviceManager. By selecting one of these auxiliary devices in the list box, the measuring signal delivered by this device will be acquired and stored by HAAKE RheoWin.

The Firmware page

From the Firmware page (see Figure 132) the HAAKE Viscotester iQ firmware can be updated. The firmware for controlling the TM-PE-C or TM-PE-P plus HX iQ temperature module is an integral part of the HAAKE Viscotester iQ firmware.

Figure 132. The Firmware page of the Properties of 'Viscotester iQ' dialog

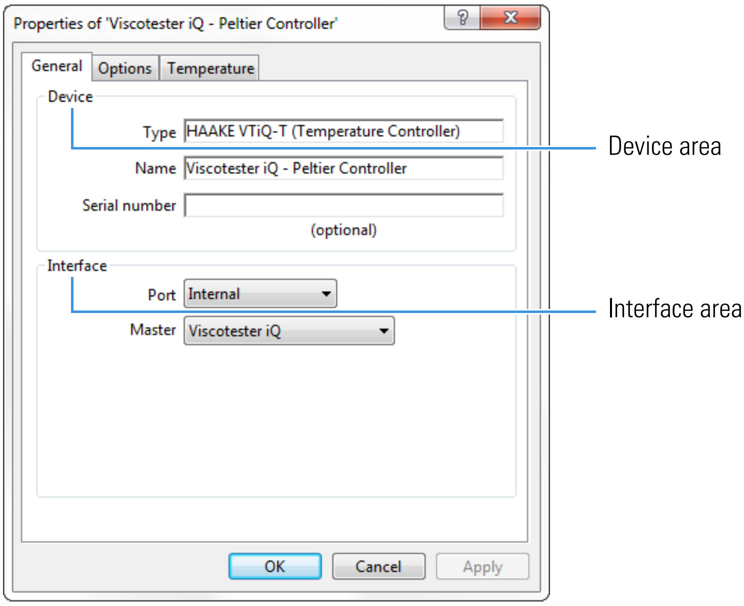


Although it is generally recommended to have a firmware update performed by a qualified service engineer, updating the firmware can be done by any user after carefully reading the instructions in Appendix D, "Firmware update."

Viscotester iQ - Peltier controller driver

The Properties of 'Viscotester iQ - Peltier controller' dialog consists of 3 pages (General, Options, Temperature, see Figure 133) which are described below.

Figure 133. The General page of the Properties of 'Viscotester iQ - Peltier controller' dialog



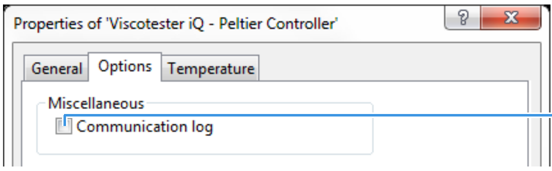
The General page

In the Device area the device Type, which is HAAKE VTiQ-T (Temperature Controller) is shown. This property can not be modified. In the Interface box the properties of the interface for the communication between the Viscotester iQ and the Viscotester iQ - Peltier controller are shown. Since the Viscotester iQ - Peltier controller is an integral part of the HAAKE Viscotester iQ electronics the value for the Port is Internal and this property can not be modified. For the Master a Viscotester iQ device must be selected.
Normally setting up the interface for the Viscotester iQ - Peltier controller is only done once during the initial installation of the instrument.

The Options page

On the Options page (see Figure 134) one option for the communication between HAAKE RheoWin and the HAAKE Viscotester iQ - Peltier controller can be set.

Figure 134. The Options page of the Properties of the 'Viscotester iQ - Peltier controller' dialog



When the Communication log check box is selected, the RheoWin Viscotester iQ - Peltier controller device driver will create a log file (in ASCII format) which contains all the commands send to the device and all the answers received from the device. This log file has the file name VTIQT.log and is stored in the `..\Thermo\RheoWin\Drivers` directory in the Windows All Users Application Data folder.

❖ To view the VTIQT.log file

1. Start the HAAKE RheoWin JobManager software.
2. Choose **Help > Show log file...** to open the RheoWin Log-Files dialog.
3. In the RheoWin Log-Files dialog select the VTIQT.log file from the list.

   The VTIQT.log file will now be displayed.

When the Communication log check box is selected HAAKE RheoWin will show a warning message every time the communication with the device is started, this because the logging may influence the timing of the communication in a negative way.

Note The Communication log check box should always be *cleared* unless it is needed for service issues, trouble shooting, debugging, etc.

The Temperature page

On the Temperature page temperature offset values can be viewed and edited and settings for a temperature alarm can be set.

Temperature offset values

Temperature offset tables are used for correcting (small) differences between the temperature value measured by the instrument and the actual temperature in the sample. These values may show (small) temperature dependent differences (or offsets) for various reasons. By defining temperature offset values, in the form of a table for a few (up to five) temperature values, the instruments firmware can calculate a corrected temperature value, by linear interpolation between to adjacent temperatures in the table, for any temperature value within the range of the table. For temperatures for which no interpolated offset can be calculated the offset of the nearest value in the list is used.

To able to determine the differences between the temperature value measured by the instrument and the actual temperature in the sample, a separate calibrated digital thermometer with a special probe that can be inserted in the gap of the measuring geometry is needed. The use of an especially designed calibration kit (order number 222-2206) which includes PC software for a fully automatic determination of the offset values is highly recommended.

On the Temperature page of the Properties of the ‘Viscotester iQ - Peltier controller’ dialog (see Figure 135) a temperature offset table (or temperature calibration table) for the temperature measured by the HAAKE Viscotester iQ can be viewed, modified or entered.

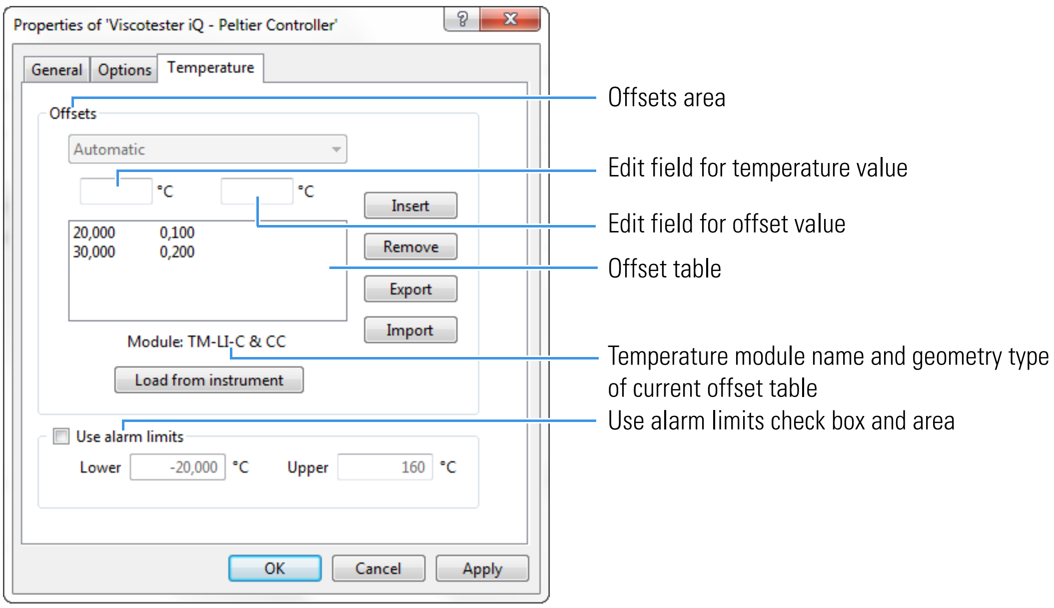
Note The temperature offset values can also be edited using the Temperature offsets menu of the instruments touchscreen user interface (see “Temperature offsets menu” on page 49).

The firmware of the HAAKE Viscotester iQ is equipped with 16 temperature offset tables, one for every possible combination of a temperature module (TM-PE-C, TM-LI-Cxx, TM-PE-P or TM-LI-P) and a certain type (CC = concentric cylinder or PP = parallel plates) of measuring geometry and one for the external the Pt100 temperature sensor.

It is not possible to manually select one of the temperature offset tables; After clicking the Load from instrument button, the dialog will always displays the table corresponding to the currently connected (detected) temperature module and measuring geometry.

Each temperature offset table can consist of up to 5 temperature values and the offset values for those temperatures.

Figure 135. The Temperature page of the Properties of the ‘Viscotester iQ - Peltier controller’ dialog



The temperature offset tables are stored in the instruments firmware. To view or edit them, they must be loaded from the instrument first.

IMPORTANT Since the temperature offset values are stored for every possible combination of a temperature module (TM-PE-C, TM-LI-Cxx, TM-PE-P or TM-LI-P) and a certain type (CC = concentric cylinder or PP = parallel plates) of measuring geometry it is crucial that the correct temperature module and the correct measuring geometry are attached to instrument both at the moment the offset table is loaded from the instrument and at the moment the offset table is send to the instrument.

❖ To load a temperature offset table from the instrument

1. Click the **Load from instrument** button.

   The temperature offset table values for the temperature module and the geometry type which are currently attached to the instrument will be displayed in the offset table.
   The temperature module name and the geometry type of the offset table are displayed below the table. In the example, see Figure 135, these are the TM-LI-Cxx module and the CC (= concentric cylinder) type geometry.

❖ To send the temperature offset table to the instrument

1. Click the **Apply** (or the **OK)** button.

   Clicking the OK button will also close the dialog window.

After an offset table is loaded from the instrument it can be viewed and edited.

❖ To add a value to a temperature offset table

1. Enter the temperature value for which an offset value is to be added in the corresponding edit field (see Figure 135).
2. Enter the offset value for that temperature in the corresponding edit field (see Figure 135).
3. Click the **Insert** button.

   The new values will automatically be inserted at the correct position in the table.

❖ To remove a value from a temperate offset table

1. Select the line in the offset table that is to be removed.
2. Click the **Remove** button.

IMPORTANT Since the offset values for temperatures that are not available in the list are calculated by means of linear interpolation from the two nearest values in the list, the list must contain offset values for at least two different temperatures.

A temperature offset table can be exported and import from a file. This can be useful for backing up the table, for transferring a table from one instrument to another, etc.

❖ To export or import a temperature offset table

1. Click the **Export** or **Import** button to export or import a temperature offset table to or from a file (in ASCII format) with the `.tot` extension.

The default directory for the `.tot` files is the Drivers sub-directory in the RheoWin program data files directory, see the RheoWin installation manual for more information.

Temperature alarm settings

For certain applications it may be necessary to limit the temperature to a range which is smaller than the maximal range achievable with a TM-XX-X module. For this reason a lower and upper alarm temperature can be defined. These alarm values are *not* saved for each TM-XX-X module individually, instead these values are used for all TM-XX-X modules. When during normal operation of the instrument the measured temperature exceeds the range defined by the alarm limits the temperature control will be stopped and a message will be shown on the HAAKE Viscotester iQ touchscreen panel and in HAAKE RheoWin.

❖ To activate the temperature alarm

1. Enter the desired lower and upper alarm values in the corresponding edit fields.
2. Activate the **Use alarm limits** option.
3. Click the **Apply** (or the **OK**) button.

   Clicking the OK button will also close the dialog window.

6

Measuring Geometries

This chapter describes the measuring geometries which are available for the HAAKE Viscotester iQ from Thermo Scientific and provides basic information for choosing the appropriate measuring geometry for a specific application. The properties as well as the advantages and disadvantages of each measuring geometry type are discussed.

Introduction

A measuring geometry is the component of the instrument that is in direct contact with the sample. In almost all cases a measuring geometry consists of two parts:

- The rotating upper and/or inner part (rotor) which is attached to the rheometer drive motor shaft.
  Examples: The cone of a cone and plate geometry, the inner cylinder (rotor) of a coaxial cylinder geometry.
- The static lower and/or outer part. In most cases this part is mounted onto/into a temperature module.
  Examples: The plate of a cone and plate geometry, the outer cylinder (cup) of a coaxial cylinder geometry.

Vane type measuring geometries (upper or inner part) are often used directly in the original sample container, for example in a jar or a can, that is without a special lower or outer part.

There are three general types of measuring geometries:

- Coaxial cylinders in various different versions.
- Cone and plate.
- Parallel plate.
- Vanes in various different versions.
- Clamps for rectangular torsion (not available for the HAAKE Viscotester iQ, Reference Manual).

Each type is available with different dimensions (diameter(s), angle, height).

By selecting a suitable measuring geometry type with the proper dimensions, the measurement ranges of the basic quantities of the HAAKE Viscotester iQ, that is approximately 3 decades in torque, 5 decades in rotational speed and more than 7 decades in angle can be used to measure the physical properties (viscosity, dynamic moduli) of samples over approximately 8 decades.

Geometry factors for calculating the stress, strain and shear-rate

In rotational rheometry the shear stress τ is given by the equation,

$$\tau = A \cdot M_d \tag{1}$$

here M_d is the torque applied or measured by the rheometer drive motor and A is a geometry factor.

The strain γ and the shear rate (or strain-rate) $\dot{\gamma}$ are given by the equations,

$$\gamma = M \cdot \varphi \tag{2}$$

$$\dot{\gamma} = M \cdot \Omega \tag{3}$$

here φ is the angle and Ω the angular-velocity applied or measured by the rheometer drive motor and M is a geometry factor. The geometry factors A and M depend on the type and the dimensions of the measuring geometry. The equations for the geometry factors as well as the (default) values of A and M for the standard measuring geometries are given in the following chapters.

Measurement range

The measurement range of a rheometer regarding shear-rate, stress and thus viscosity depends on the torque and angular-velocity range of the rheometer drive motor and the geometry factors A and M of the measuring geometry used.

The torque range is defined by the minimum torque $M_{d,min}$ and the maximum torque $M_{d,\,max}$, the angular velocity range is defined by the minimum angular-velocity Ω_{min} and the maximum angular-velocity Ω_{max}. From this the minimum shear-rate and stress values are calculated using the equation (1) and (3), this gives:

$$\tau_{min} = A \cdot M_{d,\,min} \tag{4}$$

$$\tau_{max} = A \cdot M_{d,\,max} \tag{5}$$

$$\dot{\gamma}_{min} = M \cdot \Omega_{min} \tag{6}$$

$$\dot{\gamma}_{max} = M \cdot \Omega_{max} \tag{7}$$

The viscosity η is defined by equation (8):

$$\eta = \frac{\tau}{\dot{\gamma}} \tag{8}$$

By inserting equation (4) to (7) in equation (8) the four viscosity values that define the extreme values of the viscosity range can be calculated:

$$\eta_{max}(\dot{\gamma}_{min}) = \frac{\tau_{max}}{\dot{\gamma}_{min}} \tag{9}$$

$$\eta_{min}(\dot{\gamma}_{min}) = \frac{\tau_{min}}{\dot{\gamma}_{min}} \tag{10}$$

$$\eta_{max}(\dot{\gamma}_{max}) = \frac{\tau_{max}}{\dot{\gamma}_{max}} \tag{11}$$

$$\eta_{min}(\dot{\gamma}_{max}) = \frac{\tau_{min}}{\dot{\gamma}_{max}} \tag{12}$$

In real live many other, mainly non instrument related, factors like sample filling, temperature control, gap setting, wall slip, edge effects, turbulences, shear heating, surface tension, sample inhomogeneity etc. will limit the *practically* usable measurement range in which good measurement result can be achieved for a certain sample.

In contrast to previous Thermo Scientific rheometer manuals, this manual does not contain measurement range graphs for each individual measuring geometry. Instead the RangeCalculator software tool, which is part of the HAAKE RheoWin software starting from version 4.40, offers an interactive and much more elaborate and comfortable method for displaying the *theoretical* measurement range for any measuring geometry. The Range Calculator software tool is described at the end of this chapter.

Coaxial cylinder geometries

Two different sets of coaxial cylinder geometries are available for use with the HAAKE Viscotester iQ instrument.

- Geometries with a cup with an outer diameter of 32.0 mm for use with the TM-PE-C (Peltier Cylinder) and the TM-LI-C32 (Liquid Cylinder) temperature modules.
- Geometries with a cup with an outer diameter of 48.0 mm for use with TM-LI-C48 (Liquid Cylinder) temperature modules.

These measuring geometries are described in the following chapters.

Coaxial cylinder geometries for TM-PE-C and TM-LI-C32

Four different types of coaxial cylinder geometries are available for use with both the TM-PE-C (Peltier Cylinder) and the TM-LI-C32 (Liquid Cylinder) temperature modules.

DIN 53019/ISO 3219 coaxial cylinder geometries

This type of coaxial cylinder geometry is *defined* by the DIN 53019 (part 1) and ISO 3219 standards. These standards exactly define the mathematical relations between the various dimensions of this geometry. By choosing a certain value for the outer radius of the rotor or the inner radius of the cup all other dimension are fixed.

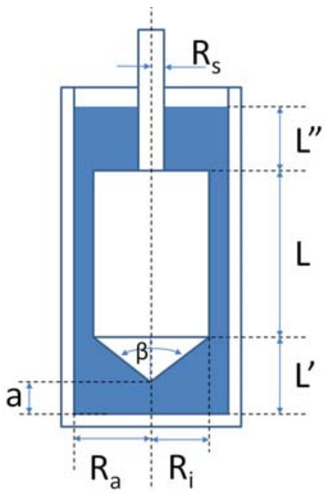
The main features of this type of coaxial cylinder geometry are:

- The dimension of this geometry type are completely standardized. This means that the results obtained with differently sized versions of this geometry as well the results obtained using these geometries with viscometers or rheometers from different manufacturers are directly comparable.
- The large sample volume above and below the cylindrical part of the rotor make this geometry relatively insensitive to not filling it with the correct sample volume.

- The cone at the bottom of the rotor makes it easier to insert the rotor into a higher viscous sample.
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of 100 micrometer is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 136 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 11 in Appendix A, "Properties of Measuring Geometries,"

Figure 136. DIN 53019 / ISO 3219 coaxial cylinder geometry



R_i =	outer radius of rotor
R_a =	inner radius of cup
$\delta = R_a / R_i$ =	radius ratio = 1,0847
$L = 3\ R_i$ =	height of cylindrical part of rotor
$L' = R_i$ =	distance between lower rotor rim and bottom of cup
$L'' = R_i$ =	sample filling height above upper rotor rim
R_s =	rotor shaft diameter, $R_s/R_i > 0{,}3$
$\beta = 120\,°$ =	cone angle of rotor (120 ° = 2,094 rad)
$V = 8.17\ R_i^3$ =	sample volume
a =	axial gap between rotor and cup

Equations for geometry factors

The equations (13) and (14) below are used to calculate the two geometry factors A and M for the DIN 53019/ISO 3219 coaxial cylinder geometries. These equations are part of the DIN 53019 (part 1) and ISO 3219 standards. With these equations the so-called representative values τ_{rep} and $\dot{\gamma}_{rep}$ of the stress and shear rate are calculated. The representative stress and shear rate occur at a particular point in the ring gap between the inner and outer cylinder, that is *not* at the inner radius R_i. In a good approximation, τ_{rep} is the arithmetic mean of the shear stresses at the outer and inner cylinders.

In the DIN 53019 standard it is stated that: "A rigorous analysis confirms that the representative values t_{rep} and $\dot{\gamma}_{rep}$ are equal to the values of t and $\dot{\gamma}$ of the true flow curve [1] for virtually all the material systems encountered in practice [1]."

$$A = \frac{1}{2 \cdot \pi \cdot R_i^2 \cdot L \cdot C_L} \cdot \frac{1+\delta^2}{2 \cdot \delta^2}, \delta = \frac{R_a}{R_i}, C_L = 1.1 \quad \textbf{(13)}$$

$$M = \frac{1+\delta^2}{\delta^2 - 1} \quad \textbf{(14)}$$

Reference: [1] Giesekus, H. and Langer, G., *Die Bestimmung der wahren Fließkurven nicht-newtonischer Flüssigkeiten und plastischer Stoffe mit der Methode der repräsentativen Viskosität* (Determination of the true flow curves of non-Newtonian liquids and plastic materials using the method of representative viscosity). Rheologica Acta, 1977: **16**, No 1, pp. 1–22.

Properties of the coaxial cylinder geometries according to DIN 53019 / ISO 3219

Three different coaxial cylinder geometries, CC10 DIN/Ti, CC16 DIN/Ti and CC25 DIN/Ti, with different dimensions according to DIN 53019 are available. Table 11 in Appendix A, "Properties of Measuring Geometries," lists all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume, the materials used as well as the part numbers for the rotors, cups and cup-gaskets. The cups CCB10 DIN and CCB16 DIN consist of a main (cylindrical) body made from Ampcoloy for a better heat transfer and an inner tube made from stainless steel. The Ampcoloy body is nickel plated.

Applications

Text missing ???

Recessed ends coaxial cylinder geometries

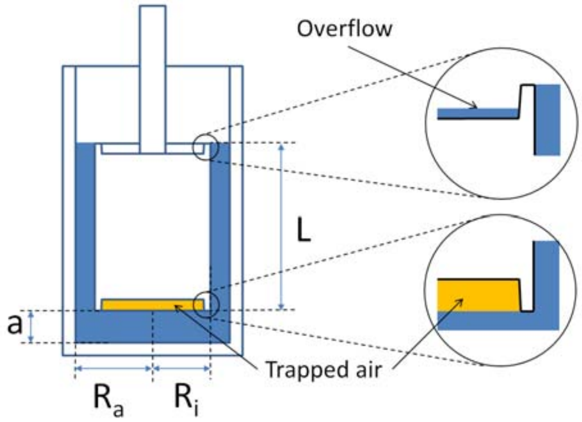
This type of coaxial cylinder geometry is described in the DIN 53019 (part 3) standard. The relations between the various dimensions of this geometry are *not* exactly defined in that standard, it is up to the rheometer manufacturer to define the dimensions. At ThermoScientific (previously HAAKE), the radius ratios δ of this type of geometry have not been changed since 1970, this guarantees a good comparability of the measurement result over several generations of instruments.

The main feature of this type of coaxial cylinder geometry is the use of recessed end surfaces on the inner cylinder (rotor):

- At the bottom surface of the rotor, the air trapped in the recessed area will prevent the sample from contacting the cylinder bottom surface (apart from the very narrow bottom edge) thereby minimizing the contribution of the bottom surface to the total torque to such an extent that it can be neglected.
- At the top surface of the rotor the recessed area serves as an overflow for surplus sample volume, this makes the sample filling less critical and at the same time prevents the upper surface of the rotor to contribute to the torque (as long as the sample volume is not too large).
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of 100 micrometer is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 137 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 13 in Appendix A, "Properties of Measuring Geometries,"

Figure 137. Recessed bottom coaxial cylinder geometry



R_i = D/2 = outer radius of rotor

R_a = D1/2 = inner radius of cup

L = height of cylindrical part of rotor

a = axial gap between rotor and cup

D, D1 are the diameters as mentioned on the certificates

Equations for geometry factors

Equations (15) and (16) below are used to calculate the two geometry factors A and M for the recessed ends coaxial cylinder geometries. These equations are described in the DIN 53019 (part 1) standard. With these equations the stress and the shear rate at the surface of the rotor (that is for the radius r = R_i) are calculated.

$$A = \frac{1}{2 \cdot \pi \cdot R_i^2 \cdot L} \quad \textbf{(15)}$$

$$M = \frac{2 \cdot \delta^2}{\delta^2 - 1}, \delta = \frac{R_a}{R_i} \quad \textbf{(16)}$$

Properties of the coaxial cylinder geometries with recessed ends

Three different coaxial cylinder geometries, CC20 Ti, CC24 Ti and CC26 Ti with different dimensions are available. Table 13 in Appendix A, “Properties of Measuring Geometries,” lists all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume, the materials used as well as the part numbers for the rotors, cups and cup-gaskets. The radius ratios δ of the CC20 Ti, CC24 Ti and CC26 Ti geometries are identical to those of the Z31, Z38 and Z41 geometries (for the TM-LI-C temperature module) and the HAAKE VT550 (and HAAKE RotoVisco RV20/RV30) MV1, MV2 and MV3 geometries respectively.

