Operation Instructions

RSX

PROPRIETARY RIGHTS NOTICE

This manual contains valuable information and material developed by AMETEK Brookfield for use with the RSX Rheometer. No part of this manual can be reproduced or transmitted in any form or by any means, electronic, mechanical or otherwise. This includes photocopying and recording or in connection with any information storage or retrieval system without the express written permission of AMETEK Brookfield.

ALL RIGHTS RESERVED

Table of Contents

1. INTRODUCTION

The RSX Rheometer is a rotational, controlled-stress, and controlled rate rheometer used in quality control, product development and research. The measuring drive developed for this instrument utilizes a high-precision dynamic drive system with optical encoder for absolute position measurement of spindle deflection.

THERE ARE TWO BASIC METHODS OF MEASUREMENT AVAILABLE WITH THE RSX RHEOMETER:

- Rotational measurement under controlled shear rate
- Rotational measurement under controlled shear stress

The RSX Rheometer has all the functionality of a standard AMETEK Brookfield rotational viscometer, performing rotational tests with pre-set speed or shear rate. The RSX Rheometer is powerful for its additional ability to perform tests with a pre-set torque or shear stress and measure the resulting shear deformation of the test substance via angular deflection of the measuring element.

The RSX Rheometer's unique controlled stress capabilities can be used for experiments such as the precise measurement of a test material's yield point without the need to shear the substance or the measurement of a material's creep behavior and its recovery after shearing.

In addition, the RSX Rheometer is equipped with a powerful motor with a usable torque range of 0.1 to 200 milli-Newton-meters. As a result, the RSX Rheometer is appropriate for rheological measurements over a wide range of test material viscosities.

The RSX Rheometer has the following features:

- Digital control of rotational speed, shear rate, torque, or shear stress
- Pre-designed measurement programs for analysis of viscosity flow curves, creep and recovery
- Behavior, yield stress, and thixotropic properties
- Automatic adjustment of control parameters during measurement
- Direct indication of measured and calculated values of speed, shear rate, torque, shear stress, viscosity, temperature, and time
- Graphical display of measured results in real time
- Internal storage of data including test parameters, measured values, and calculated values
- User interface via touch screen display
- Quick-connect coupling system for easy spindle attachment
- Barcode reader for automatic spindle recognition
- USB port for connection to computer or USB flash drive
- Operation in standalone mode via touch screen display or with a computer system running Rheo3000 application software

The RSX Rheometer includes the following:

- Assembled RSX Rheometer
- Power cord
- Operating Instructions
- Certification of Test
- AMETEK Brookfield's Rheo3000 Software (30-day trial)

- PC-USB Cable (A-B)
- Courtesy Package of RSX Series Rheometer Screen Protectors

Measuring systems and accessories for the RSX Rheometer must be ordered separately according to the user's measuring requirements.

The following additional services are available for the RSX Rheometer:

- Start-up Assistance
- Instrument Training
- Rheo3000 Software Training
- IQ, OQ, PQ (Installation, operation, and performance qualification)

1.1 Models of the RSX Rheometer

This manual addresses all models of the RSX Rheometer. When using the operating instructions provided by this manual, it is important to understand which model of the RSX Rheometer is being used. To identify the exact model of an RSX Rheometer, inspect the instrument's part number (PN). Every instrument has its part number listed on a label on the back of the instrument.

Available models of the RSX Rheometer are as follows:

RSX-CC Rheometer:

The RSX-CC is a coaxial cylinder rheometer with DIN geometries for single point QC test or full rheological profiling.

RSX-SST Rheometer:

The RSX-SST is a soft-solids tester for pastes, slurries, and materials with particulates.

RSX-CPS Rheometer:

The RSX-CPS is a cone-plate/plate-plate rheometer used for small sample volumes and a wide range of shear rates. The RSX-CPS features automatic gap setting as standard.

The RSX-CPS has two options for temperature control:

- RSX-CPS-FH: For use with a circulating temperature bath (-20°C to 200°C)
- RSX-CPS-PA: With Peltier air temperature control (20°C Below Ambient to 180°C)

1.2 Rheometer System Configuration

1.2.1 RSX-CC Rheometer

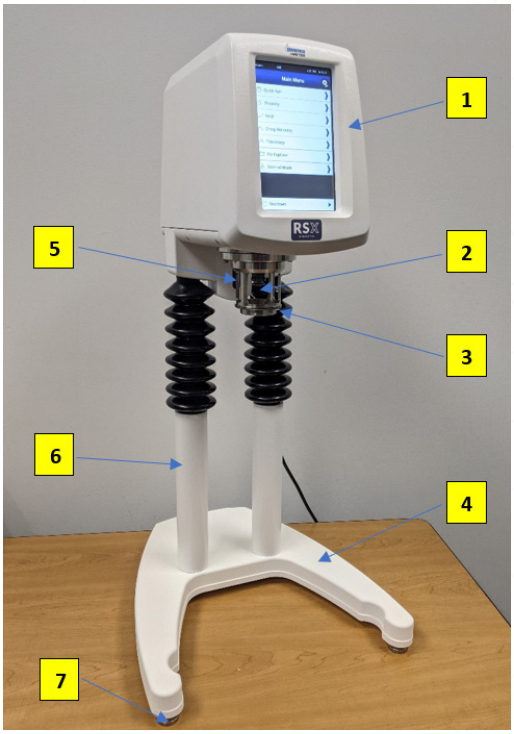


Figure 1-1

Components:

1	Rheometer head with touchscreen	5	Barcode reader
2	Measuring spindle coupling	6	Stand
3	Seat flange for sample cup	7	Leveling Foot
4	Stand base plate		

The basic configuration for the RSX-CC Rheometer includes:

- Instrument as shown above, including CC adapter flange
- Power cord

Measuring systems and accessories are not included with the RSX Rheometer and must be ordered according to the user's measuring requirements. Refer to Appendix D for details on available measuring systems.

Measurement Elements and Accessories that are used with the RSX-CC Rheometer include:

- Coaxial cylinder measuring systems. The spindle material is 316 stainless steel (Titanium optional for certain spindles). Chambers normally made of hard-anodized aluminum.
- Special measuring systems such as vane spindles
- Temperature sensor Pt100 (PN: PT-E)
- Water jacket for temperature control with coaxial cylinder measuring systems and certain vane spindles (PN: FTKY3)
- Circulating temperature bath (PN: TC-550 or TC-650)
- Concentric cylinder mounting adapter for water jacket
- Computer system
- Rheo3000 Software

1.2.2 RSX-SST Rheometer

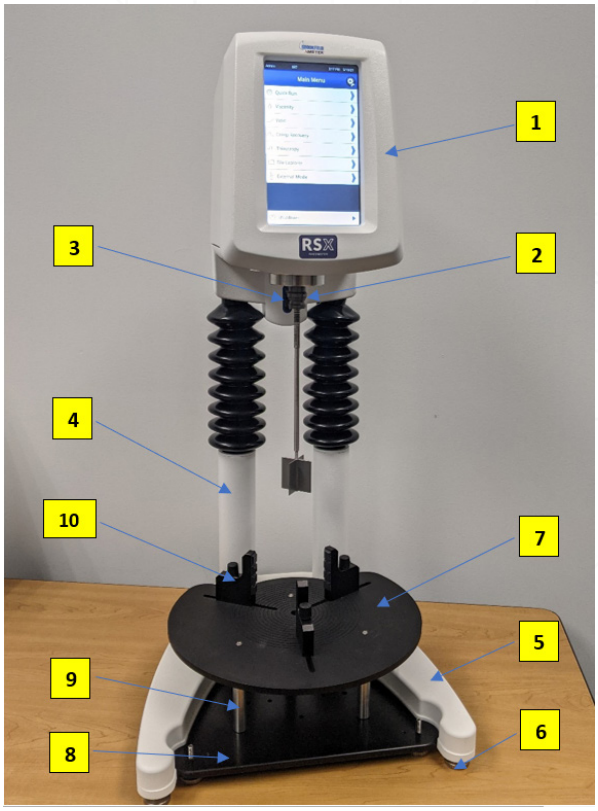


Figure 1-2

Components:

1	Rheometer head with touchscreen	6	Leveling foot
2	Measuring spindle coupling	7	Sample table
3	Barcode Reader	8	Sample table insert
4	Stand	9	Sample table legs
5	Base	10	Jaws

The basic configuration for the RSX-SST Rheometer includes:

- Instrument as shown above, including sample table
- Power cord

Measuring systems and accessories are not included with the RSX Rheometer and must be ordered according to the user's measuring requirements. Refer to Appendix D for details on available measuring systems.

Measurement Elements and Accessories that are used with the RSX-SST Rheometer include:

- Vane spindles. The spindle material is 316 stainless steel.
- Coaxial cylinder measuring systems. The spindle material is 316 stainless steel (Titanium optional for certain spindles). Chambers are normally made of hard-anodized aluminum. Must purchase coaxial cylinder mounting adapter kit (PN: RSO-CC).
- Coaxial cylinder mounting adapter for water jacket
- Temperature sensor Pt100 (PN: PT-E)
- Water jacket for temperature control with coaxial cylinder measuring systems and certain vane spindles (PN: FTKY3)

- Circulating temperature bath (PN: TC-550 or TC-650)
- Computer system
- Rheo3000 Software

1.2.3 RSX-CPS Rheometer

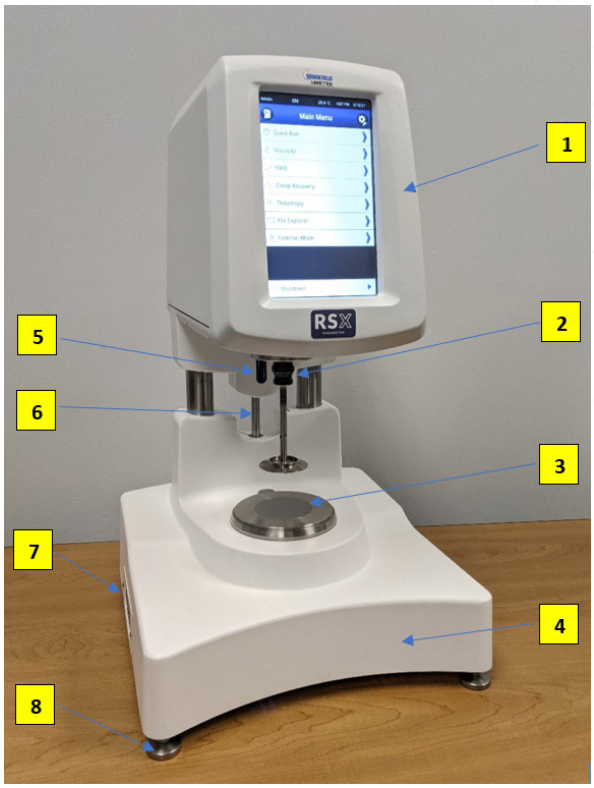


Figure 1-3

Components:

1	Rheometer head with touchscreen	5	Barcode Reader
2	Measuring spindle coupling	6	Gap drive
3	Sample plate	7	Hose connectors (RSX-CPS-FH model only)
4	Base	8	Leveling foot

The basic configuration for the RSX-CPS Rheometer includes:

- Instrument as shown above without Cone or Plate spindle
- Power cord

Measuring systems and accessories are not included with the RSX Rheometer and must be ordered according to the user's measuring requirements. Refer to Appendix D for details on available measuring systems.

Measurement Elements and Accessories that are used with the RSX-CPS Rheometer include:

- Cone/plate measuring systems. The spindle material is 316 stainless steel (Titanium versions optional).
- Plate/plate measuring systems. The spindle material is 316 stainless steel (Titanium versions optional).
- Thermal barrier for superior temperature control in heated systems (PN: RSTRAPS)

- Circulating temperature bath for use with CPS-FH model (PN: TC-550 or TC-650)
- Computer system
- Rheo3000 Software

1.2.4 Computer System with Rheo3000 Software

The computer system and the Rheo3000 Software are optional and allow for the automation of measuring procedures, modeling and analysis of measured data, and report printout. The computer system when running Rheo3000 Software is capable of controlling up to three RSX Rheometers simultaneously.

The computer system consists of a PC with the following minimum system requirements:

- CPU with at least 1.5 GHz frequency
- 1 GB RAM (primary storage)
- 2.5 GB free fixed-disk capacity
- Operating system Microsoft (32bit or 64bit) Windows, 7, 8, or 10
- Mouse and keyboard
- VGA graphic adapter with 1024 x 768 resolution and monitor
- 2 USB ports for rheometer and temperature accessory control
- Application software package Rheo3000

The application software for the RSX Rheometer (Rheo3000 Software package) is available separately and is not required for the operation of the RSX Rheometer. In the following cases, however, it is highly recommended:

- Extensive rheological analyses
- Graphical evaluation
- Evaluation using mathematical models
- Automated measurements
- Specific requirements (e.g. FDA Title 21 CFR Part 11)
- Research and development

1.3 Set-up, Safety, and Instrument Care

1.3.1 Safety

	“Danger!” indicates a situation of immediate danger which may result in severe injuries as well as damage to property if ignored.
	“Caution!” indicates a situation which may result in minor injuries or damage to property if ignored.
	Carry or lift the packed instrument with two people.
	Heavy instrument.

Read this operating manual carefully, follow all instructions provided, and observe all safety notes to ensure the proper and safe use of this measuring instrument. If you have any questions, please contact AMETEK Brookfield Technical Support or an authorized dealer.

1.3.2 Transportation and Unpacking

Always transport the RSX Rheometer in its original carton to protect against bumps and shocks. Save the original-shipment container for future use (i.e. returning the instrument to AMETEK Brookfield or your local authorized dealer for calibration service.)

After unpacking, check the instrument for any damage that may have occurred during shipping. If any shipping damage is detected, please inform the shipping carrier and contact AMETEK Brookfield or your local authorized dealer. The cause for shipping damage should be resolved before any use of the instrument. Do not begin use of a measuring instrument that shows evidence of damage.

When unpacking the RSX Rheometer, the shipment container will include:

- Assembled RSX Rheometer
- Power cord
- Operating Instructions
- Certification of Test
- PC-USB cable (A-B)
- Courtesy package of RSX Rheometer Screen Protectors
- USB Flash Drive

Additional accessories ordered with the RSX Rheometer such as measuring systems and temperature control elements are packaged and shipped in separate shipment containers.

1.3.3 Operating Environment

	Be aware of substances placed under test that may release poisonous, toxic, or flammable gases at the temperatures which they are subjected to during the testing.

Find a comfortable, convenient workplace for the installation of the RSX Rheometer. The instrument should be placed upright on a stable, level table. There should be enough room to place the instrument, measuring systems, measuring substances, and any peripheral devices (e.g. computer or bath/circulator). A grounded AC plug outlet is needed to operate the RSX Rheometer.

The RSX Rheometer's operating environment should be indoors and away from any extreme or heavily fluctuating ambient conditions.

Make sure that the RSX Rheometer is not exposed to:

- Heavy dirt or dust
- Direct sunlight
- Objects that emit strong heat (e.g. heating vents)
- Objects with a strong electromagnetic field (e.g. loudspeakers, motors, etc.)
- Liquids or corrosive chemicals

Additionally, be sure that the following ambient conditions are maintained:

- Temperature between +10°C and +40°C
- Relative air humidity between 20% and 80%

1.3.4 General Handling and Operation Safety

1.3.4.1 Moving the RSX Rheometer

	Heavy instrument.

To move the RSX-CC or RSX-SST models short distances use two people and/or a rolling cart for transportation whenever possible. Never lift the instrument by the measuring system or its coupling. Protect the instrument against heavy bumps, vibrations, or shocks that might impair the rotation of the coupling.

To move the RSX-CPS model short distances (i.e. during assembly), first protect the instrument by inserting the black foam rubber stopper between the rheometer head and instrument base. (Refer to **RSX Unpacking and Setup Instructions** for help.) During transportation, hold the instrument only by its base. Never hold the instrument by the measuring head to carry it. Never lift the instrument by the measuring system or its coupling. Protect the instrument against heavy bumps, vibrations, or shocks that might impair the rotation of the coupling. Use a rolling cart for transportation whenever possible.

1.3.4.2 Safety During RSX Rheometer Operation

	Be aware of substances placed under test that may release poisonous, toxic, or flammable gases at the temperatures which they are subjected to during the testing.
	If dangerous vapors can be released by heating the material, appropriate ventilation is required.
	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	Pinch hazard due to moving head.
	Wear gloves to protect against skin contact with potentially irritating or harmful substances.
	The RSX is an Class A instrument! The instrument has higher electromagnetic emissions and high magnetic fields. Pacemakers or other similar implanted devices may be affected.
	Electrical Hazard.
	High density barcode scanner in use. Avoid direct eye exposure.
	Hot Surface, Burn Hazard.

If this instrument is used in a manner not specified by AMETEK Brookfield, the instrument may be at risk of being damaged.

- The RSX Rheometer should only be operated by trained users.
- It is recommended that all operators wear protective goggles and gloves.
- Never operate or run the measuring instrument when the instrument or power supply components (e.g. main cable) are damaged.

- Ensure that substances placed under test do not release poisonous, toxic, or flammable gases at the temperatures which they are subjected to during testing.
- If using a temperature control system, do not touch any components (such as water jacket, hoses, measurement system) under 5°C or over 40°C. Do not disconnect any hoses when operating in this temperature range.
- Switch the measuring instrument off and disconnect the main plug when:
    - In service or repair
    - Moving the measuring instrument
    - In danger or an emergency

1.3.5 Set-up

The following section provides setup information for each model of the RSX Rheometer. Please refer to the appropriate section for information specific to the RSX-CC, RSX-SST, or RSX-CPS models.

1.3.5.1 RSX-CC Setup

	Electrical Hazard.

Level Instrument:
Use the supplied RK-PFT11 bubble level as shown in **Figure 1-4** to adjust the RSX-CC to the proper level.

Figure 1-4

Electrical Connections:
Connections for the electrical components of the RSX-CC Rheometer are located on the back of the instrument, as shown in Figure 1-5 below.

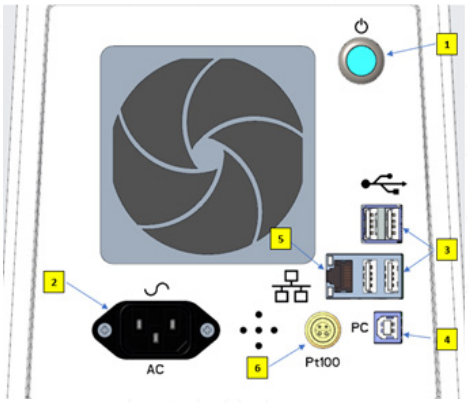


Figure 1-5

1	ON/OFF button	4	USB B (PC connection)
2	Power input (AC)	5	Ethernet
3	USB A (Memory stick)	6	Pt100 Temperature Sensor

Connect or disconnect any cables from the RSX Rheometer only while the instrument is turned off.

1.3.5.2 RSX-SST Setup

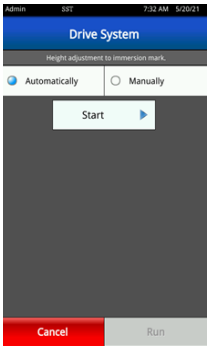
	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	Pinch hazard due to moving head.
	Electrical Hazard.

Level Instrument:

Use the supplied RK-PFT11 bubble level as shown in **Figure 1-4** to adjust the RSX-SST to the proper level.

HEIGHT ADJUSTMENT:

The RSX-SST Rheometer is designed to perform viscosity measurements on test materials in their original packing containers. The rheometer head is raised and lowered to change or clean measuring systems between tests without the need to move the test sample container. The RSX-SST features both Automatic and Manual immersion capabilities. Adjust your sample table insert to the proper height for your sample container size and spindle. Next, configure your test and mount your desired spindle. After pressing the Start button, you will be presented with the following immersion options:



- Auto Immersion: The RSX-SST features a new immersion method that will sense the top of your sample with the spindle and automatically immerse your spindle to the proper depth. To use this option, select the 'Automatically' button on your screen and press START. The spindle will be lowered into your sample to the proper depth and the test will begin automatically after a 60 second tempering/settle pause. Upon completion of your test, open the spindle coupling and the head will automatically return to the upper position, ready for your next test.

- Manual Immersion: The RSX-SST can also be adjusted manually with the Manual Up and Down arrows. Select the 'Manual' option and press the Down Arrow to operate the motorized stand and immerse your spindle to the proper immersion mark on your spindle. Upon completion of your test, open the spindle coupling and the head will automatically return to the upper position, ready for your next test.

Mounting and Removing the Sample table assembly:

The RSX-SST Rheometer features an easily removable and adjustable sample table. It can also be removed completely for specific tests or cleaning. The Sample Plate can be mounted at two different heights to accommodate test material containers of varying sizes. Your sample table assembly was shipped with two different sets of legs (2" and 4"). Choose the set that works best for your sample containers.

