



PolyVISC[®]

Dilute-Solution Polymer Viscometer

Instruction & Operation Manual





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INTRODUCTION/SOFTWARE INSTALLATION

The PolyVISC™

The PolyVISC™ provides fully-automatic sampling and measurement of dilute solutions of polymers and other materials for comprehensive viscosity analysis.

Applications

PolyVISC instruments may be used for determination of the relative, inherent, reduced and intrinsic viscosity of polymers, including polyacrylic nitrate, nylon, polyester, epoxy resins, vinyl resins, polycarbonate, and cellulose acetate.



The PolyVISC instrument

PolyVISC precursor models have been used in laboratories worldwide for several years. PolyVISC instruments have demonstrable applications in R&D laboratories, quality control laboratories, polymer processing plants, and independent testing laboratories. The PolyVISC is ideally suited for the analysis of dilute polymer solutions; however, a variety of materials may be tested with ease.

Manual

This manual is designed to provide the operator with information about:

- PolyVISC equipment installation and operation
- VISCPRO® controlling software installation and operation
- Calibration, service and maintenance procedures

Determining relative viscosity

Methodology for relative viscosity determination using the PolyVISC is compatible with that specified in ASTM Method D 2857.

Measuring viscosity

Absolute (dynamic) viscosity

The term absolute viscosity, as used in this manual, is also known as dynamic viscosity. For the purpose of VISCPRO® software viscosity calculations, and per ASTM D 2857 specifications, the absolute viscosity, n , is defined by the equation $n = C\tau - E\rho/t^2$ where C is a constant, t is the sample drop time, ρ is the solution (or solvent) density and E is the kinetic energy correction constant.

Kinematic viscosity

Kinematic viscosity is a measure of the internal resistance to flow of a fluid under gravity with the pressure head being proportional to the density of the fluid. For any particular viscometer, the time of flow of a fixed volume of fluid is directly proportional to its kinematic viscosity.

Units of measure

An accepted unit of kinematic viscosity is one centimeter squared per second, which is called one stoke. The centistoke (cSt, which is equivalent to 1 mm²/s) is the unit of measure most frequently used. The PolyVISC measures samples with kinematic viscosity ranging from 3 to 20,000 cSt.

Methodology

ASTM Methods D 445 and D 446 describe appropriate test methodologies for glass capillary viscometry.

Manual viscometers

Sections 9-11 of ASTM D 445 provide detailed instructions for using manual viscometers. ASTM D 446 suggests a minimum flow time of 200 seconds for nearly all the glass capillary viscometers (see tables in ASTM D 446).

Automatic viscometers

For automatic viscometers, ASTM D 445 (1997) Section 6.1.2 states, “Automated assemblies that measure kinematic viscosity within the limits of precision given in Section 16 are acceptable alternatives. Apply a kinetic energy correction (see Specification D 446 and ISO 3105) to kinematic viscosities less than 10 mm²/s and flow times less than 200 seconds.”

Thus, automated viscometers can be used with flow times less than 200 seconds, as long as the kinetic energy correction and precision requirements are met.

Relative viscosity

Relative viscosity (η_r), a primary concern in the polymer industry, is determined from kinematic viscosity by factoring in the density of the solvent and materials in solution and comparing the resulting absolute viscosity of the solution with the absolute viscosity of pure solvent. ASTM D 2857 states that relative viscosity is “the ratio of the viscosity of the solution, η , to the viscosity of the solvent, η_s , that is, $\eta_r = \eta/\eta_s$.”

Units of measure

As a ratio, relative viscosity is a unitless measurement.

Methodology

ASTM Method D 2857 describes the appropriate test methodology for determination of relative viscosity.

NOTES

ASTM D 2857 states that “the kinetic energy correction constant is negligible for the recommended viscometers and efflux times.” For this reason, a default value of zero is assigned for E if the PolyVISC viscometer tube/bulb has not been calibrated.

Calibration is strongly recommended to ensure the highest precision when measuring relative viscosity. Calibration is required for accurate determination of absolute viscosity. However, it is not necessary to calibrate if measuring dilute solutions in the same bulb in which the solvent “blank” has been analyzed.

Inherent viscosity

Inherent viscosity (η_{inh}) is the ratio of the natural logarithm (ln) of the relative viscosity (η_r) to the mass concentration of the polymer (c) in g/cm³, g/dl or g/ml, as expressed by the equation: $\eta_{inh} = \ln \eta_r / c$.

Reduced viscosity

Calculation of reduced viscosity is accomplished by first obtaining the relative viscosity increment, η_i , (the ratio of the difference between the viscosities of solution and solvent to the viscosity of the solvent alone, as determined by the formula $\eta_i = (\eta - \eta_s) / \eta_s$) and then relating that value to the mass concentration of the polymer (c) using the formula $\eta = \eta_i / c$.

Intrinsic viscosity

Intrinsic viscosity is the limiting value of the reduced viscosity or the inherent viscosity at infinite dilution of the polymer. This value is calculated per ASTM D 2857 by extrapolation of viscosity versus concentration for several solution concentrations. Intrinsic viscosity calculations performed by VISCPRO yield a value in dl/g (deciliters per gram). The Billmeyer and Solomon-Ciuta equations for single-point intrinsic viscosity calculation may also be used.

PolyVISC viscometer tubes*PolyVISC viscometer tubes*

The unique PolyVISC compound viscometer incorporates a dual-bulb design that permits testing over a 100-fold viscosity range.

Viscometer sensors

Sample meniscus detection for the viscometer is performed by infrared optical sensors placed at three positions on the tube. When a light intensity change occurs, as a result of the sample meniscus passing the sensor, the PolyVISC either starts or stops the timing.

PolyVISC Compound Viscometer with Optical Sensors	
Compound Viscometer Size/Range (cSt)	Part # (optical sensors with holder)
0.14 - 14	P65.2200
0.3 - 30	P65.2201
0.5 - 50	P65.2202
1 - 100	P65.2208
3 - 300	P65.2203
8 - 800	P65.2204
16 - 1600	P65.2209
25 - 2500	P65.2205
75 - 7500	P65.2210
300 - 30000*	P65.2206
600 - 60000*	P65.2207
<i>*Extended range -Consult CANNON® for assistance if testing above 20,000 cSt</i>	

PolyVISC viscosity measurement

During sample measurement, the sample carousel positions the sample vial under the viscometer tube. Then the viscometer is lowered to about 0.5 cm above the bottom of the vial.

Bulb selection

The sample is then pulled into the viscometer by vacuum. The time required for the sample to pass between the first and second sensor is measured and a calculation is performed to determine which bulb the sample will be tested in.

Sample drop

For sample testing, the viscometer is raised above the sample (but not out of the sample vial) and the sample is allowed to drop back into the sample vial. As the sample meniscus passes the upper sensor of the test bulb, the timing is started. When the sample passes the lower sensor, the sample drop time is recorded.

Safety cautions

Please observe the following safety procedures and notices for proper operation of the PolyVISC:

- Make sure that your unit is operated only by qualified personnel.
- Make sure that you read and understand all operating instructions and safety precautions listed in this manual before installing or operating your unit. If you have questions regarding instrument operation or documentation, contact **CANNON®** Instrument Company.
- Do not deviate from the installation, operation or maintenance procedures described in this manual. Improper use of the PolyVISC instrument may result in a hazardous situation and may void the manufacturer's warranty.
- Handle and transport the unit with care. Sudden jolts or impacts may cause damage to components.

- Observe all warning labels.
- Never remove warning labels.
- Never operate damaged equipment.
- Unless procedures specify otherwise, always turn off the unit and disconnect the mains cable from the power source before performing service or maintenance procedures, or before moving the unit.
- Always permit the AIRBATH® to cool, and disconnect cable and tubing connections to the computer and solvent source(s) before moving the unit.
- Never operate the equipment with damaged mains power cables.
- Refer all service and repairs to qualified personnel.

**WARNING**

When supplying power to this instrument, ensure that the protective ground (earth) terminals of the instrument are connected to the protective conductor of the (supplied) line (MAINS) power cord. Use only the manufacturer-supplied power cord, which should be inserted in a socket outlet (receptacle) which is also provided with a protective ground (earth) contact. Do not use an extension cord (power cable) without a protective conductor (grounding).

In addition to the cautionary statements listed previously, additional cautions/warnings may be posted throughout this manual. These cautions, identified by the caution/warning symbol (see left) indicate important operational procedures. Read and follow these important instructions. Failure to observe these instructions may void warranties, compromise operator safety, and/or result in damage to the PolyVISC unit.



General Caution



Hot Surface Caution



Protective Conductor

~ MAINS

AC Power Input Symbol

Hot surface caution labels may be attached on or near hot surfaces of the PolyVISC. Avoid touching hot surfaces, particularly when operating the PolyVISC at bath temperatures exceeding 50°C.

The Protective Conductor Terminal symbol is used to indicate required ground connections for your instrument electrical supply.