Applications

Text missing???

Double gap coaxial cylinder geometries

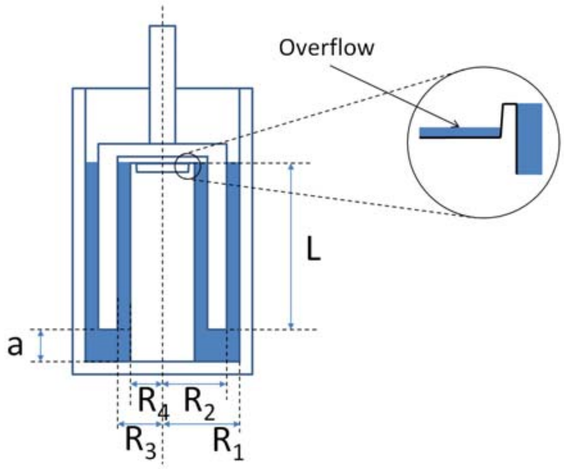
This type of coaxial cylinder geometry is described in the DIN 53544 standard. The relations between the various dimensions of this geometry are *not* exactly defined in that standard, it is up to the rheometer manufacturer to define the dimensions.

The main features of this type of coaxial cylinder geometry are:

- This geometry consists of two coaxially positioned coaxial cylinder geometries designed in such a way that the radius ratios of the two coaxial cylinder geometries are the same ($\delta_{12} = \delta_{34}$). As a result the shear rates in both ring gaps are the same for a given angular velocity Ω of the rotor.
- Compared with a ‘normal’ coaxial cylinder geometry the larger cylindrical area which is in contact with the sample, results in a smaller A factor and thus allows for smaller stresses to be measured or applied. As a result this type of measuring geometry is especially suited for use with low viscous samples.
- The recessed top surface of the inner stator serves as an overflow for surplus sample volume, thereby making the sample filling less critical.
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of around 100 micrometers is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 138 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 15 in Appendix A, “Properties of Measuring Geometries,”

Figure 138. Double gap coaxial cylinder geometry



R_1 =	inner radius of cup
R_2 =	outer radius of rotor
$\delta_{12} = R_1/R_2$ =	radius ratio of outer coaxial cylinder
R_3 =	inner radius of rotor
R_4 =	outer radius of stator
$\delta_{34} = R_3/R_4$ =	radius ratio of inner coaxial cylinder
L=	height of cylindrical part of rotor
a=	axial gap between rotor and cup

Equations for geometry factors

Equations (17) and (18) below are used to calculate the two geometry factors A and M for the recessed ends coaxial cylinder geometries. These equations are based on the equations for the recessed end coaxial cylinder geometries described in the DIN 53019 (part 1) standard. With these equations the stress and the shear rate at the inner and outer surface of the rotor (that is for the radius $r = R_2$ and $r = R_3$) are calculated.

$$A = \frac{1}{2 \cdot \pi \cdot R_2^{\ 2} \cdot L + 2 \cdot \pi \cdot R_3^{\ 2} \cdot L} \tag{17}$$

$$M = \frac{2 \cdot \delta^2}{\delta^2 - 1},\ \delta = \frac{R_1}{R_2} \cong \frac{R_3}{R_4} \tag{18}$$

Properties of the double gap coaxial cylinder geometries

One double gap coaxial cylinder geometry, the CC27 DG Ti, is available. Table 15 in Appendix A, "Properties of Measuring Geometries," lists all the relevant default properties of these geometry, this includes the dimensions, the geometry factors, the necessary sample volume, the materials used as well as the part numbers for the rotor, cup and cup-gasket.

1) The theoretical exact volume is 2.6 ml, the volume of the overflow is 0.8 ml. The recommended practical volume is 3.0 ml, when using this sample volume the overflow will be about half filled when the rotor is in the correct measurement position (axial gap a = 4.0 mm).

Applications

Text missing???

Coaxial cylinder geometries for TM-LI-C48

Three different types of coaxial cylinder geometries are available for use with TM-LI-C48 (Liquid Cylinder) temperature module.

DIN 53019/ISO 3219 coaxial cylinder geometries

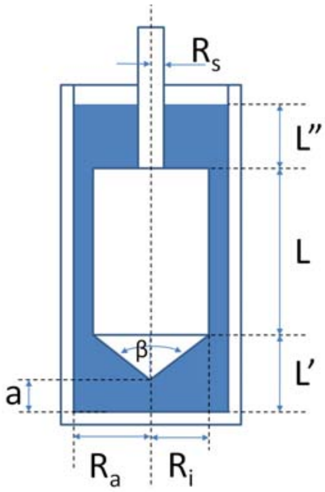
This type of coaxial cylinder geometry is *defined* by the DIN 53019 (part 1) and ISO 3219 standards. These standards exactly define the mathematical relations between the various dimensions of this geometry. By choosing a certain value for the outer radius of the rotor or the inner radius of the cup all other dimension are defined.

The main features of this type of coaxial cylinder geometry are:

- The dimension of this geometry type are completely standardized. This means that the results obtained with differently sized versions of this geometry as well the results obtained using these geometries with viscometers or rheometers from different manufacturers are directly comparable.
- The large sample volume above and below the cylindrical part of the rotor make this geometry relatively insensitive to not filling it with the correct sample volume.
- The cone at the bottom of the rotor makes it easier to insert the rotor into a higher viscous sample.
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of 100 micrometer is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 139 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions.

Figure 139. DIN 53019 / ISO 3219 coaxial cylinder geometry



R_i =	outer radius of rotor
R_a =	inner radius of cup
$\delta = R_a / R_i$ =	radius ratio = 1,0847
$L = 3\ R_i$ =	height of cylindrical part of rotor
$L' = R_i$ =	distance between lower rotor rim and bottom of cup
$L'' = R_i$ =	sample filling height above upper rotor rim
R_s =	rotor shaft diameter, $R_s/R_i > 0{,}3$
$\beta = 120\,°$ =	cone angle of rotor (120 ° = 2,094 rad)
$V = 8.17\ R_i^3$ =	sample volume
a =	axial gap between rotor and cup

Equations for geometry factors

The equations (19) and (20) below are used to calculate the two geometry factors A and M for the DIN 53019/ISO 3219 coaxial cylinder geometries. These equations are part of the DIN 53019 (part 1) and ISO 3219 standards. With these equations the so-called representative values τ_{rep} and $\dot{\gamma}_{rep}$ of the stress and shear rate are calculated. The representative stress and shear rate occur at a particular point in the ring gap between the inner and outer cylinder, that is *not* at the inner radius R_i. In a good approximation, τ_{rep} is the arithmetic mean of the shear stresses at the outer and inner cylinders.

In the DIN 53019 standard it is stated that: “A rigorous analysis confirms that the representative values t_{rep} and $\dot{\gamma}_{rep}$ are equal to the values of t and $\dot{\gamma}$ of the true flow curve [1] for virtually all the material systems encountered in practice [1].”

$$A = \frac{1}{2 \cdot \pi \cdot R_i^2 \cdot L \cdot C_L} \cdot \frac{1+\delta^2}{2 \cdot \delta^2},\ \delta = \frac{R_a}{R_i},\ C_L = 1.1 \qquad \textbf{(19)}$$

$$M = \frac{1+\delta^2}{\delta^2 - 1} \qquad \textbf{(20)}$$

Reference: [1] Giesekus, H. and Langer, G., *Die Bestimmung der wahren Fließkurven nicht-newtonischer Flüssigkeiten und plastischer Stoffe mit der Methode der repräsentativen Viskosität* (Determination of the true flow curves of non-Newtonian liquids and plastic materials using the method of representative viscosity). Rheologica Acta, 1977: **16**, No 1, pp. 1–22.

Properties of the coaxial cylinder geometries according to DIN 53019 / ISO 3219

Two different coaxial cylinder geometries, CC20 DIN and CC40 DIN, with different dimensions according to DIN 53019 are available, lists all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume, the materials used as well as the part numbers for the rotors, cups and cup-gaskets.

Applications

Text missing???

Recessed ends coaxial cylinder geometries

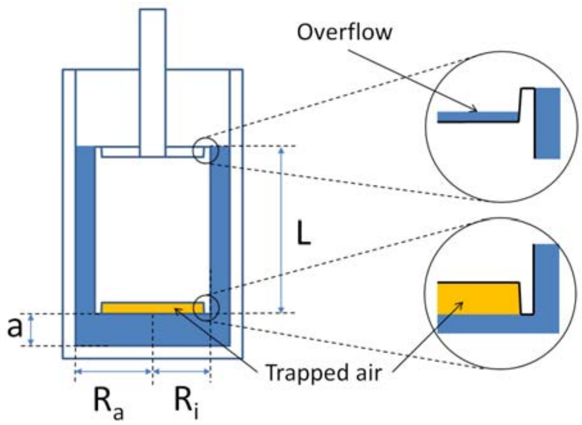
This type of coaxial cylinder geometry is described in the DIN 53019 (part 3) standard. The relations between the various dimensions of this geometry are *not* exactly defined in that standard, it is up to the rheometer manufacturer to define the dimensions. At ThermoScientific (previously HAAKE), the radius ratios δ of this type of geometry have been the same since 1970 at least, this guarantees a good comparability of the measurement result over several generations of instruments.

The main feature of this type of coaxial cylinder geometry is the use of recessed end surfaces on the inner cylinder (rotor):

- At the bottom surface of the rotor, the air trapped in the recessed area will prevent the sample from contacting the cylinder bottom surface (apart from the very narrow bottom edge) thereby minimizing the contribution of the bottom surface to the total torque to such an extent that it can be neglected.
- At the top surface of the rotor the recessed area serves as an overflow for surplus sample volume, this makes the sample filling less critical and at the same time prevents the upper surface of the rotor to contribute to the torque (as long as the sample volume is not too large).
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of 100 micrometer is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 140 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions.

Figure 140. Recessed bottom coaxial cylinder geometry



$R_i = D/2 =$ outer radius of rotor

$R_a = D1/2 =$ inner radius of cup

$L =$ height of cylindrical part of rotor

$a =$ axial gap between rotor and cup

D, D1 are the diameters as mentioned on the certificates

Equations for geometry factors

Equations (21) and (22) below are used to calculate the two geometry factors A and M for the recessed ends coaxial cylinder geometries. These equations are described in the DIN 53019 (part 1) standard. With these equations the stress and the shear rate at the surface of the rotor (that is for the radius r = R_i) are calculated.

$$A = \frac{1}{2 \cdot \pi \cdot R_i^2 \cdot L} \tag{21}$$

$$M = \frac{2 \cdot \delta^2}{\delta^2 - 1}, \delta = \frac{R_a}{R_i} \tag{22}$$

Properties of the coaxial cylinder geometries with recessed ends

Three different coaxial cylinder geometries, CC31, CC38 and CC41 with different dimensions are available. in Appendix A lists all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume, the materials used as well as the part numbers for the rotors, cups and cup-gaskets. The radius ratios δ of the CC31, CC38 and CC41 geometries are identical to those of the HAAKE VT550 (and HAAKE RotoVisco RV20/RV30) MV1, MV2 and MV3 geometries respectively.

Applications

Text missing???

Double gap coaxial cylinder geometries

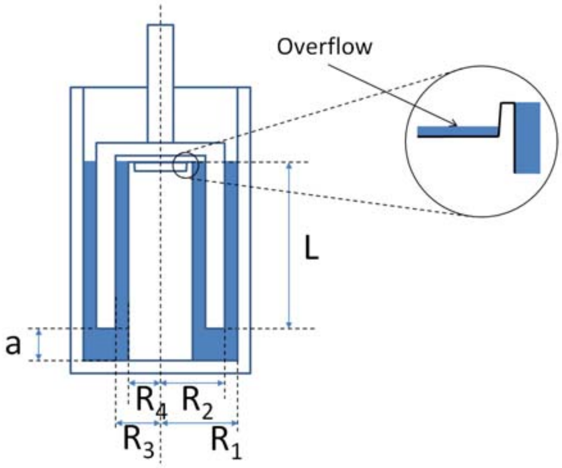
This type of coaxial cylinder geometry is described in the DIN 53544 standard. The relations between the various dimensions of this geometry are *not* exactly defined in that standard, it is up to the rheometer manufacturer to define the dimensions.

The main features of this type of coaxial cylinder geometry are:

- This geometry basically consists of two coaxially positioned coaxial cylinder geometries designed in such a way that the radius ratios of the two coaxial cylinder geometries are the same ($\delta_{12} = \delta_{34}$). As a result the shear rates in both ring gaps are the same for a given angular velocity Ω of the rotor.
- Compared with a single gap coaxial cylinder geometry, the larger cylindrical area which is in contact with the sample, results in a smaller A factor and thus allows for smaller stresses to be measured or applied. As a result this type of measuring geometry is especially suited for use with low viscous samples.
- The recessed top surface of the inner stator serves as an overflow for surplus sample volume, thereby making the sample filling less critical.
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of around 100 micrometers is sufficient.
- The cleaning of the rotor and certainly the cup can be time consuming.

Figure 141 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions.

Figure 141. Double gap coaxial cylinder geometry



R_1 =	inner radius of cup
R_2 =	outer radius of rotor
$\delta_{12} = R_1/R_2$ =	radius ratio of outer coaxial cylinder
R_3 =	inner radius of rotor
R_4 =	outer radius of stator
$\delta_{34} = R_3/R_4$ =	radius ratio of inner coaxial cylinder
L=	height of cylindrical part of rotor
a=	axial gap between rotor and cup

Equations for geometry factors

Equations (23) and (24) below are used to calculate the two geometry factors A and M for the recessed ends coaxial cylinder geometries. These equations are based on the equations for the recessed end coaxial cylinder geometries described in the DIN 53019 (part 1) standard. With these equations the stress and the shear rate at the inner and outer surface of the rotor (that is for the radius $r = R_2$ and $r = R_3$) are calculated.

$$A = \frac{1}{2 \cdot \pi \cdot R_2^{\ 2} \cdot L + 2 \cdot \pi \cdot R_3^{\ 2} \cdot L} \tag{23}$$

$$M = \frac{2 \cdot \delta^2}{\delta^2 - 1},\ \delta = \frac{R_1}{R_2} \cong \frac{R_3}{R_4} \tag{24}$$

Properties of the double gap coaxial cylinder geometries

Two different double gap coaxial cylinder geometries with different dimension are available. The main difference between the CC41 DG and CC43 DG measuring geometries is the radius ratio δ and thus the sizes of the two ring gaps.

Applications

Text missing???

Sample volume measurement

For achieving correct measurement results with a concentric cylinder geometry it is essential to fill the correct amount of sample in the cup of the measuring geometry.

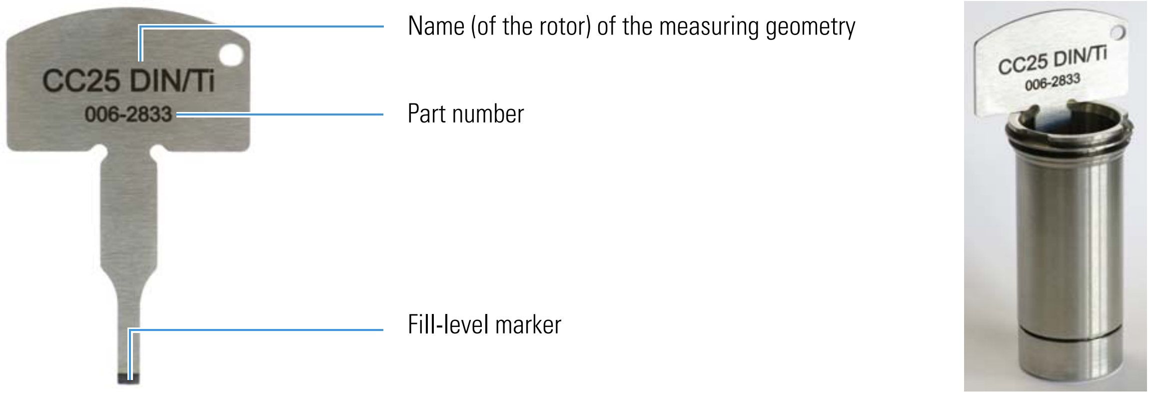
For measuring the sample volume in the cup of a concentric cylinder geometry two different tools are available:

- The “Fill Assist tool,” a sophisticated ultra-sonic level sensor which can be used for almost all concentric geometries.
- “Level gauges,” which are individual for each geometry.

Level gauges

Each concentric cylinder geometry rotor is delivered with a matching level gauge which allows for a quick and easy measurement of the correct fill-level and thus the correct sample volume.

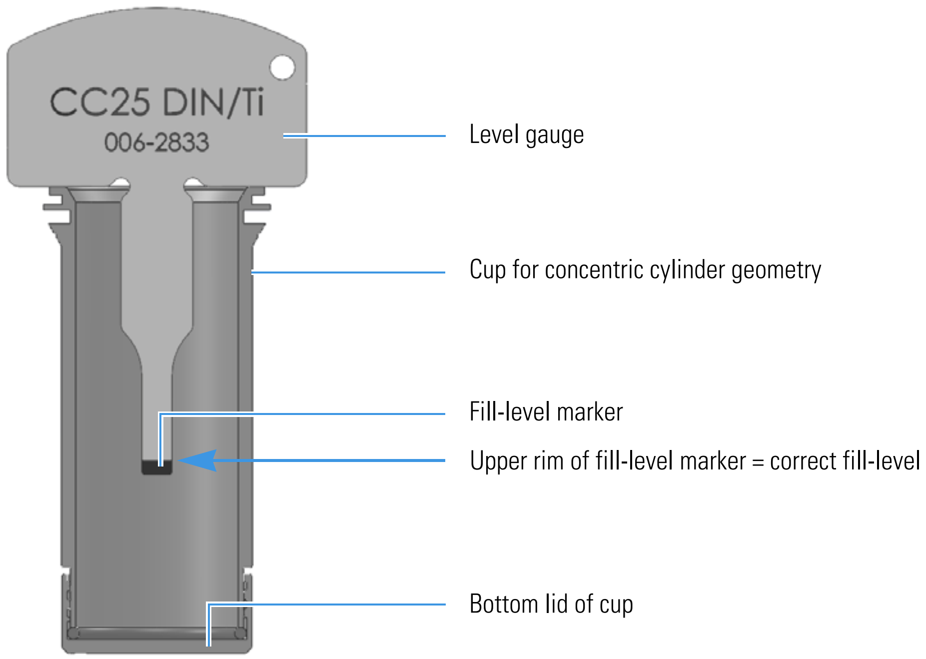
Figure 142. Level gauge (left) and level gauge in a cup (right) exemplified by the CC25 DIN geometry.



❖ To measure the sample volume in a cup using a level gauge

1. Place appropriate level gauge in the cup of the measuring geometry (see Figure 142 and Figure 143).
2. Pour the sample into the cup until the fill-level marker is completely wetted and the sample level reaches the upper rim of the fill-level marker (see Figure 143).
   During the filling process the level gauge can be withdrawn from the cup (multiple times) to check the actual fill level.

Figure 143. Level gauge in cup (exemplified by the CC25 DIN geometry)



Fill Assist tool

The Fill Assist tool is an interactive tool for checking the correct filling level of the cup of a coaxial cylinder geometry. The Fill Assist tool consists of a level sensor which is to be mounted to the Viscotester iQ drive motor shaft, an USB plug which is to be inserted in an USB socket on the Viscotester iQ plus a menu driven measuring routine which is completely integrated in the instruments touch screen user interface.

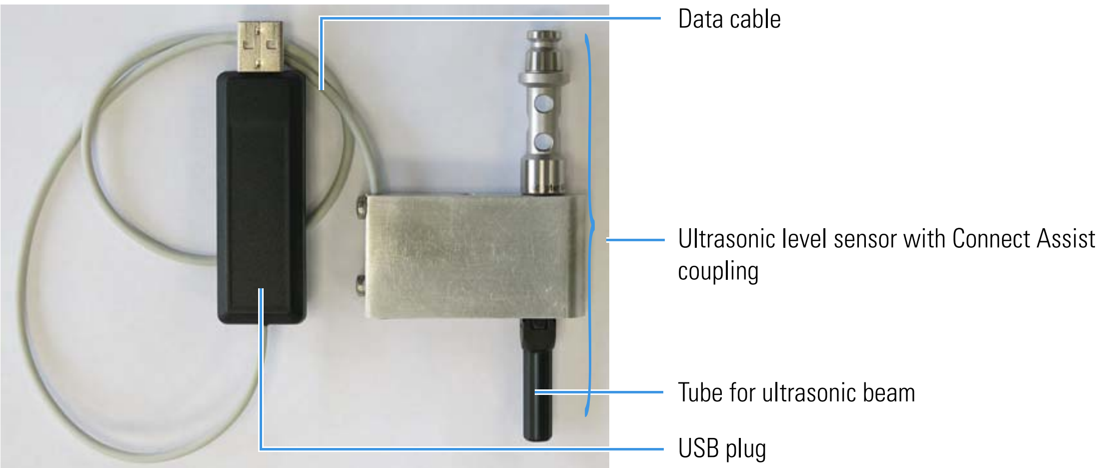
Note The Fill Assist tool can be used with all coaxial cylinder geometries apart from the CC10 DIN/Ti and all double gap geometries. It can *not* be used with all other geometries like parallel plate geometries, cone and plate geometries, etc.

Fill Assist hardware

The Fill Assist hardware consist of an ultra-sonic level sensor and an USB plug connector which are connected by a data cable (see Figure 144). The level sensor is equipped with a “Connect Assist” coupling shaft and can thus be mounted to the Viscotester iQ drive motor shaft, just like the rotor of a measuring geometry. The measured level data is transferred to the Viscotester iQ by means of the data cable and an USB plug which can be inserted in one of the USB sockets on the right hand side of the Viscotester iQ instrument head (see Figure 145).

The level sensor and the USB plug connector are independently recognized by the Viscotester iQ electronics.
When the level sensor is mounted to the Viscotester iQ drive motor shaft, the Fill Assist icon is displayed in the status bar on the Viscotester iQ touch screen display (see “Status bar” on page 13).
When the USB plug is inserted in one of the USB sockets, the Fill Assist icon is displayed in the optional button area on the Viscotester iQ touch screen display (see “Optional buttons” on page 14).

Figure 144. Fill Assist” hardware



The plastic tube for the ultrasonic beam must always be in place when the Fill Assist tool is used, but it can be easily removed for cleaning if necessary.