Assemble the Sample Table Assembly per **Figure 1-6**.

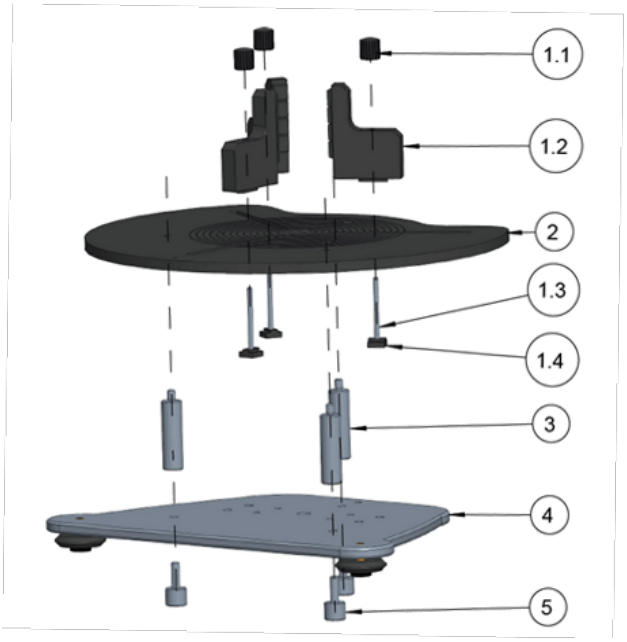


Figure 1-6

No.	Part	Qty.	Partnumber
1.1	Jaw Thumbscrew	3	RST-1165
1.2	Adjustable Jaw	3	RST-1188
1.3	M4x55 Countersunk Screw	3	RST-1181
1.4	Sliding Block	3	RST-1190
2	Sample Table with alignment markings	1	RSX-1072
3	TA-BT Standoffs in 2" or 4" lenght	3	TA-TB-7/8
4	Base Table with height adjustable feet	1	RSX-8038
5	Thumb Screws for easy assembly/disassembly	3	RSX-1075

To mount the Sample Table Assembly:

- The shape of the sample table insert is designed to nest in the mating features of the base. Simply lift the sample table assembly and drop it into the base until all feet are sitting on the bench top.
- Adjust the level of the sample table assembly. Place the **RK-PFT11** bubble level in the center of the sample table and adjust the front two leveling feet on the assembly until the bubble is centered in the ring. See **Figure 1-7**.

Figure 1-7

To remove the Sample Table Assembly:

- Simply lift the whole table assembly from the captive features in the base.
- The plate can now be disassembled for cleaning or you can change the legs for a different height container.

ELECTRICAL CONNECTIONS:

Connections for the electrical components of the RSX-SST Rheometer are located on the back of the instrument, as shown in **Figure 1-5**.

1.3.5.3 RSX-CPS Setup

	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	Pinch hazard due to moving head.
	Electrical Hazard.

Level Instrument:

Use the supplied RK-PFT11 bubble level as shown in **Figure 1-8** to adjust the RSX-CPS to the proper level. This step is critical for accurate measurements and should be performed any time the instrument is moved.

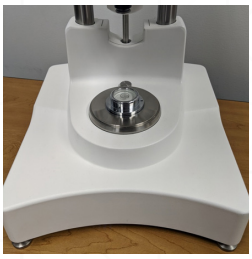


Figure 1-8

ELECTRICAL CONNECTIONS:

Connections for the electrical components of the RSX-CPS Rheometer are located on the back of the instrument, as shown in **Figure 1-9** below.

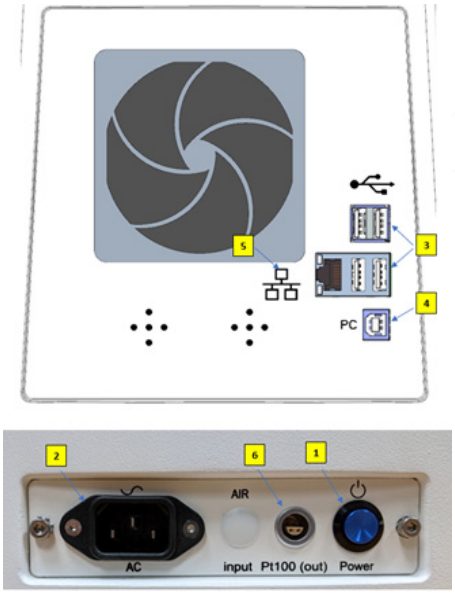


Figure 1-9

1	ON/OFF button	4	USB B (PC connection)
2	Power input (AC)	5	Ethernet
3	USB A (Memory stick)	6	Pt100 Temperature Sensor

Connect or disconnect any cables from the RSX Rheometer only while the instrument is turned off.

TEMPERATURE SENSOR:

The temperature sensor Pt100 is built into the measuring plate of the instrument. The temperature is measured continuously and is displayed on the touch screen.

1.3.5.4 Power Cord

	Electrical Hazard.

The RSX Rheometer is designed to handle AC Power inputs directly. Your instrument will be provided with an appropriate IEC power cord for your region.

Always connect the power cord to a properly grounded socket. To avoid electric shock or damage to system components, always use a properly grounded plug to connect the power cord.

Connecting the power cord:

- Insert the connecting plug of the power cord into the socket on the back of your instrument (base of RSX-CPS, head of RSX-CC & RSX-SST).
- Plug the power cord into a grounded mains socket.
- Turn the RSX Rheometer on.

1.3.5.5 RSX-CPS-FH Bath Setup

The fluid heated RSX-CPS-FH Rheometer is intended to be used with an external bath to control the temperature of the sample plate. To connect your bath, locate the hose quick connect fittings on the side of your instrument as shown in Figure 1-3. The mating female quick connect fittings are included in the Accessory kit and are shown in Figure 1-10 below.

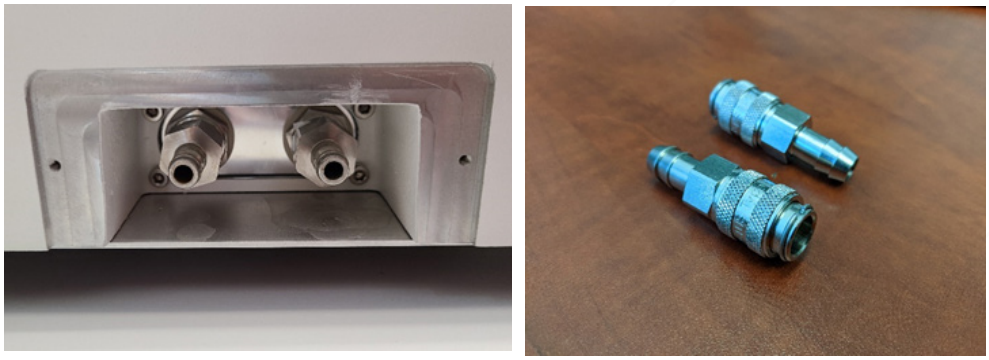


Figure 1-10

Connect the female quick connect fittings to your bath with properly rated hose for the intended temperature and fluid used in your bath. The female quick connects can now be pushed onto the mating connector on the instrument base. The direction of flow does not matter in this application. Turn on your bath and circulator and set to the desired test temperature.

1.3.6 Assembly of Additional Devices

This section describes the assembly of the FTKY3 temperature control device (water jacket) and the Thermosel temperature control device.

1.3.6.1 FTKY3 Temperature Control Device (Water Jacket)

The FTKY3 water jacket is shown assembled on an RSX-CC Rheometer in Figure 1-11:

	Hot Surface, Burn Hazard.

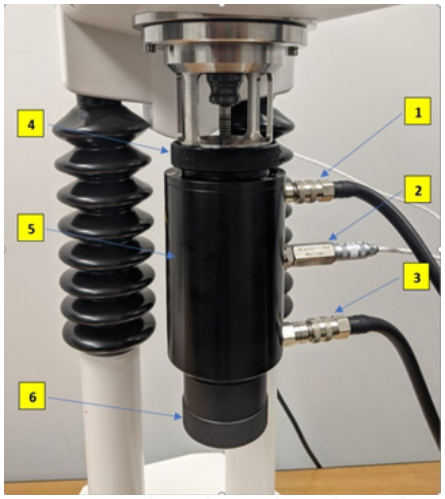


Figure 1-11

1	Outlet hose connection for circulating fluid	4	Threaded ring for mounting flange
2	Pt100 temperature sensor	5	Fluid circulation chamber
3	Inlet hose connection for circulating fluid	6	Threaded ring for securing sample cup

The FTKY3 temperature control device (PN: FTKY3) allows for controlled temperature experiments with coaxial cylinder measuring systems. Sample cups designed for use with the FTKY3 fit inside the water jacket, and the test material temperature is regulated using a circulating fluid supplied by a circulating temperature bath (PN: TC-550 or TC-650). The water jacket has a Pt100 temperature sensor built into the body of the device to report the test material temperature. The FTKY3 temperature control device is compatible with the CC and SST (with optional CC Adapter) models of the RSX Rheometer.

Typical thermostat liquids for use with the FTKY3 temperature control device are:

- Deionized water mixed with glycol for operation between -10°C to +90°C
- Thermostat oil for operation between -20°C to +180°C

Suitable thermostat liquids can be obtained from AMETEK Brookfield or an authorized dealer.

Set the upper temperature limit of the circulating temperature bath to +90°C if using water and to +180°C if using oil.

Assembly of the FTKY3 temperature control device:

1. Turn the RSX Rheometer off with the power button on the back of the instrument.
2. Secure the FTKY3 water jacket to the RSX Rheometer with the threaded ring (#4 in Figure 1-11).
3. Connect hoses from a circulating temperature bath to the FTKY3 quick-fitting couplings, as shown in Figure 1-11. To connect a hose, push the coupling sleeve slightly back, insert the hose connector, and let the coupling go. The coupling should lock securely into place. Pull lightly to check if the hoses fit tightly. Be sure to fasten the hoses to the correct fittings such that circulating fluid enters the water jacket from the bottom hose and exits through the top hose. This ensures proper fluid circulation.
4. Connect the FTKY3's built-in Pt100 temperature sensor to the back panel of the RSX Rheometer using the cable supplied with the FTKY3.
5. Turn on the RSX Rheometer.

Instructions for preparing a sample with the FTKY3 water jacket are provided in **Section 3.1.3**.

1.3.6.2 Circulating Temperature Baths

AMETEK Brookfield's TC Series Bath with AP Controller and interface cable (part number: RK-36A) allows direct control of temperature by the RSX Rheometer in standalone mode. The AP Controller on the TC Series Bath offers maximum performance capability with the highest flow rates of circulating fluid.

AMETEK Brookfield's TC Series Bath with AP or SD Controller can be used and controlled from a PC running Rheo3000 Software.

1.3.7 Computer Connection

If the RSX Rheometer is operated in remote mode with PC support via Rheo3000 Software, connect the computer to the instrument using the following procedure:

- Insert the USB interface cable provided by AMETEK Brookfield into the USB-B socket on the back panel of the RSX Rheometer.
- Connect the other end of the cable to a free USB port on the computer.
- Select 'EXTERNAL MODE' from the RSX Home screen.
- Launch Rheo3000 Software. Click on the 'Device Watch' Icon to establish communication with your RSX.

1.3.8 Cleaning

To clean the RSX Rheometer:

- Use the supplied cleaning cloth to clean the touch screen display. If necessary, replace the protective foil on the touch screen display. Replacements are available from your AMETEK Brookfield dealer (Part No. GV-1020 – two protective screens and one cleaning cloth).
- Use a dry, clean, soft, and nap-free cloth on the housing. Use natural detergent liquids if necessary.
- Do not use chemical products such as strong solvents or strong acids to clean the housing, especially the touch screen display. The paint coat of the RSX Rheometer does resist most solvents and weak acids.
- Make sure NO liquid penetrates the housing (e.g. through the instrument connecting sockets) and into the bearings of the measuring drive. This could result in the destruction of the instrument and void the instrument's warranty.

1.3.9 Maintenance

The RSX Rheometer system is designed for long-term operation.

The user can check measurement accuracy at any time. It is recommended that such measurements be performed with AMETEK Brookfield viscosity standard fluids (mineral oils). Instructions for this calibration process are detailed in Appendix B.

Important guidelines when checking the instrument's measurement accuracy include the following:

- Use temperature control
- Select the appropriate measuring system
- Use the AMETEK Brookfield viscosity standard fluid recommended for the chosen measuring system
- Carry out measurements at the following pre-set M (% torque) values: 12.5%, 25.0% and 37.5%

- Read viscosity values from the display on the RSX Rheometer and compare with the known
- fluid viscosity
- Refer to Appendix B for complete details on calibration check procedures

In case of instrument failure (or deviation from the mineral oil viscosity value), or should the instrument require repair, please contact AMETEK Brookfield or your local authorized dealer.

Only authorized service personnel may work on the control electronics, all accessories, the measuring device, as well as the power cord and all electric circuits and connections! Do not make any technical modifications on the instrument! Any modification will result in voiding of the instrument's warranty!

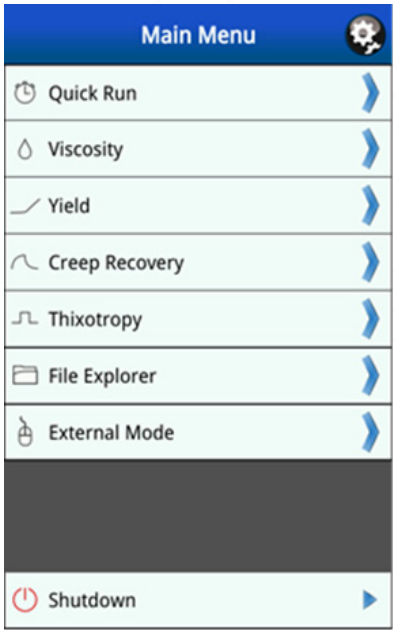
2. STANDALONE OPERATION

2.1 User Interface

All user input in standalone mode is done via touchscreen. The touchscreen doubles as both an input and output device. The touchscreen is resistive, meaning that it responds to light pressure.

Tap lightly with a finger or to select the desired option on the touchscreen. Tap and drag your finger on scroll bars to perform a scrolling action. Instead of a finger, a stylus may be used to operate the touchscreen.

2.1.1 Main Menu



After turning on and waiting for the RSX to complete the initialization, the home screen menu will appear.

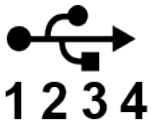
Note: If USER LOGIN is activated, a user must log in with the correct password before continuing.

Tapping at the stylized house icon at any time will return the user to the home screen.

2.1.2 Status Bar

The RSX Rheometer will display a status bar at the top of the screen.

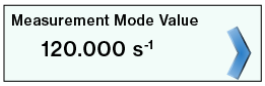
This status bar will indicate logged-in user, connection status of USB flash drives, device type, temperature, time, and date. The status icons are defined as:

User	username	Name of logged-in user. To log out see section 2.3.2 Log Out
	USB Icon with numbers from 1 to 4	Indicates physical USB-A connections (e.g. USB flash drives). If you plugged in a USB flash drive, it can be accessed by the file explorer, see section 2.6 File Explorer.

SST CPS	device type	Mode of testing. It can be SST or CPS, depending on your device type.
	attention sign	Indicates a system warning (yellow) or fault (red). See section 2.7.2.3 Logs
Pt 100	Pt100 sign	Appears only on CC and SST devices when a Pt100 temperature sensor is plugged at the back. See Section **3.1.3** FTKY3 and Temperature Control Device.
20.6°C	temperature	Displays the current temperature of the plate for CPS instruments and or of the external Pt100 probe for CC and SST instruments. To change between °C and °F, see section 2.7.1 Display
10:31 2/5/21	time and date	Current time and date. To change the time and date, see section 2.7.3 Set Time and Date. To change the format of time and date, see section 2.7.1 Display

2.2 Navigation

Navigation of the instrument features is done using a variety of data fields, arrows, command keys, and navigation icons. The operating system has been designed for intuitive operation and employs color to assist the user in identifying options.

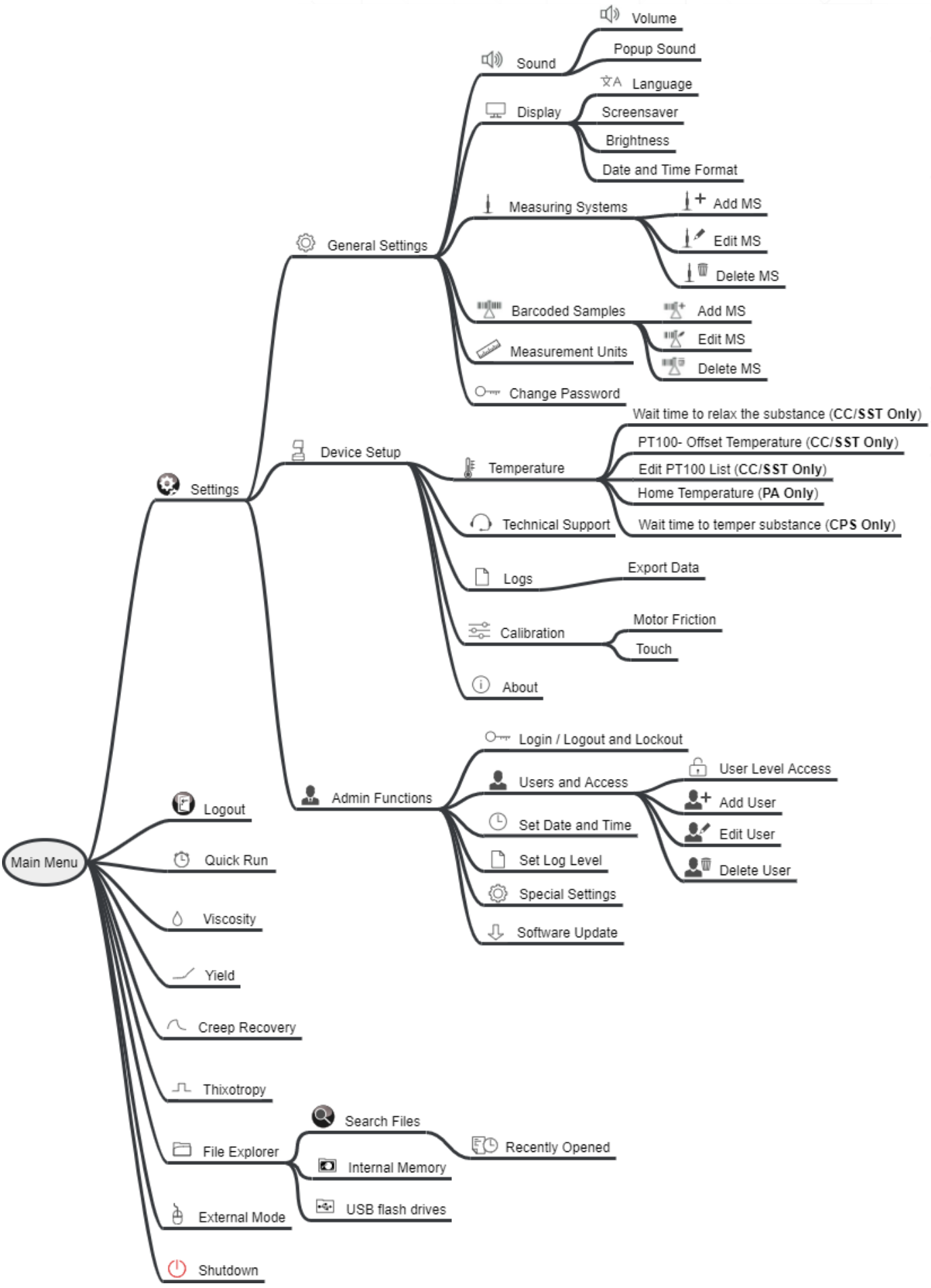
	Data fields require that the user touches the screen to initiate the data entry/selection process. These fields are normally outlined in black and include a blue arrow.
	Blue arrows to the right indicate that options exist for a data field. These buttons lead to a new screen. If the arrow is greyed out, the button is not accessible, or the data field cannot be changed.
	Blue arrows pointing down indicate that you can make a dropdown selection. A small panel below the button will appear and you can select the desired item.
	Blue switches indicate that the option can be toggled. Each switch has two different selections.
	Command keys are buttons that direct the RSX Rheometer to perform a specific action such as save a data set or stop a program. Command keys are presented in a variety of colors. These keys are found at the bottom of the screen.
	Navigation Icons are found in the title bar to the left and right. These buttons will lead to specific areas of the operating system.

Main navigation items are shown below

	main menu
	settings menu
	back (return to previous screen)
	search files
	log out (will only be available if the administrator has activated user log in)

2.2.1 Settings Structure

The following is a schematic representation of the settings menu for the RSX Rheometer.