The ~MAINS symbol indicates instructions or connections for the AC power supply. The AC Power input must match the electrical specifications listed on the label on the rear panel of the instrument. The supplied AC Mains power cord must be attached to the connector labelled ~MAINS. This connection serves as a means of disconnect and should be readily accessible.

Hazardous materials

Routine PolyVISC operation may require the use and handling of hazardous chemicals and solutions. **CANNON®** Instrument Company strongly urges the operators and technicians working with the PolyVISC to take proper safety precautions when working with these materials. These safety procedures can be found in the Material Safety Data Sheets which accompany the materials.

Solvent compatibility

The sample, solvent, and effluent fluid flow paths for the PolyVISC instrument consist of components manufactured from various materials. The material selection for these components has been optimized to provide compatibility with a wide range of chemicals. However, use of some chemicals in the instrument may require preventive maintenance intervals inside the normal 12-month product warranty. This maintenance may involve cleaning or replacement of fluid control valves and related tubing and interconnects, and is not covered under the normal warranty. Components used in the fluid flow path are made from the following materials: PTFE, PFA, Kel-F, 316 Stainless Steel, Borosilicate Glass and PTFE coated aluminum. It is the responsibility of the user to determine appropriate chemical compatibility with these materials.

**WARNING**

Selection, handling and disposal of solvents are the responsibility of the user. CANNON® Instrument Company does not make specific solvent recommendations. Refer to the Material Safety Data Sheet (MSDS) provided with the solvent material, and exercise the necessary safety precautions. Use extreme care when working with hazardous solvents.

PolyVISC specifications

POLYVISC Specifications	
Temperature resolution	± 0.01°C at calibrated temperature
Temperature range	20°C to 100°C (135°C model available by special order)
Viscosity range	0.3 cSt to 20,000 cSt (mm ² /sec.)
Solvent volume	Determined by solvent settings, approximately 10 ml for each rinse cycle, 5-7 cycles per sample
Dimensions	515 mm wide x 520 mm deep x 756 mm high (20.3 x 20.5 x 29.8")
Weight	50 kg (110 lbs)
Shipping weight	Add approximately 9 kg (20 lbs) to weight of instrument
Electrical	MODEL: POLYVISC Item # 9724-Z18: 100 volts AC, 50/60 Hz, 1600W MODEL: POLYVISC Item # 9724-Z19: 115 volts AC, 50/60 Hz, 1750W MODEL: POLYVISC-F Item # 9724-Z20: 230 volts AC, 50/60 Hz, 1850W
Operating Conditions	15°-30°C, 10%-90% RH non-condensing, Installation Category II, Pollution degree 2
Fuse Rating	MODEL: POLYVISC: M 250V 15A, 1-1/4 x 1/4" MODEL: POLYVISC: M 250V 15A, 1-1/4 x 1/4" MODEL: POLYVISC-F: M 250V 8A, 1-1/4 x 1/4"
Compliance	CE Mark: EMC directive (89/336/EEC); Low voltage directive (73/23/EEC); HI-POT (1900 VDC, 60 sec.)
<i>Use only the approved power cord supplied with your unit.</i>	

Installation overview

To use the PolyVISC you will unpack all components at the desired location. Then you will complete the installation by making all necessary tubing and electrical connections between PolyVISC unit and system components, including the computer and solvent/waste system. You will also install the VISCPRO® controlling software to your computer if software has not been pre-installed at the factory by **CANNON®**. For additional installation information and diagrams, see APPENDIX A.

Unpacking the PolyVISC instrument

1. Remove all components from the shipping container(s).
2. Remove any and all packing materials (packing foam, etc.) from the components.
3. Verify reception of shipped materials by comparing equipment items with packing/parts list(s). Report missing items to **CANNON®** Instrument Company immediately.
4. Inspect each component for signs of damage. Report damages to the shipper and to the **CANNON®** Instrument Company immediately.

Damaged items

Retain all packing materials until the instrument is connected and functioning properly. If any component(s) must be returned to **CANNON®** Instrument Company, the damaged item(s) should be packaged in the original shipping container. Refer to the final chapter of this manual for instructions on returning defective equipment. Customers outside the United States should contact the local **CANNON®** agent for procedures on returning products to **CANNON®**.

Connecting solvent delivery lines

External solvent lines transfer solvent to the PolyVISC unit from the user-supplied solvent containers. There are two 1/8" solvent inlet lines provided with the PolyVISC, each with connectors on one end and a 10-micron stainless steel filter on the other.

Washing solvent connection

Connect part # 65.3004 (a 1/8" OD PFA tube) from the user-supplied washing solvent container to the WASH SOLVENT IN fitting on the rear panel of the PolyVISC using the PFA Quikgrip® fittings provided (see diagram and note, next page). Fasten with a torque of 3 inch•lbs (.3 N•m). Place the filter end of the tube into the washing solvent container.

Drying solvent connection

Connect part # 65.3004 (a 1/8" OD PFA tube) from the user-supplied drying solvent container to the DRYING SOLVENT IN fitting on the rear panel of the PolyVISC using the PFA Quikgrip® fittings provided. Fasten with a torque of 3 inch•lbs (.3 N•m). Place the filter end of the tube into the drying solvent container.

NOTE

The filtered end of the solvent delivery lines must be placed below the liquid level of solvent in the solvent containers.



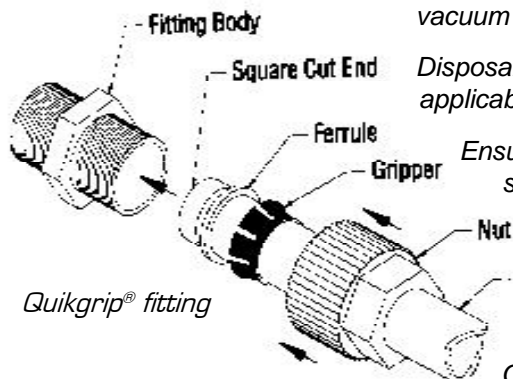
WARNING Hazardous solvents may require use of a ventilation system or vent hood.

Connecting solvent/sample drain lines

The drain line from the PolyVISC should be connected to a suitable safe container with the provided tubing. Local safety personnel should inspect and approve the waste container. **CANNON**® provides a heavy-duty polypropylene waste container with the PolyVISC. This container may not be suitable for some solvent/sample mixes.



CAUTION The customer must empty the waste container as necessary. Drain lines should be kept short and neat (no loops or knots) or function of the vacuum drain system may be compromised.



Disposal of solvent/sample waste should be in accordance with all applicable safety and environmental regulations.

Ensure compatibility of dual solvents at all times. If switching from one solvent to another with potential compatibility problems, make certain to empty the waste container and flush the solvent lines several times with a neutral solvent. Run several manual wash cycles with the neutral solvent to ensure evacuation of previous solvent from the solvent system (see Chapter 5, Maintaining the Solvent System). **CANNON**® Instrument Company is not responsible for damage to the solvent system caused by a combination of user-selected solvents.

Procedure

NOTE: If stainless steel fittings are provided in place of Quikgrip® indicated in diagram, tighten swage connection finger tight and complete connection by tightening an additional 1/4 turn with an adjustable wrench.

1. Connect a 1/4" OD PFA tube from the waste container to the WASTE SOLVENT/VACUUM OUT port on the PolyVISC using the PFA Quikgrip® fittings provided (see diagram, left, and note). Fasten with a torque of 8 inch•lbs (.9 N•m).
2. Connect a 1/4" OD PFA tube from the air escape port on the waste container to the vacuum pump inlet (**B**) using the PFA Quikgrip® fittings provided. Fasten with a torque of 8 inch•lbs (.9 N•m).
3. Connect a 1/4" OD PFA tube from the user's ventilation system to the vacuum pump outlet (**A**) using the PFA Quikgrip® fittings provided. Fasten with a torque of 8 inch•lbs (.9 N•m).

Situating solvent and waste containers

Place the rack containing solvent and waste containers on the same bench or tabletop as the PolyVISC and in close proximity to the unit.



WARNING Do not place the waste container in an excessively warm area or near open flames. Do not place the waste container in an enclosed area where fumes and vapors may build up.

Completing electrical/serial connections

NOTE Use only the **CANNON**[®]-approved supplied power cables for the CCS unit. Do not use serial or power cables exceeding 3 meters in length.

Vacuum pump power connection

To provide power for the PolyVISC vacuum pump, plug the PolyVISC vacuum pump power cord into the female power terminal on the rear panel of the PolyVISC instrument, just above the main power terminal.

Serial communication

Connect the provided RS-232 cable from the serial port of your computer to the 9-pin connector on the rear panel of the PolyVISC. For multi-unit installations, use the RS-485 modular RJ45 connection.

Main power cord

Attach the power cord to the power terminal on the rear panel of the PolyVISC. The terminal is located below the Vacuum Pump terminal. Make sure that the power switch on the front panel is set to OFF. Then plug the other end of the power cord into an appropriate power outlet matching the electrical specifications on the rear panel of the unit.