Figure 145. Fill Assist hardware mounted to the Viscotester iQ

When the Fill Assist tool is used on a regular basis or even for every measurement it is recommended to keep the Fill Assist USB plug inserted in the USB socket. The data cable is long enough to place the Fill Assist sensor on the lab bench, aside from the instrument, when it is not used.

Fill Assist measuring routine

The Fill Assist tool can not only be used in a job or manual controlled measurement started from the Viscotester iQ touch screen user interface, but also as part of a RheoWin job, see "Fill Assist in JobEditor and Jobs" on page 102 in Chapter 5, "HAAKE RheoWin Software."

The use of the Fill Assist tool is completely menu driven by a routine which is integrated in the instruments touch screen user interface.

IMPORTANT To use the Fill Assist tool for a measurement started from the Viscotester iQ touch screen user interface, the Configuration > Device settings > Use Fill Assist check box must be activated, see "Use Fill Assist" on page 57 in Chapter 2, "Touchscreen User Interface."

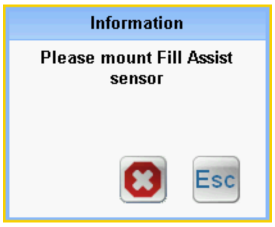
For a job controlled measurement use the following procedure.

❖ To use the Fill Assist tool in a Job controlled measurement

1. Start a Job, see "Running a Job measurement" on page 19 in Chapter 2, "Touchscreen User Interface."

2. When the Mount Fill Assist sensor message appears (see Figure 146), mount the Fill Assist sensor to the Viscotester iQ drive motor shaft.

Figure 146. Mount Fill Assist sensor popup message



In case the Fill Assist USB plug was not yet inserted in a USB socket on the right hand side of the Viscotester iQ instrument head, the operator will be prompted to do so (see Figure 147).

Figure 147. Insert Fill Assist USB plug popup message

3. Continue with the “To use the Fill Assist tool procedure” on page 128.
4. *After* the Fill Assist routine is completed, tap the Start  button to actually start the job.

For a manual controlled measurement use the following procedure.

❖ To use the Fill Assist tool in a manual controlled measurement

1. Navigate to the Viscotester iQ touchscreen Main menu (see “Main menu” on page 13 in Chapter 2, “Touchscreen User Interface.”)
2. Mount the desired rotor to the Viscotester iQ drive motor shaft.

IMPORTANT The rotor must be mounted *before* opening the Manual control menu.

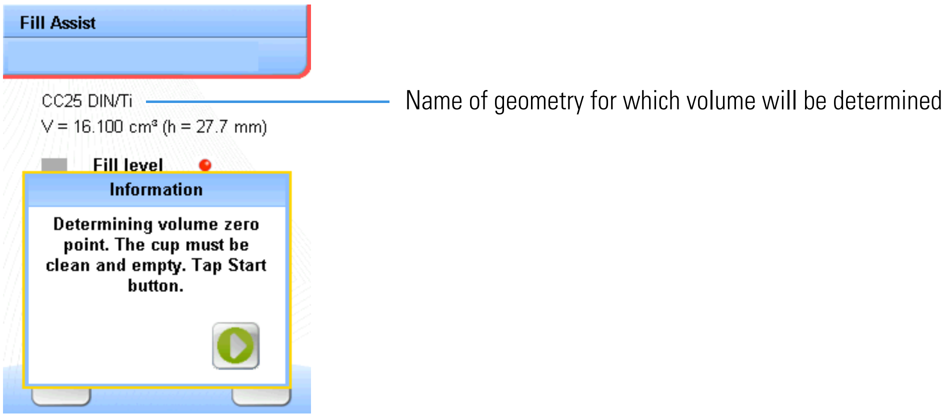
3. Open the **Manual control** menu and prepare a Manual controlled measurement, see “Manual control menu” on page 40 in Chapter 2, “Touchscreen User Interface.”
4. Dismount the rotor from the Viscotester iQ drive motor shaft.
5. Mount the Fill Assist sensor to the Viscotester iQ drive motor shaft.
6. Continue with step 1 of the “To use the Fill Assist tool procedure” on page 128.
7. Run the measurement (see “Running a manual control measurement” on page 45) *after* the Fill Assist routine is completed.

The following procedure is used for both job and manual controlled measurements.

❖ To use the Fill Assist tool procedure

After mounting the Fill Assist sensor to the drive motor shaft the volume zero point will be determined automatically, this takes less than a second (see Figure 148).

Figure 148. Determine volume zero point message

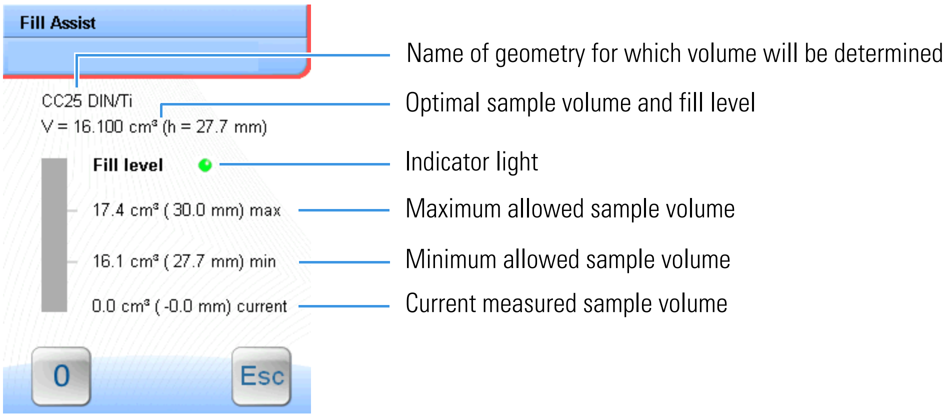


1. Tap the **Start**  button to continue.

   The indicator light must now be green and the current measured sample volume must be zero (see Figure 149).

2. In case the current measured sample volume is *not* in the range of 0.0 +/- 0.1 cm^3 tap the **Zero**  button to re-zero the volume measurement

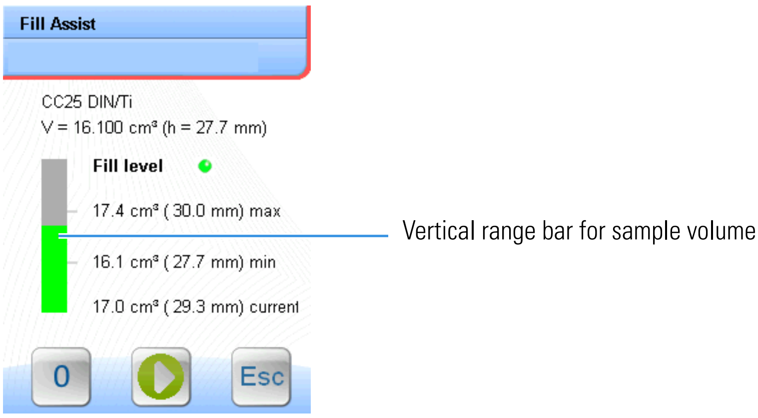
Figure 149. Start of volume measurement



3. Slowly poor the sample into the cup until the measured sample volume is between the min and max values (see Figure 150).

   When the sample volume is within the allowed range the vertical range bar will become green and the **Start**  button will appear in the menu (see Figure 150).

Figure 150. Volume measurement



4. Tap the **Start** button to continue.

   The dismount Fill Assist sensor message will appear (see Figure 151).

   Figure 151. Dismount Fill Assist sensor message

5. Dismount the Fill Assist sensor from the Viscotester iQ drive motor shaft.

   The mount geometry message will appear automatically (see Figure 152).

   Figure 152. Mount geometry (rotor) message

6. Mount the correct geometry (rotor) to the Viscotester iQ drive motor shaft.

   When the correct geometry (rotor) is mounted and detected by the Viscotester iQ the mount geometry message will automatically disappear.

   The Fill Assist routine is now completed.

Cone and plate geometries

All cone and plate geometries are designed to be used with the TM-PE-C (Peltier Cylinder), TM-LI-C (Liquid Cylinder), TM-PE-P (Peltier Plate) or TM-LI-P (Liquid Plate) temperature modules. For use with the TM-PE-C and TM-LI-C temperature module, the TMP adapter, order number 222-2010 is needed.

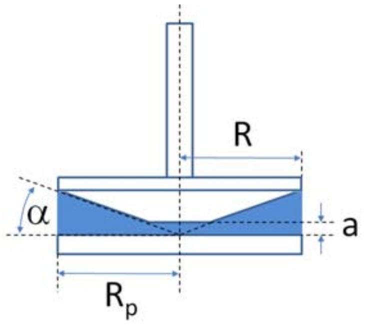
The main features of the cone and plate geometry are:

- The shear rate is the same throughout the sample, that is the same everywhere in the gap between cone and plate.
- All cones are truncated
- The axial gap setting is crucial for achieving correct results, an accuracy in the range of 1 micrometer is needed.
- Sample filling is not trivial and should be done with care. Applying too much sample, so that it spills out of the gap, or not enough sample, so that the gap is not completely filled, can have a significant influence on the results.

- Lower plates (TMPxx) that match the diameter of the cone are available for all cone diameters. The use of a matching plate is highly recommended as this makes the correct sample filling easier. The diameter of the matching lower plate is always a bit larger as the diameter of the cone, this is necessary for achieving the correct sample filling.
- The cleaning of the cone and plate is quick and easy.

Figure 153 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 23 to Table 27 in Appendix A, "Properties of Measuring Geometries,"

Figure 153. Cone and plate geometry



$R = D/2 =$ radius of rotor (cone)

$R_p =$ radius of plate

$\alpha = B =$ cone angle of rotor

$a = C =$ cone truncation = axial gap between cone and plate

D, B and C are the dimensions as mentioned on the certificates

Equations for geometry factors

The equations (25) and (26) below are used to calculate the two geometry factors A and M for the cone and plate geometry. These equations can be found in the DIN 53019 (part 1) standard as well as in many books on Rheology.

$$A = \frac{3}{2 \cdot \pi \cdot R^3} \tag{25}$$

$$M = \frac{1}{\alpha} \tag{26}$$

Properties of the cone and plate geometries

Cone rotors made from Titanium with a steel shaft (Cxx y°/Ti) with three different cone angles, 1.0 °, 3.0 ° and 4.0 ° and with two different diameters 35 mm and 60 mm are available as standard geometries.

Matching lower plates made from steel (TMPxx) are available with two different diameters 35 mm and 60 mm are available as standard geometries.

The three tables (sorted by cone angle) listed below list all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume the materials used as well as the part numbers for the rotors and the matching lower plates (TMPxx).
- Table 23, "Properties of Cxx 2.0°/Ti cone and plate geometries," on page 152
- Table 25, "Properties of Cxx 3.0°/Ti cone and plate geometries," on page 154
- Table 27, "Properties of Cxx 4.0°/Ti cone and plate geometries," on page 156

Applications

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Parallel plate geometries

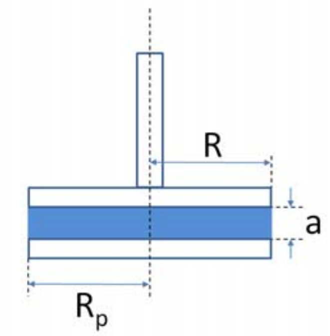
All cone and plate geometries are designed to be used with the TM-PE-C (Peltier Cylinder), TM-LI-C (Liquid Cylinder), TM-PE-P (Peltier Plate) or TM-LI-P (Liquid Plate) temperature modules. For use with the TM-PE-C and TM-LI-C temperature module, the TMP adapter, order number 222-2010 is needed.

The main features of the parallel plate geometry are:

- The shear-rate varies along the radius of the plates, that means that the shear rate is *not* the same throughout the sample.
- By changing the axial gap between the plates the shear-rate range can be modified.
- The axial gap setting is crucial for achieving correct results, an accuracy in the range of 1 micrometer is needed.
- Sample filling is not trivial and should be done with care. Applying too much sample, so that it spills out of the gap, or not enough sample, so that the gap is not completely filled, can have a significant influence on the results.
- Lower plates (TMPxx) that match the diameter of the upper plate are available for all upper plate diameters. The use of a matching lower plate is highly recommended as this makes the correct sample filling easier. The diameter of the matching lower plate is always a bit larger as the diameter of the upper plate, this is necessary for achieving the correct sample filling.
- The cleaning of both the upper and lower plate is quick and easy.

Figure 154 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 29 and Appendix A, "Properties of Measuring Geometries,"

Figure 154. Parallel plates geometry



$R = D/2 =$ radius of rotor (cone)

$R_p =$ radius of (lower) plate

a axial gap between rotor and plate

D is the dimension as mentioned on the certificate

Equations for geometry factors

The equations (27) and (28) are used to calculate the two geometry factors A and M for the parallel plate geometry. These equations can be found in the DIN 53019 (part 1) standard as well as in many books on Rheology. With these equations the stress and the shear-rate at the outer rim of the rotor (that is for the radius r = R) are calculated.

$$A = \frac{2}{\pi \cdot R^3} \qquad \textbf{(27)}$$

$$M = \frac{R}{a} \tag{28}$$

Properties of the parallel plate geometries

Upper plate rotors made from Titanium with a steel shaft (Pxx Ti L, Titanium) with three different diameters 20 mm, 35 mm, 60 mm are available as standard geometries.

Matching lower plates made from steel (TMPxx) are available with five different diameters 8 mm, 20 mm, 25 mm, 35 mm, 60 mm are available as standard geometries.

As an easier to clean alternative to the lower plates with a matching diameter, a special "EasyClean" lower plate with a large 80 mm diameter flat surface is also available.

The Table 29 in Appendix A, "Properties of Measuring Geometries," list all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the necessary sample volume the materials used as well as the part numbers for the rotors (upper plates) and the matching lower plates (TMPxx).

The geometry factor M listed in the tables below is the value for an axial gap of 1.0 mm. To get the geometry factor M for any other value of the axial gap, the factor M must be divided by that value (in mm).

Applications

Text missing???

The parallel-plate geometry is determined by the plate radius and the variable distance between the stationary and the movable plate. This distance should not be smaller than 0.5 mm and not larger than 3 mm as other measurement errors, depending on the substance, could be experienced.

The distance of the plate should be at least three times larger than the largest particle contained in the substance. The parallel-plate geometry must be very carefully filled in to minimize measurement errors. Both, too low a filling and too high a filling will cause measurement errors.

Vane geometries

A vane rotor is commonly used directly in the original container of a sample, for example in a jar, a beaker or a can (without temperature control) or in another larger container like a standard laboratory glass beaker. A vane rotor can also be used in a large enough cup in the TM-LI-C (Liquid Cylinder) temperature module, however in most cases wall effects can be not neglected in such a configuration.

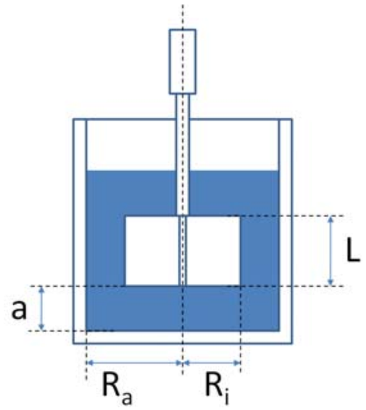
The main features of the vane geometries are:

- The vane rotor can be inserted into the sample virtually without disturbing the sample and without introducing initial stresses which would falsify the measured results.
- The vane rotor can be used in an original sample container.
- The vane rotor is easy to use and easy to clean.
- The axial gap setting is *not* crucial for achieving correct results, an accuracy in the range of 1 millimeter is sufficient.

- In order for the wall effects of the vertical and bottom wall of the sample container to be negligible, the radius Ra of the container should be $R_a \geq 2\ R_i$ and the axial gap a between the vane rotor and the bottom of the container should be a =≥ L. For smaller values of R_a and a, the equation (29) for the geometry factor A can only be used as an approximation.

Figure 155 supplies a schematic drawing of this geometry together with its relevant geometrical dimensions. The dimension values of the individual measuring geometry are listed in Table 31 in Appendix A, "Properties of Measuring Geometries,"

Figure 155. Vane geometries



R_i = radius of vane blades

R_a = inner radius of sample container

L = height of van blades

a = axial gap between vane rotor and bottom of sample container

Equations for geometry factors

The equation (29) used to calculate the geometry factor A for a vane geometry was first given by Dzuy and Boger in [2]. With this equation the stress at the outer rim of the vane rotor (that is for the radius r = R) is calculated.

$$A = \frac{1}{4 \cdot \pi \cdot R_i^3 \cdot \left(\frac{L}{2 \cdot R_i} + \frac{1}{3}\right)} \qquad \textbf{(29)}$$

Due to the fact that there is no defined flow field for the flow of the sample around the vane, the shear-rate in the sample can not be calculated. As consequence the geometry factor M for the shear-rate is not defined and set to 1.0.

Reference: [2] N.Q. Dzuy and D.V. Boger, *Yield stress measurements for concentrated suspensions*, J. Rheol., 27 (1983) 321.

Properties of the vane geometries

Three different vane rotors FL16 4B/SS, FL22 4B/SS, FL26 2B/SS with different dimensions are available, see figure x. The FL26 2B/SS rotor has two blades which are positioned at an angle of 15° relative to vertical shaft, the FL16 4B/SS, FL22 4B/SS rotors all have four vertical positioned blades.

Table 31 in Appendix A, "Properties of Measuring Geometries," lists all the relevant default properties of these geometries, this includes the dimensions, the geometry factors, the materials used as well as the part numbers for the rotors. In contrast to all other standard measuring geometries, the vane geometries consist of an upper or inner part, that is a rotor, only.

Applications

Text missing???

Connect Assist adapters

Several adapters are available for using non Connect Assist rotors or spindles with the Connect Assist coupling of the Viscotester iQ drive motor shaft, see Figure 156 and Table 10.

Figure 156. Connect Assist adapters P1, U1, U2 and ISO

The adapter ISO is designed for use with spindles according to ISO 2555 (so-called Brookfield spindles) which are originally used with the Viscotester C/D/E range of instrument.

The universal adapters U1, U2 and U3 can be used for mounting any rotor with a 6 mm (U1) or 4 mm (U2 and U3) diameter shaft.

The plate adapters P1, P2 and P3 are designed for use with special disposable plate (D Pxx/Al).

IMPORTANT The A- and M-factor values as well as the inertia value and the gap value, which are stored in the Connect Assist tag, can be edited to match the adapter with the attached rotor or spindle.

See “To edit the properties of a geometry” on page 58 in Chapter 2, “Touchscreen User Interface,” on how to edit the geometry properties using the Viscotester iQ touch screen interface.

Table 10. Connect Assist adapters (Sheet 1 of 2)

Name	Purpose	Interface to rotor
Adapter ISO	For VT C/D/E spindles according to ISO 2555 (Brookfield spindles)	Threaded stud with a 3-56 UNF 2A left thread
Adapter U1	For RSxxx and MARS I/II/III vane geometries (FL16, FL22, FL26-2b, FL40) with a 6 mm diameter shaft	6 mm diameter hole rigid shaft
Adapter U2	For VT550 E and FL rotors with a 4 mm diameter shaft	4 mm diameter hole rigid shaft
Adapter U3	For VT550 E and FL rotors with a 4 mm diameter shaft	4 mm diameter hole flexible cardan joint shaft

Table 10. Connect Assist adapters (Sheet 2 of 2)

Name	Purpose	Interface to rotor
Adapter P1	For disposable plates in combination with TM-xx-x modules	Conical stud with a M5 thread shorter steel shaft
Adapter P2	For disposable plates in combination with the CTC oven	Conical stud with a M5 thread longer ceramic shaft
Adapter P3	For disposable plates in combination with TM-xx-x modules	Conical stud with a M5 thread shorter ceramic shaft

For more detailed and technical information on the Connect Assist adapters see Appendix A, “Properties of Measuring Geometries,”

Special customer and/or application specific geometries

Despite the wide range of standard measuring geometry types, each available with several different sizes, which cover almost all applications, a situation in which a special non-standard measuring geometry is needed may be encountered. In case a special geometry is needed, for example a rotor with dimensions (diameter, length, cone angle) different from a standard geometry, or a rotor made from a special material, or a rotor with a special (for example serrated or sand-blasted) surface, or something completely new, please do not hesitate to contact your local sales person or Thermo Scientific directly. In most cases Thermo Scientific will be able to help you.

Selecting a measuring geometry

The following text needs to be edited ???

Although the rheological properties of a sample are per definition *independent* of the measuring geometry (and the rheometer) used to measure those properties, the measuring geometry chosen and used for a measurement may very well influence the measuring results. It is therefore important to select the proper measuring geometry. Factors that should be included in the selection process are:

- The consistency and other properties of the sample itself, for example: The viscosity value (low, medium, high), the values of the viscoelastic moduli, the homogeneity, the maximum size of particulates, the chemical aggressivity, the likelihood to show slippage, the likelihood of solvent evaporation, the likelihood of particle sedimentation, the available sample volume.
- The rheological property that is to be measured, for example: The viscosity (at a certain shear-rate), the shear-rate dependence of the viscosity, the yield stress, the viscoelastic properties in a certain frequency range, the stability of the viscosity or the viscoelastic properties as a function of time or as a function of temperature, etc.
- The preset value(s) or the range of preset values like the shear-rate, stress, strain, frequency, temperature, pressure for which the properties must be determined.
- Company, inter-company, industry, national or other standards or regulations that must be complied to. Often, but not always, standards or regulations include the definition of measurement procedures and ask for the use of a certain measurement geometry.

A large number of standardized absolute measuring geometries are available such as plate/plate, plate/cone and coaxial cylinder, as well as relative measuring systems with modified, e.g. serrated surface and vane or spiral rotors, which often provide the only option for obtaining reproducible measuring results. In a generously sized rheometer using suitable special rotors, measurements can be carried out directly in the original packaging, such as up to a 10-liter bucket.

Advantages of a plate/plate or plate/cone measuring geometry compared to coaxial cylinders include easier cleaning and low sample volume. Cylindrical measuring geometries make it possible to measure samples with larger particles, while the prevailing guideline for all measuring geometries is that the measuring gap must be at least 3 times larger than the largest particle. Measuring rotors should be manufactured from a material of low mass (such as titanium) in order to keep its mass moment of inertia low, which is advantageous for quick speed changes, such as during disturbance tests or an oscillation test at higher frequencies.

To ensure optimal gap filling, the measuring geometries should have overfill protection, e.g. a lower measuring plate with the same diameter as the upper plate or the upper cone, so that surplus sample can drain off or simply be removed. If samples tend to dry out, a sample compartment cover and integrated solvent trap can counteract the evaporation of the solvent.

The measuring geometries are the core of a rheometer and determine the quality of the measuring results.

Attaching a rotor to the drive motor shaft

The mounting and dismounting of a rotor to rheometer drive motor shaft is described in the chapter “Mounting/dismounting a rotor” on page 29 of the HAAKE Viscotester iQ Instruction Manual.

A

Properties of Measuring Geometries

This appendix contains detailed information on the properties of all standard measuring geometries which are available for the HAAKE Viscotester iQ from Thermo Scientific.