Main Menu
Settings
General Settings
Sound
Volume
Popup Sound
Display
Language
Screensaver
Brightness
Date and Time Format
Measuring Systems
Add MS
Edit MS
Delete MS
Barcoded Samples
Add MS
Edit MS
Delete MS
Measurement Units
Change Password
Device Setup
Temperature
Wait time to relax the substance (CC/SST Only)
PT100- Offset Temperature (CC/SST Only)
Edit PT100 List (CC/SST Only)
Home Temperature (PA Only)
Technical Support
Wait time to temper substance (CPS Only)
Logs
Export Data
Calibration
Motor Friction
Touch
About
Admin Functions
Login / Logout and Lockout
Users and Access
User Level Access
Add User
Edit User
Delete User
Set Date and Time
Set Log Level
Special Settings
Software Update
Logout
Quick Run
Viscosity
Yield
Creep Recovery
Thixotropy
File Explorer
Search Files
Recently Opened
Internal Memory
USB flash drives
External Mode
Shutdown

2.3 User Management

The RSX Rheometer may be set up for a single user (used by one or more operators) or for multiple users who access through a login and password. If user accounts are enabled by the administrator, users can log in, log out, or be locked out.

2.3.1 Log In

To log in, the user must select their account name. The required password can be entered through the keypad. If locking is enabled, the user will be locked out after a certain number of failed login attempts.

2.3.2 Log Out

Main Menu → Logout

To log out, the user must go back to the main menu and select the door icon at the top of the screen. After confirmation, the login menu will be displayed. If the timed logout is activated by the administrator, the screen will go blank after a longer period of no user interaction. The user can log in again and start where they left off.

2.3.3 Lock Out

If the Lock Out option is activated by the administrator, the user will be locked out after a certain number of failed login attempts. A locked account can only be reset by an administrator (see chapter 2.7.3 Users and Access).

2.4 CC/SST and CPS Rheometer

The RSX Rheometer is available in multiple configurations.

2.4.1 CPS

A RSX CPS Rheometer is used to perform measurements with Cone-Plate or Plate-Plate geometries. These Geometries may be used to test wide viscosity ranges, with the possibility of very high shear rates and/or very small sample sizes.

The RSX CPS is available with two different temperature control systems:

- PA – The Peltier plate setup provides a fully integrated temperature control from 20°C below ambient – 180°C which makes accessories like baths redundant. 25mm and 50mm measuring systems may be used with this setup.
- FH – The fluid heated version requires an external circulating water bath for temperature control. The allowed temperature range is -20°C – 200°C. The Rheometer features an integrated PT100 temperature probe which is routed to the back panel of the instrument and may be used to control the bath for maximum temperature accuracy. 25mm, 50mm and 75mm measuring systems may be used with this setup.

2.4.2 CC/SST Rheometer

A RSX CC/SST Rheometer may be used for Coaxial/Concentric Cylinder geometry (CC) or as a Soft-Solids Tester (SST) for pastes, slurries, and materials with particulates.

- CC: The use of cylindric geometries provides the most accurate measurement results, especially in the low viscosity ranges. The temperature control can be done by using a FTK (see section **3.1.3**) and a circulating bath or by immersion into a bath.
- SST: Soft solid measurements typically use vane or Brabender spindles. For these spindle types, a cup or bucket with the sample can be put under the Rheometer and the spindle is lowered into the sample. The RSX SST Rheometer features an automated sample search and immersion. For low viscosity samples, it is recommended to use manual immersion. The temperature of the sample can be measured by connecting an external temperature probe to the back of the Rheometer.

2.5 Rotational Measurements

All measurements are directly started from the main menu.

2.5.1 General CPS Procedure

	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	Pinch hazard due to moving head.
	Hot Surface, Burn Hazard.

1. Make sure the plate and Measuring System are clean.
2. Choose corresponding test in Main Menu.
3. Attach Measuring System and close the coupling.
4. Configure the test parameters. For a detailed explanation see sections **2.5.4** to **2.5.8** .
5. Press the ‘Next’ button to initiate the Zero Gap Search. Keep your hands clear while the instrument is searching for the Zero position for the attached Measuring System.
6. The spindle will now move into contact with the plate for the Tempering step. This will heat your spindle to the desired plate temperature for the most accurate Zero Gap setting.
7. The Zero Gap Position is now determined with the tempered spindle. (Keep hands away from the spindle during this process)
8. The Head now moves up into filling position.
9. Apply the appropriate amount of sample in the middle of the plate and press ‘Run’.
10. The Spindle moves into gap position. For high viscous samples it may takes some time for the sample to relax and the gap position to be reached.
11. Wait while the Sample is tempered.
12. Remove overfill.
13. Press ‘Run’ to finally start the measurement.

2.5.2 General CC Procedure

	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.

1. Prepare the coaxial cylinder measuring system. (see section **3.1**)
2. Attach the measuring system to the Rheometer and close the coupling.
3. Configure the test parameters. For a detailed explanation see sections **2.5.4** to **2.5.8** .
4. Press the 'Run' button to start the measurement.

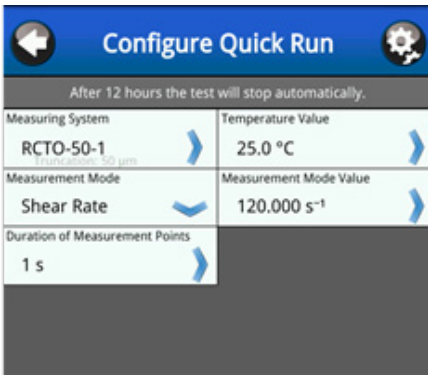
2.5.3 General SST Procedure

	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	Pinch hazard due to moving head.

1. Make sure the Measuring System is clean.
2. Choose corresponding test in Main Menu.
3. Attach Measuring System and close the coupling.
4. Configure the test parameters. For a detailed explanation see sections **2.5.4** to **2.5.8**.
5. Press the Next button, which will open the immersion screen.
    - Manual Option: Press down arrow to manual drive your Measuring System into the sample to the proper immersion mark (Recommended for low viscosity samples).
    - Auto Immersion Option: Press the Start button, and the Measuring System will automatically be immersed to the proper depth. (The depth can be adjusted manually by using the up and down buttons if necessary.)
    - For more details on the Immersion options, see section 1.3.5.2.
6. Press 'Run' to start the measurement.

2.5.4 Quick Run

A Quick Run test is optimal for getting a rough idea about the sample and how to configure the test parameters, because it is possible to change the control parameter at runtime.

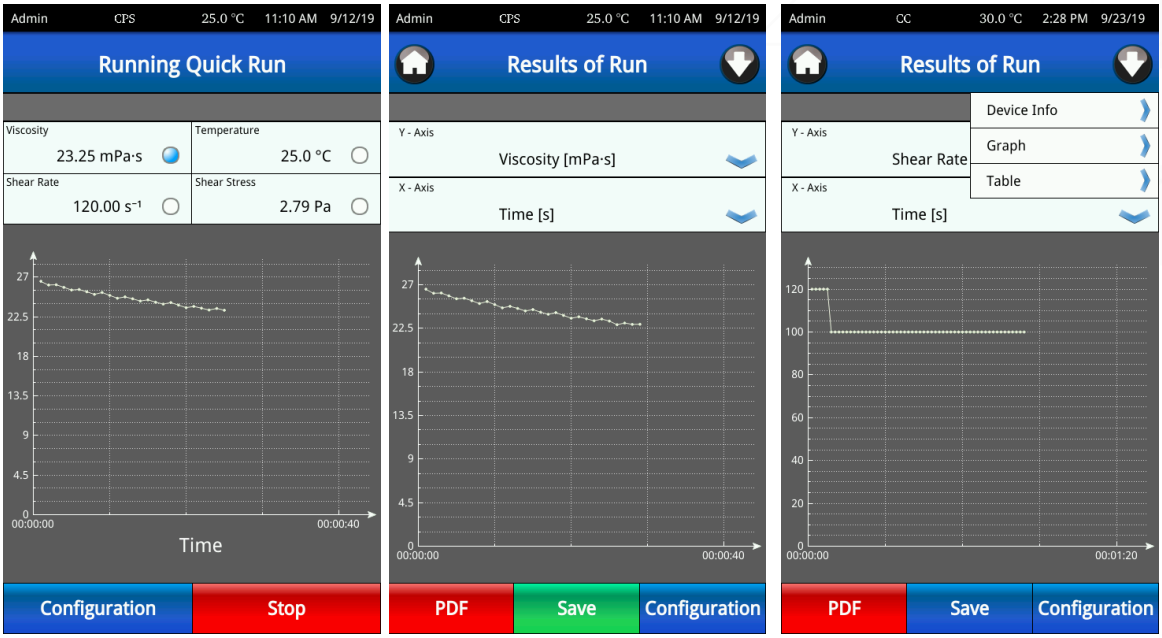


Test Configuration

- Attach spindle and close coupling (Select manually if automatic recognition failed.)
- Choose control mode (Shear rate/Shear stress/RPM/Torque).
- Set the Measurement Mode Value.
- Select data point collection rate (1 MP/second).
- Set test temperature (RSX-CPS-PA only).
- Press ‘Run’ and the test will begin.
    - CPS and SST instruments will need go through Gap/Immersion setting routines.
- Use the “configuration” button during the test to change the controlled speed, shear rate, torque and shear stress at run time.

Interpretation

During the experiment, the live graph can be configured to display viscosity, shear rate/stress, or temperature as a function of time. After the test, switch to the “Results” view which shows viscosity, shear rate, shear stress, and temperature in a table or a configurable graph (press the down arrow).



You can save the data or create a PDF document.

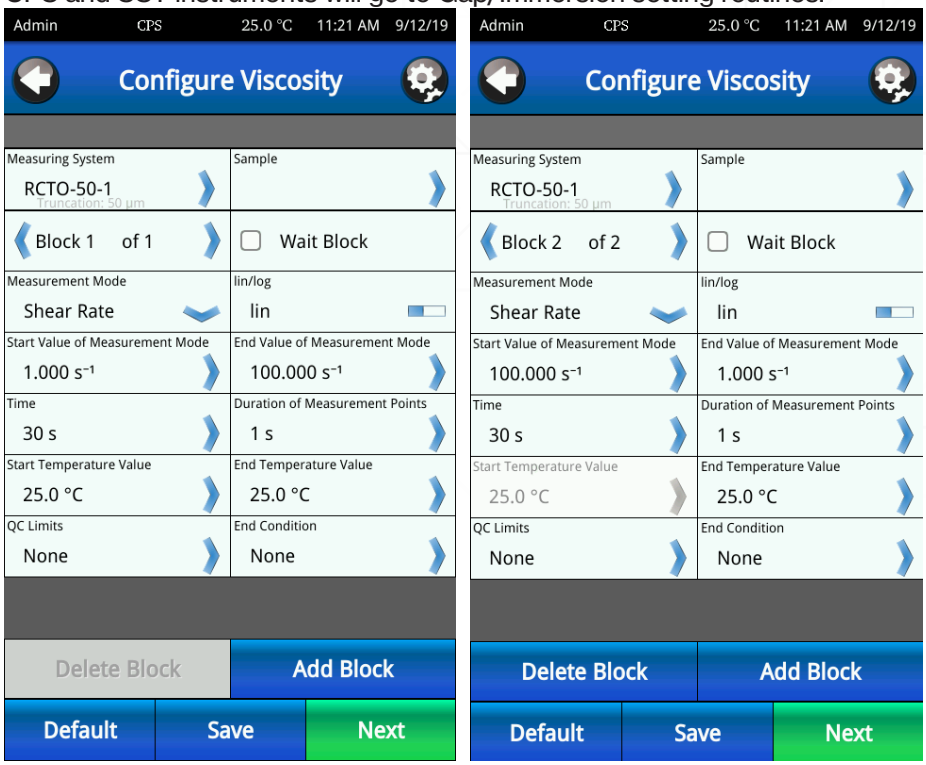
2.5.5 Viscosity

In this mode it is possible to run a single block or create an experiment consisting of a sequence of blocks. For example, block one can be the ramp up from 1 to 100 rpm and the second block can be the ramp down from 100 to 1 rpm. The maximum number of blocks is 10.

Test Configuration

- Select or attach spindle.
- Choose Measurement Mode (Shear rate/Shear stress/RPM/Torque).
- Choose Start and End Values of Measurement Mode.
- Chose linear or logarithmic graphing per the “lin/log” selection.

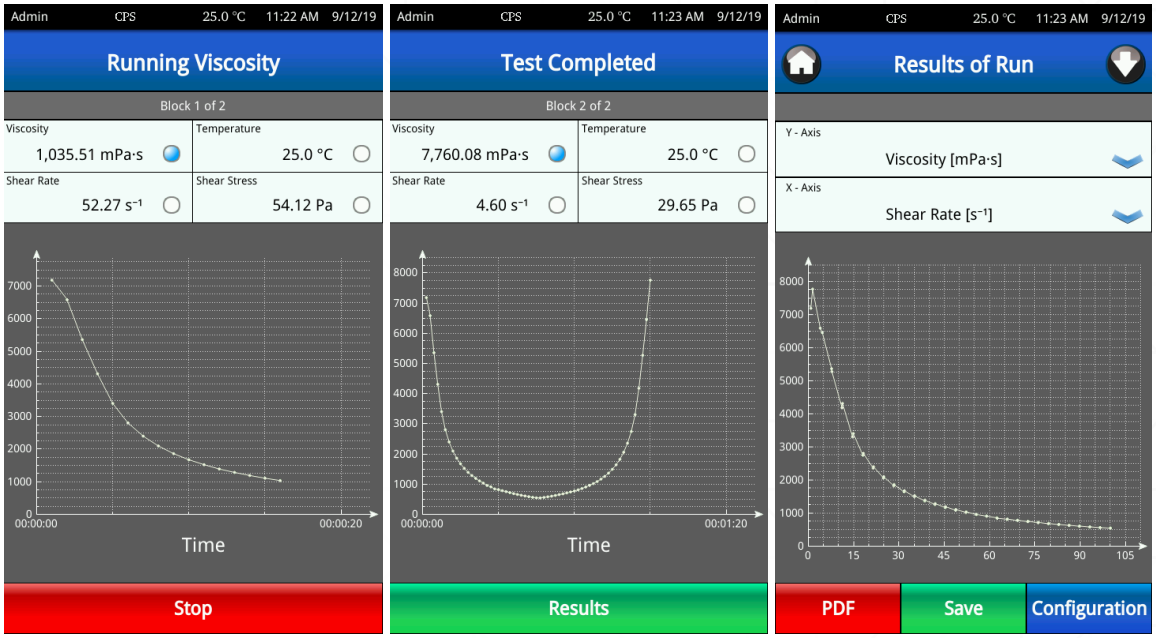
- Select data point collection rate (1 Measuring Point/second).
- To create a new block, click Add Block.
- Enter the sample name (optional).
- To start the test, press ‘Run’.
    - CPS and SST instruments will go to Gap/Immersion setting routines.



The RSX CPS PA Rheometer default setting is to maintain a constant temperature. Setting different Start and End Temperatures will allow examination of the sample at different temperatures. The End Temperature of each block is automatically set as the Start Temperature of the next block. With this feature, the samples’ response to temperature can be determined. Due to thermal expansion, the gap will always be set at the highest temperature of all blocks.

Interpretation

During the experiment, the live graph can be configured to display viscosity, shear rate/stress, or temperature as a function of time. After the test, switch to the “Results” view, which shows viscosity, shear rate, shear stress, and temperature in a table or a configurable graph (press the down arrow).



You can save the data or create a PDF document.

2.5.6 Yield

This test is used to calculate the yield point of the sample (onset of flow). The yield stress is the stress required to make a solid-like material flow like a liquid. The test is run in controlled stress mode. The control parameter is either shear stress or torque, and the resulting strain is recorded. The applied stress is increased slowly on the sample, to reach the point at which the material starts to flow.

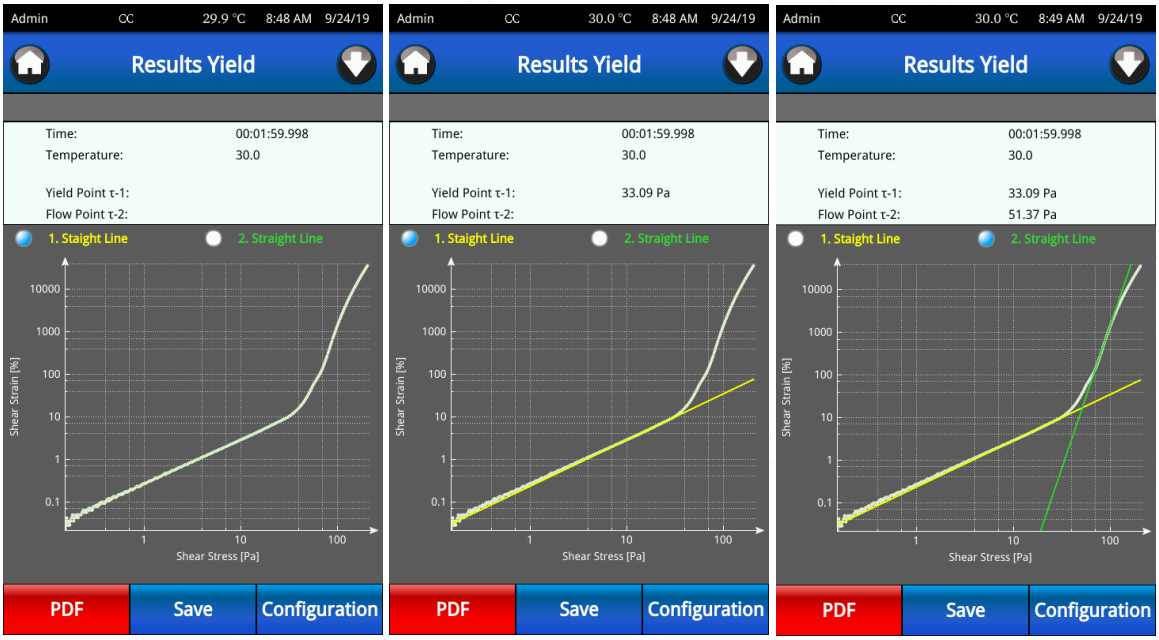
Configuration

- Select or attach spindle.
- Choose control mode (Shear stress/Torque).
- Choose Start and End Value of Measurement Mode. (The instrument will create a logarithmic ramp from the Start to the End value within the given time. For the best accuracy, the flow point needs to be around the middle between the Start and End value.
- Set the Time duration of the test.
- The number of Measuring Points is defaulted to 10 times the duration.
- Set test temperature (RSX-CPS-PA only).

- Enter the sample name (optional).
- To start the test, press ‘Run’.
- CPS and SST instruments will go to Gap/Immersion setting routines.

Interpretation

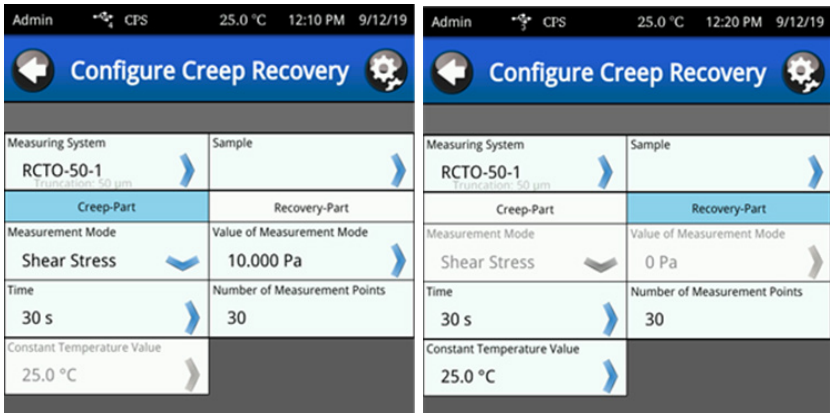
By clicking appropriate points of the graph, line 1 is to be placed manually in the linear-elastic range, and line 2 in the flow range. From these lines, the software determines both the yield and flow point.



You can save the data or create a PDF document.

2.5.7 Creep Recovery

This test is used to determine the elastic recovery of a sample. Constant stress below the yield value is applied for a period of time and the resulting deformation is measured. In the recovery phase the stress is released, and the sample recovery is monitored.