VISCPRO[®] for Windows[®] 98/NT[®]/XP

VISCPRO[®] is a powerful new software product providing a generic instrument interface for controlling and operating your **CANNON**[®] instrument(s) via computer. All instrument functions necessary for testing may be computer-controlled. VISCPRO[®] also includes reporting/analysis modules for processing and displaying sample data.

Installing VISCPRO[®] software

To install the VISCPRO[®] software, follow the instructions below in the sequence presented. Make certain that you complete the sections on checking instrument settings and calibration data. If you encounter difficulties at any stage in the installation process, call **CANNON**[®] Technical Services at 814-353-8000.

Computer requirements

IBM-compatible computer with Pentium[®] processor and Windows[®] 95/98 or NT[®] installed and operating normally • SVGA compatible display • 32 MB RAM • 200 MB hard disk space • CD-ROM drive • serial port

Windows[®] 98/2000/NT[®]/XP installation

NOTE Windows NT[®] users may require administrative rights in order to complete the VISCPRO[®] installation process. See your network administrator for assistance.

1. Turn on your computer. Wait for the Windows[®] software to load.
2. From the Windows[®] Start Bar click Settings/Control Panel. Insert the first VISCPRO[®] installation disk or CD-ROM into the disk drive.

3. Double-click the Add/Remove Programs icon and follow the Windows prompts to complete the installation procedure. The executable file for VISCPROR[®] software installation is SETUP.EXE.

Installation actions

The installation program will:

- create a directory for your data files. The default directory is C:\Program Files\Cannon Instrument\VISCPROR).
- write SETUP information to the Windows[®] registry.
- copy the software executable file and other necessary files to the directory you specify.
- update other files in your Windows[®] directories to versions fully compatible with the current VISCPROR[®] software.
- place a shortcut icon for the VISCPROR[®] executable file on your Windows[®] desktop.

Running the software



To load your newly-installed VISCPROR[®] software, double-click on the VISCPROR[®] icon on your Windows[®] desktop (or click Start/Programs/VISCPROR/VISCPROR Application).

NOTE

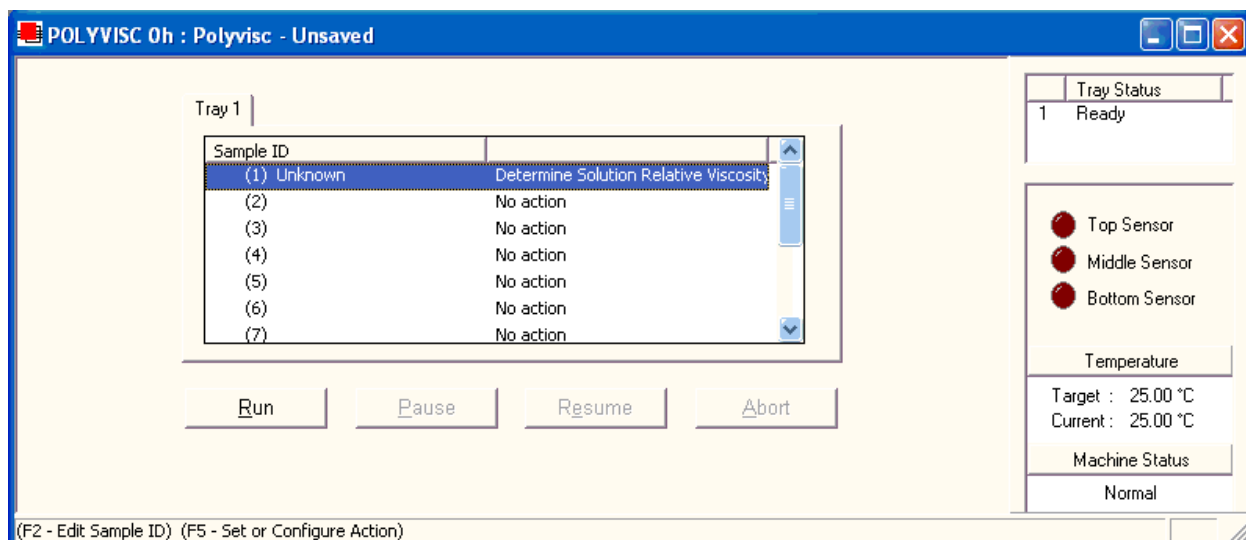
Windows[®] NT[®] users will need rights to the CANNON Instrument Company registry key: `0000_00000_00000000\00000000\0000000000000000`
See your NT[®] administrator for more assistance.

The screenshot shows the VISCPROR software interface. On the left, labels with lines pointing to the interface components are: Title Bar, Menu Bar, Instrument View window, Analysis window, and Status bar. The interface includes a menu bar (Main, Analyses, Configure, Service, Window, Help), a main window with a table of sample IDs and actions, and a status bar at the bottom showing various system and instrument information.

Sample ID	INV	Temp (°C)	KV (mm ² /s)	% Diff	T1 (s)	T2 (s)	Trey	Bulb	Date	Time
(1)										
(2)										
(3)										
(4)										
(5)										
(6)										
(7)										
(8)										
(9)										
(0)										

The VISCPROR[®] primary display

The VISCPRO® primary display window is framed on the top by the VISCPRO® title bar and menu bar, and on the bottom by the VISCPRO® status bar. The application window can be configured to include two child windows, as shown in the previous graphic. The first is an Instrument View window, which describes your **CANNON**® instrument and provides controls for testing samples:

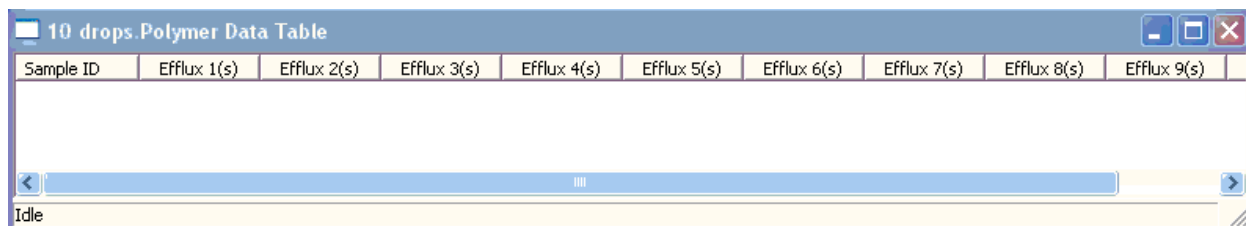


The Instrument View window

NOTE

If the Instrument View window does not appear, click View Instrument from the Main menu, click the desired instrument from the list of available instruments and click OK. If the Available Instruments list box is blank, your PolyVISC instrument may not be on-line. Check cable connections and make certain the PolyVISC power switch is ON.

The second child window is a report window which displays test results:




The Sample Analysis Table window

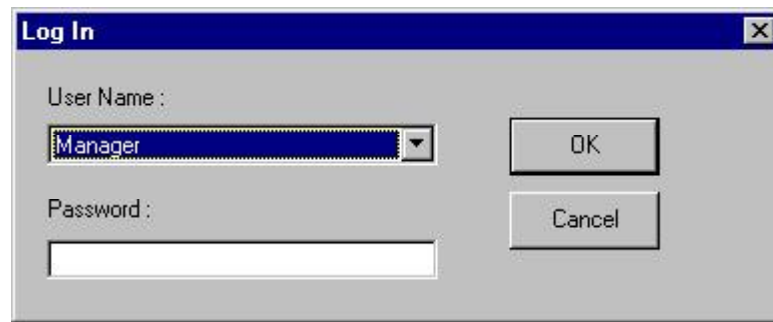
To display an analysis window, see the instructions in Chapter 6. To save a desired window configuration for display each time the software is loaded, see *Window Options* in Chapter 4.

Completing configuration settings

To complete the software configuration settings for your instrument(s), you must log in to the security system as a manager. The software is installed with a default Manager account. This account has no password, allowing any operator access to manager-level software functions as long as the password is not activated/changed. If you would like to engage the security options, see *Security Options* in Chapter 4 for instructions.

Logging in

1. Use your mouse to click **Main** from the VISCPRO® menu bar.
2. Click **Log In** from the **Main** menu options.
3. Click on the  (arrow) on the right side of the **User Name:** list box to display the list of registered users.
4. Click **Manager**. Do NOT enter a password!



5. Click **OK**. The **Log In** window will close automatically and you will be logged in as management personnel.

Checking Instrument Settings

1. Use your mouse to click (select) **Configure** from the VISCPRO® menu bar.
2. Select your instrument from the list of available instruments (there may be only one instrument in the list).
3. Select option 2, **Instrument Settings**, from the list of configuration options. The **Instrument Settings** window will appear.

Instrument Settings...

You will use the **Instrument Settings** window (see graphic, next page) to describe and control PolyVISC instrument operational features. These settings affect the instrument as a whole. Check the instrument settings for the instrument per the following instructions, and make any necessary changes as follows:



Use the **ID** field to input instrument identification information using up to 30 alphanumeric characters.