Contents of this appendix

DIN 53019 / ISO 3219 coaxial cylinder geometries (TM-PE-C, TM-LI-C32)

Table 11. Properties of coaxial cylinder geometries according to DIN 53019 / ISO 3219

Measuring geometry	**CC10 DIN/Ti**	**CC16 DIN/Ti**	**CC25 DIN/Ti**
Geometry factor A (Pa/Nm)	356800	92220	22630
ΔA (%)	0.3	0.2	0.2
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	12.285	12.325	12.35
ΔM (%)	0.8	0.6	0.5
Radius ratio $\delta=R_a/R_i$	1.085	1.0847	1.0845
Ring gap R_a-R_i (mm)	0425	0.665	1.06
Axial gap a (mm)	2.1	3.3	5.3
Sample volume V (cm^3)	1.02	3.95	16.1
Max. temperature (°C)	200	200	200

Rotor	**CC10 DIN/Ti**	**CC16 DIN/Ti**	**CC25 DIN/Ti**
Rotor, order no.	222-2025	222-2026	222-2029
Radius R_i (mm)	5.000	7.85	12.54
ΔR_i (mm)	± 0.0015	± 0.002	± 0.00225
Length L (mm)	15	23.55	37.6
ΔL (mm)	± 0.03	± 0.03	± 0.03
Inertia I (kg m^2 10^{-6})	0.669	1.20	4.59
Mass m (g)	36.2	53.6	71.2
Material	Titanium 3.7035	Titanium 3.7035	Titanium 3.7035

Cup	**CCB10 DIN**	**CCB16 DIN**	**CCB25 DIN**
Cup, order no.	222-1971	222-1972	222-1956
Radius R_a (mm)	5.425	8.515	13.60
ΔR_a (mm)	± 0.002	± 0.002	± 0.00325
Material (inner tube)	Steel 1.4305	Steel 1.4305	Steel 1.4305
Material (main body)	Ampcoloy 972	Ampcoloy 972	Steel 1.4305
Gasket (200 °C) order no.	222-1292	222-1994	222-1993

Figure 157. Viscosity measurement ranges of CC10 DIN/Ti, CC16 DIN/Ti, CC25 DIN/Ti

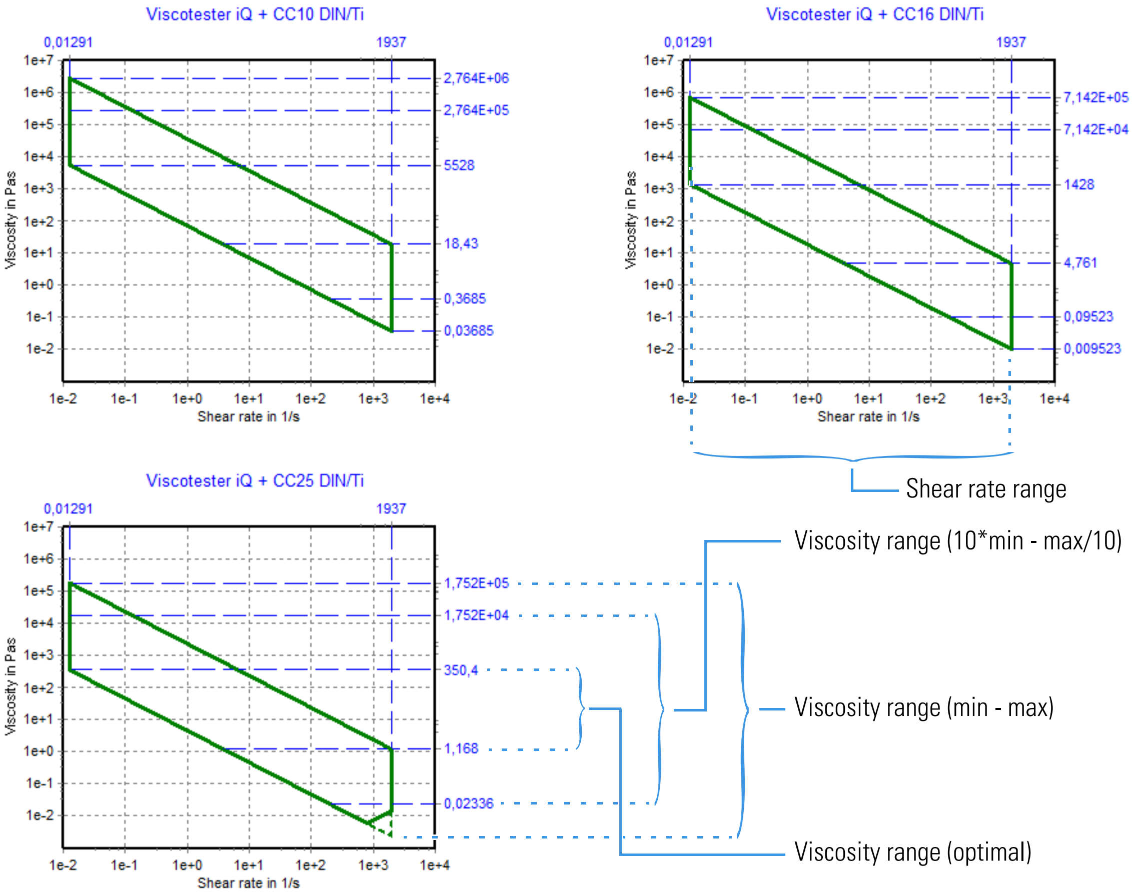


Table 12. Measurement ranges of CC10 DIN/Ti, CC16 DIN/Ti, CC25 DIN/Ti

	CC10 DIN/Ti		**CC16 DIN/Ti**		**CC25 DIN/Ti**	
	From	**To**	**From**	**To**	**From**	**To**
Strain range [a]						
Shear rate range in 1/s [b]	0.0129	1940	0,0129	1940	0.0129	1940
Shear stress range in Pa [c]	71.4	35700	18.4	9220	4.52	2260
Viscosity range in Pas [d] (min - max)	0.0369	2.76e+06	0.00952	714000	0.00234	175000
Viscosity range in Pas [e] (10*min - max/10)	0.369	276000	0.0952	71400	0.0234	17500
Viscosity range in Pas [f] (optimal)	18.4	5530	4.76	1430	1.17	350

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Maximal range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Recessed ends coaxial cylinder geometries (TM-PE-C, TM-LI-C32)

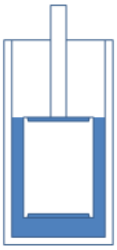


Table 13. Properties of recessed ends coaxial cylinder geometries

Measuring geometry	CC20/Ti	CC24/Ti	CC26/Ti
Geometry factor A (Pa/Nm)	47550	32410	27380
ΔA (%)	0.1		
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	4.205	8.668	22.38
ΔM (%)	0.1	0.2	0.5
Radius ratio $\delta=R_a/R_i$	1.381	1.14	1.048
Ring gap R_a-R_i (mm)	3.75	1.672	0.622
Axial gap a (mm)	11	5	1.9
Sample volume V (cm^3)	16	7.5	2.9
Max. temperature (°C)	200	200	200

Rotor	CC20/Ti	CC24/Ti	CC26/Ti
Rotor, order no.	222-2027	222-2028	222-2030
Radius R_i (mm)	9.85	11.93	12.98
ΔR_i (mm)	± 0.00225	± 0.00225	± 0.00225
Length L (mm)	34.5	34.5	34.5
ΔL (mm)	± 0.03	± 0.03	± 0.03
Inertia I (kg m^2 10^{-6})	2.0	3.34	4.3
Mass m (g)	53.3	60.5	65.2
Material	Titanium, DIN No. 3.7035		

Cup	CCB26
Cup, order no.	222-1976
Radius R_a (mm)	13.60
ΔR_a (mm)	± 0.00325
Material	Stainless steel, DIN No. 1.4305
Gasket (200 °C) order no.	222-1992

Figure 158. Viscosity measurement ranges of CC20/Ti, CC24/Ti, CC26/Ti

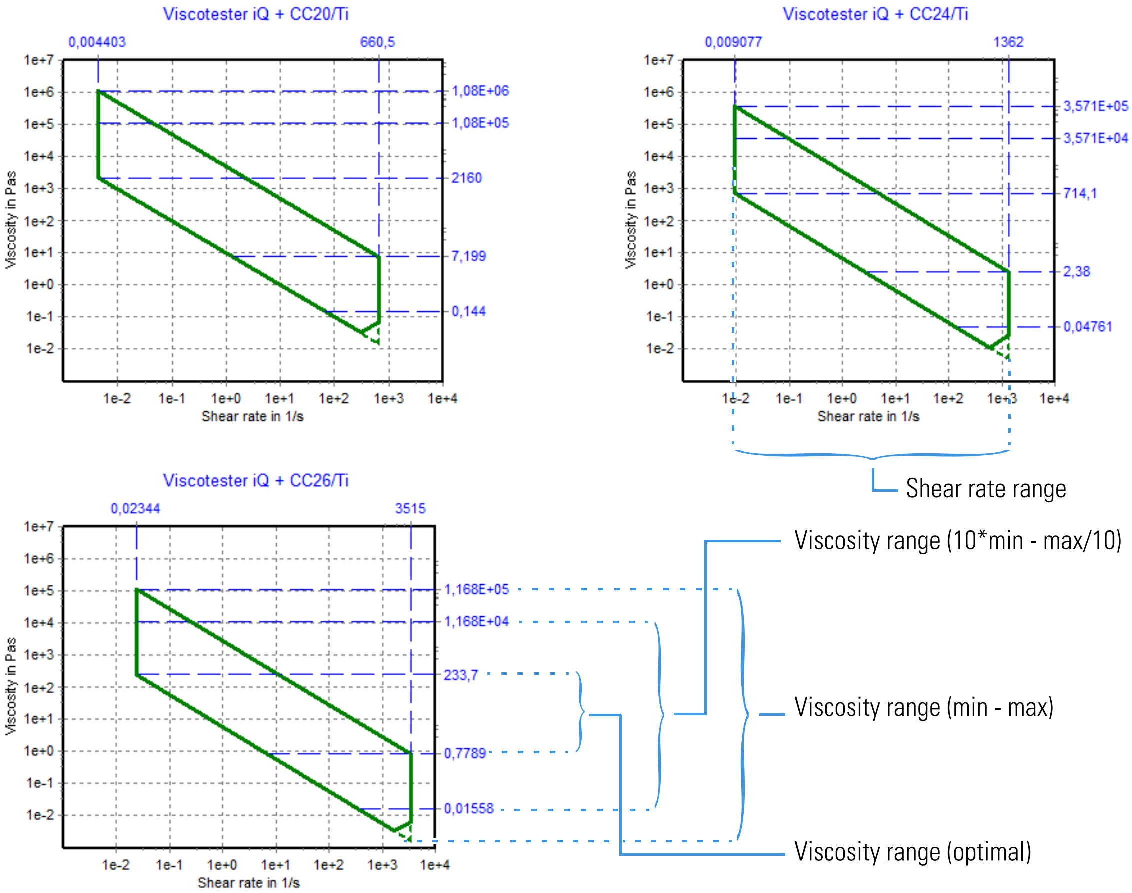


Table 14. Measurement ranges of CC20/Ti, CC24/Ti, CC26/Ti

	CC20/Ti		CC24/Ti		CC26/Ti	
	From	**To**	**From**	**To**	**From**	**To**
Strain range [a]						
Shear rate range in 1/s [b]	0.0044	661	0.0091	1360	0,0234	3520
Shear stress range in Pa [c]	9.51	4760	6.48	3240	5,48	2740
Viscosity range in Pas [d] (min - max)	0.0144	1.08e+06	0.00476	357000	0.00156	117000
Viscosity range in Pas [e] (10*min - max/10)	0.144	108000	0.0476	35700	0.0156	11700
Viscosity range in Pas [f] (optimal)	7.20	2160	2.38	714	0.779	234

[a]Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b]Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c]Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d]Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e]Realistic range with at least one decade of usable shear rate range.

[f]Optimal range with maximum possible shear rate range.

Double gap coaxial cylinder geometries (TM-PE-C, TM-LI-C32)

Table 15. Properties of double gap coaxial cylinder geometries

Measuring geometry	**CC27 DG/Ti**
Geometry factor A (Pa/Nm)	13720
ΔA (%)	0.15
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	45.81
ΔM (%)	2.3
Radius ratio $\delta=R_1/R_2 \cong R_3/R_4$	1.023
Ring gap R_4-R_3 (mm)	0.3
Ring gap R_2-R_1 (mm)	0.235
Axial gap a (mm)	4.0
Sample volume V (cm^3)	3.0
Max. temperature (°C)	200

Rotor	**CC27 DG/Ti**
Rotor, order no.	222-2031
Radius R_2 (mm)	13.3
ΔR_2 (mm)	± 0.00225
Radius R_3 (mm)	10.64
ΔR_3 (mm)	± 0.00325
Length L (mm)	40.0
ΔL (mm)	± 0.06
Inertia I (kg m^2 10^{-6})	6.7
Mass m (g)	76.2
Material	Titanium 3.7035

Cup	**CCB27 DG**
Cup, order no.	222-1980
Radius R_1 (mm)	13.6
ΔR_1 (mm)	± 0.00325
Radius R_4 (mm)	10.405
ΔR_4 (mm)	± 0.00325
Material	Steel 1.4305
Gasket (200 °C) order no.	222-1992

Figure 159. Viscosity measurement ranges of CC27 DG/Ti

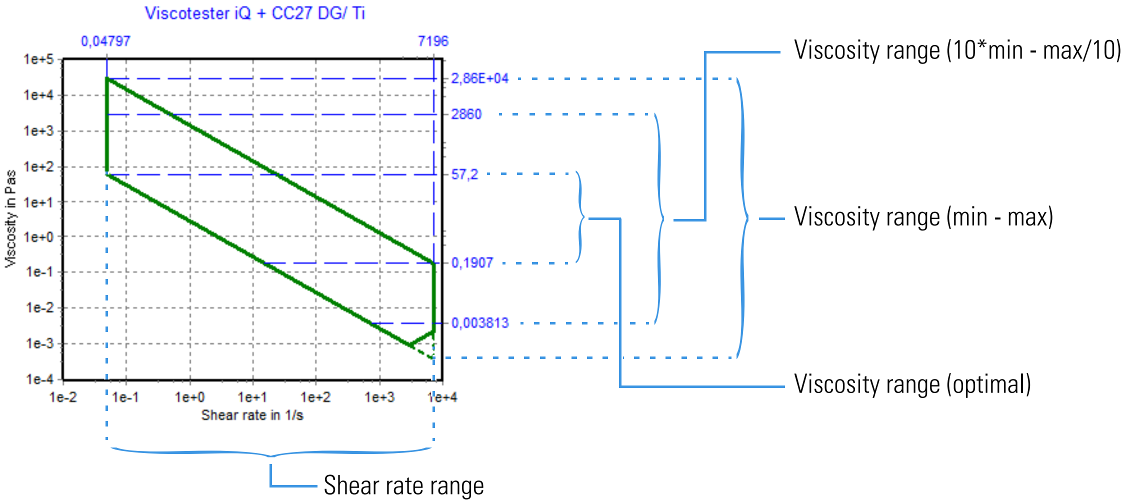


Table 16. Measurement ranges of CC27 DG/Ti

	CC27 DG/Ti	
	From	**To**
Strain range [a]		
Shear rate range in 1/s [b]	0.0480	7180
Shear stress range in Pa [c]	2.74	1370
Viscosity range in Pas [d] (min - max)	0.000381	28600
Viscosity range in Pas [e] (10*min - max/10)	0.00381	2860
Viscosity range in Pas [f] (optimal)	0.191	57.2

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.
[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.
[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.
[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.
[e] Realistic range with at least one decade of usable shear rate range.
[f] Optimal range with maximum possible shear rate range.

DIN 53019/ISO 3219 coaxial cylinder geometries (TM-LI-C48)

Table 17. Properties of coaxial cylinder geometries according to DIN 53019/ISO 3219

Measuring geometry	**CC25 DIN**	**CC40 DIN**
Geometry factor A (Pa/Nm)	22630	5575
ΔA (%)	0.2	0.151
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	12.35	1
ΔM (%)	0.5	0.4
Radius ratio $\delta=R_a/R_i$	1.0845	
Ring gap R_a-R_i (mm)	1.06	1.7
Axial gap a (mm)	5.3	8.0
Sample volume V (cm^3)	16.1	65.4
Max. temperature (°C)	200	200
Rotor	**CC25 DIN/Ti**	**CC40 DIN**
Rotor, order no.	222-2029	222-2168
Radius R_i (mm)	12.54	20.000
ΔR_i (mm)	± 0.00225	± 0.004
Length L (mm)	37.6	60
ΔL (mm)	± 0.03	± 0.06
Inertia I (kg m^2 10^{-6})	4.59	30.417
Mass m (g)	71.2	150
Material	Titanium 3.7035	Titanium 3.7035
Cup	**CCB25 DIN 48**	**CCB40 DIN**
Cup, order no.	222-2182	222-2169
Radius R_a (mm)	13.60	21.70
ΔR_a (mm)	± 0.00325	± 0.00275
Material	Steel 1.4305	Steel 1.4305
Gasket (200 °C) order no.	222-1993	222-1290

Figure 160. Viscosity measurement ranges of CC25 DIN/Ti and CC40 DIN/Ti

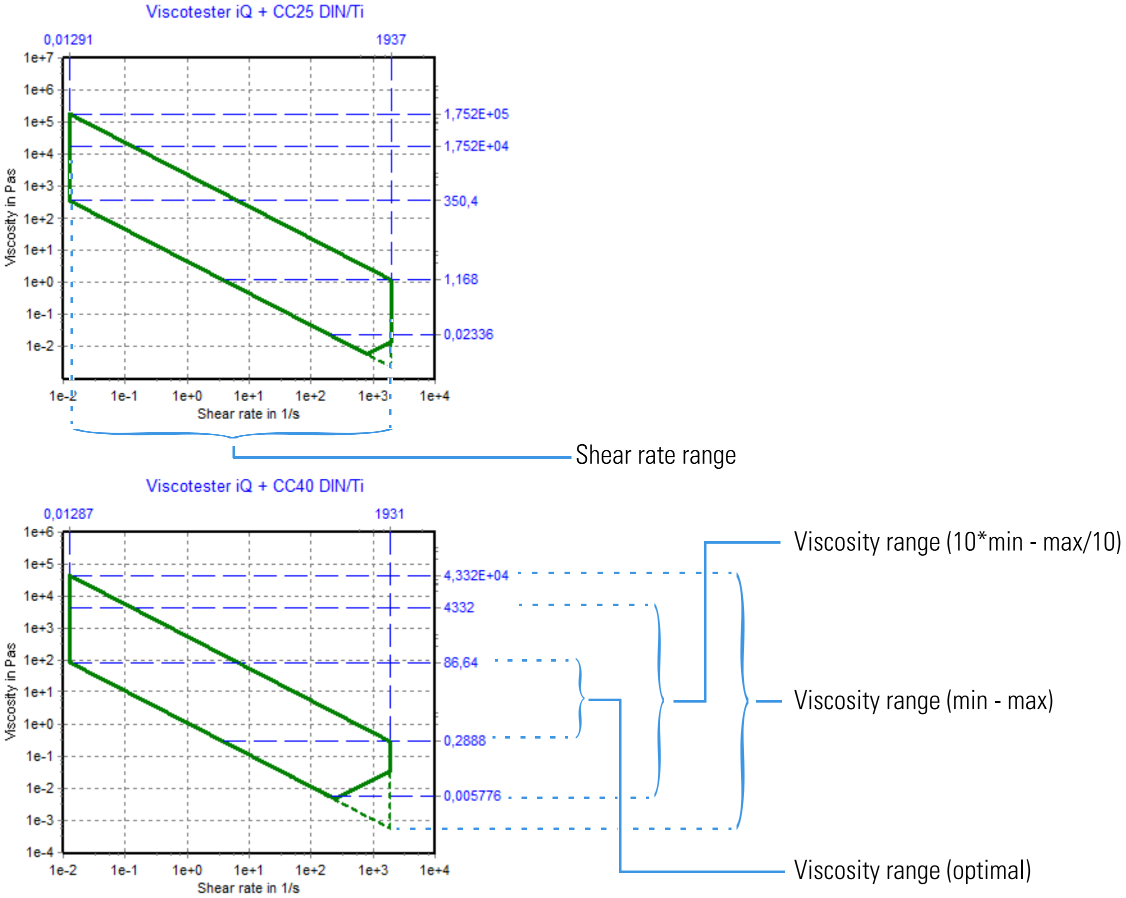


Table 18. Measurement ranges of CC25 DIN/Ti and CC40 DIN/Ti

	CC25 DIN/Ti		CC40 DIN/Ti	
	From	To	From	To
Strain range [a]				
Shear rate range in 1/s [b]	0.0129	1930	0.0129	1930
Shear stress range in Pa [c]	4.52	2260	1.112	558
Viscosity range in Pas [d] (min - max)	0.00234	175000	0.000578	43300
Viscosity range in Pas [e] (10*min - max/10)	0.0234	17500	0.00578	4330
Viscosity range in Pas [f] (optimal)	21.17	350	0.289	86.6

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Recessed ends coaxial cylinder geometries (TM-LI-C48)

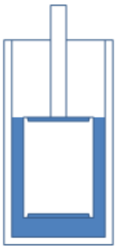


Table 19. Properties of recessed ends coaxial cylinder geometries

Measuring geometry	CC31	CC38	CC41
Geometry factor A (Pa/Nm)	11710	8010	6750
ΔA (%)	0.5		
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	4.21	8.60	22.40
ΔM (%)	0.5		
Radius ratio $\delta=R_a/R_i$	1.3804	1.1415	1.0478
Ring gap R_a-R_i (mm)	5.98	2.69	0.99
Axial gap a (mm)	8.1	8.1	3
Sample volume V (cm^3)	52.0	33.0	14.0
Max. temperature (°C)	200	200	200

Rotor	CC31	CC38	CC41
Rotor, order no.	222-2124	222-2123	222-2122
Radius R_i (mm)	15.720	19.010	20.710
ΔR_i (mm)	± 0.004	± 0.004	± 0.004
Length L (mm)	55.0	55.0	55.0
ΔL (mm)	± 0.03	± 0.03	± 0.03
Inertia I (kg m^2 10^{-6})	11.7	21.7	28.8
Mass m (g)	99	117	128
Material	Titanium 3.7035	Titanium 3.7035	Titanium 3.7035

Cup	CCB43
Cup, order no.	222-2170
Radius R_a (mm)	21.700
ΔR_a (mm)	± 0.004
Material	Steel 1.4305
Gasket (200 °C) order no.	222-1293