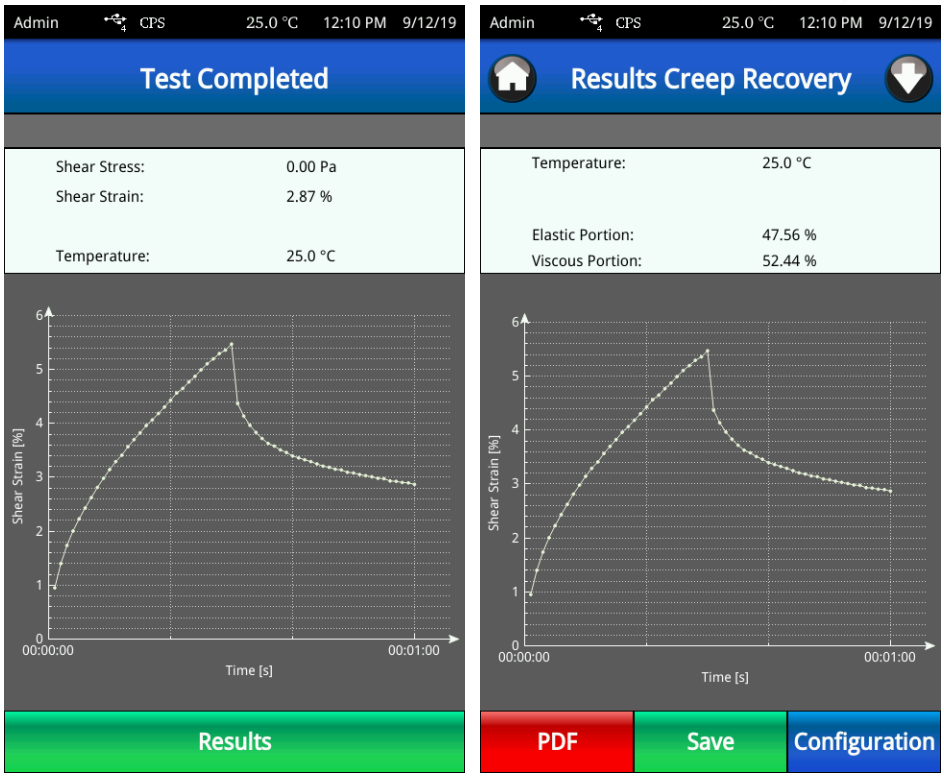
Configuration

- Select or attach spindle.
- In the “Creep-Part” Tab of the Configuration:
  - Choose control mode (Shear stress/Torque).
  - Enter the Value of Measurement mode. (The recommended value is between a third and a half of the

yield point. It may make sense to determine this point in a yield test first).
    - Set the Time duration of the test.
    - The number of Measuring Points is defaulted to 10 times the duration.
    - Set test temperature (RSX-CPS-PA only).
    - Enter the sample name (optional).
- In the “Recovery-Part” Tab of the Configuration:
    - Set the Time duration of the test.
    - The number of Measuring Points is defaulted to 10 times the duration.
- To start the test, press ‘Run’.
    - CPS and SST instruments will go to Gap/Immersion setting routines.

Interpretation

The data is visually shown on the graph. Once the test is complete, a value of the elastic portion of the sample and a value of the viscous portion of the sample is displayed.



During the Creep phase of the test, a constant stress is applied to deform the sample. A flattening curve indicates an elastic portion of the sample while an increasing curve rate indicates a more viscous/flow behavior of the sample. At the end of the Creep phase, the stress is removed, and the sample’s elastic behavior may cause the material to recover in the direction of its original position. This is the Recovery Phase, Shear Strain decreases during this period.

A viscoelastic material exhibits both viscous and elastic behavior. Although there may be some elastic deformation, it does not fully recover. The Elastic and Viscous Portion % are calculated by using the maximum Creep Strain % and the Strain % value measured at the end of the Recovery Phase. The maximum Shear Strain value occurs at the end of the Creep Step, while the Final Shear Strain value occurs at the end of the Recovery step.

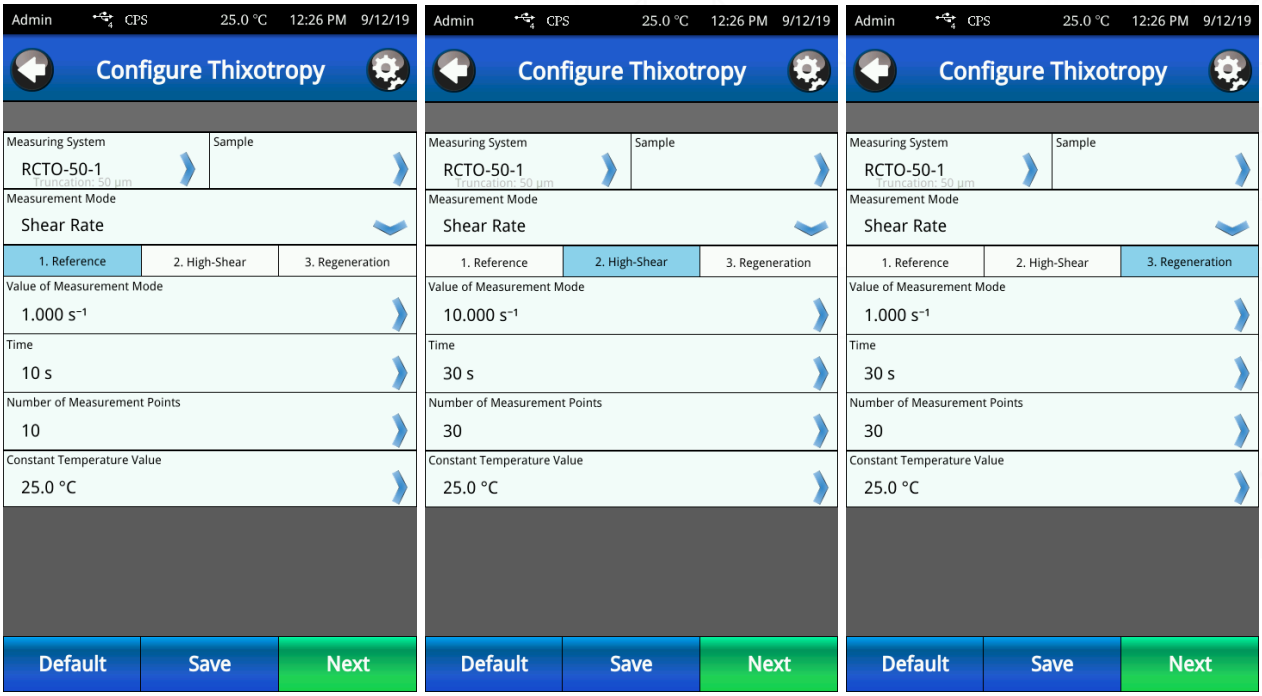
Elastic Portion % = [(Maximum Strain - Final Strain)/(Maximum Strain)] x 100%
Viscous Portion % = (Final Strain)/(Maximum Strain) x 100%

2.5.8 Thixotropy

Thixotropy is the decrease in apparent viscosity over time, at a constant shear rate or shear stress. The apparent viscosity of a thixotropic material increases over time when the shear rate or shear stress is decreased and held at the new, lower value. Some paints and coatings are thixotropic, as are many ketchups and hair conditioners, for example.

There are various types of thixotropic tests. Our method is a typical, widely used, three-step thixotropy test: low shear, high shear, and low shear. The low-shear step provides a reference value. The high-shear step decreases the viscosity by breaking down the sample's structure. The final, low-shear recovery step provides a measure of how the material structure recovers, as shown by the increase in apparent viscosity over time.

Configuration

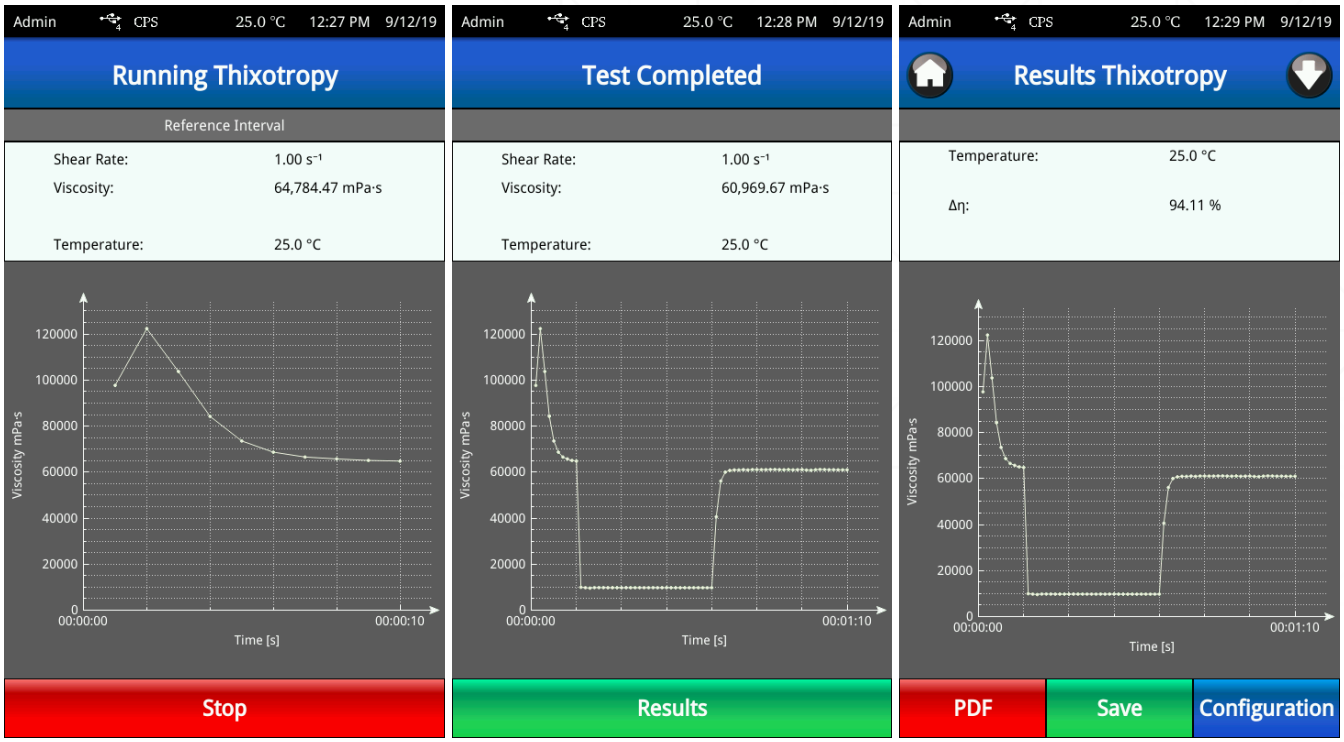


- Select or attach spindle.
- Choose control mode (Shear rate/Shear stress/RPM/Torque).
- Enter the sample name (optional).
- In the "Reference" Tab of the Configuration:
    - Enter the Value of Measurement mode (This value should be small enough not to damage the sample structure).
    - Set the Time duration of this phase.
    - The number of Measuring Points (The selected duration needs to be long enough to get a stable reference result).
    - Set test temperature (RSX-CPS-PA only).
- In the "High-Shear" Tab of the Configuration:
    - Enter the Value of Measurement mode (The value must be big enough to break the sample structure and is typically much higher than the reference value).
    - Set the Time duration of this phase.
    - The number of Measuring Points (The selected duration needs to be long enough to get a stable reference result).
    - Set test temperature (RSX-CPS-PA only).
- In the "Regeneration" Tab of the Configuration:
    - Enter the Value of Measurement mode. (This value is typically the same as the Reference phase.)

- Set the Time duration of this phase.
- The number of Measuring Points (The selected duration needs to be long enough to get a stable reference result).
- Set test temperature (RSX-CPS-PA only).

- To start the test, press ‘Run’.
  - CPS and SST instruments will go to Gap/Immersion setting routines.

Interpretation



The graph shows the viscosity change in the three steps, and the result is shown as a percentage regeneration of the sample.

Δη = [(Viscosity at end of Regeneration)/(Viscosity at end of Reference step)] x 100%

2.6 File Explorer

In the file explorer, all files and folders in the internal memory and on USB flash drives can be managed. USB flash drives can be plugged into the four ports at the back. The File Explorer can be accessed directly from the main menu.

2.6.1 Internal Memory

Main Menu → File Explorer → Internal Memory

All measurement results and configurations of the different users are stored in the internal memory.

There is a separate folder for each user, which only the user itself can see. The users’ folders are stored in the folder “Users”. The administrator can see and change all users’ folders. Be aware that if a user gets deleted, its folder will be moved into the administrator’s folder.

In addition, new folders can be created, and files and folders can be deleted. Files and folders can also be copied and pasted to all directories. See section **2.6.3 Context Menu**

2.6.2 External Memory

Main Menu → File Explorer → External Memory

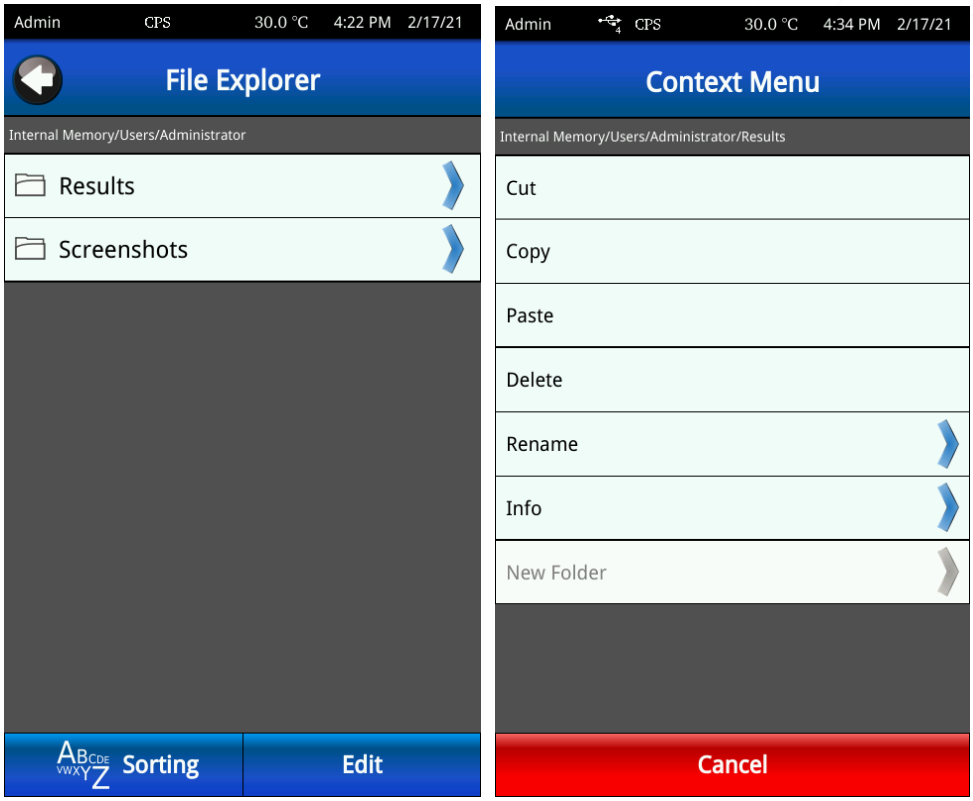
Almost all files and folders are displayed (only files that are for the RSX Rheometer) and can be copied, cut, pasted, and deleted.

2.6.3 Context Menu

The Context Menu is used for:

- creating/deleting folders
- renaming folders
- cutting/copying & pasting files
- renaming files
- Showing information like path, size, and date of last change

It can be accessed by pressing the “Edit” button or press on a folder/file for 2 seconds (turns blue) and releasing.



Example for copying a file from internal memory to an USB stick:

- Navigate to the file
- Press on the file and hold until it turns blue
- Release and the Context menu will appear
- Press Copy – the Context menu will disappear
- Navigate to the target directory
- Press Edit and Paste in the Context menu

2.7 Settings

The settings menu provides access to the many controls and features of the RSX Rheometer. This can be accessed

through the Settings Navigation Icon, which is located in the title bar of many views. The settings menu is divided into: General Settings, Device Setup, and Admin Functions.

2.7.1 General Settings

The general settings menu includes settings related to specific users and display options. Two global settings and two user settings are available.

Global settings:

	Measuring Systems	Manage spindles database.
	Barcoded Samples	Manage stored samples database.
	Measurement Units	Select the unit of measure for several parameters.

Local user settings

	Display	Display options: including date/time format, decimal separator, language, and backlight brightness.
	Sound	Option for Volume and Popup Sound.
	Change password	Change the password for the current user account.

Each user can set their own preferences for volume, brightness, and language.

Display

Main Menu → Settings → General Settings → Display

Language:

Select the appropriate language from the list.

Screensaver:

This option enables or disables the screensaver which will be activated after 5 minutes of inactivity.

Brightness:

The brightness adjustment applies to all screen views within the RSX Rheometer.

When screen saver is disabled, the screen brightness is dimmed automatically after five minutes of no touch-screen activity. A single touch restores the brightness.

Date Format, Date Separator, Time Format:

With these settings, you can customize the appearance of the date and time format.

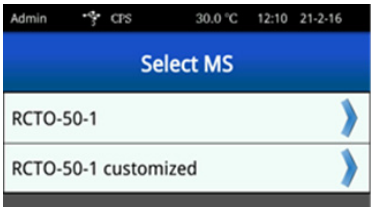
Decimal Point:

- Selecting ". Dot" will use the dot as the decimal and comma as the thousand's separator
- Selecting ", Comma" will use the comma as the decimal and the dot as the thousand's separator

Measuring Systems

Main Menu → Settings → General Settings → Measuring Systems

The Measuring Systems menu allows the user to manage customized Measuring Systems.



After attaching any measuring system to the instrument, the automated spindle-detection will recognize the type (e.g. RCTO-50-1) and the serial number of this spindle. This settings menu provides the possibility to customize the parameters of the detected spindle. For best accuracy, it is recommended to enter the parameters from the spindle protocol and an appropriate name.

In the configuration screen of each measurement, the customized or standard spindle can be selected.

Barcoded Samples

Main Menu → Settings → General Settings → Barcoded Samples

RSX Rheometers feature the use of handheld (USB) barcode scanners for sample entry. The barcode scanner must be connected to one of the four USB ports on the back of the device.

To add a new sample, navigate to the Add Barcode view. Enter the barcode in the upper input field (can be done with the scanner itself) and the corresponding sample name in the lower one.

Entering the sample name during a measurement setup can now be done simply by scanning the appropriate bar-code.

Change Password

Main Menu → Settings → General Settings → Change Password

Any user can change their password at any time. The user must enter the current and the new password and confirm the new password.

If the administrator password is lost, it can be reset. Please contact AMETEK Brookfield or the local authorized dealer. Remember to have the information found in the Technical Support Info screen available. See **section 2.7.2** Technical Support Info.

2.7.2 Device Setup

Temperature

Main Menu → Settings → Device Setups → Temperature

CPS PA:

The Peltier controlled Rheometer allows users to set a "Home Temperature". This defines the temperature between measurements. If most measurements done with the Rheometer are at one temperature, it is recommended to set

the Home Temperature to the same value.

“Wait time to temper the substance” defines the time which should be waited before the start of a measurement to make sure that the sample is well tempered.

CC/SST:

RSX CC/SST Rheometers allow users to save offsets for multiple external probes.
Steps to set a new offset:

- Connect a probe to the back of the device
- Press “Edit PT100 List” and then “Add PT100 Offset”
- Enter a name for the probe
- Use a calibrated reference thermometer and enter the value in “Target Temperature”
- Confirm with OK. The device will calculate the offset.

Technical Support Info

Main Menu → Settings → Device Setups → Technical Support Info

This view shows hardware and software revisions of the assembled submodules of the Rheometer and other information relevant to technical support.
Please have this screen ready when contacting AMETEK Brookfield or your dealer concerning any issues.

Logs

Main Menu → Settings → Device Setups → Logs

During operation, all errors, warnings, and events are logged automatically for diagnostic purposes.

Calibration

Main Menu → Settings → Device Setups → Calibration

Motor Friction:

The friction calibration ensures measurement accuracy especially at low torques. It should be repeated monthly,

whenever the environmental conditions changes significantly, or when performing very low torque (<1mNm) measurements. If this calibration is overdue, a warning is displayed after restarting your instrument.

Touch:

A recalibration of the touchscreen can be done if the position sensing is inaccurate.
Use the stylus to touch the three points as precisely as possible and confirm the calibration after the automated instrument reboot.

About

Main Menu → Settings → Device Setups → About

The About screen displays the firmware version and the serial number of the Rheometer.