S/N :

The S/N: field is a non-editable field that displays the serial number from the label on the bottom right corner of the PolyVISC rear service panel.

Bath Equilibration : Minutes

Use the Bath Equilibration field to set the time delay (in minutes) between the attainment of the test temperature in the PolyVISC AIRBATH® and the initiation of the first sample run. This delay is only applicable to the first of the samples in the test sequence. Values between 1 and 60 are acceptable; lower values will enhance throughput.

The Instrument Settings window

Verify all settings, then click **OK** to save the current instrument settings and exit the Instrument Settings window.

NOTES

To exit the Instrument Settings window *WITHOUT* saving changes, click **CANCEL**. For additional information on Instrument Settings, see Chapter 4.

Checking and adjusting tray settings

Before running samples or check standards with the PolyVISC unit, you should verify and/or update configuration information for the viscometer tube and solvents you will be using. Tube configuration information is maintained from the Tray Settings: Tube and Tray Settings: Wash windows.

Procedure

1. Click **Tray Settings: Tube** from the VISCPRO® Configure menu options for your PolyVISC instrument.
2. Input the tube serial number (as indicated on the viscometer tube) into the **Tube S/N** field.
3. If necessary, change other operating parameters from this window. For more information, see *Tray Settings—Tube* in Chapter 4 of this manual. To restore **CANNON**®-recommended default settings, click the **Defaults** button. When you have completed the changes, click **OK** to save the settings.

4. Click Tray Settings: Wash from the VISCPRO® Configure menu options for your PolyVISC instrument.
5. Select Solvent A and click the Set Max fill time button to adjust the solvent system timing for the viscosity of Solvent A. When the A solvent has been flushed from the system, repeat the procedure for Solvent B. Then click OK to exit the Tray Settings: Wash window.

NOTE

New PolyVISC users should calibrate the instrument by testing standards with VISCPRO® per the calibration instructions in Chapter 3. Make certain to save the instrument configuration (see Save Instrument in Chapter 4).

Printing Instrument and Tray Settings

Print instrument settings

The Print Instrument and Tray Settings option from the Configure menu prints instrument and tray settings. When you select this option, the Print window is opened. Select the desired print settings and click OK to print out a hard copy of the instrument and tray settings.

NOTE

CANNON® Instrument Company recommends retaining a printout of current settings at all times for diagnostics, verification and record-keeping purposes.

Adjusting front panel pressure/vacuum settings

Regulator location

Two regulators are mounted on the PolyVISC front panel—the Air FLOW Adjust regulator and the VACUUM Adjust regulator. Adjust these regulators only when the PolyVISC instrument is IDLE (no tests in progress), using the procedure following.

NOTES

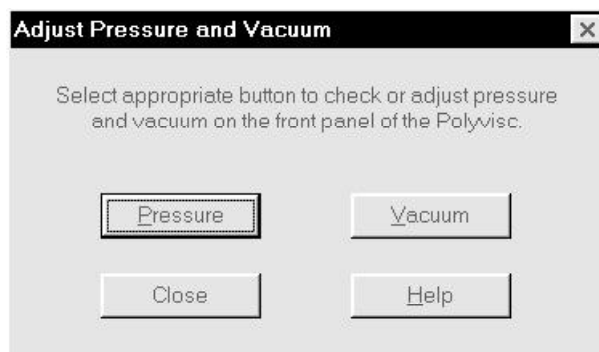
Optimum regulator settings will depend on the nature of solvent and sample materials.

Empirical testing has suggested that a pressure setting of +4 psi and a vacuum setting of -3 in/Hg are optimal for most solvents/samples.



Regulator adjustment procedure

1. Make certain that the PolyVISC instrument is on, and that the tube status is Idle. Verify VISCPRO software communication with the PolyVISC instrument (Main/Poll for Instruments).
2. Click **Service/Adjust Pressure and Vacuum**. The Adjust Pressure and Vacuum window will open (see graphic).



3. Click on the desired button to adjust pressure or vacuum.
4. Adjust the desired setting from the PolyVISC front panel.
5. Click **Abort** to reset valve settings.
6. Click **Close** to exit the Adjust Pressure and Vacuum window.

AIR FLOW Adjust

The AIR FLOW Adjust regulator adjusts the intensity of pressurized air used to inject cleaning solvent, and to air-dry the viscometer tube following the automatic solvent rinse. The knob regulates pressure between 0 and 10 psi. Turning the adjustment knob clockwise will increase the pressure. Turning the knob counterclockwise will decrease the pressure.

Adjusting air flow

The air flow adjustment will depend on the viscosity of the chosen solvent. If the pressure is set too high, solvent may bubble up in the wash station and spill onto the sample carousel. If the setting is too low, tubes may not be adequately cleaned or dried. If uncertain of the desired setting, set the regulator at +4 psi and observe the rinse and air-dry cycles during sample testing. Adjust the regulator as necessary for the desired instrument performance.

VACUUM Adjust

The VACUUM Adjust regulator is mounted below the vacuum gauge. This regulator adjusts the intensity of vacuum used to draw samples into the viscometer tube prior to sample drop timing. The knob regulates vacuum between 0 and -30 in/Hg.

Adjusting vacuum

The vacuum adjustment will depend on the viscosity of the sample material. If the intensity is too great, the sample may be pulled into the tube capillary with a “geyser” effect that could prematurely trip the upper sensor and cause a malfunction in the analysis. If the intensity is insuffi-

cient, sample may not be drawn into the viscometer tube in an appropriate time frame. If uncertain of the desired setting, set the regulator at -3 in/Hg on the gauge and observe the behavior of the sample material during sample testing. Adjust the regulator as necessary for the desired instrument performance.



CAUTION

Vacuum and pressure settings should be adjusted with care, since instrument operation is directly affected by variations in vacuum and pressure. In particular, the behavior of solvent and sample material in the viscometer tube will change with variations in vacuum/pressure, as well as temperature. For this reason, the Adjust Solvent Fill Time action should be executed from the Wash service window (Service Menu) any time the PolyVISC front panel pressure or vacuum settings are changed. This software feature performs an internal solvent reservoir fill procedure while timing the process. Then the solvent is evacuated to the waste receiver at the wash station. The reservoir fill time is automatically stored in instrument firmware and copied to the Maximum Solvent "X" Fill Time field in the Tray Settings: Wash window (see Configuration menu options for more information). All other timing parameters (see next section) should also be updated.

Preliminary instrument configuration procedures

Prior to running samples for the first time, and AFTER setting the desired intensity of vacuum and pressure (see previous section), execute the following VISCPRO® software Configure and Service menu options (described in Chapter 4) in sequence. Make certain that the PolyVISC instrument is ON and that the serial connection has been made between the computer and the PolyVISC.



WARNING

The configuration procedures following should ALWAYS be performed:

- 1. immediately after changing the viscometer tube.*
- 2. immediately after a new solvent has been introduced into the solvent system.*
- 3. immediately following adjustments to the vacuum or pressure settings.*

Improper configuration can cause damage to the PolyVISC instrument and/or create a hazardous condition.

Procedural overview

To properly configure the PolyVISC, you must adjust three parameters from the Tray Settings: Wash window; Max Solvent [x] fill time, Solvent [x] injection time, and Tube tip soak time. First you will execute an automated procedure to determine the optimum Max Solvent fill time for Solvent A (the heavier solvent). You will time the automatic procedure with a stopwatch or other timer. Then you will use the derived Max Solvent fill time value and the timed value to calculate an appropriate injection time for Solvent A. You will repeat this procedure for the Solvent B (the lighter solvent). Then you will select the optimum Tube tip soak time.

The Max solvent fill time parameter should be the maximum amount of time permitted for filling the internal solvent reservoir prior to viscometer tube washing. Since the internal reservoir is not visible to the user, this value can be calculated automatically during configuration using the Adjust Solvent Fill Time function from the Wash service window (see procedure following).

The Solvent [x] injection time value is the amount of time (in seconds) that solvent from the internal reservoir will be injected under pressure into the viscometer tube during solvent washing. For maximum time efficiency during automatic viscosity testing, the solvent injection time value should correspond to the amount of time required to evacuate solvent from the viscometer tube into the wash station waste receiver at the conclusion of the wash cycle.