Figure 161. Viscosity measurement ranges of CC31/Ti, CC38/Ti, CC41/Ti

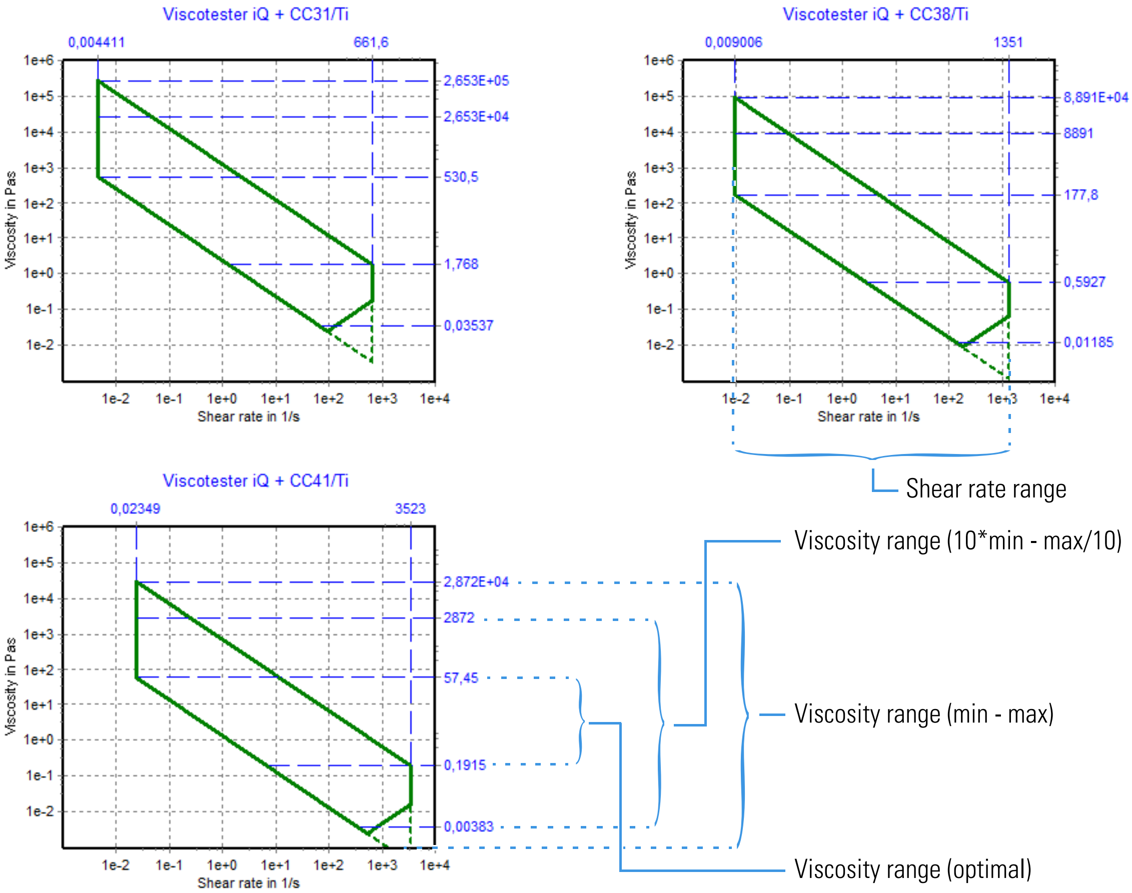


Table 20. Measurement ranges of CC31/Ti, CC38/Ti, CC41/Ti

	CC31/Ti		CC38/Ti		CC41/Ti	
	From	To	From	To	From	To
Strain range [a]						
Shear rate range in 1/s [b]	0.00441	662	0.009	1350	0.0235	3520
Shear stress range in Pa [c]	2.34	1170	1.60	801	1.35	675
Viscosity range in Pas [d] (min - max)	0.00354	265000	0.00119	88900	0.000383	28700
Viscosity range in Pas [e] (10*min - max/10)	0.0354	26500	0.0119	8890	0.0383	2870
Viscosity range in Pas [f] (optimal)	1.77	530	0.593	178	0.192	57.5

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Double gap coaxial cylinder geometries (TM-LI-C48)

Table 21. Properties of double gap coaxial cylinder geometries

Measuring geometry	CC41 DG	CC43 DG
Geometry factor A (Pa/Nm)	3701	3723
ΔA (%)	0.1	
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	72.67	31.08
ΔM (%)	6	
Radius ratio $\delta=R_1/R_2\cong R_3/R_4$	1.014	1.0338
Ring gap R_4-R_3 (mm)	0.3	0.71
Ring gap R_2-R_1 (mm)	0.25	0.6
Axial gap a (mm)	5.1	
Sample volume V (cm^3)	6.3	11.5
Max. temperature (°C)	200	200

Rotor	CC41 DG	CC43 DG
Rotor, order no.	222-2133	222-2134
Radius R_2 (mm)	18	18.35
ΔR_2 (mm)	± 0.004	± 0.004
Radius R_3 (mm)	21.4	20.99
ΔR_3 (mm)	± 0.004	± 0.004
Length L (mm)	55	55
ΔL (mm)	± 0.06	± 0.06
Inertia I (kg m^2 10^{-6})	47.8	38.4
Mass m (g)	166	143
Material	Titanium 3.7035	Titanium 3.7035

Cup	CCB41
Cup, order no.	222-2171
Radius R_1 (mm)	17.75
ΔR_1 (mm)	± 0.004
Radius R_4 (mm)	21.7
ΔR_4 (mm)	± 0.00434
Material	Steel 1.4305
Gasket (200 °C) order no.	222-1293

Figure 162. Viscosity measurement ranges of CC41 DG/Ti and CC43 DG/Ti

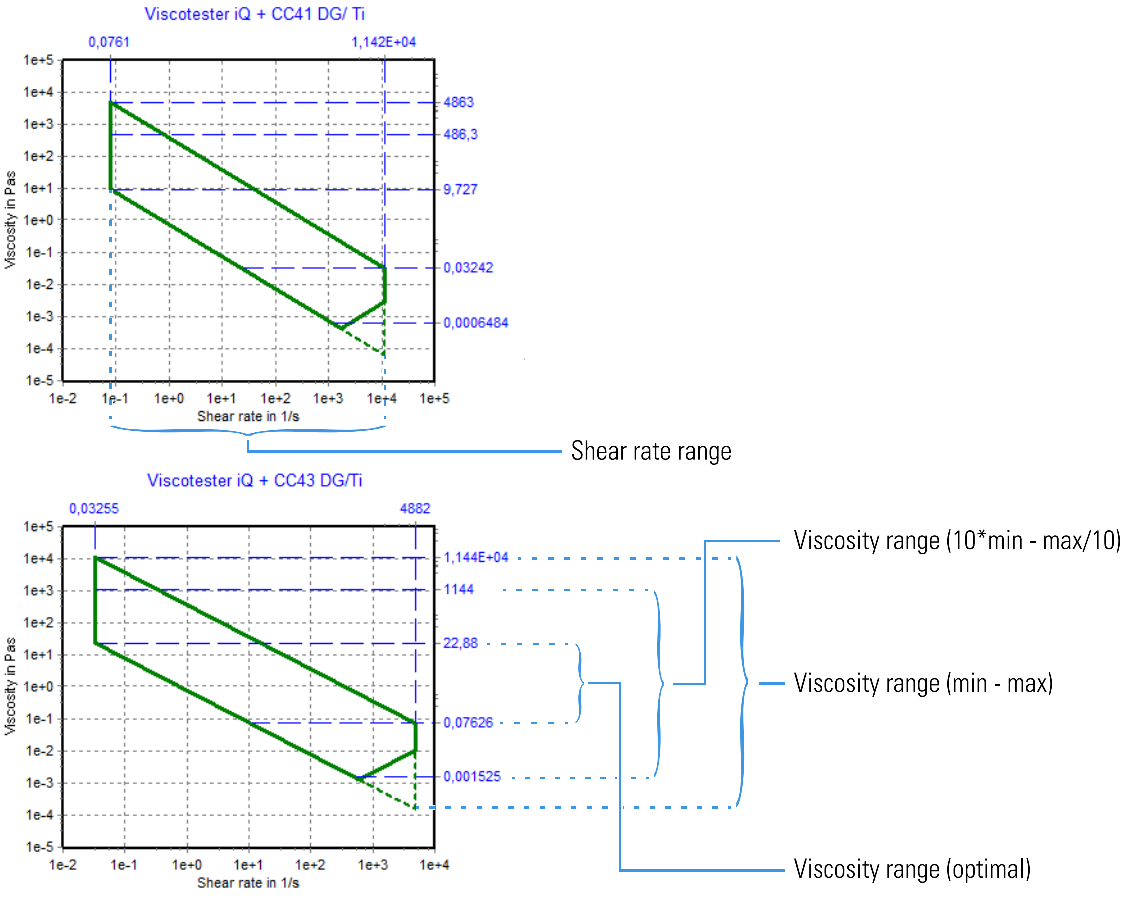


Table 22. Measurement ranges of CC41 DG/Ti and CC43 DG/Ti

	CC41 DG/Ti		CC43 DG/Ti	
	From	**To**	**From**	**To**
Strain range [a]				
Shear rate range in 1/s [b]	0.076	11400	0,033	4880
Shear stress range in Pa [c]	0.740	370	0.745	372
Viscosity range in Pas [d] (min - max)	6.48e-05	4860	0,000153	11400
Viscosity range in Pas [e] (10*min - max/10)	0.000648	486	0.00153	1140
Viscosity range in Pas [f] (optimal)	0.0324	9,73	0.0763	22.9

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Cone and plate geometries (2.0° cones)

Table 23. Properties of Cxx 2.0°/Ti cone and plate geometries

Measuring geometry	**C35 2.0°/Ti**	**C60 2.0°/Ti**
Geometry factor A (Pa/Nm)	89090	17680
ΔA (%)		
Geometry factor M(s^{-1}/rad^{-1})	28.65	28.65
ΔM (%)		
Axial gap a (mm)	0.100	0.100
Sample volume V (cm^3)	0.4	2.0
Max. temperature (°C)	200	200

Rotor	**C35 2.0°/Ti**	**C60 2.0°/Ti**
Rotor, order no.	222-2113	222-2104
Radius R_i (mm)	17.5	30.0
ΔR_i (mm)		
Cone angle α (°)	2.0	2.0
Inertia I (kg m^2 10^{-6})	1.78	14.624
Mass m (g)	38.2	64.5
Material	Titanium 3.7035	

Lower plate	**TMP35**	**TMP60**
Lower plate, order no.	222-1892	222-1891
Radius R_a (mm)	18.0	30.5
ΔR_a (mm)	0.025	0.025
Material	Steel 1.4305	

* The exact values are specified on the individual certificate for each rotor.

Figure 163. Viscosity measurement ranges of C35 2°/Ti and C60 2°/Ti

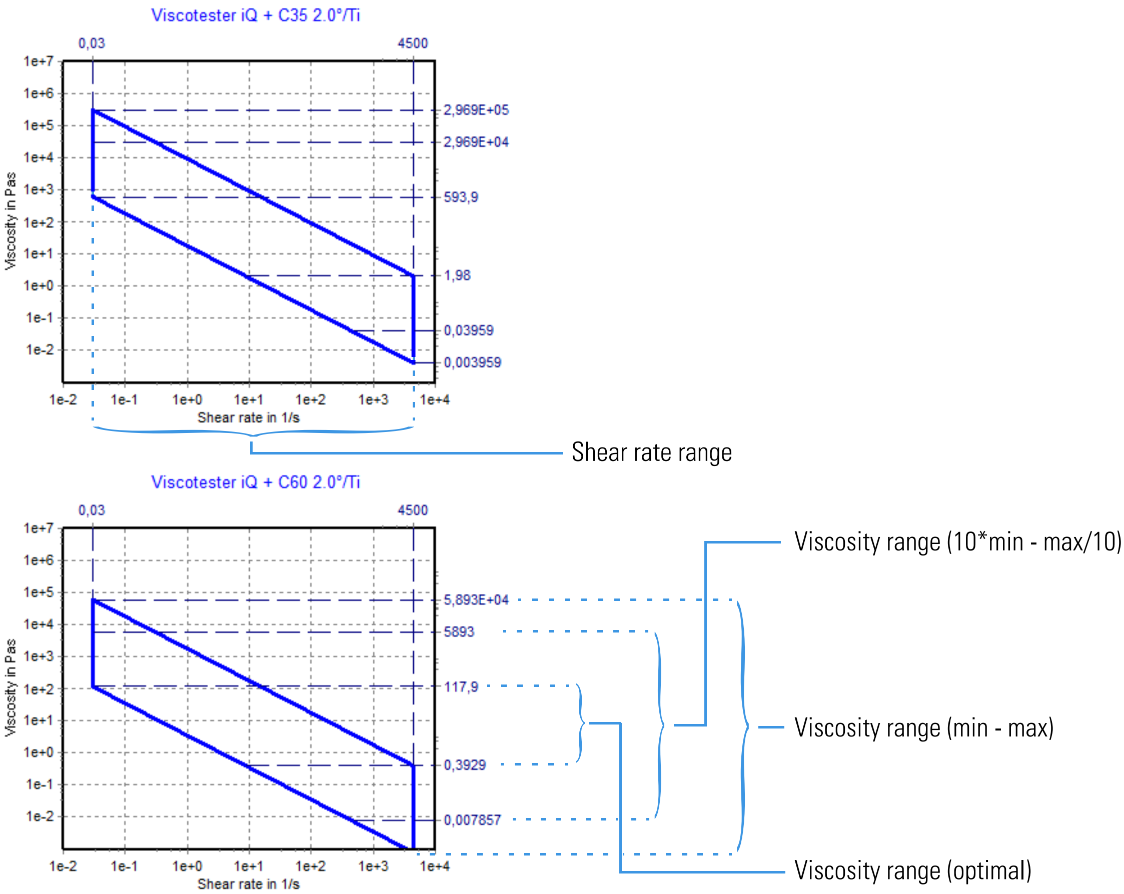


Table 24. Measurement ranges of C35 2°/Ti and C60 2°/Ti

	C35 2°/Ti		C60 2°/Ti	
	From	**To**	**From**	**To**
Strain range [a]				
Shear rate range in 1/s [b]	0.03	4500	0.03	4500
Shear stress range in Pa [c]	17.8	8910	3.54	1768
Viscosity range in Pas [d] (min - max)	0.004	2.97e+5	0.0008	5.89e+4
Viscosity range in Pas [e] (10*min - max/10)	0.04	2.97e+4	0.008	5890
Viscosity range in Pas [f] (optimal)	1.98	594	0.39	118

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Cone and plate geometries (3.0° cones)

Table 25. Properties of Cxx 3.0°/Ti cone and plate geometries

Measuring geometry	**C35 3.0°/Ti**	**C60 3.0°/Ti**
Geometry factor A (Pa/Nm)	89090	17680
ΔA (%)		
Geometry factor M(s^{-1}/rad^{-1})	19.10	19.10
ΔM (%)		
Axial gap a (mm)	0.150	0.150
Sample volume V (cm^3)	0.7	3.3
Max. temperature (°C)	200	200

Rotor	**C35 3.0°/Ti**	**C60 3.0°/Ti**
Rotor, order no.	222-2184	222-2185
Radius R_i (mm)	17.5	30.0
ΔR_i (mm)	0.01	0.01
Cone angle α (°)	3	3
Inertia I (kg m^2 10^{-6})	1.81	15.205
Mass m (g)	38.3	66.2
Material	Titanium 3.7035	

Lower plate	**TMP35**	**TMP60**
Lower plate, order no.	222-1892	222-1891
Radius R_a (mm)	18.0	30.5
ΔR_a (mm)	0.025	0.025
Material	Steel 1.4305	

* The exact values are specified on the individual certificate for each rotor.

Figure 164. Viscosity measurement ranges of C35 3°/Ti and C60 3°/Ti

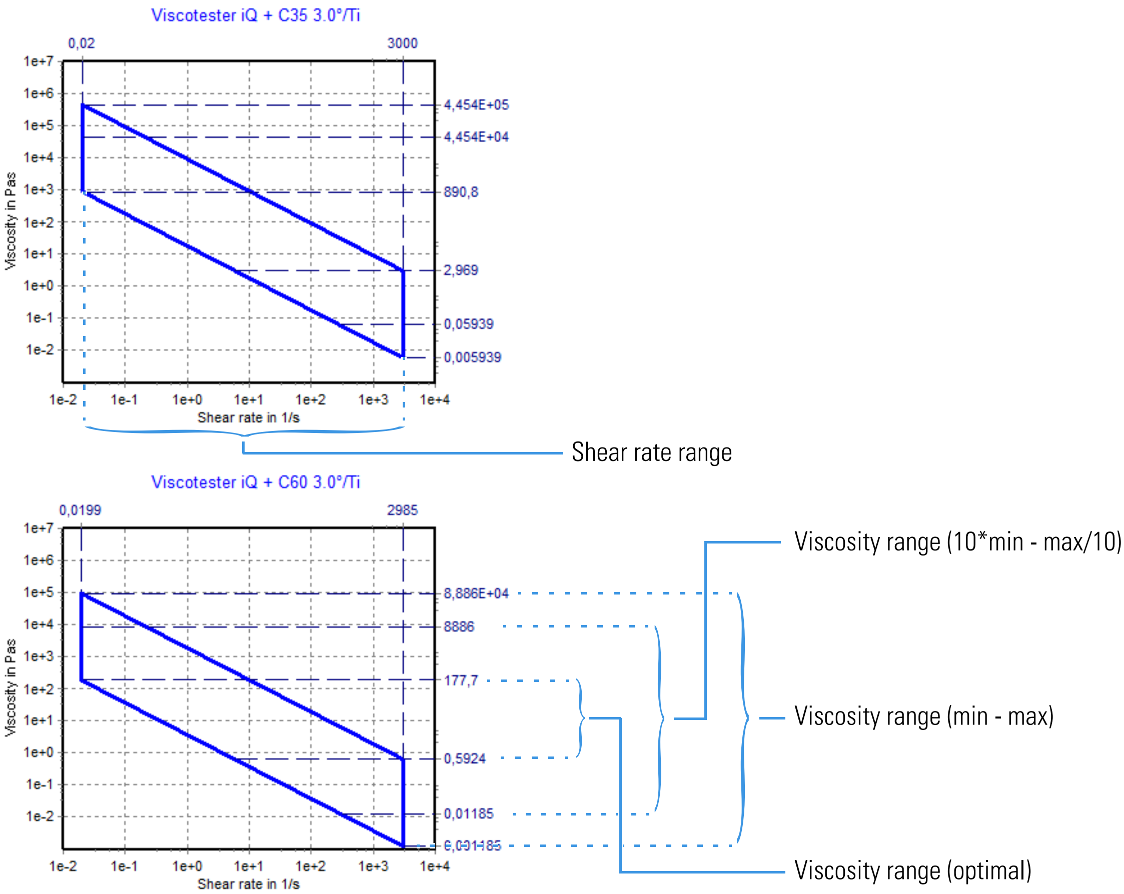


Table 26. Measurement ranges of C35 3°/Ti and C60 3°/Ti

	C35 3°/Ti		C60 3°/Ti	
	From	To	From	To
Strain range [a]				
Shear rate range in 1/s [b]	0.02	3000	0.02	3000
Shear stress range in Pa [c]	17.8	8909	3.54	1770
Viscosity range in Pas [d] (min - max)	0.006	4.45E+5	0.001	8.89e+4
Viscosity range in Pas [e] (10*min - max/10)	0.06	4.45e+4	0.01	8890
Viscosity range in Pas [f] (optimal)	2.97	891	0.592	178

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.
[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.
[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.
[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.
[e] Realistic range with at least one decade of usable shear rate range.
[f] Optimal range with maximum possible shear rate range.

Cone and plate geometries (4.0° cones)

Table 27. Properties of Cxx 4.0°/Ti cone and plate geometries

Measuring geometry	**C35 4.0°/Ti**	**C60 4.0°/Ti**
Geometry factor A (Pa/Nm)	89090	17680
ΔA (%)		
Geometry factor M(s^{-1}/rad^{-1})	14.32	14.32
ΔM (%)		
Axial gap a (mm)	0.150	0.150
Sample volume V (cm^3)	0.8	4.3
Max. temperature (°C)	200	200

Rotor	**C35 4.0°/Ti**	**C60 4.0°/Ti**
Rotor, order no.	222-2114	222-2186
Radius R_i (mm)	17.5	30.0
ΔR_i (mm)	0.01	0.01
Cone angle α (°)	4.0	4.0
Inertia I (kg m^2 10^{-6})	1.839	15.788
Mass m (g)	38.4	67.9
Material	Titanium 3.7035	

Lower plate	**TMP35**	**TMP60**
Lower plate, order no.	222-1892	222-1891
Radius R_a (mm)	18.0	30.5
ΔR_a (mm)	0.025	0.025
Material	Steel 1.4305	

* The exact values are specified on the individual certificate for each rotor.

Figure 165. Viscosity measurement ranges of C35 4°/Ti and C60 4°/Ti

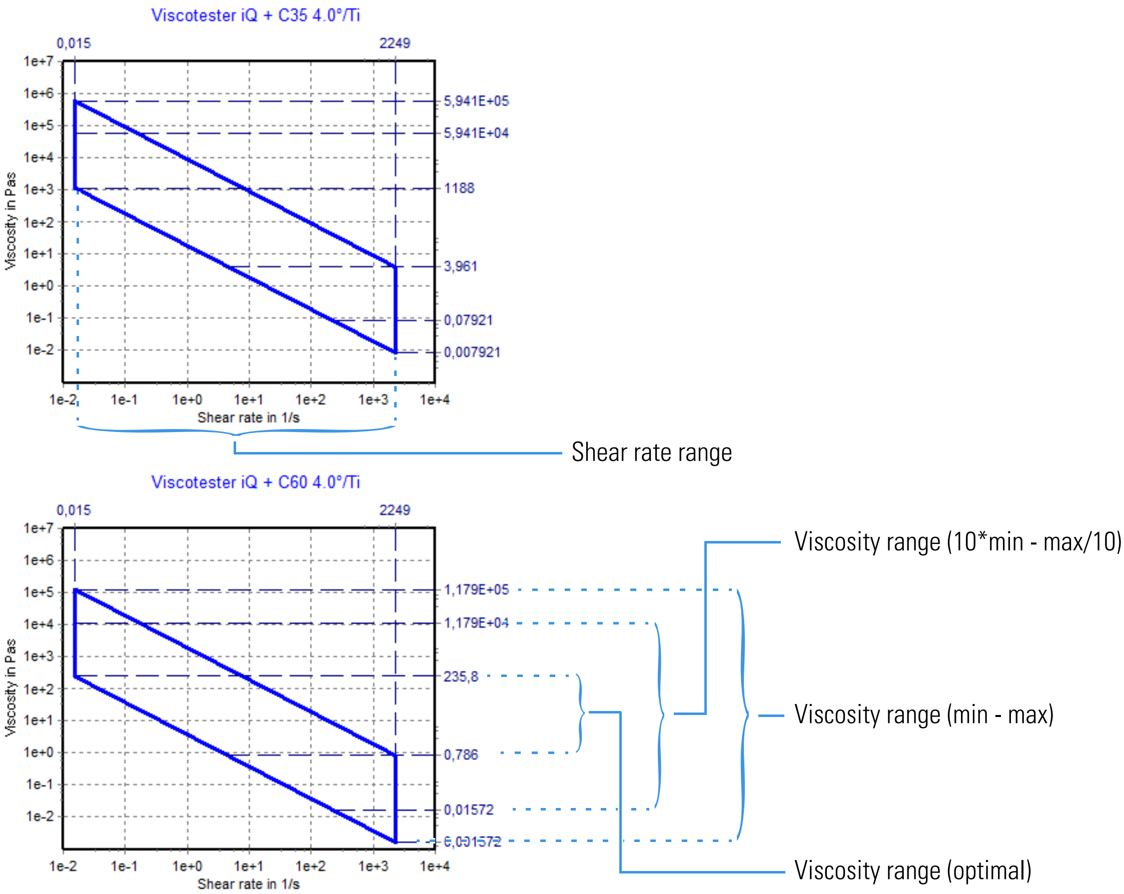


Table 28. Measurement ranges of C35 4°/Ti and C60 4°/Ti

	C35 4°/Ti		C60 4°/Ti	
	From	**To**	**From**	**To**
Strain range [a]				
Shear rate range in 1/s [b]	0.015	2250	0.015	2250
Shear stress range in Pa [c]	17.8	8909	3.54	1768
Viscosity range in Pas [d] (min - max)	0.008	5.94e+5	0.002	1.18e+5
Viscosity range in Pas [e] (10*min - max/10)	0.08	5.94e+4	0.02	1.18e+4
Viscosity range in Pas [f] (optimal)	3.96	1190	0.786	236

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Parallel plate geometries

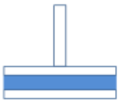


Table 29. Properties of Pxx Ti L parallel plate geometries

Measuring geometry	P20/Ti	P35/Ti	P60/Ti
Geometry factor A (Pa/Nm)	636600	118800	23580
ΔA (%)	0.3	0.2	0.1
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	10	17.5	30
ΔM (%)			
Axial gap a (mm)	variable		
Sample volume V (cm^3)	0.4	1.0	4.0
Max. temperature (°C)	200	200	200

Rotor	P20/Ti	P35/Ti	P60/Ti
Rotor, order no.	222-2024	222-2023	222-2022
Radius R_i (mm)	10	17.5	30
ΔR_i (mm)	± 0.002	± 0.0035	± 0.06
Inertia I (kg m^2 10^{-6})	0.73	1.82	13.56
Mass m (g)	42.5	47.6	70.8
Material	Titanium 3.7035		

Lower plate	TMP20	TMP35	TMP60
Lower plate, order no.	222-1893	222-1892	222-1891
Radius R_a (mm)	10.5	18.0	30.5
ΔR_a (mm)			
Material	Steel 1.4305		

* The exact values are specified on the individual certificate for each rotor.