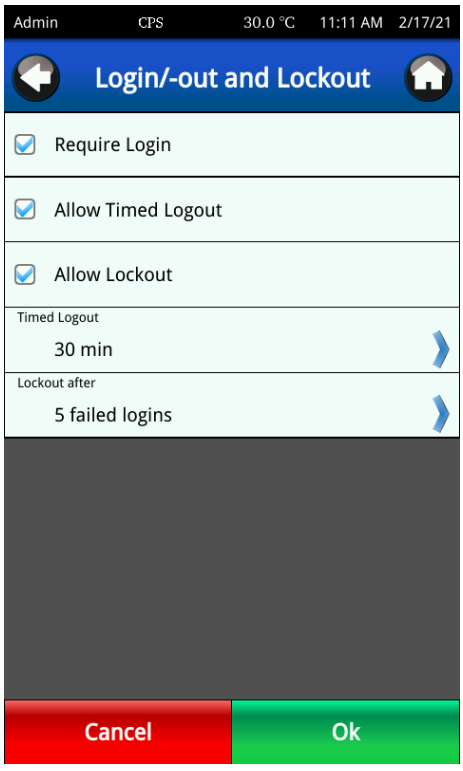
Measurement Settings:

The Smooth Acceleration option activates speed ramping between measuring steps during a viscosity measurement. The spindle will ramp to the next set speed over 3.5 seconds to avoid pulse loading of the sample. This may prevent a minor speed overshoot that could affect shear sensitive materials. To activate, simply check the box and press OK.

2.7.3 Administrator Functions

The “Administrator Functions” submenu is only available when logged in as Administrator or having the login functionality disabled (automatically logged in as Admin).

Login/Logout and Lockout



In this section, the Administrator can enable or disable the Login/User functionality.

If “Require Login” is disabled, the Rheometer grants full Administrator rights for any operator!

The option “Allow Timed Logout” logs off the user automatically after a certain time, which gets set in the “Timed Logout” input field.

“Allow Lockout” locks a user account after a certain number of failed logins (password entered incorrectly). The number can be defined in the “Lockout after” input field.

Changes must be confirmed with “Ok”.

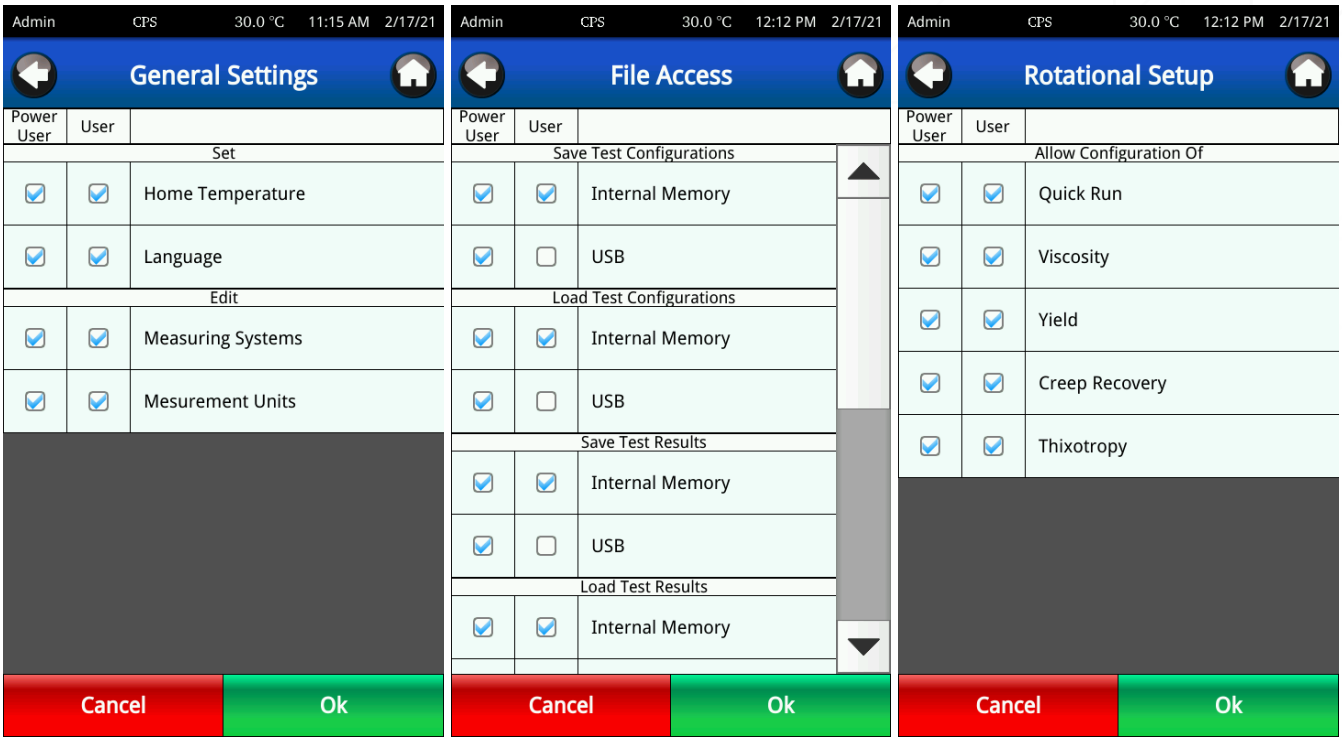
Users and Access

The RSX Rheometers feature three access levels for normal operation:

Administrator	Has full rights and access to all functionalities
Power User	Rights and accessible functions can be defined.
User	Rights and accessible functions can be defined.

User Access Level:

In this submenu, the Administrator can define which access, functionalities, and test programs Users and Power Users are allowed to change or use. It is divided into three categories:



All changes must be confirmed with “Ok”.

Add, Edit and Delete User:

The administrator can create new Users, modify their properties & access levels, and delete users.
To unlock a locked user, go to “Edit User”, select the affected user, and uncheck the “User is Locked” box.

Set Time and Date

In this submenu, it is possible to change the system time. Changes will take effect after pressing “Apply”. If you want to change the displayed format for date and time, see **section 2.7.1** Display.

Set Log Level

Log Errors, Errors & Warnings, or Error, Warnings & Events. For best support in case of an issue, it is recommended to log all Errors, Warnings & Events.

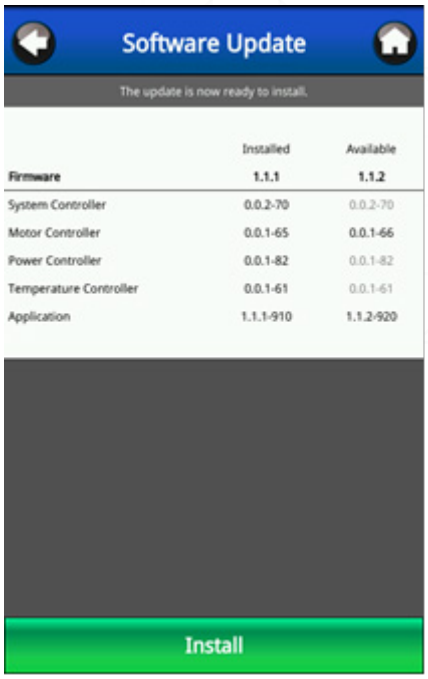
To view or export the log, see **section 2.7.2** Logs.

Special Settings

In this setting, the “Mandatory adding of measuring systems” can be toggled. When this setting is activated, the operator is forced to add and customize the spindle if this was not done previously.

Software update

To update the Software of the Rheometer, load the update file (e.g. “RSX_FW_Update_v1.1.2.rsx”) on the root directory of the USB stick. Connect the stick to a free USB port of the Rheometer and navigate to the “Software update” option. The orange bar at the top indicates that the instrument is searching and loading available updates. Once complete, press Install to get the update installed.



After the update, the Rheometer will restart automatically.

2.8 External Mode

Main Menu → External Mode

This section describes how to connect the RSX Rheometer with Rheo3000 Software.

Setup

First, connect the PC-USB interface cable provided into the “PC”/USB-B socket on the back panel of the RSX Rheometer. Do not use any interface cable other than that provided by AMETEK Brookfield. Connect the other end of the cable to an unoccupied USB port on the Computer. The device driver installs automatically. Turn the RSX Rheometer on and go to external mode, this menu can be found directly in the main menu.

All further steps are described in the Rheo3000 Software manual.

Range of application

Advantages of using Rheo3000 include:

- Control of multiple devices
- Thermostat compatibility
- Freely configurable programs, which can contain loops, handle events, and calculate math models

- Title 21 CFR Part 11 compliance
- Measurement data can be stored and retrieved in the database almost without limit
- Different data sets can be displayed simultaneously
- The application is offered in eleven languages
- User management with group policies

3. MEASURING SYSTEMS AND SAMPLE PREPARATION

	Be aware of substances placed under test that may release poisonous, toxic, or flammable gases at the temperatures which they are subjected to during the testing.
	Wear gloves to protect against skin contact with potentially irritating or harmful substances.
	If flammable substances are tested, the temperature must be 25 °K below the flashpoint of the material. In general, the flashpoint of the test sample material must not be below +205°C (+401°F).

The general procedure for measurements with an RSX Rheometer is as follows:

- Connect the AC adapter.
- Connect a PC, if required.
- Assemble any accessories to be used (e.g. FTKY3 water jacket).
- Connect a Pt100 temperature sensor, if required.
- Remove any attached spindle.
- Turn the power button ON and wait until the main menu is shown by the touch screen display system.
- Turn on computer system, if required.
- Prepare the sample.
- Attach the measuring system.
- Start a measuring program.
- Begin fluid circulation if temperature control is being used. Wait until the substance to be measured has reached the desired temperature.
- Start measurement.
- After completion of measurement, turn off temperature control and wait until your sample has cooled down to a safe temperature.
- Remove and clean the measuring system.

This section provides instructions on how to prepare measuring systems and sample materials for measurement with the RSX Rheometer.

3.1 Preparing Samples for use with the RSX-CC and RSX-SST Rheometers

The following measuring systems are used with RSX-CC and RSX-SST Rheometers:

- Standard coaxial geometry measuring systems:
  - sample cup (MBT-40...MBT-8, MBT-DG, and special order MBT-45 and MBT-48)
  - sample cup bottom
  - cylinder spindle (CCT-40...CCT-8, CCT-DG, and special order CCT-45 and CCT-48) threaded joint for securing the sample cup to the instrument

- Coaxial geometry measuring systems for measurement with FTKY3 temperature control:
  - sample cup (MBT-40F...MBT-8F, MBT-DGF, and special order MBT-45F and MBT-48F)
  - cylinder spindle (CCT-40...CCT-8, CCT-DG, and special order CCT-45 and CCT-48)
  - threaded joint for securing the sample cup in FTKY3
  - FTKY3 temperature control device

- Disposable measuring systems for measurement with FTKY3 temperature control:
  - disposable aluminum sample cup (CC-3-40-DC...CC-3-8-DC)
  - measuring chamber for sample cup (CC-3-40-R...CC-3-8-R)

    - sample cup ejector (CC-3-40-P...CC-3-8-P)
    - cylinder spindle (CCT-40...CCT-8 or disposable spindle CCT-25D)

- Vane measuring systems for measurement of soft solids directly in the sample container:
    - vane spindle (VT-10-5...VT-80-70)
- Vane measuring systems for measurement of soft solids in a measuring chamber:
    - sample cup (MBT-40 and MBT-25)
    - vane spindle (VT-40-20MB)

To carry out measurements, select a measuring system suited for the desired measuring range and rheological requirements.

3.1.1 Measurement Directly in the Sample Container

3.1.1.1 Coaxial Cylinder Measuring Systems

	High density barcode scanner in use. Avoid direct eye exposure.
	Hot Surface, Burn Hazard.

To prepare a coaxial cylinder measuring system for testing directly in the sample container, as shown in Figure 3-1:

1. Open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under the coupling sleeve. Figure 3-3 shows an open spindle coupling.
2. Insert the spindle of choice into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down. Figure 3-4 shows a closed spindle coupling.
3. Remove the sample cup screw cap. It will not be used.
4. On the instrument, remove the threaded ring for securing the sample cup. Place the sample cup through the threaded ring so that the sample cup flange sits on the threaded ring.
5. Reattach the threaded ring to the instrument to secure the sample cup in place. Be careful not to bump the spindle when sliding the sample cup and threaded ring over the spindle.
6. Immerse the sample cup in the sample material as far as the ring mark or conical **swelling (shown in the Figure 3-2**). Use the manual motor drive buttons found under the Device Settings menu.
7. Insert a Pt100 sensor into the sample material to record the sample temperature during measurement. Do not immerse the Pt100 temperature sensor into the sample deeper than 2/3 of the length of the metal rod. The Pt100 cable must remain outside the sample.
8. Connect the Pt100 sensor to the instrument using the port on the back of the instrument.
9. Proceed with measurement.

Figure 3-1

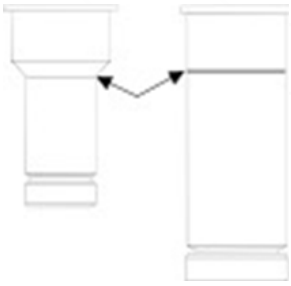


Figure 3-2

Figure 3-3

To disassemble a coaxial cylinder measuring system used for testing directly in the sample container:

1. Use the manual motor drive buttons found under the Device Setting menu to raise the head from the sample.
2. Hold the sample cup in place and unscrew the threaded ring securing the sample cup. Remove the sample cup and threaded ring. Be careful not to bump the spindle when removing the sample cup and threaded ring.
3. Open the spindle coupling and remove the spindle carefully.
4. Clean the sample cup and spindle. Do not use any objects in cleaning that might scratch the sample cup or spindle.
5. Store the spindle on a soft surface or in its original container.
6. Remove and clean the Pt100 sensor.

Figure 3-4

3.1.1.2 Vane Measuring Systems

	Pinch hazard due to moving head.
	High density barcode scanner in use. Avoid direct eye exposure.

To prepare a vane measuring system for soft-solid testing directly in a sample container, as shown in Figure 3-5

1. Open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under the coupling sleeve. Figure 3-3 shows an open spindle coupling.
2. Insert the spindle of choice into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down. Figure 3-4 shows a closed spindle coupling.
3. Ensure that the sample table is assembled. The instrument has two height options for the sample table. Use the height most appropriate for the sample container height. Instructions on adjusting the sample table are supplied in Section 1.3.5.2.
4. Secure the sample container in place on the plate with the jaws.
5. After configuring your test, follow the prompts to Automatically (or Manually) insert the spindle to the proper depth in the Sample. Instructions on using the Auto-Immersion feature are shown in Section 1.3.5.2.
6. Insert a Pt100 sensor into the sample material to record the sample temperature during measurement. Do not immerse the Pt100 temperature sensor into the sample deeper than 2/3 of the length of the metal rod. The Pt100 cable must remain outside the sample.
7. Connect the Pt100 sensor to the instrument using the port on the back of the instrument.

Figure 3-5

To disassemble a vane measuring system used for testing directly in the sample container:

1. Open the spindle coupling and the head will automatically raise into the upper position.
2. Remove the spindle carefully.

3. Clean the spindle. Do not use any objects in cleaning that might scratch the spindle.
4. Store the spindle on a soft surface or in its original container.

3.1.2 Measurement with the Sample in the Measuring System

	High density barcode scanner in use. Avoid direct eye exposure.

To prepare a sample for testing with a cylinder measuring system, as shown in Figure 3-6:

1. Determine the sample volume appropriate for the measuring system to be used (Refer to Appendix D: “Data Sheets for Standard Measuring Systems”). Fill the sample cup with sample material accordingly. Avoid trapping air bubbles in the sample material, as they may result in irreproducible or false data.
2. Carefully insert the spindle into the sample cup. Avoid introducing air bubbles to the sample.
3. Ensure that the spindle coupling is open. If it is closed, open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under the coupling sleeve. Figure 3-3 shows an open spindle coupling.
4. Remove the threaded ring for securing the sample cup from the instrument. Place the sample cup through the threaded ring so that the sample cup flange sits on the threaded ring.
5. Reattach the threaded ring to the instrument to secure the sample cup in place. Be careful to align the spindle shaft with the coupling.

Figure 3-6

6. Insert the spindle into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down. Figure 3-4 shows a closed spindle coupling.
7. A circulation bath can be used for temperature control. Set the fluid circulation bath to the intended sample temperature. Never operate beyond the temperature range of -20°C to +180°C.
8. Immerse the sample cup into the circulation bath as far as the ring mark or conical swelling (shown in the Figure 3-2 above). Do so by adjusting the rheometer head height. Ensure that no circulating fluid will splash into the sample cup. Ensure that no sample material or circulating fluid contaminates the spindle coupling or measuring drive. Wait for the sample to come to temperature.
9. Insert a Pt100 sensor into the circulating bath to record the sample temperature during measurement. Do not immerse the Pt100 temperature sensor deeper than 2/3 of the length of the metal rod. The Pt100 cable must remain outside the circulating bath.
10. Connect the Pt100 sensor to the instrument using the port on the back of the instrument.
11. Proceed with measurement.

To disassemble a cylinder measuring system:

1. Take note of the operating temperature. Allow the measuring system to cool to a safe temperature before disassembling.
2. Release the spindle by opening the spindle coupling.
3. Hold the sample cup in place and unscrew the threaded ring securing the sample cup. Remove the sample cup and threaded ring.
4. Remove the spindle from the sample cup.
5. Dispose of the used sample material properly.
6. Clean the spindle and sample cup. To clean the sample cup, unscrew the sample cup bottom and clean each piece of the sample cup separately. Do not use any object in cleaning that might scratch the spindle or sample cup pieces.
7. Store the spindle on a soft surface or in its original container.
8. Remove the Pt100 sensor from the circulating bath and clean it. Do not use solvent on any piece of the sensor beyond the metal rod.

3.1.3 Measurement with the FTKY3 Temperature Control Device

3.1.3.1 Standard Measuring Systems

	Pinch hazard due to moving head.
	High density barcode scanner in use. Avoid direct eye exposure.

To prepare a sample for testing in a cylinder measuring system with FTKY3 temperature control:

1. Assemble the FTKY3 temperature control device as instructed in Section 1.3.6.1
2. Set the fluid circulation bath to the intended sample temperature. Do not operate beyond the temperature range of -20°C to +180°C .
3. Determine the sample volume appropriate for the measuring system to be used. (Refer to **Appendix D**: “Data Sheets for Standard Measuring Systems”.) Fill the sample cup with sample material accordingly. Avoid trapping air bubbles in the sample material, as they may result in irreproducible or false data. Be sure to use a sample cup designed for use with the FTKY3.
4. Carefully insert the spindle into the sample cup. Avoid introducing air bubbles to the sample. Figure 3-7 shows how the measuring system should look so far.
5. Ensure that the spindle coupling is open. If it is closed, open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under the coupling sleeve. Figure 3-3 shows an open spindle coupling.
6. Remove the threaded ring for securing the sample cup from the FTKY3 device.
7. Insert the sample cup into the water jacket from below and reattach the threaded ring to secure the sample cup in place. Be careful to align the spindle shaft with the coupling. Figure 3-4 shows a closed spindle coupling.
8. Reattach the threaded ring to the instrument to secure the sample cup in place.
9. Insert the spindle into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down.
10. Begin circulation to the FTKY3 water jacket. Wait for the sample to come to temperature.
11. Proceed with measurement.

Figure 3-7

To disassemble a cylinder measuring system used with the FTKY3 temperature control device:

1. Take note of the operating temperature. Allow the measuring system to cool to a safe temperature before disassembling.
2. Release the spindle by opening the spindle coupling.
3. Unscrew the threaded ring securing the sample cup. Remove the sample cup and threaded ring.
4. Remove the spindle from the sample cup.
5. Dispose of the used sample material properly.
6. Clean the spindle and sample cup. To clean the sample cup, unscrew the sample cup bottom and clean each piece of the sample cup separately. Do not use any object in cleaning that might scratch the spindle or sample cup pieces.
7. Store the spindle on a soft surface or in its original container.

3.1.3.2 Disposable Measuring Systems

	Pinch hazard due to moving head.
	High density barcode scanner in use. Avoid direct eye exposure.

To prepare a sample for testing in a disposable measuring system with FTKY3 temperature control:

1. Assemble the FTKY3 temperature control device as instructed in **Section 1.3.6.1** Set the fluid circulation bath to the intended sample temperature. Do not operate beyond the temperature range of -20°C to +180°C.
2. Insert a disposable aluminum cup into its measuring chamber as far as the widening of the aluminum cup. Due to the widening in its upper part, the sample cup is held and clamped tightly.

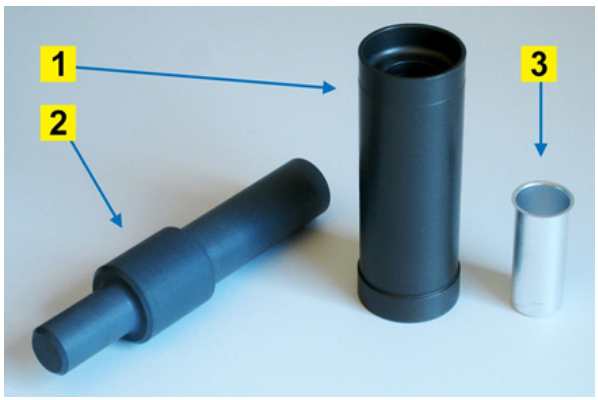


Figure 3-8

1	Measuring chamber	3	Disposable aluminum sample cup
2	Sample cup ejector		

3. Determine the sample volume appropriate for the measuring system to be used. (Refer to **Appendix D**: “Data Sheets for Standard Measuring Systems”). Fill the sample cup with sample material accordingly. Avoid trapping air bubbles in the sample material, as they may result in irreproducible or false data.
4. Carefully insert the spindle into the sample cup. Avoid introducing air bubbles to the sample.
5. Ensure that the spindle coupling is open. If it is closed, open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under

the coupling sleeve. **Figure 3-3** shows an open spindle coupling.