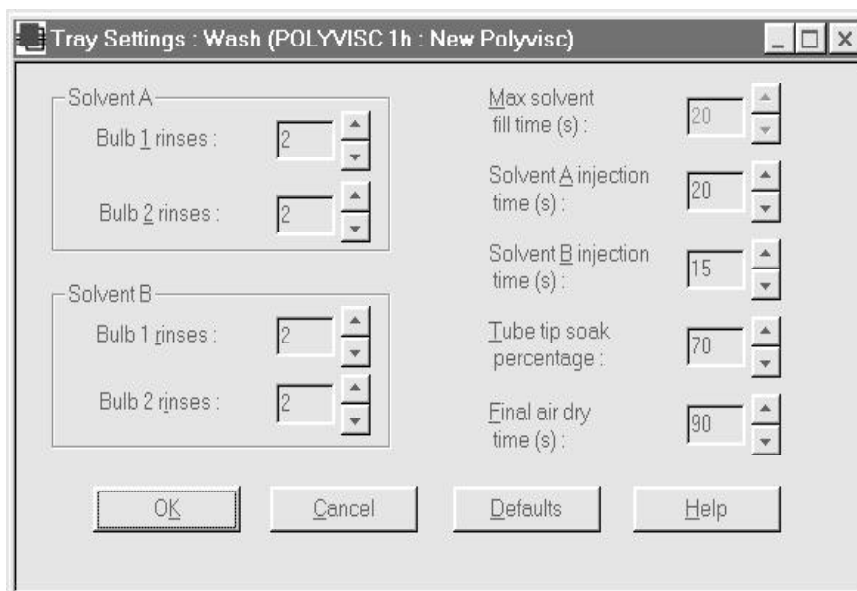
The Tube tip soak time is the amount of time that solvent injected into the viscometer tube remains in the waste receiver prior to solvent evacuation. If the Tube tip soak time is too low, tube cleaning may be compromised. If the Tube tip soak time is too high, the automatic test cycle will be unnecessarily prolonged.

Configuration procedure

1. Select the Tray Settings: Wash option from the VISCPRO® Configure menu. From the Tray Settings: Wash window (see graphic, next page), set the Tube tip soak time to an initial setting of “20”. This is satisfactory for most solvents.
2. Set the Solvent A and Solvent B injection times to a midrange value of 45 seconds (settings from 5 to 90 are permitted). Then click OK to save the settings and close the window.

NOTE

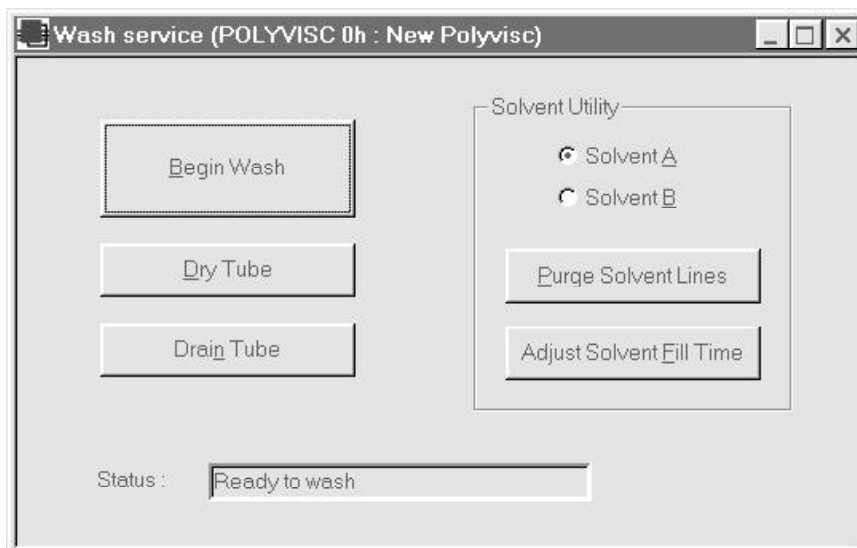
For some heavier solvents, the injection time may need to be increased from the initial setting. If a significant amount of solvent is left in the tube following injection (see step 6, following), it will be necessary to increase the injection time and repeat the configuration procedure beginning from step 3.



The Tray Settings: Wash window

Adjusting Max Fill Times

- From the **Service** menu options for your instrument, click the Wash service option to open the Wash service window.



The Wash service window

- Click the **Solvent A** radio button.
- Click the **Adjust Solvent Fill Time** button and simultaneously start your stopwatch or timer.

6. Observe the solvent action in the viscometer tube through the glass panel in the oven door. The PolyVISC will execute a solvent wash cycle and the solvent will be forced out of the tube by pressurized air. When the solvent is no longer being injected into the viscometer tube, and when the remaining solvent has been evacuated to the waste receiver, stop the timer. Write down the results (in seconds).
7. Reopen the **Tray Settings: Wash** window. Note that a new value has been copied to the **Max solvent fill time** field for Solvent A. Click **OK** to close the window.
8. Select **Solvent B** and repeat the **Adjust Solvent Fill Time** procedure (Steps 5-7) for the lighter solvent.
9. Reopen the **Tray Settings: Wash** window and calculate an appropriate value for the **Solvent A injection time** by subtracting the new **Max solvent A fill time** value displayed in the **Tray Settings: Wash** window from the timed value obtained in step 6. Input the value (to the nearest second, rounding up) into the **Solvent A injection time** field using the spin controls.
10. Repeat Step 9 for **Solvent B** (the lighter solvent) to calculate and input the **Solvent B injection time**.
11. After completing the above timing configuration, click the **Begin Wash** button from the **Wash service** window to execute a solvent wash.

Setting injection times

Final Tube Soak adjustment

After setting solvent injection times, maximize the effectiveness of viscometer tube cleaning by adjusting the value for the **Tube tip soak time** from the **Tube Settings: Wash** window. The **Tube tip soak time** is the amount of time during the wash cycle that the tip of the viscometer tube is submerged in solvent in the waste receiver prior to evacuation of solvent from the receiver. Select a value that balances effectiveness and efficiency in removing all traces of sample from the exterior surfaces of the viscometer tube.

Adjustment procedure

Adjust the **Tube tip soak time** as follows:

1. Open the **Tray Settings: Wash** window (Configuration option).
2. Input the desired soak time value in the **Tube tip soak time** field.
3. Click **OK**.

The instrument configuration is complete. You should save instrument software settings using the **Save Instrument** option (see *Main Options* in *Chapter 4* for more information).

Additional notes

Purging solvent lines

The Purge Solvent Lines option, accessible from the Wash service window, enables the user to clear solvent lines A or B (depending on which solvent is selected) with pressurized air. You should be able to see expelled air bubbling up in the solvent container as solvent is returned to the solvent containers.



WARNING

Traces of solvent will remain in the solvent system even after execution of the Purge Solvent Lines option. Always ensure compatibility of solvents used in the PolyVISC. Follow all MSDS procedures when using hazardous materials. Use extreme caution when handling internal or external solvent lines, or damage to the PolyVISC instrument and/or physical harm may result.

TESTING SAMPLES WITH THE *PolyVISC*

This chapter of the manual will provide information on testing samples using the PolyVISC instrument. Observe the safety cautions noted in the introductory chapter when operating equipment. The PolyVISC should only be operated by qualified personnel.

Preparing the PolyVISC

Turning on the PolyVISC

If PolyVISC power is off, turn on the PolyVISC instrument by twisting the power switch clockwise to the ON position.

NOTE

To remove power from the PolyVISC, place the switch in the OFF position by pushing the switch in.

Inserting/removing the reference thermometer

Internal AIRBATH® temperature may be verified with a suitable temperature reference device.

Inserting the thermometer

1. Check the current temperature setting of the PolyVISC and select the calibrated thermometer appropriate for that temperature.



CAUTION *Do not insert the temperature reference into the AIRBATH when the AIRBATH temperature is greater than 50°C or burns may result. Do not install a thermometer into the AIRBATH if the PolyVISC is to be operated at temperatures exceeding the temperature scale on the thermometer.*

2. Open the door to the AIRBATH and insert the temperature reference device. Secure it close to the PolyVISC temperature probe (located behind the top of the viscometer tube) and in a position where the temperature reading is easily visible from the front window, then close the door.
3. After the temperature has equilibrated click Service/Temperature Calibration to open the Update Temperature Calibration Data window. Then input the temperature from your reference device and click OK.



CAUTION *Remove the temperature reference from the AIRBATH if the PolyVISC is to be operated at temperatures exceeding the reference temperature range. If it is not removed, it may be damaged. Use caution when removing the reference device from a hot bath or burns may result.*

PolyVISC operation

Hardware and software

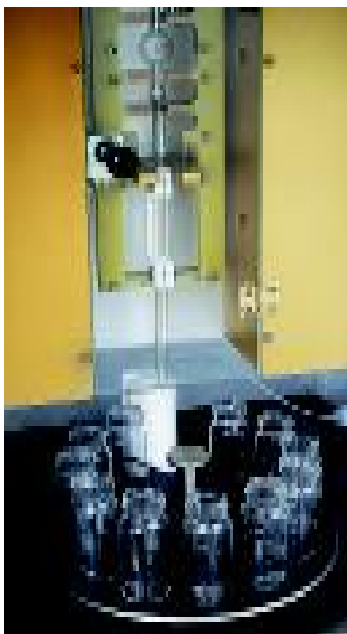
Automated PolyVISC operation is achieved through the cooperation of the embedded microprocessor and the VISCPRO® controlling software. The microprocessor controls the hardware activities relating to the test sequence and VISCPRO® provides the user interface for data entry and test initiation, data collection, and reporting. All valid test data is automatically stored to the VISCPRO® database (`samples.mdb`). Several reports (analyses) may be used to calculate and display relative viscosity and other related values. See the chapters on VISCPRO® analyses for further information.