As an easier to clean alternative to the TMP20, TM35 and TMP60 lower plates with a matching diameter, the TMP80 “EasyClean” TM-PE-C lower plate (order no. 222-2073) with a 80 mm diameter flat surface is available. This plate is manufactured from the same material as the TMPxx in Table 29.

Figure 166. Viscosity measurement ranges of P20/Ti, P35/Ti, P60/Ti (with 1.0 mm gap)

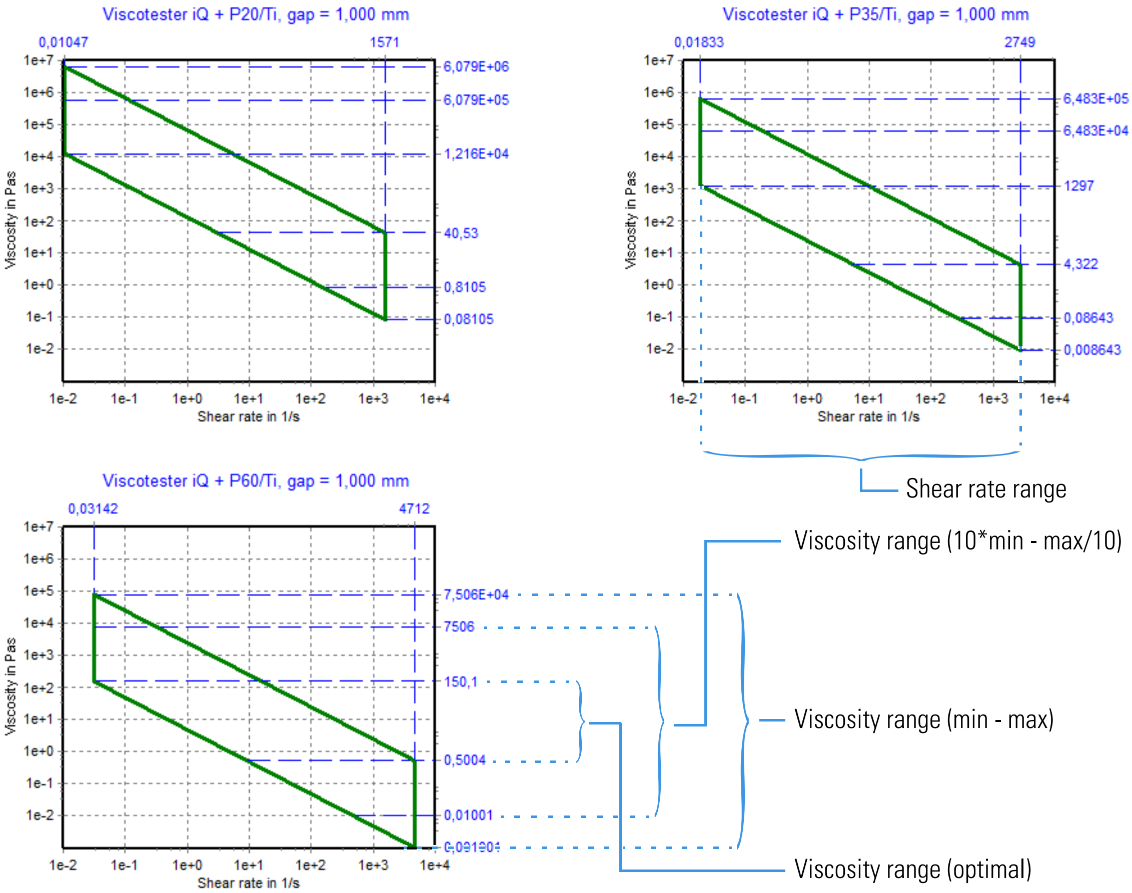


Table 30. Measurement ranges of P20/Ti, P35/Ti, P60/Ti (with 1.0 mm gap)

	P20/Ti		P35/Ti		P60/Ti	
	From	**To**	**From**	**To**	**From**	**To**
Strain range [a]						
Shear rate range in 1/s [b]	0.0105	1570	0.0183	2750	0.0314	4710
Shear stress range in Pa [c]	127	63700	23.8	11900	4.72	2360
Viscosity range in Pas [d] (min - max)	0.0811	6.08e+06	0.00864	648000	0.001	75100
Viscosity range in Pas [e] (10*min - max/10)	0.811	608000	0.0864	64800	0.01	7510
Viscosity range in Pas [f] (optimal)	40.53	12200	4.32	1300	0.5	150

[a] Theoretical maximal range based on the instruments angle resolution and the geometry factor M.

[b] Theoretical maximal range based on the instruments angular velocity range and the geometry factor M.

[c] Theoretical maximal range based on the instruments torque range and the geometry factor A.

[d] Theoretical maximal range based on the instruments angular velocity and torque range and the geometry factors M and A.

[e] Realistic range with at least one decade of usable shear rate range.

[f] Optimal range with maximum possible shear rate range.

Vane geometries

Table 31. Properties of vane geometries

Measuring geometry	FL16 4B/SS	FL22 4B/SS	FL26 2B/SS
Geometry factor A (Pa/Nm)	175000	56370	27800
ΔA (%)			
Geometry factor M ($s^{-1}/(rad/s^{-1})$)	1.0[a]	1.0[a]	1.0[a]
ΔM (%)	n.a.	n.a.	n.a.
Axial gap a (mm)	≥ 8 (23.2[b])	≥ 11 (23.2[b])	≥ 25.8 (23.2[b)])
Sample volume V (cm^3)	n.a. (23.0[b])	n.a. (28.2[b])	n.a. (35.2[b])
Max. temperature (°C)	200	200	200

Rotor	FL16 4B/SS	FL22 4B/SS	FL26 2B/SS
Rotor, order no.	222-2069	222-2070	222-2071
Radius R_i (mm)	8.0	11.0	25.8
ΔR_i (mm)	± 0.1	± 0.1	± 0.1
Length L_i (mm)	8.8	16	25.8
ΔL_i (mm)	± 0.1	± 0.1	± 0.1
Blade thickness	1.0	1.0	1.0
Number of blades	4	4	2
Inertia I ($kg\ m^2\ 10^{-6}$)	0.76	0.93	1.13
Mass m (g)	44	46	58
Material	Steel 1.4305		
Sample container			
Radius R_a (mm) [c]	≥ 17.6	≥ 32	≥ 51.6

[a] Due to the fact that there is no defined flow field a value for the shear-rate can not be calculated

[b] When using the vane in a CCB25 DIN cup 222-1956

[c] In order for wall effects to be negligible

Table 32. Measurement ranges of FL16 4B/SS, FL22 4B/SS and FL26 2B/SS

	FL16 4B/SS		FL22 4B/SS		FL26 2B/SS	
	From	**To**	**From**	**To**	**From**	**To**
Strain range [a]						
Shear rate range in 1/s [a]						
Shear stress range in Pa [b]	35.2	17600	11.3	5640	5.56	2780
Viscosity range in Pas [a] (min - max)						
Viscosity range in Pas [a] (10*min - max/10)						
Viscosity range in Pas [a] (optimal)						

[a] Due to the fact that there is no defined flow field a value for the strain, the shear-rate and the viscosity can not be calculated.
[b] Theoretical maximal range based on the instruments torque range and the geometry factor A.

Adapter ISO

The adapter ISO is designed for use with spindles according to ISO 2555 (so-called Brookfield spindles) which are originally used with the HAAKE Viscotester 6/7 and HAAKE Viscotester C/D/E range of instruments.

Figure 167. Adapter ISO dimensions

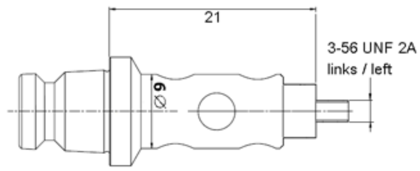


Figure 168. Adapter ISO with a selection of ISO spindles

Table 33. Part numbers

Part name	Part number
Adapter ISO	222-2200

For the part numbers of the ISO spindles see the HAAKE Viscotester 6/7 or HAAKE Viscotester C/D/E manuals or contact Thermo Fisher Scientific or your local agent.

Adapter U1

The universal adapter U1 can be used for mounting any rotor with a 6 mm diameter shaft, for example the old style FLxx rotors which were used with HAAKE RheoStress xxx and HAAKE MARS I/II instruments.

Figure 169. Adapter U1 dimensions

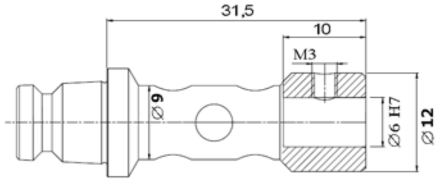


Figure 170. Adapter U1 with vanes FL22, FL26-2b and FL40

Table 34. Part numbers

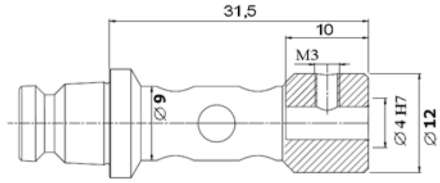
Part name	Part number
Adapter U1	222-2130
Vane rotor FL16	222-1326
Vane rotor FL22	222-1325
Vane rotor FL26-2b	222-1599
Vane rotor FL40	222-1324

Adapter U2 and U3

The universal adapters U2 and U3 can be used for mounting any rotor with a 4 mm diameter shaft, for example the FLxxx and Exxx rotors of the HAAKE Viscotester 550.

The adapter U2 is completely rigid.

Figure 171. Adapter U2 dimensions



The adapter U3 is equipped with a flexible cardan joint.

Figure 172. Adapter U3 dimensions

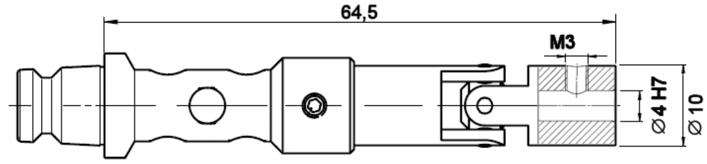


Figure 173. Adapter U2 with rotors E100, E500, FL100 and FL1000

Table 35. Part numbers

Part name	Part number
Adapter U2	222-2199
Adapter U3	222-2131

For the part numbers of the HAAKE Viscotester VT550 Exxx and/or FLxxx rotors see the HAAKE Viscotester 550 manual or contact Thermo Fisher Scientific or your local agent.

Adapter P1 and P3

The plate adapters P1 and P3 are designed for use with special disposable plates (D Pxx/Al) in combination with the TM-xx-x modules. Adapter P1 is made completely out of steel, where adapter P3 has a ceramic shaft.

Figure 174. Adapter P1 and P3 dimensions

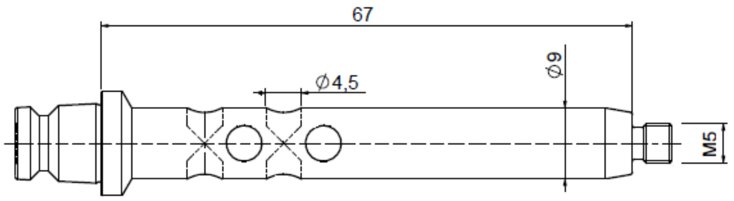


Figure 175. Adapter P1 with 8, 20, 25 and 35 mm disposable plates

Table 36. Order numbers

Part name	Part number
Adapter P1 (steel shaft)	222-2150
Adapter P3 (ceramic shaft)	222-2290
D Pxx/Al (x mm plate, 40 pcs)	see table Table 37

Table 37. Properties of D Pxx/Al parallel plate geometries with Adapter P1 or Adapter P3

Measuring geometry	**D P8/Al**	**D P10/Al**	**D P20/Al**	**D P25/Al**	**D P35/Al**	**D P60/Al**
Geometry factor A (Pa/Nm)	9947000	5093000	636600	325900	118800	23580
ΔA (%)						
Geometry factor M ($s^{-1}/(rad/s^{-1})$) [a]	4.0	5.0	10.0	12.5	17.5	30.0
ΔM (%)						
Axial gap a (mm)	variable					
Sample volume V (cm^3) [a]	0.05	0.08	0.32	0.5	1.0	2.9
Max. temperature with Adapter P1 (°C)	200	200	200	200	200	200
Max. temperature with Adapter P3 (°C)	400	400	400	400	400	400

Rotor	**D P8/Al**	**D P10/Al**	**D P20/Al**	**D P25/Al**	**D P35/Al**	**D P60/Al**
Rotor, order no. (40 pcs)	222-2152	222-2153	222-2154	222-2155	222-2156	222-2157
Radius R (mm)	4.0	5.0	10.0	12.5	17.5	30
ΔR (mm)	0.015	0.015	0.015	0.015	0.015	0.015
Inertia I with Adapter P1 (kg m^2 10^{-6})	0.438	0.441	0.527	0.67	1.403	9.53
Inertia I with Adapter P3 (kg m^2 10^{-6})	0.374	0.377	0.463	0.606	1.339	9.46
Mass m (g)	2.6	2.7	4.4	5.7	9.3	23.8
Material	AlMgSi1 (3.2315)					

Lower plate	**TMP8 Al**	**TMP10 Al**	**TMP20 Al**	**TMP25 Al**	**TMP35 Al**	**TMP60 Al**
Lower plate, order no. (100 pcs)	222-1921	222-1922	222-1924	222-1925	222-1926	222-1910
Radius R (mm)	4.5	5.5	10.5	13	18	30.5
ΔR (mm)	0.01	0.01	0.01	0.01	0.01	0.01
Material	AlMgSi1 (3.2315) or AlCu6BiPb					

[a] calculated based on an axial gap of 1.0 mm

B

Symbols, Quantities and Units

This appendix contains tables of all the quantities and their symbols and units as used in the HAAKE Viscotester iQ touchscreen panel user interface, the RheoApp software as well as in this manual.

Table 38. Instrument and general quantities

Symbol	Quantity	Unit	mult. Factor	Unit name
ϕ	Angle	rad		radiant
		mrad	0.001 rad	milli radiant
		µrad	10^{-6} rad	micro radiant
		°	$\pi/180$ rad	degree
n	Rotational speed	rpm		revolutions per minute
		1/min	1.0 rpm	revolutions per minute
Ω	Angular velocity	rad/s		radiants per second
M	Torque	N m		Newton meter
		N cm	0.01 N m	Newton centimeter
		mN m	0.001 N m	milli Newton meter
		µN m	10^{-6} N m	micro Newton meter
		dyn m	10^{-5} N m	dyne meter
		kgf m	9.80665 N m	kilogram-force meter
t	Time	s		second
		ms	0.001 s	milli second
		min	60 s	minute
		h	3600 s	hour
t-seg	Segment time	see t		
f	Frequency	Hz		Hertz
ω	Angular frequency	rad/s		radiants per second
T	Temperature	K		Kelvin
		°C		degree Celsius
		°F		degree Fahrenheit

Table 39. Rheological quantities

Symbol	Quantity	Unit		
γ	Strain or deformation	- %		
$\dot{\gamma}$	Shear rate or strain rate	1/s		one per second
τ	Shear stress	Pa mPa kPa MPa dyn/cm^2 kgf/cm^2	 10^{-3} Pa 10^3 Pa 10^6 Pa 0.1 Pa 98066.5 Pa	Pascal milli Pascal kilo Pascal mega Pascal dyne per square centimeter kilogram-force per square centimeter
η	Viscosity	Pas mPas P cP	 0.001 Pa s 0.1 Pa s 0.001 Pa s	Pascal second milli Pascal second Poise centi Poise
J	Compliance	1/Pa 1/kPa 1/MPa	 10^{-3} 1/Pa 10^{-6} 1/Pa	Pascal inverse kilo Pascal inverse mega Pascal inverse
δ	Phase angle	see ϕ		
tan δ	tangens of phase angle	-		
G’	Loss modulus	Pa kPa MPa	 1000 Pa 10^6 Pa	Pascal kilo Pascal mega Pascal
G”	Storage modulus	see G’		
G*	Complex modulus	see G’		
η'		see η		
η”		see η		
η*	Complex viscosity	see η		

C

User Privileges

This appendix contains information on the user privileges HAAKE Viscotester iQ touchscreen panel user interface and the RheoApp software.

Table 40. User privileges

	RheoApp				HMI	
Function	**Level 1**	**Level 2**	**Level 3**	**Admin** [a]	**Level 1, 2** [b]	**Level 3**
Jobs						
Create Job	✓				[c]	[c]
Rename Job	✓				✓	
Remove Job	✓				✓	
Copy Job	✓				✓	
Copy Job to other user				✓	[c]	[c]
Add/Remove elements (from Job)	✓				[c]	[c]
Edit element parameters	✓	✓			✓	
View	✓	✓	✓		✓	✓
Run	[c]	[c]	[c]	[c]	✓	✓
Data files						
Remove	✓				[c]	[c]
View	✓				[c]	[c]
Configuration						
Edit	✓				✓	✓
View	✓				✓	✓
User management						
Add/Remove user				✓	[c]	[c]

[a] Admin (Administrator) privileges are additional to level 1, level 2 or level 3 privileges.

[b] Users of level 1 and users of level 2 are treated identically in the HAAKE Viscotester iQ touch screen panel user interface (HMI).

[c] Function not implemented in RheoApp or HAAKE Viscotester iQ touch screen panel user interface (HMI).

D

Firmware update

This appendix contains information on how to update the firmware of the HAAKE Viscotester iQ.

The firmware of the HAAKE Viscotester iQ can be updated using the HAAKE Viscotester iQ update tool which can be launched from the HAAKE RheoWin software, from the HAAKE Viscotester iQ USB flash drive or from any PC after downloading the tool from the RheoWin web-site first. These three options are described below.

IMPORTANT Read this appendix completely and thoroughly before updating the firmware.

The HAAKE Viscotester iQ firmware consist of two parts, one for each of the two microprocessors which are part of the instruments electronics.

Note For each microprocessor a separate file (which contains the firmware) must be uploaded to the instrument. The version numbers of the two firmware parts are not necessary identical.

Note It is not always necessary to update the firmware of both microprocessors at the same time.

Note When the firmware is to be updated for both microprocessors at the same time, the order in which they are updated is not important.

Table 41. Microprocessors and firmware files

Microprocessor	Tasks	Firmware filename
µC1	User interface control, Job control, TM-PE-C control, communication with PC, USB control	VTIQ-V1-xx.xx.xxx.bin[a]
µC2	EC drive motor control	VTIQ-V2-xx.xx.xxx.i00[a]

[a] Here xx.xx.xxx stands for the actual version number.

In case the HAAKE Viscotester iQ user interface (HMI = Human Machine Interface) is modified (or when a new user interface language is available), the user interface must (can) be updated as well. Updating the user interface is performed with the HAAKE Viscotester iQ update tool as well.

Information on the current firmware versions as well as download links for the firmware and HMI files are available in the HAAKE Viscotester iQ section on the www.rheowin.com/firmware.htm web page.

Update from HAAKE RheoWin

The HAAKE Viscotester iQ Update Tool is part of the HAAKE RheoWin installation and can be comfortably accessed from the HAAKE RheoWin JobManager.

❖ To launch the HAAKE Viscotester iQ Update Tool from HAAKE RheoWin

1. Establish a hardware (cable) connection between the PC (on which HAAKE RheoWin is running) and the HAAKE Viscotester iQ and make sure the PC network interface is configured correctly.

   When the PC with HAAKE RheoWin was already used for controlling the HAAKE Viscotester iQ the network connection is already setup. If not see "Setting up a HAAKE Viscotester iQ using a point-to-point network" on page 90 for detailed information.

   > **WARNING** Only use a point-to-point network connection for updating the firmware. Do *not* update the firmware using a company (LAN) network connection.

2. Start the HAAKE RheoWin JobManager software.
3. Choose **Configuration > DeviceManager** to open the DeviceManager dialog.
4. In the Rheometer/Viscometers list select **Viscotester iQ**.
5. Click the **Edit** button to open the Properties of 'Viscotester iQ' dialog.
6. Click the **Firmware** tab.

   The Firmware page appears.

7. Click the **Launch update tool** button.

   The HAAKE Viscotester iQ Update Tool program window appears.

   > **Note** In case the HAAKE Viscotester iQ Update Tool program window does not appear the program can be launched by navigating to the `c:\Program Files\Thermo\RheoWin` directory and running the `VTiQUpdate.exe` program.

8. See "Updating the firmware using the HAAKE Viscotester iQ Update Tool," on how to use the HAAKE Viscotester iQ Update Tool program.

Update from the HAAKE Viscotester iQ USB flash drive

The HAAKE Viscotester iQ update tool can be run directly from the USB flash drive, it does not need to be installed first.

❖ To launch the HAAKE Viscotester iQ Update Tool from the HAAKE Viscotester iQ USB flash drive

1. Establish a hardware (cable) connection between the PC (to which the USB flash drive is plugged in) and the HAAKE Viscotester iQ and make sure the PC network interface is configured correctly.

   See "Setting up a HAAKE Viscotester iQ using a point-to-point network" on page 90 for detailed information.

> **WARNING** Only use a point-to-point network connection for updating the firmware. Do *not* update the firmware using a company (LAN) network connection.