6. Remove the threaded ring for securing the measuring system from the FTKY3 device.
7. Insert the measuring system into the water jacket from below and reattach the threaded ring to secure the measuring system in place. Be careful to align the spindle shaft with the coupling. **Figure 3-4** shows a closed spindle coupling.
8. Reattach the threaded ring to the instrument to secure the measuring system in place.
9. Insert the spindle into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down.
10. Begin circulation to the FTKY3 water jacket. Wait for the sample to come to temperature.

11. Proceed with measurement.

To disassemble a disposable measuring system used with the FTKY3 temperature control device:

1. Take note of the operating temperature. Allow the measuring system to cool to a safe temperature before disassembling.
2. Release the spindle by opening the spindle coupling.
3. Unscrew the threaded ring securing the measuring system. Remove the measuring system and threaded ring.
4. Remove the spindle from the measuring system.
5. Clean the spindle carefully. Do not use any object in cleaning that might scratch the spindle.
6. Store the spindle on a soft surface or in its original container.
7. Dispose of the used sample material properly.
8. Eject the disposable sample cup. Use the ejector to push the disposable cup out from the measuring chamber and into the receptacle for its disposal. When ejecting the disposable cup, point the measuring chamber and ejector nowhere other than the receptacle for the sample cup's disposal, as the sample cup may eject with some velocity.
9. Clean the measuring chamber as necessary.

3.2 Preparing Samples for use with the RSX-CPS Rheometer

The cone/plate and plate/plate measuring systems consist of the fixed bottom plate on the instrument and the upper measuring cone or plate element that is height-adjustable to set the required gap.

To carry out measurements, please select a measuring system suited for the desired measuring range and your rheological requirements.
The Teflon thermal barrier (RSTRAPS) is plastic shroud that fits over the cone spindle and rests on the sample plate.
There is an area in the top of the spindle that you can flood with water or solvent.

3.2.1 Setting automatic spindle gap

	DO NOT touch rotating spindles. Damage to the spindle and/or RSX may occur.
	Safeguard any loose-fitting clothing (sleeves). Remove any jewelry, rings, watches, etc. Protect long hair. Tie hair back or work with a cap or hairnet.
	High density barcode scanner in use. Avoid direct eye exposure.
	Hot Surface, Burn Hazard.

The RSX-CPS instruments feature 1-piece measuring systems and automatic spindle gap setting as standard. The gap is set at 50µm for cone spindles and 1mm for plate spindles as standard.

Figure 1: 1-Piece Spindle

To prepare a sample with a cone or plate measuring system using an RSX-CPS instrument:

1. Ensure that the spindle coupling is open. If it is closed, open the spindle coupling by lifting the black coupling sleeve up. The inner ring of the coupling will be visible under the coupling sleeve. **Figure 3-3** shows an open spindle coupling.
2. When the coupling is opened, the instrument's gap drive will automatically move the rheometer head to the raised position.
3. Insert the spindle of choice into the coupling. Be careful to insert the spindle shaft into the coupling without bumping against it. Close the coupling by sliding the coupling sleeve down. **Figure 3-4** shows a closed spindle coupling. The integrated barcode scanner will automatically detect your spindle type when the coupling is closed.
4. After configuration of your test, press the 'NEXT' button and follow the prompts to automatically find the zero gap position. A one-minute spindle tempering step ensures that your system has equilibrated for best gap setting accuracy.
5. After tempering the spindle, the RSX-CPS will automatically sense the zero gap position and then raise the spindle for sample loading.
6. When prompted, load the sample onto the center of the bottom plate. The appropriate sample volume is indicated on the spindle data sheet. Avoid air bubbles in the sample material, as they may result in poor data. Press 'Run' to continue.
7. Your spindle will now move into position and the sample will be tempered to the plate temperature. Proper tempering of the sample will improve the accuracy of your results.
8. After Tempering, press the Next button and trim the overfill carefully.
9. Press 'Run' to begin your test.

Note: The UI will allow you to skip the automatic gap setting of a recognized spindle if the plate temperature for your test configuration has not changed. For best accuracy, perform the automatic zero gap procedure before each test.

To disassemble a cone or plate measuring system:

1. Take note of the operating temperature. Allow the measuring system to cool to a safe temperature before disassembling.
2. Release the spindle by opening the spindle coupling.
3. The gap drive will automatically move the rheometer head to its raised position.
4. Carefully slide the spindle off the measuring table or remove the spindle from the coupling.
5. Wipe sample material from the spindle and measuring table. Clean the spindle and measuring

table. Do not use any cleaning materials or devices that might scratch the spindle or measuring table.

6. Store the spindle on a soft surface or in its original container.

3.2.2 CPS Instrument with Peltier Temperature Control

Shut Down procedure during power off automatically brings bottom plate temperature to 30°C.
This is the best practice for preserving the life of the Peltier element. Fluid Heated instruments are controlled by the external bath. Shutdown the external bath or reduce temperature to non-hazardous levels.

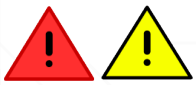
4. TROUBLESHOOTING

The following section describes situations that may occur when operating the instrument. Use the corrective action described in this section. If you need further assistance to fix the problem, please contact AMETEK Brookfield or your local authorized dealer.

4.1 Error Cases

Listed are some of the more common problems that you may encounter while using your rheometer.

4.1.1 Spindle does not rotate



- Make sure no errors or warnings have occurred.
- Check the measurement configuration, very low speeds (<0.2 rpm) can appear as no rotation. This may be a result of choosing too low torque/shear stress values on high viscous samples.

4.1.2 Spindle wobbles when rotating or looks bent

- Make sure the spindle is tightened securely to the rheometer coupling.
- Inspect the coupling mating surfaces for damage or contamination.
- Try to use a different spindle to see if the issue persists.
    - If yes, it is possible that the motor axle or the coupling have been damaged.
    - If not, the spindle may be damaged.

In either case, contact AMETEK Brookfield or your dealer for support.

4.1.3 Inaccurate/Unstable Readings

- If reading is decreasing over time, take into consideration that the sample has a thixotropic behavior (see section **2.5.8 Thixotropy**) or the sample is shear heating/ thinning.
- Verify environmental influences such as ambient temperature or blowing air. These may have a large influence on the temperature and the readings.
- Verify the temperature setup, including the bath and calibrated temperature probes if used. Many samples are sensitive to changes in temperature.
- Verify the selected temperature offset (RSX CC/SST)
- Verify spindle & speed/torque. Low speed and torque (below 1 mNm) at the same time may result in unstable readings. High speeds can cause the sample to flow out of the gap due to centrifugal forces. It is recommended that less measuring points (MP/Second) are used when torque and speed are very low to help smooth data output.
- Verify spindle selection is correct on the Rheometer (check spindle parameters if customized measurement systems are used).
- Verify test parameters: temperature, container, volume, method. Refer to:
    - “More Solutions to Sticky Problems” (section III), found under Technical Document on the AMETEK Brookfield website
- Perform a calibration check. Follow the instructions in **Appendix B**.
- Verify the calibration check procedures were followed exactly.
- Verify tolerances are calculated correctly.

If the unit is found to be out of tolerance, the unit may need service. See **Appendix I: Warranty and Repair**.

4.1.4 Reference Run Failed at Start-Up

- Make sure the motor can rotate freely and is not blocked in any way.

4.1.5 Automated spindle recognition is not working

- Make sure the barcode on the spindle shaft is clean and not damaged.
- Make sure the window in front of the barcode scanner is clean and not damaged.

4.1.6 Communication with Rheo3000 Software not working

- Check that USB-PC cable is plugged into the instrument with USB-B and into the computer with USB-A.
- RSX Rheometer must be powered on and the Menu must be in external mode.
- Select “Device Watch” in Rheo3000 and click the “Check Communication” button. Rheo3000 will automatically recognize the RSX Rheometer model and serial number.

4.1.7 Display Freeze

Press the power on/off button on the back of the instrument and hold down for 3 to 5 seconds. The instrument will shut down. Press the power on/off button to turn the instrument on. Power up will take place and the home screen will be displayed.
If such an incident happens, AMETEK Brookfield should be contacted. Please export the log files and send them to AMETEK Brookfield or your local authorized dealer so that we may resolve the issue. See section **2.7.2** Logs.

4.2 Logs

Log files can be generated as described in section **2.7.2** Logs.

Appendix A - Technical Data

RSX Rheometer	
Viscosity range [1]	$0.1*10^{-3}$ to $10.8*10^{6}$ Pa*s
Torque range line-powered	0.1 to 200 mNm
Torque resolution	1.2 µNm
Speed range	0.01 to 1000 rpm
Angular resolution	1.2 µrad
Temperature range [2]	-20° to +180°C -4° to +356°F
Range of shear rate [1]	0.013 to $6.0*10^{3}$ s-1
Range of shear stress [1]	0.134 to $139*10^{3}$ Pa
Weight (CPS)	21 kg 46 lbs
Weight (CC)	21 kg 46 lbs
Weight (SST)	25 kg 55 lbs
Dimensions CPS (Width x Height x Depth)	325 mm x 575 mm x 349 mm 12.8 in x 22.7 in x 13.7 in
Dimensions CC/SST (Width x Height x Depth)	380 mm x 810 mm x 438 mm 15 in x 31.9 in x 17.2 in
Ambient conditions	
Temperature	
in operation	+10°C to +40°C +50°F to +104°F
in storage	-30°C to +65°C -22°F to +149°F
Relative humidity (non-condensing)	
in operation	20% to 80%
in storage	15% to 85%
Altitude	< 2000m
Indoor / Outdoor use	Indoor
Degree of Pollution	2
IP Protection Level	
Head (all instruments)	40
Base (CPS)	42
Supply Voltage	90-263VAC, 50/60Hz

Power Consumption	
CPS	< 250VA
CC/SST	< 75VA
Overvoltage Category	II
Supported USB File Systems	FAT32 NFTS

1. The range depends on the used measuring system and the sample. Contact you AMETEK Brookfield dealer for further information.
2. The range depends on the temperature control. Contact your AMETEK Brookfield deal for further information.

Appendix B - Calibration Check

The calibration check procedure is performed to verify that your RSX Rheometer is making correct viscosity measurements. It can be done in standalone mode or under control of Rheo3000 Software. Perform the calibration check with the spindle that is most frequently used with your instrument. You do not need to perform a calibration check with additional spindles unless there is a concern that a specific spindle is not measuring properly.

The calibration check can be performed at regularly scheduled time intervals determined by you (before each shift, weekly, monthly, etc.) or at any time when there is concern that the instrument is not measuring correctly.

Before performing the calibration check, it is advisable to perform the Zeroing procedure. This feature is accessed in the Settings menu in standalone mode. At a minimum, run both the High Range and Low Range Zeroing procedures. The time required to do both is slightly more than a half hour.

Use the appropriate viscosity standard for the spindle that you want to test. Consult the following table, which shows the fluid that is recommended for each type of spindle and the required sample volume to perform the calibration check:

Cone Spindles	Fluid	Sample Volume
RCTO-25-1	B41000	0.1mL
RCTO-25-2	B73000	0.2mL
RCTO-50-1	B10200	1.0mL
RCTO-50-2	B21000	2.0mL
RCTO-75-1	B4900	2.5mL
RCTO-75-2	B10200	5.0mL

Coaxial Spindles	Fluid	Sample Volume
CCT-8	B360000	**Do Not Perform Calibration Checks with this Spindle!**
CCT-14	B73000	**Do Not Perform Calibration Checks with this Spindle!**
CCT-25	B21000	16.8mL
CCT-40	B2000	68.5mL
CCT-DG	B200	15.7mL

If you have an RSX-SST Rheometer and use vane spindles, AMETEK Brookfield recommends that you perform a calibration check with either the CCT-40 or CCT-25 Coaxial Spindles and the associated chamber, which will also attach to your instrument.

You will also need a circulating temperature bath to condition the viscosity standard to a set temperature, normally 25°C. All AMETEK Brookfield viscosity standards are calibrated at 25°C. Additional temperature calibrations are available upon request when the fluid is ordered from AMETEK Brookfield or an authorized dealer.

If you have an RSX-CPS Rheometer with Peltier Temperature control, you do not require the circulating temperature bath. Temperature control capability is built into the instrument.

Prepare the proper sample volume for the test and condition to the defined temperature within +/- 0.1°C. Mineral oil is highly temperature sensitive, so it is important to do this correctly.

The calibration check procedure is performed at 3 separate controlled torque values: 12.5mNm, 25mNm and 37.5mNm. The spindle rotates for a minimum of 15 seconds at each torque value. Observe that the viscosity reading remains relatively constant vs. time. The viscosity reading at each torque value is recorded after 15 seconds or a longer time interval of your choosing. The three viscosity readings must each be within +/- 3% for RSX-CC or RSX-SST and within +/-5% for RSX-CPS of the actual fluid value for the calibration check to pass. Double Gap Measurement system used with RSX-CC or RSX-SST also has +/-5%.

If the calibration check fails, review each step to make sure that everything was done correctly in accordance with the test procedure. Repeat the test procedure if necessary. Areas for potential error are not having the proper sample volume and not conditioning the sample to the correct temperature. It is also possible that shear heating may occur at the highest torque 37.5mNm for certain spindle geometries; if the viscosity value starts to drop, it may be due to shear heating; record the viscosity reading 15 seconds after the test starts at this torque to minimize potential error. If the instrument fails when you repeat the calibration check, contact AMETEK Brookfield or your local authorized dealer.

Appendix C - Symbols for Test Parameters and Units of Measurement

Parameter	Symbol	Unit
Speed	n	$[min^{-1}]$

Torque	M	[100% = 200 mNm]
Temperature	T	[°C, °F]
Time	t	[s]
Shear Rate	$\dot{\gamma}$	[s^{-1}]
Shear Stress	τ	[Pa]
Viscosity	η	[Pa•s, mPa•s, cP, P]

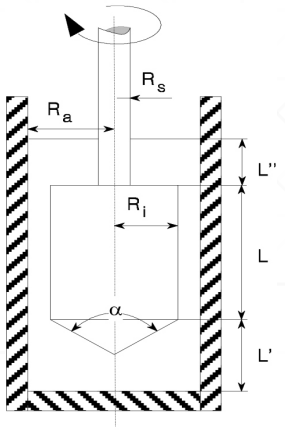
Appendix D - Data Sheets for Standard Measuring Systems

Table of Coaxial Cylinder Measuring Systems according to DIN 53018/53019/ISO 3219
(consisting of measuring spindle and sample cup)

Three sample cup models are available for use with the RSX-CC and RSX-SST Rheometers; the following example is for CCT-40 spindle:

- MBT-40 for direct immersion
- MBT-40F for use with FTKY3 water jacket
- CC3-40-R for disposable chambers

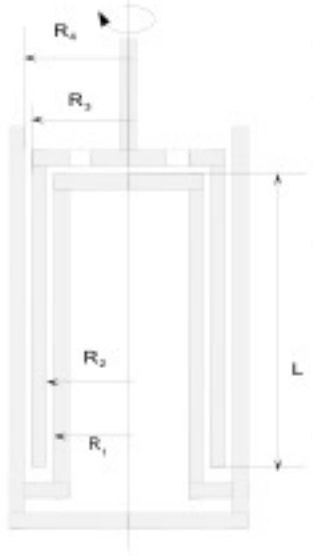
Measuring System	CCT-40	CCT-25	CCT-14	CCT-8
Shear rate range [s^{-1}]	0.0215 ... 2,790	0.013 ... 1,670	0.013 ... 1,680	0.013 ... 1,672
Shear stress range [Pa]	0.89 ... 594	3.43 ... 2,280	19.5 ... 13,000	104 ... 69,600
Viscosity range [Pa*s]	0.0003 ... 27,600	0.002 ... 177,000	0.012 ... 1,000,000	0.065 ... 5,410,000
Filling quantity [mL]	68.5	16.8	3.4	1
Shear rate factor K $\dot{\gamma}$ [s-1/RPM]	2.1480	1.2894	1.2969	1.2865
Shear stress factor τ‰ [Pa]	0.2969	1.1419	6.5052	34.8426
Measuring bob radius Ri [mm]	20.0	12.5	7	4
Sample cup radius Ra [mm]	21.0	13.56	7.59	4.34
Shaft radius Rs [mm]	3.5	3.5	2.1	1.2
Angle of measuring bob cone α [°]	120	120	120	120
Distance from lower edge of measuring bob to sample cup bottom L' [mm]	20.5	15.5	13	12
Length of shaft immersed L" [mm]	20	12.5	7	4
Length of measuring bob L [mm]	60	37.5	21	12
Radius ratio δ	1.050	1.0847	1.0847	1.0847
Coefficient of resistance c_L	1.1	1.1	1.1	1.1



Measuring geometry according to DIN 53019

Table of double gap cylinder measuring system according to DIN 54453 (consisting of measuring spindle and sample cup)

Measuring System	CCT-DG
Shear rate range [s^{-1}]	0.043 ... 5,640
Shear stress range [Pa]	0.265 ... 177
Viscosity range [Pa*s]	0.00005 ... 4,070
Filling quantity [mL]	15.7
Shear rate factor K $\dot{\gamma}$ [s-1/RPM]	4.3443
Shear stress factor τ‰ [Pa]	0.0884
Inside radius of measuring bob R2 [mm]	19.72
Outside radius of measuring bob R3 [mm]	20.5
Inside radius of sample cup R1 [mm]	19.25
Outside radius of sample cup R4 [mm]	21.0
Length of measuring bob L [mm]	111
Radius ratio δ	1.0244
Coefficient of resistance c_L	1



Measuring geometry according to DIN 54453

Table of cone/plate measuring systems

Measuring System	RCTO-25-1	RCTO-25-2	RCTO-50-1	RCTO-50-2	RCTO-75-1	RCTO-75-2
Shear rate range [s^{-1}]	0.06 ... 7,800	0.03 ... 3,900	0.06 ... 7,800	0.03 ... 3,900	0.06 ... 7,800	0.03 ... 3,900
Shear stress range [Pa]	36.7 ... 24,400	36.7 ... 24,400	4.58 ... 3,050	4.58 ... 3,050	1.36 ... 905	1.36 ... 905
Viscosity range [Pa*s]	0.005 ... 407,000	0.01 ... 814,000	0.0006 ... 50,900	0.0012 ... 101,000	0.0002 ... 15,000	0.0004 ... 30,000
Filling quantity [mL]	0.1	0.2	1	2	2.5	5
Shear rate factor K $\dot{\gamma}$ [s^{-1}/RPM]	6.00	3.00	6.00	3.00	6.00	3.00
Shear stress factor τ‰ [Pa]	12.223	12.223	1.5279	1.5279	0.4527	0.4527
Measuring cone radius R [mm]	12.5	12.5	25	25	37.5	37.5
Angle of measuring cone α [°]	1	2	1	2	1	2
Cone truncation [µm]	50	50	50	50	50	50

Table of plate/plate measuring systems
(consisting of measuring spindle and RSX-CPS measuring bottom plate)

The following values pertain to a plate distance of 1 mm. For all other plate distances, you can easily calculate **K$\dot{\gamma}$** using the formula:
K$\dot{\gamma}$ = (2*π/60) * (R/H) R = radius, H = plate distance

Measuring System	RPTO-25	RPTO-50	RPTO-75
Shear rate range [s^{-1}]	0.013 ... 1,700	0.027 ... 3,400	0.04 ... 5,100
Shear stress range [Pa]	49 ... 32,600	6.2 ... 4,070	1.8 ... 1,200
Viscosity range [Pa*s]	0.03 ... 2,490,000	0.002 ... 155,000	0.0004 ... 30,700
Filling quantity [mL]	0.5	2.0	4.5
Shear rate factor K $\dot{\gamma}$ [s^{-1}/RPM]	1.309	2.618	3.927
Shear stress factor τ‰ [Pa]	16.297	2.037	0.604

Radius of measuring plate R [mm]	12.5	25.0	37.5

Table of Vane Spindles for use with the RSX-SST Soft Solids Tester

Vane	Height [mm]	Diameter [mm]	Shear Stress [Pa]
VT-10-5	10	5	330 ... 210,000
VT-20-10	20	10	41 ... 27,000
VT-20-20	20	20	9 ... 5,900
VT-30-15	30	15	12 ... 8,000

Vane	Height [mm]	Diameter [mm]	Shear Stress [Pa]
VT-40-20	40	20	5.2 ... 3,400
VT-40-40	40	40	1.2 ... 740
VT-50-25	50	25	2.7 ... 1,700
VT-60-8	60	8	24 ... 15,000
VT-60-15	60	15	7 ... 4,300
VT-60-30	60	30	1.6 ... 1,000
VT-80-40	80	40	0.7 ... 420
VT-80-70	80	70	0.2 ... 120

Stress Constant: τ *prom*

All standard vanes supplied for the Soft Solids Tester have a height (H) to diameter (D) ratio of 2:1. A stress constant is required for each vane to convert torque in Newton meters to shear stress in Pascals. This constant is calculated as follows:

The constants for the standard vanes are as follows:

Vane	Height [mm]	Diameter [mm]	τ *prom*
VT-10-5	5	10	109.206
VT-20-10	10	20	13.651
VT-20-20	20	20	2.986
VT-30-15	15	30	4.045
VT-40-20	20	40	1.706
VT-40-40	40	40	0.373
VT-50-25	25	50	0.874
VT-60-8	8	60	1.971
VT-60-15	15	60	2.178
VT-60-30	30	60	0.506
VT-80-40	40	80	0.213
VT-80-70	70	80	0.063

These are pre-loaded in the Rheo3000 Software. If you do not have these vanes available in Block Editor or on your instrument, then please load them using Meas-Editor for software driven setups.