Most analyses provide a dynamic operation mode which can immediately display and transmit test results to your computer screen, printer, local or network drive, and/or serial port for an in-house data collection system. See Chapter 6 for more information on configuring analyses.

Testing samples

Loading software

NOTE



CAUTION
Internal components
may be hot

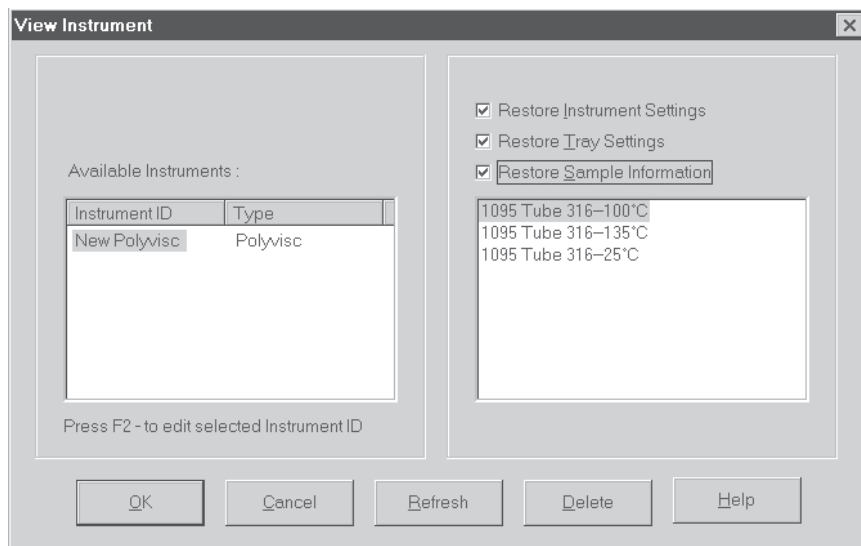
NOTE

If the software is already loaded, use your computer mouse to click Main from the menu bar and click Poll for Instruments from the Main menu options. This will establish communications between the computer and any on-line instrument(s).

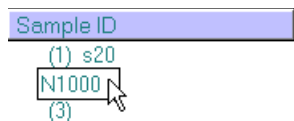
2. Verify that the AIRBATH temperature is below 50°C. Then open the door and remove the sample carousel from the AIRBATH. Obtain clean glass vials for samples to be tested and set the desired temperature for sample testing using the procedure below:
 - a. Click **Configure** from the VISCPRO primary display.
 - b. Click on the instrument ID corresponding to your PolyVISC.
 - c. Click **Instrument Settings**.
 - d. Click the radio button option corresponding to the desired temperature scale (°C or °F).
 - e. Click in the **Bath Temperature** field to position the cursor in the field. Then use the keyboard to input the desired temperature to the nearest 0.01°; then click **OK**.
3. Pour sample material into the glass vial(s). Fill to within 1.3 cm (½”) of the top of each vial (somewhat less sample may be required for testing in the lower bulb of the viscometer). Place the glass vials into the sample carousel in the desired test sequence. Carousel locations are numbered from 1 to 11. Sample 1 is tested first. During sample testing, vials are automatically advanced to a position directly under the viscometer tube.

Do not fill the vials to the top. Sample overflow may damage the carousel or AIRBATH components.

4. As samples are being loaded into the carousel, complete data entry for each sample in VISCPRO as follows:
5. Open the View Instrument window (if it is not already open) by clicking View Instrument from the Main menu, selecting the desired PolyVISC instrument from the list box on the left, and defining or selecting the desired instrument configuration using the check box options (see Chapter 4 for more information).



The View Instrument window



6. Click OK to display the Instrument View for the desired instrument.
7. Double-click on the desired Sample ID number with the left mouse button to access the sample ID data entry field (or press **F2**).
8. Enter sample ID information in the sample list box using your computer keyboard. After you have typed the sample ID, press the **Enter** key to save the entry. An options window for the default sample measurement option, Determine Solution Relative Viscosity, will appear (see graphic, next page)

Polymer measurement

The Polymer Sample Measurement Options window provides an interface for setting test parameters for individual samples. The default values displayed in this window are those chosen by the user in the Tray Settings: Tube configuration window. To make changes to default settings, click the appropriate check boxes or radio buttons and/or click in any of the data entry fields and input new values using the computer keyboard.

For additional information on the software interface options for polymer sample measurement, see Chapter 4.

The Polymer Sample Measurement Options window

- To accept the default values for sample measurement, click OK. To change the values, click on the appropriate controls or data entry fields and type the desired values. Then click OK.

If it is necessary to define or change a sample action, highlight the appropriate Sample ID(s) using the mouse or arrow keys, then click the RIGHT mouse button to access sample action options. Use your mouse pointer or keyboard arrow keys (↑↓) to highlight the desired action; then press **Enter** or left-click with your mouse to select it.



Sample action options

NOTES

If no Sample ID has been entered when a sample action is selected for a carousel tray position, the sample is automatically labeled Unknown. To change a sample ID, double-click on the ID field for the sample and enter the new ID using the keyboard. For other time-saving data entry options, see Sequential Sample IDs ... and Save/View Instrument options in chapter 4.

See *Sample Action Options* section of this chapter for information on software selection of test options.

For additional information on software data entry features, including multiple sample selection and cut & paste options, see *Testing samples—software options* in Chapter 4.

For information on using RV sample information for instrument calibration, refer to Chapter 3.

10. Continue entering information for all desired samples. When sample ID data entry is complete, place the carousel on top of the carrier in the AIRBATH, making certain that the standoffs are aligned with the holes. Then check the Tray Status window to verify that the carousel is ready for testing.
11. Close the door to the AIRBATH and secure the latch by pushing the handle downward. The instrument will not operate if the door is open.
12. Click on the RUN button to begin the PolyVISC test(s).

Pausing a test

To temporarily halt testing, click the **Pause** button from the Instrument View window.

NOTE

If a test was paused following temperature equilibration and prior to the initiation of the Wash cycle, drop time data for that particular test will be discarded.

Resuming a test

To resume testing after a test has been paused, click the **Resume** button from the Instrument View window. PolyVISC will resume sample testing with the next sample (see note in previous section).

Aborting a test

To permanently halt testing, click the **Abort** button from the Instrument View window. At the software prompt, click **Yes** to abort testing. All test actions will cease immediately.

NOTE

Aborting a test clears all sample test information for that tray. If test actions are aborted, it is the responsibility of the user to restore the instrument to a safe state before running tests (see Service menu options in chapter 4 for information on tube washing and drying).

Concluding a test

After automatic testing has been completed, make certain that the final sample has drained and the tray status for the tube, as indicated in the VISCPRO® Instrument View Tray Status window, is **READY**. Then open the door of the AIRBATH and carefully remove the sample carousel from the PolyVISC.
 permitting data entry of relevant parameters for the creation of a solvent “blank” (see *Defining and using a solvent blank for RV analysis*, later in this chapter).

**WARNING**

Use appropriate procedures when handling the carousel and heated sample vials to avoid the possibility of burns. Some samples/solvents may be hazardous. Consult the MSDS (Material Safety Data Sheet) for your materials to obtain information on potential hazards and procedures. It is the responsibility of the user to determine appropriate handling procedures for specific samples/solvents.

Cleaning up

At the conclusion of sample testing, empty the used sample vials into the appropriate container(s) for disposal. Clean glass vials per approved laboratory procedures.

Remove any excess sample from the table, sample carousel and vial holders. If necessary, clean these items with appropriate solvent.

**WARNING**

CANNON® does not recommend sample solvents. Many solvents used in the polymer industry are hazardous. Follow all relevant MSDS procedures when handling and disposing of PolyVISC solvents/samples!

Viewing results

Data obtained from all instruments during sample testing is stored in the central VISCPRO® database. To view data, you must create an analysis requesting the desired sample information.

The following analyses are shipped with the software:


- Polymer Data Table—displays test information of your choosing.
- Sample Data Table—displays test information of your choosing.
- Check Standard Data Table analysis—displays check standard information of your choosing.
- Error Log Table—displays error messages and related data.
- Error Data and Sample Data Export Analyses—configures data for output to a file, parallel port, printer or serial port.

Creating an analysis

The following procedure creates a typical Sample Data Table which will be updated as samples are tested. For additional information on analyses, consult the manual chapter corresponding to the desired analysis.


1. Select Analyses from the VISCPRO® primary menu options.
2. Select View Analysis ... from the Analyses menu. The Choose Analysis window will appear.