2. Using the Windows Explorer browse to the `Firmware Update Tool` directory on the HAAKE Viscotester iQ USB flash drive.

3. Run the program `VTiQUpdate.exe.`

   The HAAKE Viscotester iQ Update Tool program window appears.

4. See "Updating the firmware using the HAAKE Viscotester iQ Update Tool," on how to use the HAAKE Viscotester iQ Update Tool program.

Update after downloading the HAAKE Viscotester iQ update tool

In case neither a PC with HAAKE RheoWin already installed for the Viscotester iQ nor the HAAKE Viscotester iQ flash drive is available, the HAAKE Viscotester update tool can be downloaded from the internet and installed on any PC running the Windows (XP or newer) operating system.

❖ To download and launch the HAAKE Viscotester iQ Update Tool

1. Using a suitable internet browser navigate to the www.rheowin.com/firmware.htm web page.

2. From the HAAKE Viscotester iQ section of that web page download the `VTIQ_Update_Tool_xxxx.zip` file (`xxxx` stands for the actual version number).

3. Unzip the **`VTIQ_Update_Tool_xxxx.zip`** file in a new and empty directory.

4. Establish a hardware (cable) connection between the PC (on which the VTIQ_Update_Tool.zip file was unzipped) and the HAAKE Viscotester iQ and make sure the PC network interface is configured correctly.

   See "Setting up a HAAKE Viscotester iQ using a point-to-point network" on page 90 for detailed information.

> **WARNING** Only use a point-to-point network connection for updating the firmware. Do *not* update the firmware using a company (LAN) network connection.

5. Run the program `VTiQUpdate.exe.`

   The HAAKE Viscotester iQ Update Tool program window appears.

6. See "Updating the firmware using the HAAKE Viscotester iQ Update Tool," on how to use the HAAKE Viscotester iQ Update Tool program.

Updating the firmware using the HAAKE Viscotester iQ Update Tool

When the HAAKE Viscotester iQ Update Tool was launched for the first time from a certain location (path) on a PC, a Windows Security Alert dialog (issued by the Windows Firewall), see Figure 176, may pop up. When a different Firewall software is used, another but similar dialog may pop up.

Note Sometimes the security alert dialog does pop up but stays in the background (behind other windows) and is not (easily) visible.

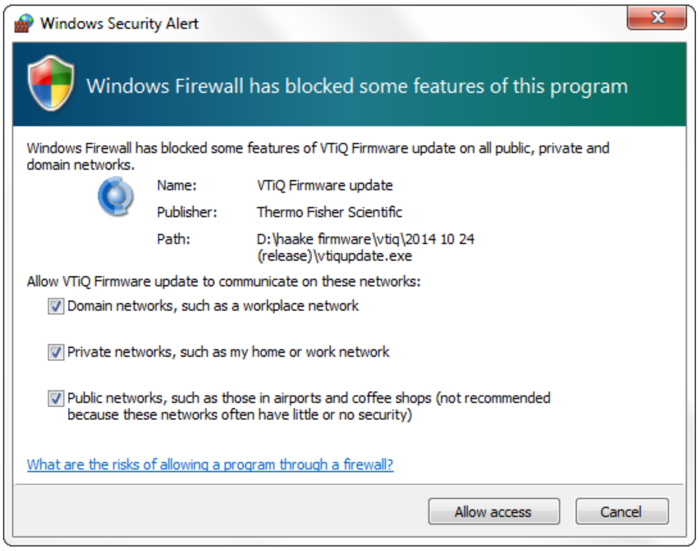
IMPORTANT In the Windows Security Alert dialog (or in a similar dialog from another Firewall software) the Viscotester iQ Update Tool *must* be allowed to communicate over all the listed networks, otherwise updating the firmware or HMI will *not* work. Depending on the computer, up to three networks can be listed.

IMPORTANT When the Viscotester iQ Update Tool is launched from a different location on the same computer later, the Windows Security Alert dialog will pop up again, and the communication over all listed networks *must* be allowed again.

❖ To allow communication on the listed networks

1. In the Windows Security Alert dialog select the **Domain networks**..., **Private networks**... and **Public networks**... checkbox(es) when available.

   Figure 176. Windows Security Alert dialog

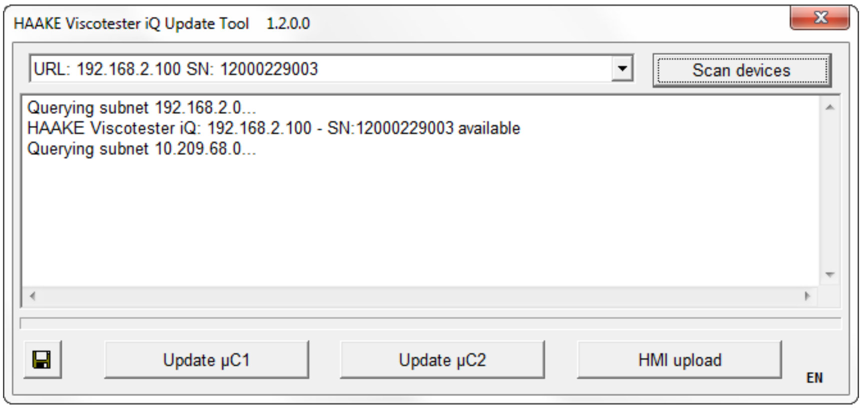
2. Click **Allow access** to close the dialog.

After the HAAKE Viscotester iQ Update Tool has been launched (and the communication on the network(s) allowed), proceed as described in the following procedure to update the firmware.

❖ To update the HAAKE Viscotester iQ firmware

After the update tool is launched it will automatically search for HAAKE Viscotester iQ instruments connected to the PC the update tool is running on, and display the instrument(s) found in a list, showing the URL and the serial number (SN) of the instrument(s), see Figure 177.

Figure 177. The HAAKE Viscotester iQ Update Tool program window



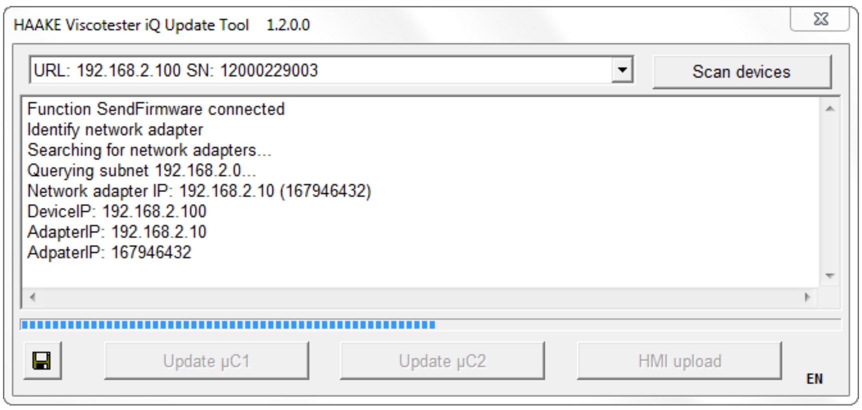
1. Select the instrument for which the firmware is to be updated from the list by referring to its serial number.

> **Note** Since in most cases only one HAAKE Viscotester iQ will be connected to the PC the correct instrument will automatically be selected.

2. Click the **Update** µ**C1** button to update the firmware for microprocessor µC1,
   or
   Click the **Update** µ**C2** button to update the firmware for microprocessor µC2.

   Status information on the network connection will appear, see Figure 178.

Figure 178. Network status information



Directly after that the Windows file open dialog will appear, see Figure 179 or Figure 180.

Figure 179. Window file open dialog for the microprocessor µC1 firmware file

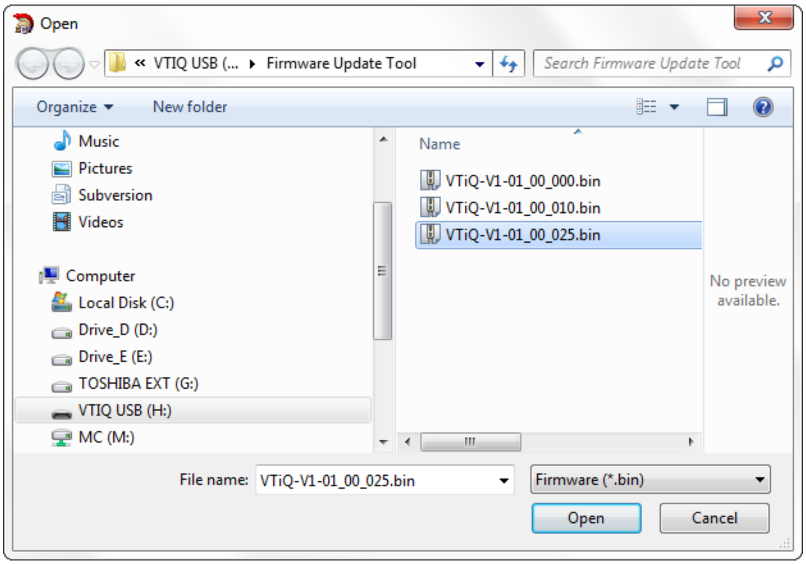
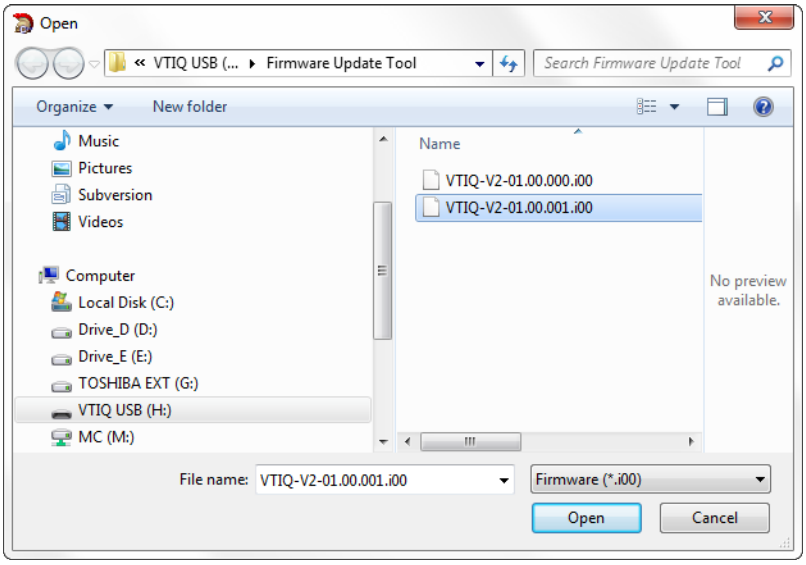


Figure 180. Window file open dialog for the microprocessor µC2 firmware file



3. Navigate to the directory where the firmware files are stored and select the file for the microprocessor µC1 (with the extension `.bin`) or for the microprocessor µC2 (with the extension `.i00`) that is to be used for the update.

4. Click the **Open** button to initialize the firmware update process.

   Status information on the selected firmware file and processor will appear, see Figure 181 or Figure 182.

Figure 181. Firmware status information for the microprocessor µC1 file

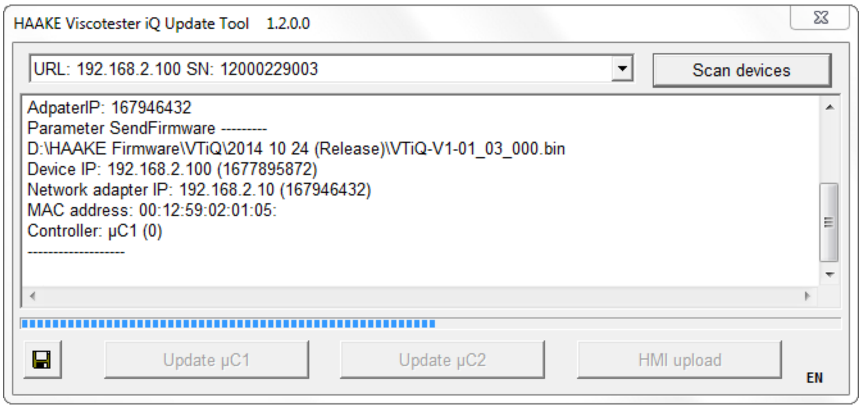
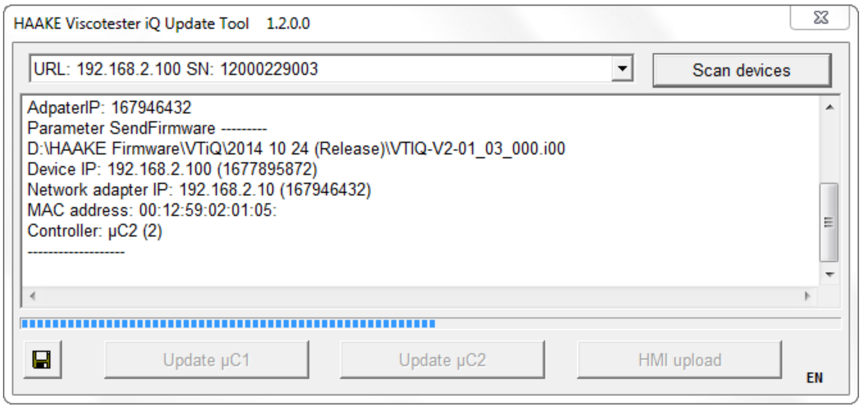
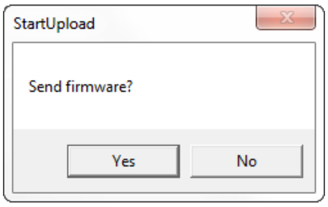


Figure 182. Firmware status information for the microprocessor µC2 file



Directly after that the StartUpload confirmation dialog will appear, see Figure 183.

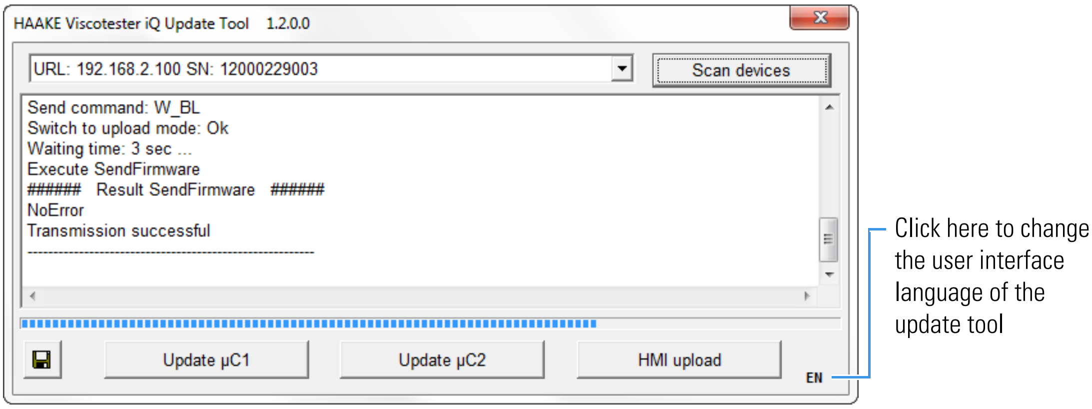
Figure 183. Confirmation dialog



5. Click the **Yes** button to start the actual firmware update process.

   Status information on the firmware update process will appear, see Figure 184.

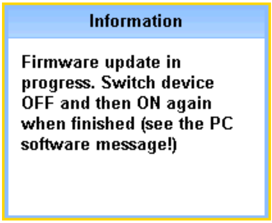
Figure 184. Update process status information



The text `Transmission successfull` will appear, after about 10 seconds, when the firmware update process was successfully finished. At the same time a popup message will appear on the HAAKE Viscotester iQ touchscreen, see Figure 185.

> **IMPORTANT** When the text `Transmission successfull` does not appear within 20 seconds after clicking the Yes button in the StartUpload confirmation dialog (see Figure 183) proceed to step 6 anyway and then restart the update process by starting at step 1 again.

Figure 185. Touchscreen popup message



6. Switch the HAAKE Viscotester iQ off and on again using the operating switch on the right side of the instrument head, see Figure 6 on page 6 in Chapter 2, “Functional Elements,” of the HAAKE Viscotester iQ Instruction Manual.

   > **Note** The HAAKE Viscotester iQ must be switched off and on again before the firmware of the other microprocessor can be updated. See step 6 of this procedure.

7. Return to step 1 of this procedure to update the firmware of the other microprocessor if required. In this case click the **Scan devices** button before starting the second update.

8. Click the **Close** button , to close the HAAKE Viscotester iQ Update Tool program window.

Updating the HMI using the HAAKE Viscotester iQ Update Tool

After the HAAKE Viscotester iQ Update Tool has been launched, proceed as described in the following procedure to update the HMI.

❖ To update the HAAKE Viscotester iQ HMI

After the update tool is launched it will automatically search for HAAKE Viscotester iQ instruments connected to the PC the update tool is running on, and display the instrument(s) found in a list, showing the URL and the serial number (SN) of the instrument(s), see Figure 177.

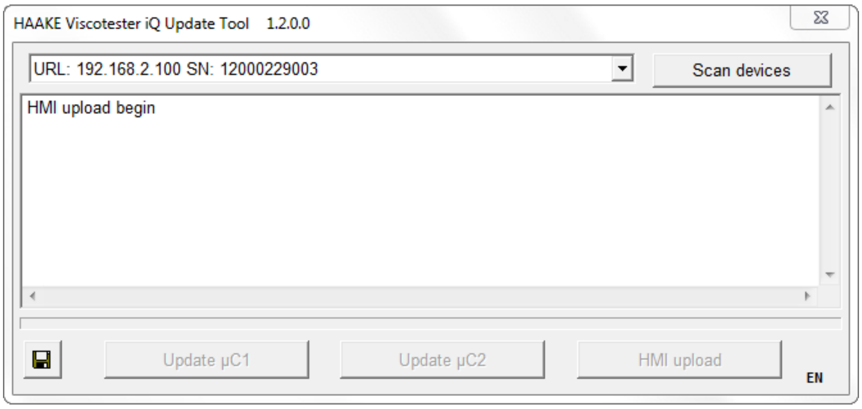
1. Select the instrument for which the HMI is to be updated from the list by referring to its serial number.

   > **Note** Since in most cases only one HAAKE Viscotester iQ will be connected to the PC the correct instrument will automatically be selected.

2. Click the **HMI Upload** button to update the HMI.

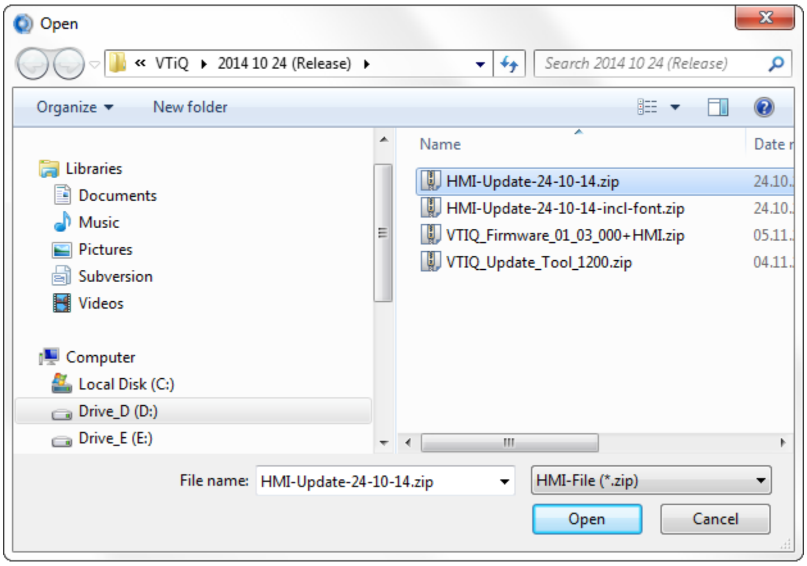
   Status information on the HMI update process will appear, see Figure 186.

Figure 186. HMI update status information



Directly after that the Windows file open dialog will appear, see Figure 187.

Figure 187. Window file open dialog for HMI update file



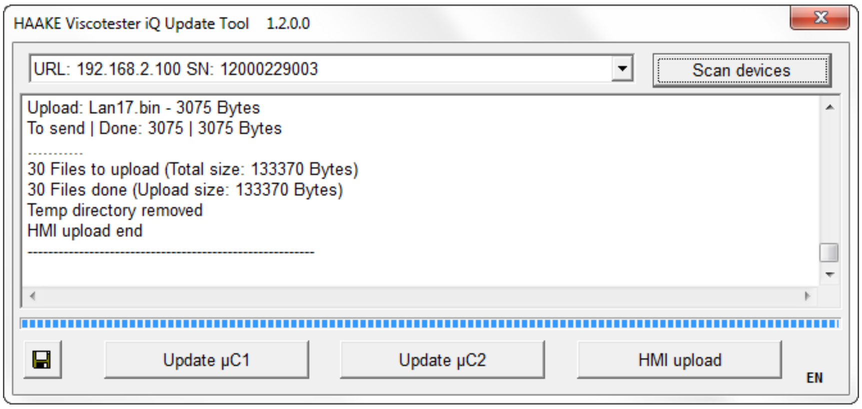
3. Navigate to the directory where the HMI update files are stored and select the file `HMI-Update-xx-xx-xx.zip` (where `xx-xx-xx` stands for the actual date).

IMPORTANT Select the file `HMI-Update-xx-xx-xx-incl-font.zip` only when the firmware for the µC1 was just updated from an (older) 01.01.xxx version to a 01.02.xxx or newer version.

4. Click the **Open** button to initialize the HMI update process.

   Status information on the HMI update will now appear, see Figure 188.

Figure 188. HMI update status information



The text `HMI upload end` will appear, after about 20 seconds, when the HMI update process was successfully finished.

> **Note** Updating the HMI using an update file that includes a font will take approximately 3 minutes and 20 seconds.

5. Switch the HAAKE Viscotester iQ off and on again using the operating switch on the right side of the instrument head, see Figure 6 on page 6 in Chapter 2, "Functional Elements," of the HAAKE Viscotester iQ Instruction Manual.

6. Click the **Close** button , to close the HAAKE Viscotester iQ Update Tool program window.

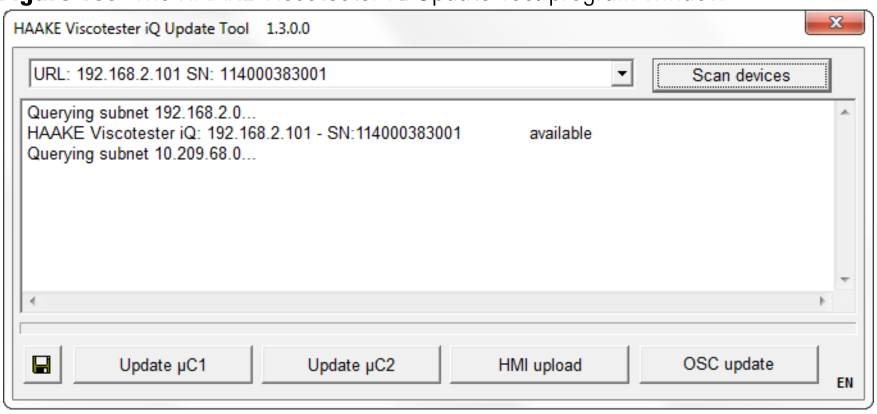
Applying the OSC Update using the HAAKE Viscotester iQ Update Tool

The HAAKE Viscotester iQ rheometer is equipped with an optional oscillation mode which can be activated any time by applying the OSC Update (order number 222-2207). The OSC Update consists of an installation key which must be entered in a dialog using the HAAKE Viscotester iQ Update Tool.