Strain/Rate Constant: K-Gamma

The constant K-Gamma converts the rotational rate or position into shear rate/strain values. Its value is dependent upon the ration of container-to-vane diameter. The vanes pre-loaded into the Rheo 3000 Software (e.g. V40-20-3 to 1) assume a ratio of 3:1. If you use vane/container combinations that don't match this, you will need to set up a new measuring system in Meas-Editor. You can calculate out the required value using this equation:

$$K\text{ - gamma} = \frac{0.2094}{1 - b^2}$$

where b is the ratio of vane to container diameters. Alternatively, select an appropriate value from the following table:

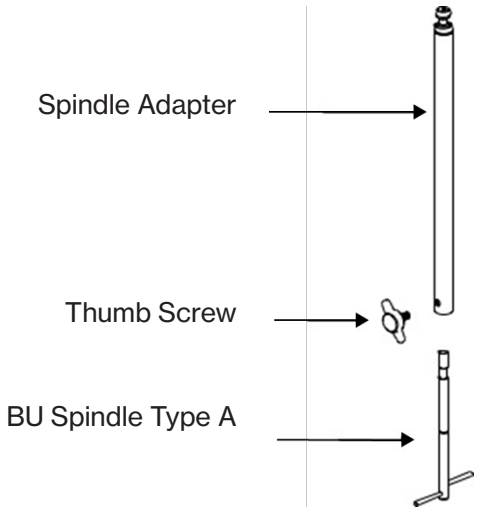
Container to Vane Diameter Ratio	Shear Rate Constant Kγ̇
1,5 : 1	0.3763
2 : 1	0.2792
3 : 1	0.2355
4 : 1	0.2234
5 : 1	0.2181
∞ : 1	0.2094

It is also possible to use a vane spindle with the MBT measuring chamber. This combination can be used to measure slurries (fluids with suspended particles). The standard vane spindle (e.g. VT-40-20) will appear with a modified part number (e.g. VT-40-20MB) in our AMETEK Brookfield price lists. The shaft on the vane spindle has been shortened to allow the spindle to fit in the MB chamber. For example, VT-40-20MB spindle can be used with the MBT-25 chambers. Contact AMETEK Brookfield or your local authorized dealer for more information.

Appendix E - Measuring in Brabender Units (BU)

RSX-SST Rheometers have firmware that will recognize spindle geometry RSX-90Y for testing according to ASTM C474. RSX-90Y is used with RSX-SST Rheometers having serial numbers beginning with 70 or with 304.
The RSX-90Y spindle has three parts, illustrated in the figure below:

- Spindle Adapter (PN: RSX-BBT)
- BU Spindle Type A (PN: RSS-88)
- Thumb Screw (PN: C1K-34Y)



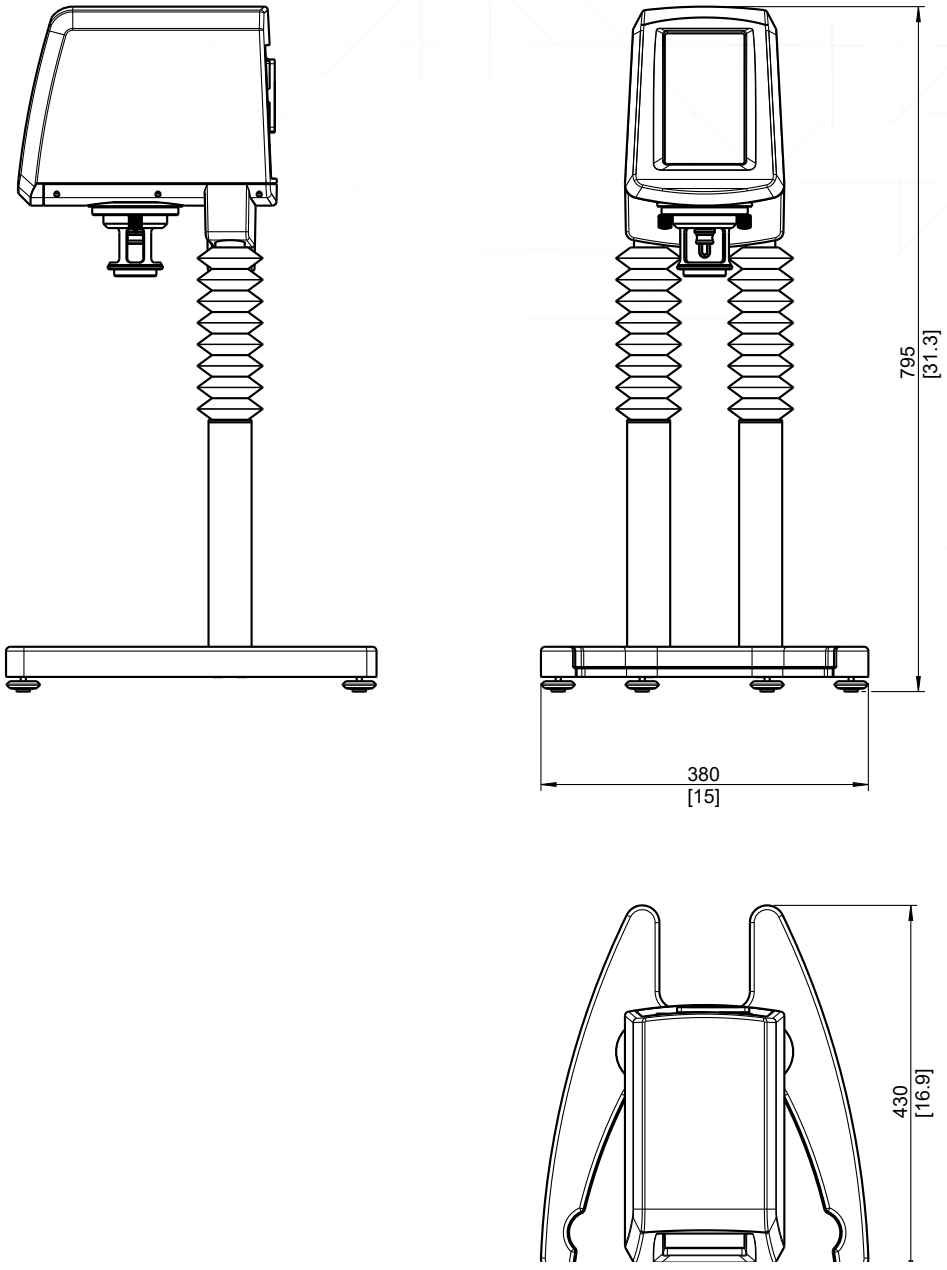
A typical test runs for 60 seconds at 78 RPM. The Brabender Unit (BU) value at the end of the time interval is recorded.
The measurement unit is the “BU”, which replaces the shear stress value on the rheometer display. BU is calculated by multiplying the measured FSR torque value by the BU Factor. The BU Factor is set to a value of 4.0 for the RSX-SST Rheometer, but may be adjusted if necessary, in the Edit feature for Measuring Systems.

Calibration check of the RSX Rheometer, when using a Brabender spindle, is done with the special kit RSS-109, which

includes CCT-40 spindle, MBT-40 chamber, and 1000 cP viscosity standard fluid.

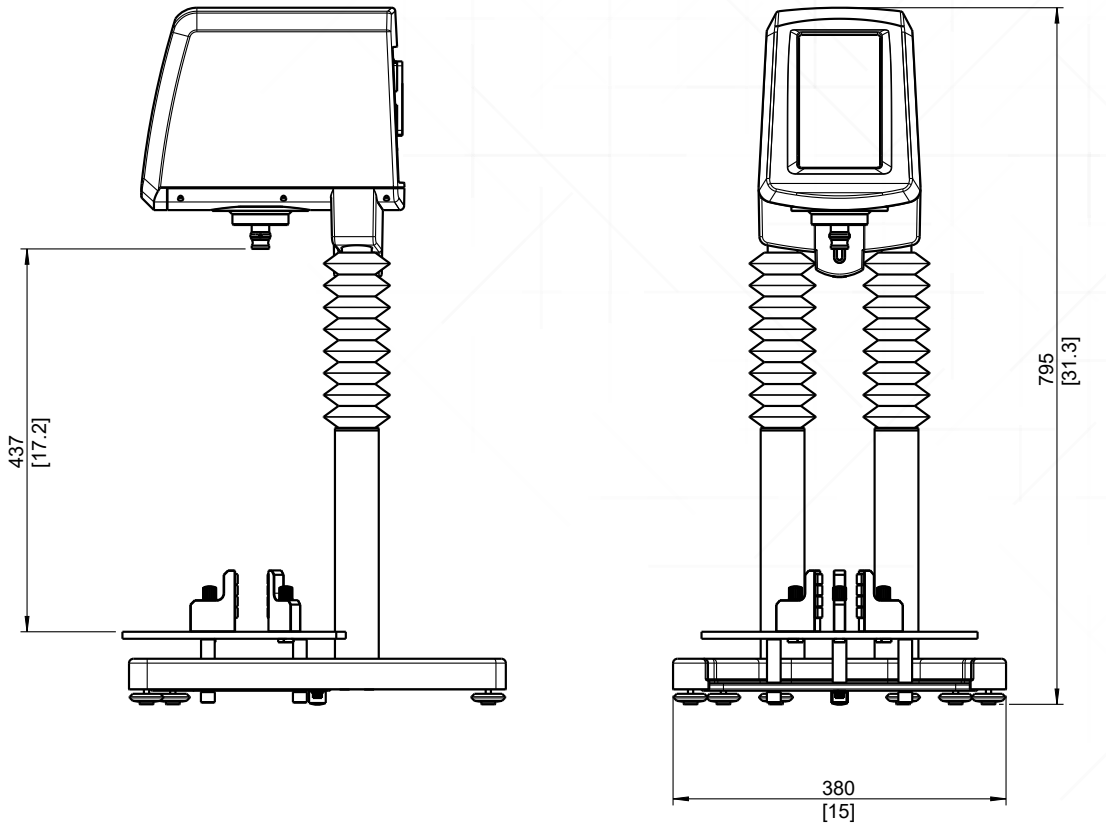
Appendix F - Instrument Dimensions

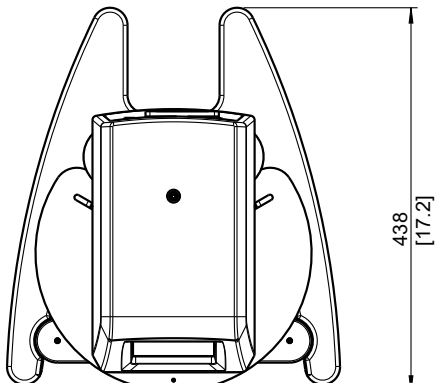
RSX-CC:



Units: mm(in)

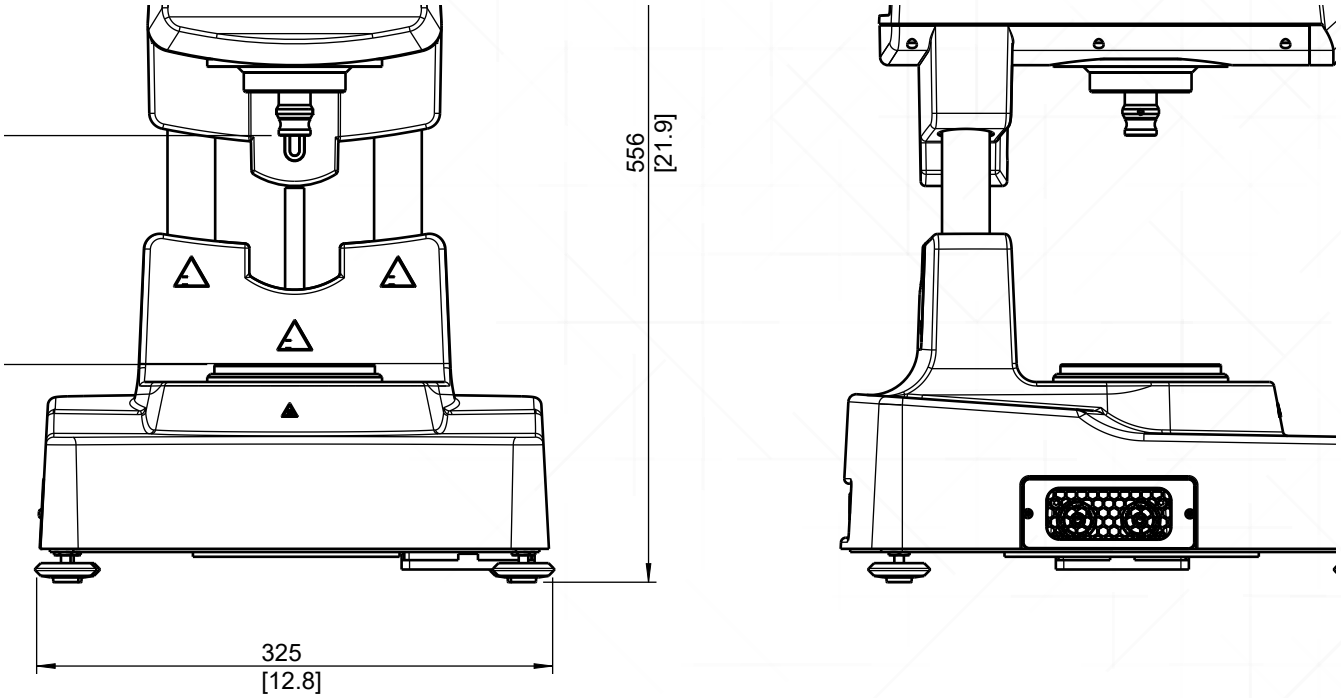
RSX-SST:

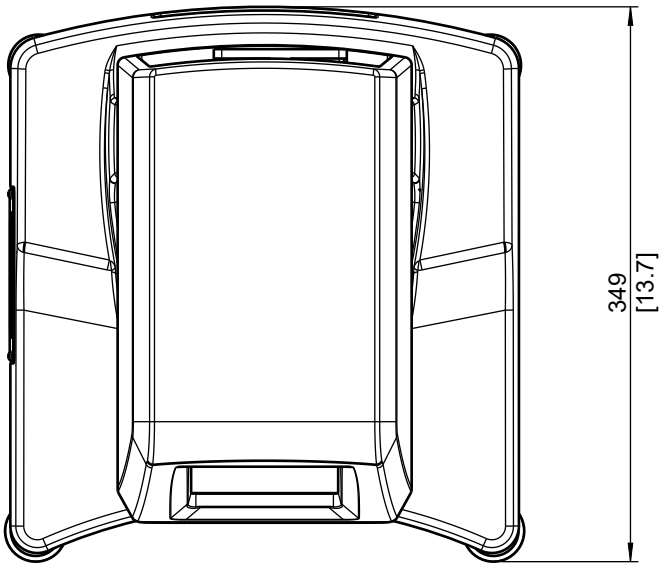




Units: mm(in)

RSX-CPS-PA & FH:





Units: mm(in)

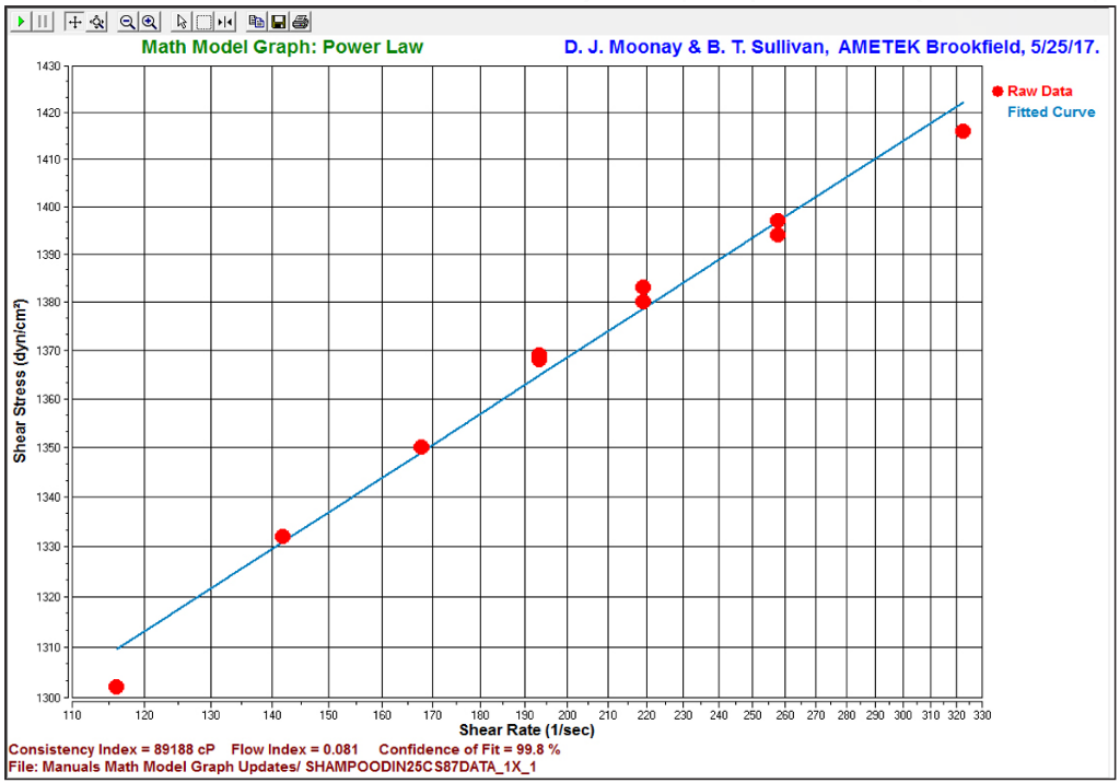
Appendix G – Math Models

Many Math Models are available in Rheo3000.

1. The Power Law (Ostwald) Model

$$\tau = k\dot{\gamma}^n \quad (\tau = \text{shear stress}, k = \text{consistency index}, \dot{\gamma} = \text{shear rate, and } n = \text{flow index})$$

The Power Law model provides a consistency index, k, which is a product's viscosity at one reciprocal second (Reciprocal seconds are the units of measurement for shear rate). It also provides a flow index, n, which indicates the degree to which a material exhibits non-Newtonian flow behavior. SinceNewtonian materials have linear shear stress vs. shear rate behavior and n describes the degree of non-Newtonian flow, the flow index essentially indicates how "non-linear" a material is.



When n < 1, the product is shear-thinning or Pseudoplastic. This means the apparent viscosity decreases as shear rate increases. The closer n is to 0, the more shear thinning the material is. When n > 1, the product is shear-thickening or Dilatant. Their apparent viscosity increases as shear rate increases.

When should it be used?

This model should be used with non-Newtonian, time-independent fluids that do not have a yield stress. These fluids will begin to flow under any amount of shear stress. Graphs of such material generally intersect the y-axis at 0.