3. Double-click on **Basic Package** to reveal the available sample analyses.
4. Click on the **Define and Open New Configuration** radio button  (or verify that the option is selected).
5. Click **OK**. The **Sample Analysis Configuration** window will appear. The **Sample Analysis Configuration** window consists of tabbed pages with filter options appropriate for the analysis.
6. Click on **Date Filter** and then click the **Use Dynamic Update** check box.

NOTE

For additional information on analysis filter options, consult the manual chapter corresponding to the desired analysis.

7. Click on the spin controls  to select a value for the sample time window (the time parameter you desire for the report of recent test data) and click **OK**. The program will prompt you to save the analysis configuration.
8. Click **Yes** to save the analysis (*OR* click **NO** to display the analysis without saving the analysis configuration).
9. If **Yes** was selected, use your keyboard to type the name you wish to use for the analysis in the text box.
10. Click **OK**. The analysis configuration will be saved, and data obtained during the selected time window will be displayed.

Sample testing options

The following sample testing actions may be selected by right-clicking your mouse on the desired sample ID from the Instrument View window:

- No action
- Determine Solution Relative Viscosity
- Determine Solvent Viscosity
- Verify Known RV
- Measure Kinematic Viscosity
- Verify Known KV

No action

If **No action** is selected, all information for that sample position will be cleared and that carousel position will not be tested.

Determine Solution RV

If **Determine Solution Relative Viscosity** is selected as the test option for a sample, the **Polymer Sample Measurement Options** window will open, permitting data entry of relevant parameters for the determination of RV. For information on data entry options, see Chapter 4.

Determine Solvent Viscosity

If **Determine Solvent Viscosity** is selected as the test option for a sample, the **Polymer Sample Measurement Options** window will open,

Verify Known KV/RV

If Verify Known RV (relative viscosity) or Verify Known KV (kinematic viscosity) are selected as the test option for a sample, the Polymer Sample Measurement Options window will include a new data entry field, RV or Check Standard Viscosity, which permits the user to enter the known RV or KV of the sample:

The screenshot shows a software interface with two input fields: 'Density: 1.0000 g/ml' and 'RV: 1.0000'. Below these fields are three buttons: a dropdown arrow, 'Delete Blank', and 'OK'.

This information will permit the VISCPRO software to compare calculated RV or KV values with known values to determine the accuracy of current calibration and machine performance.

Measure Kinematic Viscosity

If Measure Kinematic Viscosity is selected as the test option for a sample, the VISCPRO software will calculate kinematic viscosity for the sample using the sample drop time and ASTM D 445 formulas. For information on kinematic viscosity calculations, see Measuring viscosity in Chapter 1.

Defining and using a solvent blank for RV analysis

Using a solvent blank

Relative viscosity by definition is a ratio between the absolute viscosity* of a solution containing a solvent and sample material, and the absolute viscosity* of the pure solvent. VISCPRO calculates this ratio by comparing sample drop times for the solution and the solvent “blank”. The significance of the resultant value is enhanced as two additional variables are taken into account—sample/solvent density and (with drop times under 200 seconds) an empirically-determined kinetic energy correction constant.

**The term absolute viscosity, as used in this manual, is also known as dynamic viscosity. For the purpose of VISCPRO® software viscosity calculations, and per ASTM D 2857 specifications, the absolute viscosity is defined by the equation $\eta = Ct\rho - E\rho/t^2$ where C is a constant, t is the drop time, ρ is the solution or solvent density and E is the kinetic energy correction constant.*

Relative viscosity calculation

The relative viscosity (RV) ratio (solute to solvent blank) is therefore defined by the equation:

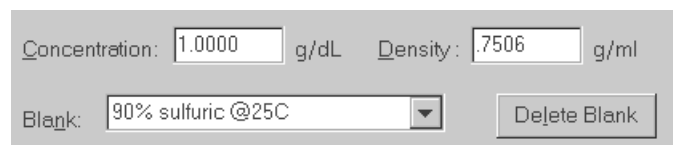
$$\eta_{rel} = \frac{\rho_1(C_1t_1 - E_1/t_1^2)}{\rho_0(C_0t_0 - E_0/t_0^2)}$$

Software selection of blank

Since determination of a relative viscosity involves a comparison of solution and blank, the VISCPRO controlling software requires the identification of a blank for any samples tested using the Determine Solution Relative Viscosity sample action. The blank is ordinarily selected from a list of solvents maintained by the VISCPRO database. This list is accessible from the Polymer Measurement Sample Options window by using the drop-down list feature:

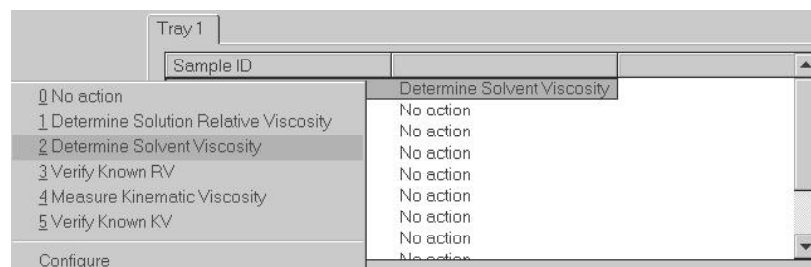


To display the list, click on the ▼ arrow. If the correct blank has not yet been defined, the user may create a new blank by typing an ID for the blank into the open field in the Polymer Measurement Sample Options window:

*Procedure for blank definition*

New blanks are created by testing the solvent in the PolyVISIC using the Determine Solvent Viscosity sample action. Follow the procedure for testing samples (see *PolyVISIC Operation/Testing Samples*, earlier in this chapter) with the following variations:

1. Select Determine Solvent Viscosity as the sample action for the desired sample.



2. Enter an ID for each blank that includes both a description of the blank and also the temperature at which that blank is to be tested in the PolyVISIC. The blank must be tested at the same temperature intended for the solution!

NOTES

In some PolyVISIC applications involving dilute solutions, it may not be necessary to input the density for the solvent blank and/or solution. If you choose not to input solvent density for either the blank or for the sample, the density of both will not be included in relative viscosity calculations.

Unity Reference blank

A preexistent blank, Unity Reference, is hard-coded in the VISCPRO® software with a value of "1". Users selecting this blank when running an RV sample are effectively calculating the kinematic viscosity of the solution in a manner which permits them to use VISCPRO® polymer report options.

Testing volatile samples

The environment for viscosity measurement using the PolyVISC AIRBATH and compound viscometer is much different than it would be with a conventional liquid bath and a U-shaped viscometer. Because of the continuous downward flow of air in the AIRBATH, evaporation of sample components has the potential to adversely affect the analysis. This is because evaporation changes the composition of the sample and may also affect temperature stability).

If you are testing at higher temperatures and/or with samples containing components which may evaporate during the analysis, cover the sample with aluminum foil or other easily penetrable membrane and secure with the “O” ring and cap supplied for that purpose with the PolyVISC. This will seal the sample until the viscosity measurement is performed. Then the viscometer tip penetrates the aluminum foil/membrane and performs the entire analysis without withdrawing completely from the sample vial.

NOTES

If the aluminum foil has been penetrated and the sample has remained in the analysis chamber for more than a few minutes, do not attempt to reuse the sample. A new sample should be prepared.

It is especially important to cover the samples when performing solution viscosity analysis of polymers. Even a slight change of composition caused by solvent evaporation may cause significant error.

Even samples that are high in viscosity may still contain volatile components; these samples should also be covered before analysis. Most lubricating oils, because they are manufactured at high temperatures and low pressures, do not contain significant volatile components and can be analyzed without being covered.

Washing the viscometer capillary

Even a small amount of contamination in the viscometer capillary may adversely affect the accuracy of viscosity measurement, since the flow through a tube decreases proportionally to the reduction in tube diameter. Contaminants on the side walls of the viscometer capillary will affect viscosity measurements significantly.

Viscometer washing in the PolyVISC is highly effective, since nearly all of the sample is already removed from the viscometer during the measurement. Automated cleaning is performed immediately after the analysis—the PolyVISC cleaning procedure should prevent any significant contamination of the capillary if solvents are appropriate for the sample being tested.

If any sample/solvent residue is observed in the viscometer tube at the conclusion of testing, use the Wash Tube option from the Service menu to clean and dry the tube.



WARNING

Selection, handling and disposal of solvents are the responsibility of the user. CANNON® Instrument Company does not make specific solvent recommendations. Refer to the Material Safety Data Sheet (MSDS) provided with the solvent material, and exercise the necessary safety precautions. Use extreme care when working with hazardous solvents.

VISCPRO® polymer viscosity calculation equations

The VISCPRO® software uses a variety of equations to provide accurate data for absolute (dynamic) viscosity, kinematic viscosity, relative viscosity, reduced viscosity, inherent viscosity, intrinsic viscosity, and other important polymer-related output.

Following is a synopsis of the calculations used for viscosity determination.