❖ To enter the installation key

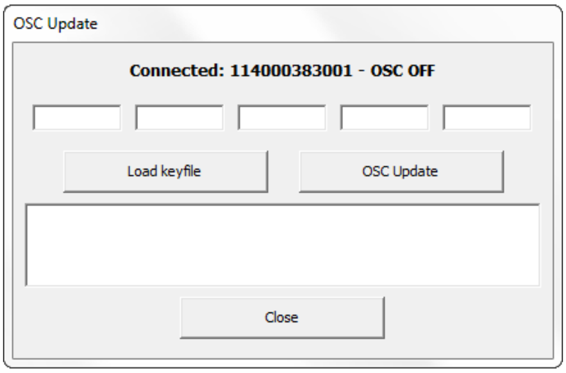
1. Launch the HAAKE Viscotester iQ Update Tool (version 1.3.0.0) or newer.

Figure 189. The HAAKE Viscotester iQ Update Tool program window



2. Click the **OSC update** button to open the OSC Update dialog. The number behind Connected is the serial number of the Viscotester iQ which must match the serial number in the installation key. The text OSC OFF indicates that the oscillation option is not yet activated.

Figure 190. OSC Update dialog



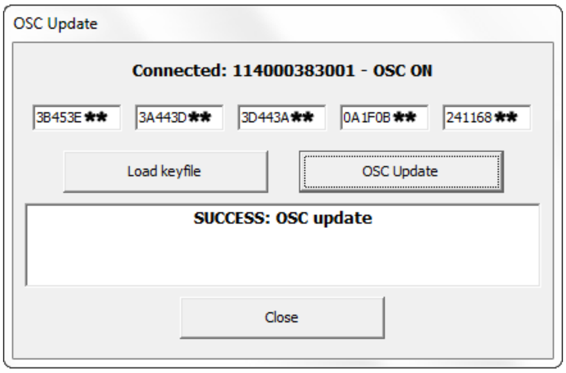
3. Enter the key information in the five edit fields above the two buttons.

   or

   Click the **Load keyfile** button to read the key information from a key file if available.

4. When the update was successful the text SUCCESS OSC update will be displayed in the area below the two buttons

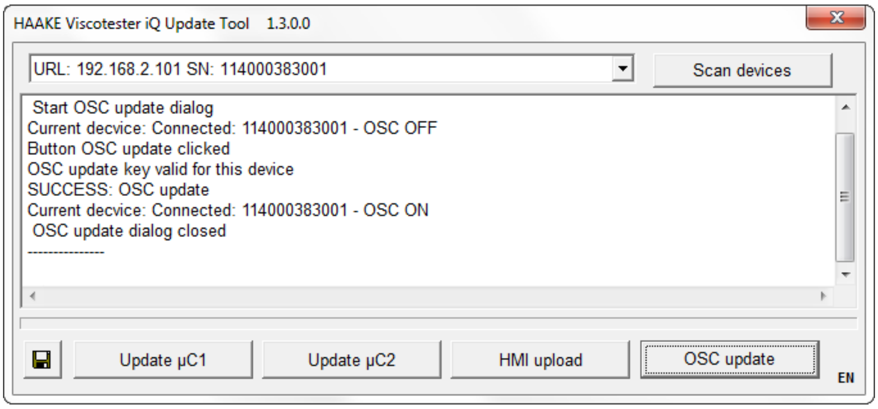
   Figure 191. OSC Update dialog after entering the key



5. Click the **Close** button to close the OSC Update dialog.

   A confirmation text for the update is now displayed in the HAAKE Viscotester iQ Update Tool program window.

   Figure 192. OSC update status information



6. Click the **Close** button, to close the HAAKE Viscotester iQ Update Tool program window.

7. On the Viscotester iQ touchscreen panel tap the **Configuration** button.

8. In the Configuration menu select **Device info**.

   In the first line of the Device info menu the text OSC should now be displayed to show that the oscillation option is activated. See Figure 59 on page 48.

Troubleshooting Firewall and other network settings

In case the HAAKE Viscotester iQ Update Tool does not transfer the firmware and/or HMI files to the instrument as intended, check the firewall and network settings as described below.

Basic Firewall settings

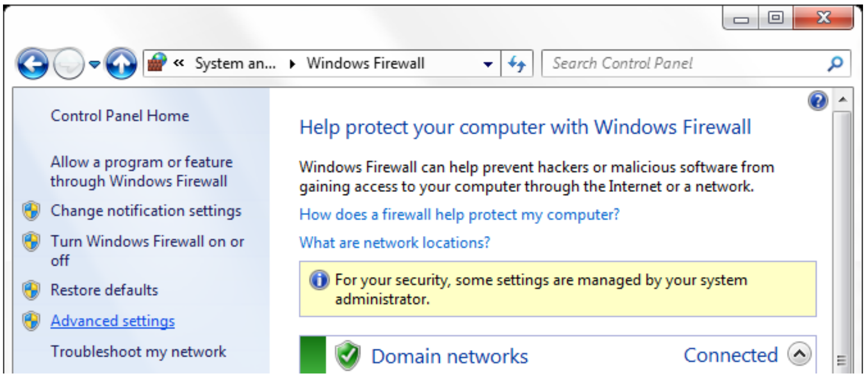
In case the HAAKE Viscotester iQ Update Tool does not work, first check whether the settings in the Firewall program used on the computer are correct.

Note The following procedure describes how to check the settings in the Windows Firewall program. In other IT environments other Firewall programs may be used.

❖ To check the Windows Firewall settings for the HAAKE Viscotester iQ Update Tool

1. In the Windows Control Panel select **System and Security > Windows Firewall**, then select **Advanced settings** (on the right hand side of the dialog) see Figure 193, to open the Windows Firewall with Advanced Security dialog.

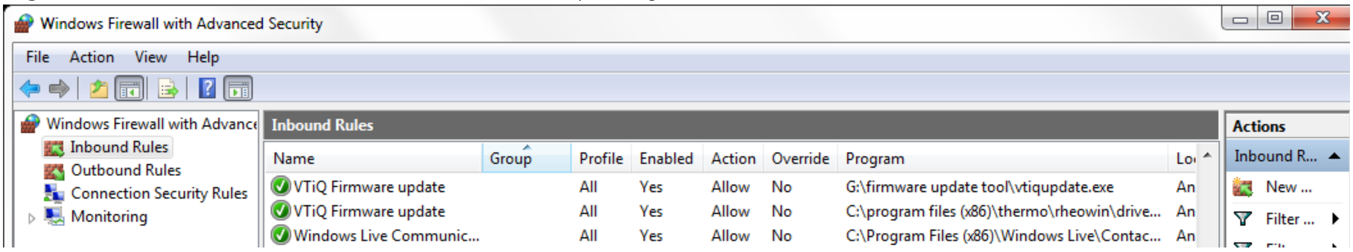
Figure 193. Firewall dialog in Windows Control Panel



2. In the Windows Firewall with Advanced Security dialog select **Inbound Rules** then scroll down to **VTiQ Firmware update**, in the Inbound Rules list, see Figure 194.

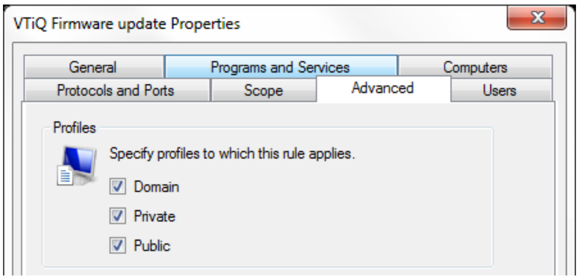
Note There may be multiple entries for VTiQ Firmware update in the list because there is an entry for every path the program was launched from.
Note Entries for VTiQ Firmware update in the list that are not needed anymore can be deleted. When all entries are deleted the Windows security alert dialog, see "To allow communication on the listed networks," will pop-up again on the next launch of the HAAKE Viscotester iQ Update Tool.

Figure 194. Windows Firewall with Advanced Security dialog



3. Double click on the **VTiQ Firmware update** entry that needs to be checked, to open the VTiQ Firmware update Properties dialog, see Figure 195.

   Figure 195. VTiQ Firmware update Properties dialog

4. In the VTiQ Firmware update Properties dialog make sure that the check boxes for **Domain**, **Private** and **Public** are all selected (when available).

5. Close all Firewall and Control Panel dialogs.

The Bootp protocol

In case the (basic) Firewall settings are ok and updating the firmware still does not work, check whether the Firewall allows the so called Bootp protocol to run on the PC. Although the Bootp protocol, as defined in RFC 951 is a standard RFC 951 network protocol, it is often blocked (by IT policies in the Firewall) in company networks.

IMPORTANT The Bootp protocol *must* be allowed (not blocked) on the PC otherwise the HAAKE Viscotester iQ Firmware Updater will *not* work.

At Thermo Fisher Scientific the Bootp protocol is (was) blocked by default on all company notebooks by the McAfee Host Intrusion Prevention program.

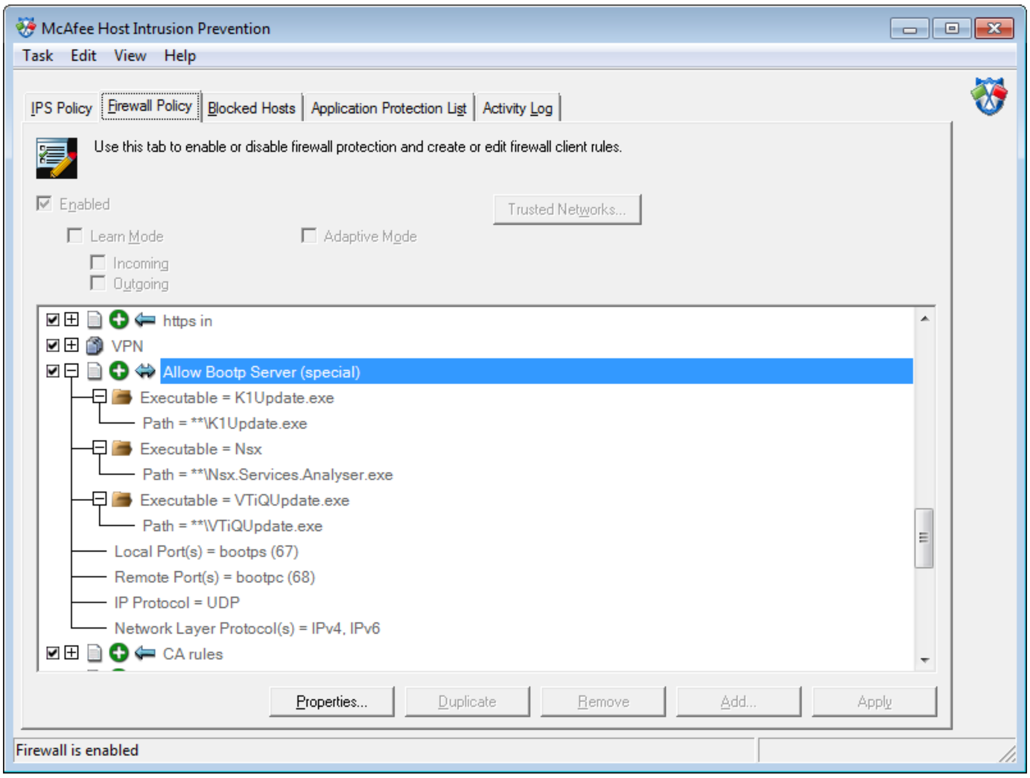
Note The following procedure describes how to check the settings in the McAfee Host Intrusion Prevention (McAfee Firewall) program. In other IT environments other Firewall programs may be used.

❖ To check the Bootp settings in McAfee Host Intrusion Prevention (McAfee Firewall)

1. Navigate to the directory `c:\Program Files\McAfee\Host Intrusion Prevention` and run the program **McAfeeFire.exe**.

2. In the McAfee Host Intrusion Prevention program window select the **Firewall policies** page, see Figure 196.

Figure 196. McAfee Firewall dialog



3. In the list scroll down to the **Allow Bootp Server (special)** entry (just below the VPN entry).
4. Check whether **VTiQupdate.exe** is listed as an executable file.

   If this is not the case consult the IT department of your company to unblock the Bootp protocol.

Air Compressor

This appendix contains information on the optional SICOLAB 38 mini air compressor for the HAAKE Viscotester iQ Air that is available from Thermo Fisher Scientific.

Figure 197. SICOLAB 38 mini air compressor with external (water) filter and pressure regulator unit

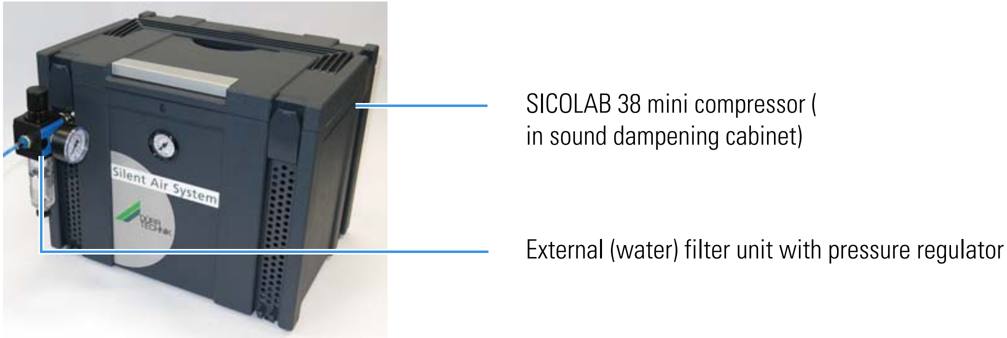
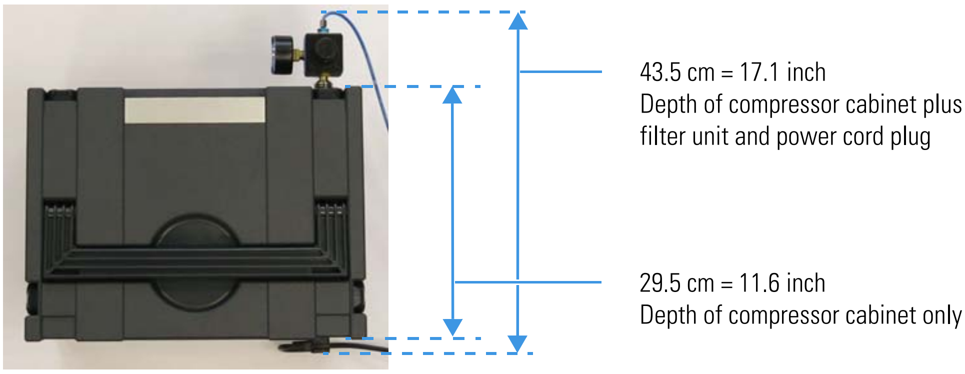


Table 42. Properties of the SICOLAB 38 mini air compressor

Property	Value
Compressor type	Oil free with 3 l vessel
Dimensions of cabinet only (W x D x H)	395 mm x 295 mm x 325 mm 15.5 inch x 11.6 inch x 12.8 inch
Dimensions with power cord & filter unit (W x D x H)	395 mm x 435 mm x 325 mm 15.5 inch x 17.1 inch x 12.8 inch
Weight	17 kg = 37.5 lbs
Duty cycle with Viscotester iQ Air (P = 2.0 bar)	1 minute on / 2 minutes off
Noise level	≈ 50 dB(A)

Figure 198. SICOLAB mini 38 compressor top view with dimensions



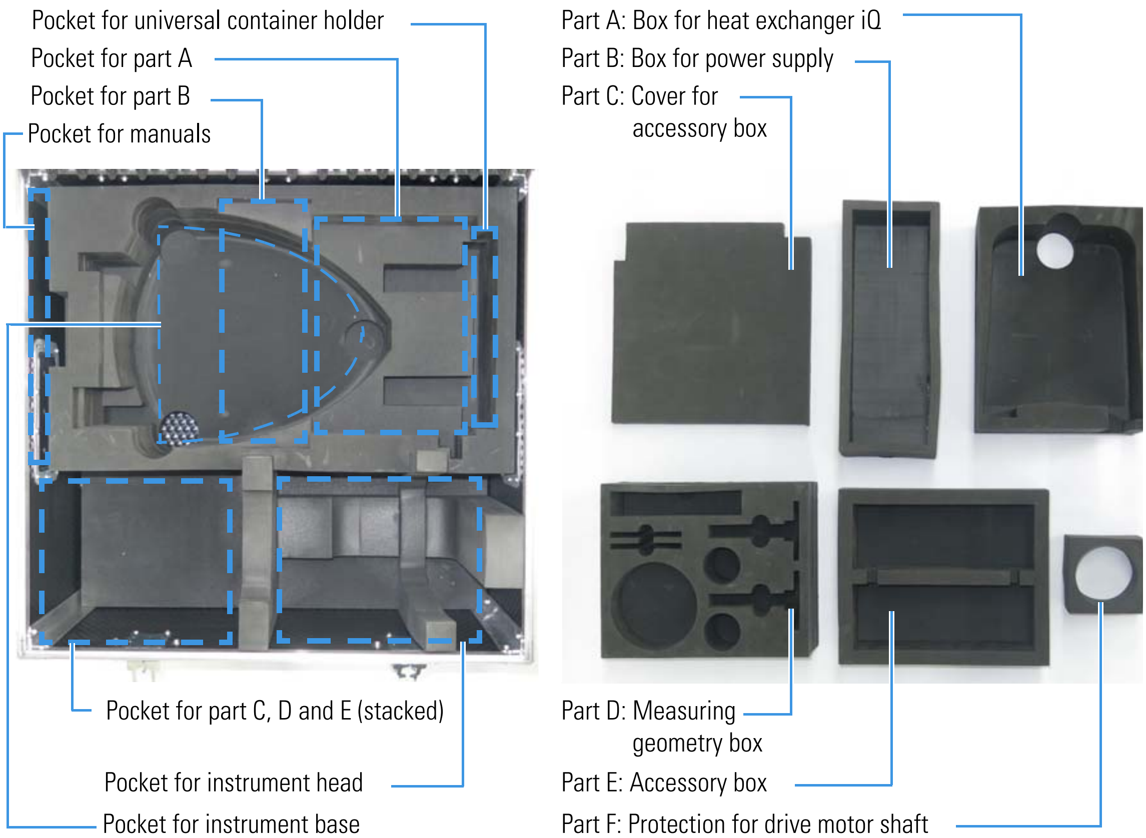
Transport case

This appendix contains information on the trolley like transport case that was especially designed for the HAAKE Viscotester iQ, Reference Manual.

The HAAKE Viscotester iQ, Reference Manual transport case is equipped pockets for the various parts of the instrument and with especially designed boxes with pockets for the various accessories, see Figure 199.

The dimensions of the HAAKE Viscotester iQ, Reference Manual transport case are 500 mm x 375 mm x 520 mm (W x D x H), the weight of the empty transport case is 10.5 kg. The maximum weight of the completely packed transport case is approximately 30 kg.

Figure 199. Transport case (empty) with inlays (empty)



❖ **To pack the HAAKE Viscotester iQ and its accessories in the transportation case**

1. Switch the instrument off and disconnect all cable connections, also disconnect the mains cable from the power supply.

In case a TM-PE-C or TM-PE-P is mounted on the instrument:

2. Dismount TM-PE-C or TM-PE-P from the instrument base.
3. Disconnect the cable and the hoses between TM-PE-C or TM-PE-P and HXiQ.
4. Dismount the HXiQ from the instrument base.
5. Mount the TM-PE-C or TM-PE-P back on the instrument base.

In case a TM-LI-Cxx or TM-LI-P is mounted on the instrument:

6. Disconnect the cable and the hoses between the TM-LI-Cxx or TM-LI-P and the circulator.

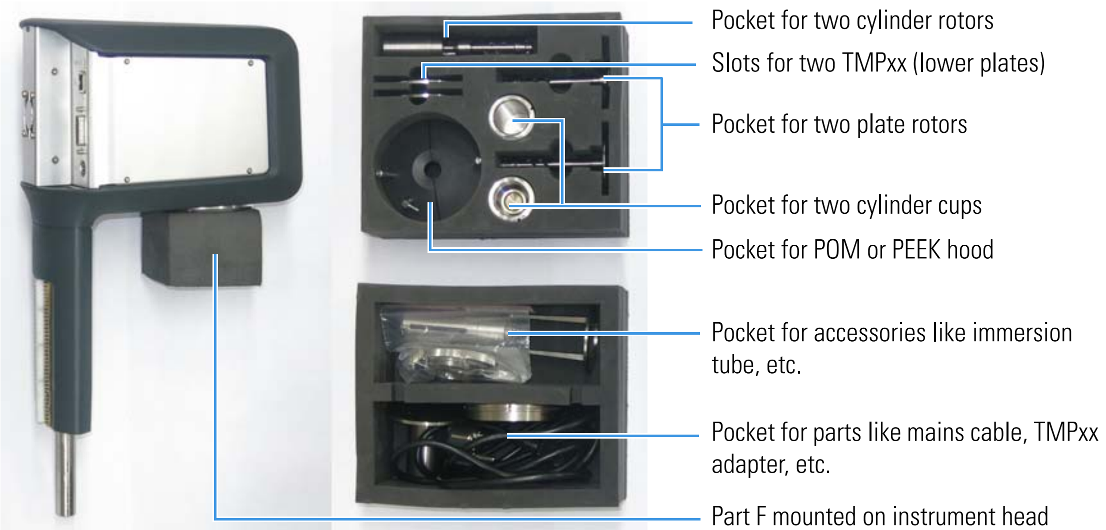
In case the universal container holder is mounted on the instrument:

7. Dismount the universal container holder from the instrument base.

In all cases:

8. Remove the instrument head from the instrument base.
9. Fold the lift hand wheel crank handle into the lift hand wheel.
10. Place the instrument base with the TM-xx-x mounted in its designated pocket in the transportation case.
11. Place the universal container holder in its designated pocket in the transportation case (if applicable).
12. Place the measuring geometries, hood, power cable, etc. in their designate pockets in the accessories box (Part E) and the geometry box (Part D).
13. Mount the protection for the drive motor shaft (Part F) on the instrument head.

Figure 200. Instrument head and accessories and geometry boxes



14. Place the accessories box (Part E) and the geometry box (Part D) in the designated pockets in the transportation case. See Figure 199 for a description of part D and part E.
15. Place the manuals in the designated pocket in the transportation case.

The inside of the transportation case should now look like in Figure 201.

Figure 201. Transportation case partly packed.

16. Place the cover (Part C) on top of the accessory box and geometry box.

17. Place the instrument base in its designated pocket in the transportation case.

18. Place the power supply in its box (Part B) and place the box in its designated pocket in the transportation case.

19. Place the heat exchanger iQ in its box (Part A) and place the box in its designated pocket in the transportation case. Carefully guide the cables and the hoses between the box (Part A) and the instrument head, see Figure 202.

    The inside of the transportation case should now look like in Figure 202.

Figure 202. Transportation case packed

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