An Example of the Power Law Model at Work

Shampoo
Flow Index (n) = 0.081
Consistency Index (k) = 89,188 cP

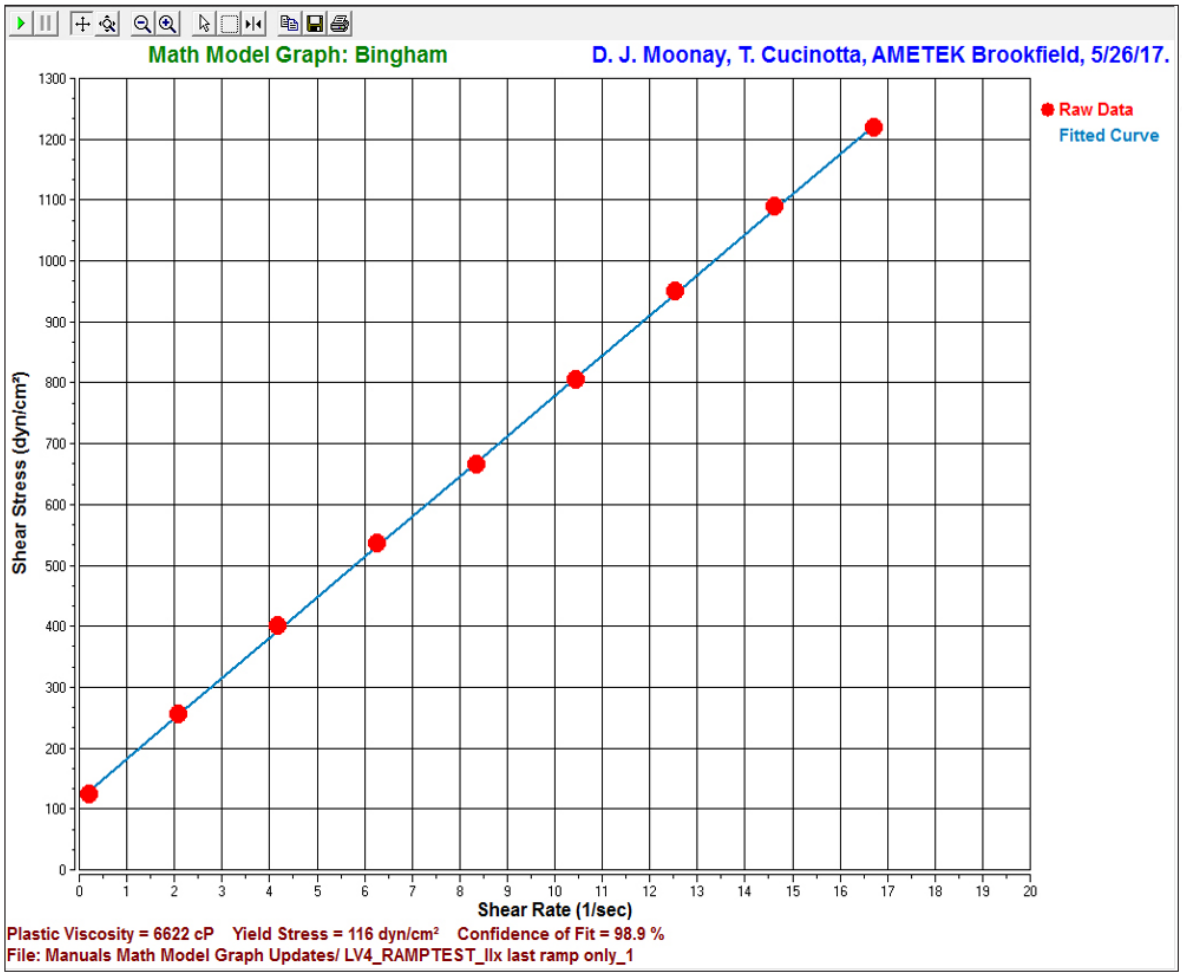
Formulators at a personal care company would like to use a substitute ingredient to decrease cost. They use the

Power Law model to evaluate the effect the new ingredient will have on the behavior of their shampoo. They need to know how it will behave during processing and how it will behave when it is being used by the customer. With the new ingredient the shampoo has a flow index (n) of 0.081. This indicates that the shampoo is shear-thinning enough to flow properly during processing and that it will flow properly for the end-user. The consistency index, k, indicates how the shampoo behaves when it experiences low shear rates. The power low values show that the shampoo becomes quite thin at process shear rates and therefore it can be easily pumped into filling equipment, hold tanks, etc. The consistency index of 89,188 cP shows that the shampoo is very viscous at low shear rates, and as a result, it will appear to customers to be “rich and creamy” while still being easy to apply.

2. The Bingham Model

$\tau = \tau_O + \eta D$ (τ = shear stress, τ_O = yield stress, η = plastic viscosity, and D = shear rate)

The Bingham model indicates a product’s yield stress, τ_0, which is the amount of shear stress required to initiate flow. It also provides the plastic viscosity, η, which is the viscosity after a product yields.



When should it be used?

This model should be used with non-Newtonian materials that have a yield stress and then behave in a Newtonian fashion once they begin to flow. As a result, the shear stress-shear rate plot forms a straight line after yielding. (Products that have a yield stress only begin to flow after a certain amount of shear stress is applied. They are also called “viscoplastic”. Their shear stress vs. shear rate graphs intersect the y-axis at a point greater than 0).

An Example of the Bingham Model at Work

Drilling Fluid

Plastic Viscosity (η) = 6622 cP

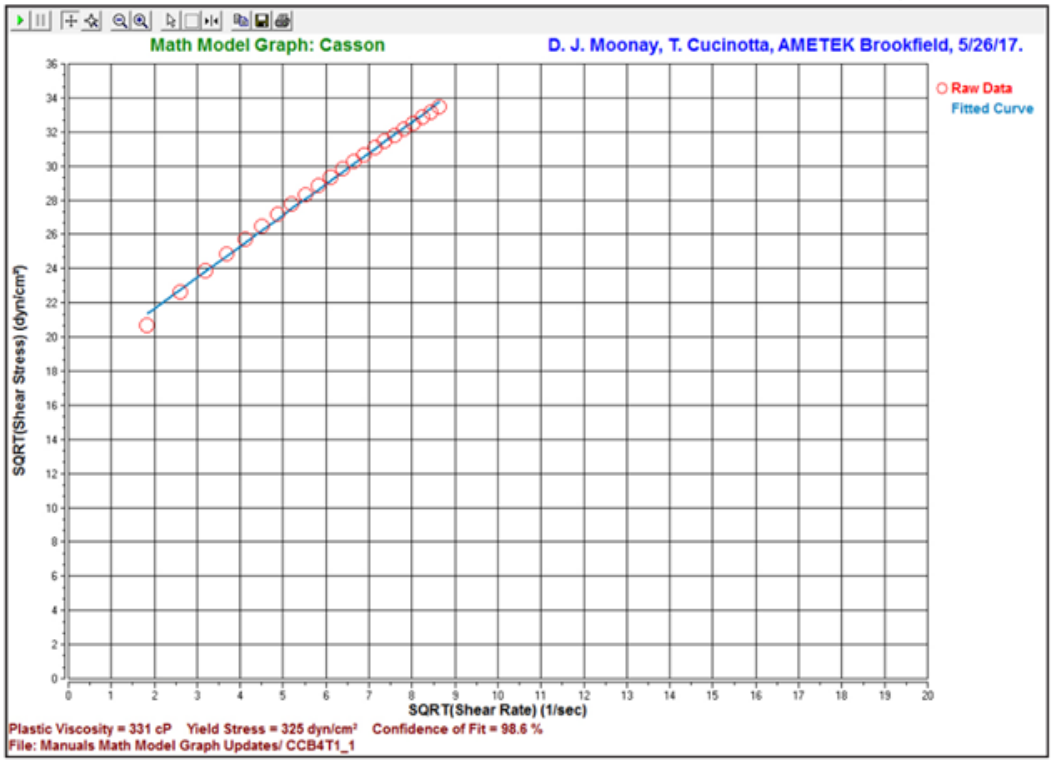
Yield Stress (τ_O) = 116 dynes/cm^2

A manufacturer of drilling fluid applies the Bingham Model to ensure the quality of their product. Results from a recent batch, shown in the figure, showed that the yield stress and plastic viscosity were both below the pass/fail criteria, which would cause the fluid to insufficiently hold-up the cuttings. The shipment was canceled, and the root-cause of the problem was identified.

3. The Casson Model

$$\sqrt{\tau} = \sqrt{\tau_0} + \sqrt{\eta D} \qquad (\tau = \text{shear stress}, \tau_O = \text{yield stress}, \eta = \text{plastic viscosity, and } D = \text{shear rate})$$

The Casson model provides parameters similar to that of the Bingham model. However, unlike the Bingham model, it was developed for materials that exhibit non-Newtonian flow after yielding. The Casson model indicates the product's yield stress (τ0) which is the amount of shear stress required to initiate flow, and the product's plastic viscosity, η, which is the viscosity of the product after it yields.



When should it be used?

The Casson model should be used with non-Newtonian materials that have a yield stress and that do not exhibit a "Newtonian-like" behavior once they begin to flow. This model is most suitable for fluids that exhibit Pseudoplastic or shear thinning, flow behavior after yielding. These fluids have a non-linear flow curve. The point at which it crosses the y-axis is the product's yield stress (τ0). To protect the point at which the curve will intersect with the y-axis, the Casson model linearizes or straightens the plot by taking the square root of the data. To ensure accurate extrapolation to yield stress, it is best to take some data at low shear rates.

An Example of the Casson Model at Work

Pharmaceutical Gel
Plastic Viscosity (η) = 331 cP Yield Stress (τ_o) = 325 dynes/cm

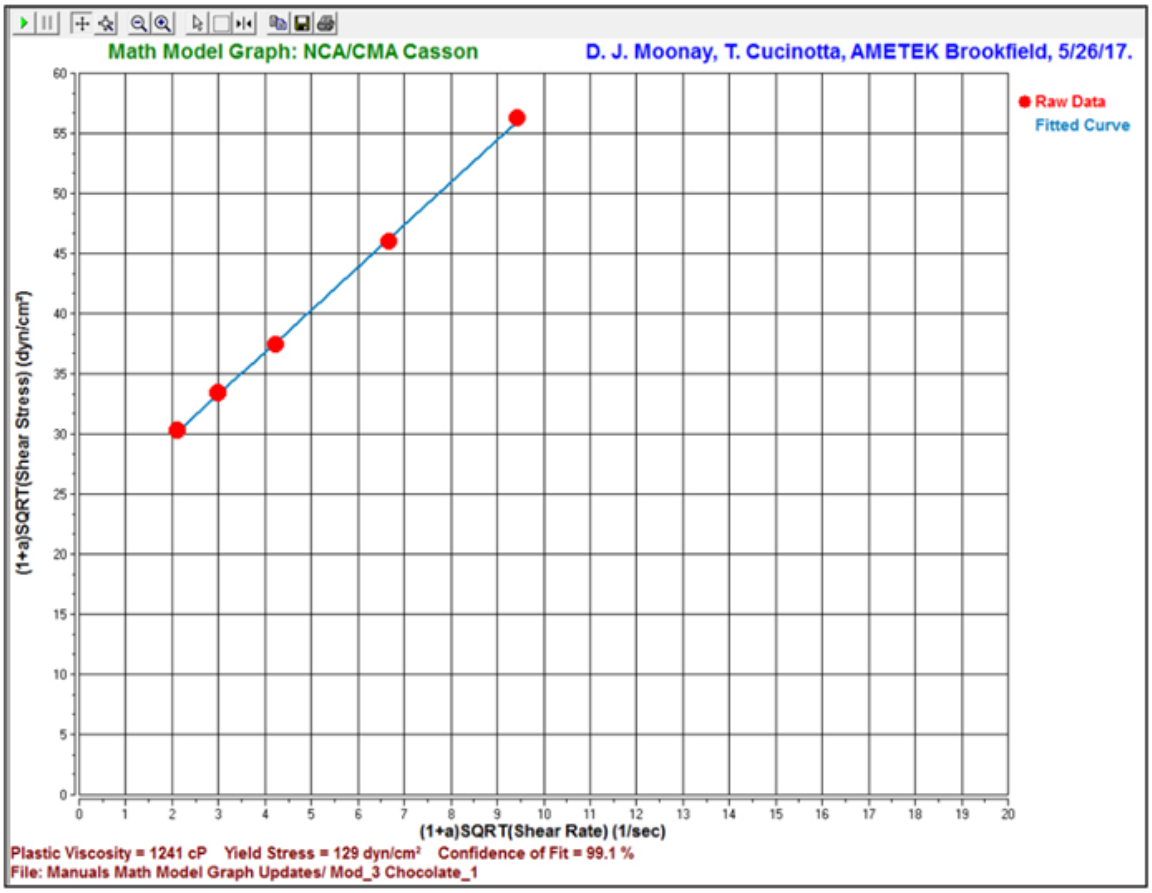
Before releasing a new over-the-counter gel, a pharmaceutical company needs to learn how it will behave when it is being used by the end customer. They perform a full viscosity profile and apply the Casson model. From the results, shown in the figure, they learn that their ointment has a higher yield stress, τ0, and a lower plastic viscosity, η, than they originally intended.

As a result, it is difficult or dispense from its container (due to the high yield stress) and it does not hold it shape very well (due to the low plastic viscosity), making it difficult to apply a small amount to the affected area of the skin. Based on this data, formulators can modify the ingredients accordingly. Once a formulation is established, multi-point tests and the Casson model is performed as a QC tool to check batches before and after processing.

4. The NCA/CMA Casson Model

$(1 + a)\sqrt{\tau} = 2\sqrt{\tau}o + (1 + a)\sqrt{\eta D}$ (τ = shear stress, τ_o = yield stress, η = plastic viscosity, and $\dot{\gamma}$ = shear rate)

The NCA/CMA Casson model is designed by the National Confectioners Association and the Chocolate Manufacturers Association as the standard rheological model for the industry. This model determines yield and flow properties under specified conditions and closely approximates the plastic behavior of chocolate before final processing.



When chocolate is used for enrobing, it must have a yield stress high enough to stay in place once it enrobes the filling.

In the case of decorating chocolate, the yield stress must be high enough that it can keep its shape once it has been squeezed into place through a nozzle. For molding chocolate, the plastic viscosity must be low enough to completely fill the mold.

5. Other Models

Newton model

This is the simplest; Newtonian liquids have a viscosity that, at constant Temperature & Pressure, is independent of shear rate.

$$\tau = \eta \cdot \dot{\gamma}$$

τ = shear stress, η = viscosity, $\dot{\gamma}$ = shear rate

$$(1 + a)\sqrt{D} = 2\sqrt{k4} + (1 + a)\sqrt{k5 \cdot \tau}$$

a = coaxial cylinder gap constant (it depends upon geometry), D = shear rate, k4 and k5 are adjustable parameters, τ = shear stress

Steiger-Ory Model

$$\dot{\gamma} = k1 \cdot \tau + k2 \cdot \tau^3$$

τ = shear stress and $\dot{\gamma}$ = shear rate,

The Steiger-Ory k1 and k2 are adjustable parameters.
This model was originally developed by researchers in the European pharmaceutical industry.

Best Model

Rheo3000™ determines the model which best fits the data, based upon the highest Stability Factor.

Rheotec Weighted Model

$$y = [\, f(x_{-1}) \cdot W + f(x) \,] / \, (W + 1)$$

This is a “generic” model that may be weighted to an operator-specified number of data points.

Windhab Model

This model was developed in Europe to fit chocolate viscosity data.

$$\tau = \tau_0 + \eta_\infty \cdot \dot{\gamma} + (\tau_1 - \tau_0) \cdot (1 - e^{-\left(\frac{\dot{\gamma}}{\dot{\gamma}^*}\right)})$$

τ = shear stress, τ_0 = yield stress, η_∞ = high shear rate viscosity, $\dot{\gamma}$ = shear rate,

τ_1 = shear stress corresponding to “maximum shear induced structuring”,

$\dot{\gamma}^*$ = the shear rate at which approximately (1 – 1/e) or ~63% of the structure has been built up.

Ref.: ICA Analytical Method 46, “Viscosity of Cocoa and Chocolate Products”, 2000.

Appendix H - Online Help and Additional Resources

WWW.BROOKFIELDENGINEERING.COM**
The AMETEK Brookfield website is a good resource for additional information and self-help whenever you need it. Our website offers a selection of “how-to” videos, application notes, conversion tables, instructional manuals, material safety data sheets, calibration templates, and other technical resources.

http://www.youtube.com/user/BrookfieldEng

AMETEK Brookfield has its own YouTube channel. Videos posted to our website can be found here as well as other "home-made" videos made by our own technical sales group.

ARTICLE REPRINTS

Available in Print Only

- AMETEK Brookfield has an extensive library of published articles relating to viscosity, texture and powder testing. Due to copyright restrictions, these articles cannot be emailed. Please request your hardcopy of articles by calling our customer service department directly or by emailing: MA-MID.sales@ametek.com

Available Online

- AMETEK Brookfield has a growing number of published articles that can be downloaded directly from the AMETEK Brookfield website. These articles can be found on our main site by following this path: https://www.brookfieldengineering.com/brookfield-university/learning-center/articles-and-technical-papers

MORE SOLUTIONS TO STICKY PROBLEMS

Learn more about viscosity and rheology with our most popular publication. This informative booklet will provide you with measurement techniques, advice, and much more. It's a must-have for any AMETEK Brookfield Viscometer or Rheometer operator. More Solutions is available in print and also as a downloadable pdf on the Brookfield website by following this path: https://www.brookfieldengineering.com/downloads/technical-documents

TRAINING/COURSES

Whether it is instrument-specific courses, training to help you better prepare for auditing concerns, or just a better understanding of your methods, who better to learn from than the worldwide leaders of viscosity measuring equipment? Visit our Services section on our website to learn more about training.

** Downloads will require you to register your name, company, and email address. We respect your privacy and will not share this information outside of AMETEK Brookfield.

Appendix I - Warranty Repair and Service

AMETEK Brookfield Viscometers are guaranteed for one year from date of purchase against defects in materials and workmanship. They are certified against primary viscosity standards traceable to the National Institute of Standards and Technology (NIST). The Viscometer must be returned to AMETEK Brookfield or the authorized dealer from whom it was purchased for a warranty evaluation. Transportation is at the purchaser's expense. The Viscometer should be shipped in the packaging originally provided with the instrument. If returning to AMETEK Brookfield, please contact us for a return authorization number prior to shipping. Failure to do so will result in a longer repair time.

For a copy of the Repair Return Form, go to the AMETEK Brookfield website.
https://www.brookfieldengineering.com/services/repair-forms

For repair or service in the United States return to:

AMETEK Brookfield Headquarters
11 Commerce Boulevard
Middleboro, MA 02346 U.S.A.
Telephone: (508) 946-6200
Fax: (508) 923-5009
www.brookfieldengineering.com

USA - Chandler, AZ
AMETEK Brookfield
3375 N. Delaware St.
Chandler, AZ 85225 USA
Phone: 800.528.7411
Phone: 602.470.1414
Fax: 602.281.1745
Email (Sales): ma-mid.sales@ametek.com
Email (Service): ma-mid.ccs@ametek.com
brookfieldengineering.com

For repair or service outside the United States, consult AMETEK Brookfield or the authorized dealer from whom you purchased the instrument.

For repair or service in the United Kingdom return to:

AMETEK GB LTD T/A Brookfield
Brookfield Technical Centre
1 Stadium Way
Harlow, Essex, CM19 5GX
Tel: +44 (1279) 451774
Email (Sales): uk-har.sales@ametek.com
Email (Service): uk-har.service@ametek.com
brookfieldengineering.uk

For repair or service in Germany return to:

AMETEK GmbH/B.U. Brookfield
Oberweyerer Str. 21
65589 Hadamar-Steinbach, Germany
Tel.: 06433-9145-4900
Service: 06433-9145-4901
Email (Sales): brookfield.de@ametek.com
Email (Service): brookfieldservice.de@ametek.com
brookfieldengineering.de

For repair or service in China return to:
AMETEK Commercial Enterprise (Shanghai) Co. Ltd.
4th Floor Building #4
No. 155 Puhui Road
Jiuting, Songjiang, Shanghai, China (210615)
Tel: 86-21-37632111 Ext. 8893
Email (Sales): brookfield-china.sales@ametek.com
Email (Service): brookfield-china.service@ametek.com
brookfieldengineering.cn

For repair or service in India return to:
AMETEK Instruments India Pvt. Ltd.
207-208, A Wing, 215 Atrium,
Andheri Kurla Road,
Behind Hotel Courtyard Marriot,
Andheri (East), Mumbai
brookfieldengineering.in

For repair or service in Thailand return to:
AMETEK (Thailand) Co., Ltd
Bhiraj Tower at Bitec, 23rd Floor, Room no 23009
Sukhumvit Road, Bangna, Bangna
Bangkok 10260 Thailand
Tel : +66(0)83 820 5872
Fax: +66 (0)2 012 7501
Email (Sales): brookfield-thailand.sales@ametek.com
Email (Service): brookfield-thailand.service@ametek.com
brookfieldengineering.com

On-site service at your facility is also available from AMETEK Brookfield. Please contact our Service Department in the United States, United Kingdom, Germany, India, Thailand, or China for details.