Absolute viscosity

Absolute viscosity, n , is defined by the equation: $n = Ct\rho - E\rho/t^2$

Where:

C	=	tube calibration constant (cSt/s)
t	=	flow time (seconds)
ρ	=	is the solution (or solvent) density (g/ml)
E	=	kinetic energy correction constant (cSt·s ²)

Rules for calculations

The VISCPRO® software will calculate for viscosity based on all available data. The following rules govern the method of calculation, including calculation in the event of missing information:

1. In cases where sample density and/or tube calibration constants are unknown (set to default values $\rho = "1"$, $C = "1"$, $E = "0"$), absolute viscosity is reported as "N/A" (not available) in relative viscosity analyses. This is because the absolute viscosity cannot be reliably calculated in the absence of this information.
2. The only exception to the rule above occurs when density *and* tube constants *are* available for the solvent blank in a relative viscosity determination. In that event, the absolute viscosity of the sample can be calculated using the absolute viscosity of the solvent blank and the relative viscosity value that was automatically calculated for the solution at the time of the test (see relative viscosity equation, next page).

For additional rules relating to relative viscosity calculations, see the section on relative viscosity calculation, following.

Kinematic viscosity

Kinematic viscosity, ν , is defined by the equation: $\nu = Ct - E/t^2$

Where: ν = kinematic viscosity (cSt)
 C = tube calibration constant (cSt/s)
 E = kinetic energy correction constant (cSt·s²)
 t = flow time (seconds)

Relative viscosity

Relative Viscosity is defined by the equation: $n_{rel} = \frac{\rho_1(C_1t_1 - E_1/t_1^2)}{\rho_0(C_0t_0 - E_0/t_0^2)}$

Where: ρ = density

Rules for calculations

1. The tube calibration constants (C) are only factored into the relative viscosity equation if constant real values (*not* default values) for the solution and the solvent blank were available at the times the blank and the solution were tested.
2. The kinetic energy correction, E, is used in relative viscosity calculations only if *both* tube calibration constants (C and E values) are available for *both* the solution and the solvent blank.
3. Density is factored into relative viscosity equations only if available for *both* the solution and the solvent blank ($\rho \neq 1$).

NOTE

If ρ_1/ρ_0 effectively equals 1, density values need not be entered in the VISCPRO® software for the solvent and sample.

4. In cases where density and constants are unknown ($\rho = "1"$, $C = "1"$, $E = "0"$), the relative viscosity equation simplifies to t_f/t_0 .
5. If no absolute viscosity values (see previous page) can be calculated, "N/A" will be displayed.

Other calculations

Reduced viscosity equation: $\eta_{red} = \frac{\eta_{rel} - 1}{c}$

Where: c = concentration in deciliters

Inherent Viscosity equation: $\eta_{inh} = \frac{\ln \eta_{rel}}{c}$

Intrinsic Viscosity equation: $[\eta] = \lim_{c \rightarrow 0} \eta_{red}$

Intrinsic viscosity (logarithmic) equation: $[\eta] = \lim_{c \rightarrow 0} \eta_{inh}$

Solomon-Ciuta* equation: $[\eta] = \frac{1}{c} \sqrt{2(\eta_{red}c - \ln \eta_{rel})}$

$$\text{Billmeyer* equation: } [\eta] = \frac{1}{4} \eta_{rel} + \frac{3 \ln \eta_{rel}}{4c}$$

**note that both the Solomon-Ciuta and Billmeyer equations are single-point intrinsic viscosity calculations.*

K-Value equation after Fickentscher:

$$K = \frac{a - 1 + \sqrt{1 + a^2 + 2 \times a \times (1 + 100/c)}}{0.15 + 0.003 \times C}$$

Where: $a = 1.5 \log 1.5 \log (\eta_{rel})$

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CALIBRATING THE PolyVISC

Calibration is essential for obtaining precise results with the PolyVISC. The PolyVISC is calibrated before it is shipped to the customer. The **CANNON**® representative who sets up the PolyVISC will calibrate it again after installation. Frequency of recalibration is at the discretion of the user. There are two types of calibrations—the *temperature calibration* ensures that the temperature probe readings conform to the reference thermometer, and the *standard calibration* ensures that the mathematical constants used in calculation of viscosity from sample flow times accurately reflect the unique properties of the specific viscometer tube.

Calibrating temperature

Periodically, the temperature of the PolyVISC instrument should be verified using a reference thermometer for that temperature. The PolyVISC temperature control system permits the calibration of the bath temperature to agree with any temperature reference standard, including an ASTM thermometer mounted within the bath. The bath can be calibrated by the user whenever the bath temperature is stable for any given target temperature in degrees Celsius or Fahrenheit.

Calibration procedure

1. Obtain a calibrated reference thermometer with the accuracy required for your application(s).
2. Place your calibrated reference thermometer inside the AIRBATH. Secure it close to the PolyVISC temperature probe (located behind the top of the viscometer tube) and in a position where the temperature reading is visible from the front window. Then close the door.
3. If PolyVISC power is off, turn on the PolyVISC power. Then turn on the computer and load the PolyVISC software.

NOTE

If the software is already loaded, use your computer mouse to click Main from the menu bar and click Poll for Instruments from the Main menu options. This will establish communications between the computer and the on-line PolyVISC instrument.

4. Set the desired calibration temperature of the AIRBATH and permit temperature to stabilize.

NOTE

To set the temperature, click Configure from the primary display and select Instrument Settings from the Configure options for the desired instrument. The Instrument Settings window will open. Then set the desired AIRBATH temperature by clicking on the radio button corresponding to the desired temperature scale (°F or °C), typing the temperature value into the Bath Temperature field and clicking OK.

**CAUTION**

When using thermometers containing mercury, make certain that the temperature of the AIRBATH does not exceed the temperature range of the thermometer. If it does, damage to the thermometer may result.

5. Permit the AIRBATH temperature and temperature reference to stabilize for at least ten minutes.
6. Click **Service** from the primary display and select your PolyVISC instrument. Then click option 4—Temperature Calibration. The Update Temperature Calibration Data window will open.
7. Input the temperature to the nearest 0.01 degree from the reference thermometer and click OK.
8. Repeat steps 5-7 until the desired AIRBATH temperature is achieved.

NOTES

The PolyVISC will not accept temperature reference data outside certain parameters. Additionally, if the amount of the correction is too large, the correction will not be accepted. Instrument service may be required.

The PolyVISC instrument can only store calibration data for one temperature at a time. If you are testing at multiple temperatures, you can save the calibration data for a given temperature by saving the Instrument (Save Instrument option from the Main menu) before recalibrating at a new temperature. Make certain to give the new instrument a name associated with the calibration temperature.

Tube calibration

During tube calibration, the software uses sample data from previous PolyVISC tests of materials with known viscosities to perform the mathematical calculations necessary to derive new constants for each timing bulb of the viscometer tube. The program displays the new constants and computes a viscosity for each sample using the actual flow time of the check standards. The resulting viscosity calculation is compared with the known viscosity of the standard (provided by the user at the time of the test) and displayed on the computer screen.

NOTES

The software allows the operator to manually change the calibration constants if necessary to enable the calculated values to more closely match actual viscosities.

A separate calibration must be performed for each temperature and each bulb of the tube in which samples will be run (see notes, previous section, and procedure following).

Tube calibration is not necessary for RV calculation if: 1) dilute solutions are being tested AND 2) solute and solvent blank are run in the same bulb AND 3) a value for absolute viscosity is not needed.

Calibration procedure

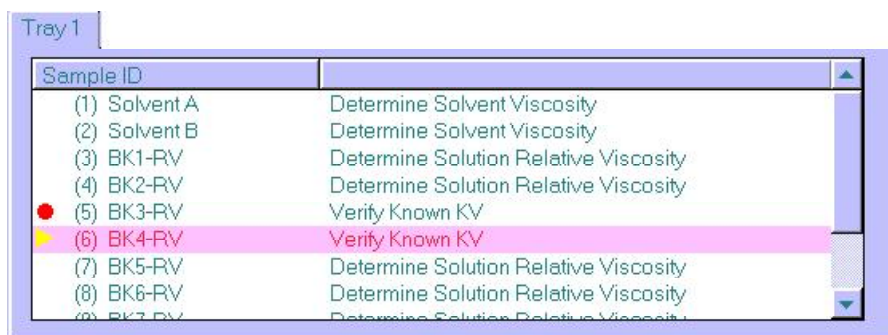
1. Assemble a group of standards with known kinematic viscosities for calibration.

NOTE

At least two different standards for each timing bulb are required for proper calibration. If you run calibration standards regularly, it may not be necessary to process additional standards. Existing sample data for the standards may be retrieved from the software database by specifying the appropriate time parameter from the software selection options (see steps 6-12).

2. Complete sample ID data entry for each sample of known viscosity.
3. After entering each sample ID, click on the highlighted ID entry using the RIGHT mouse button (or press **F5**). Then select Verify Known KV from the popup window. The Known KV options window will appear.
4. Enter the viscosity for each sample from the standard bottle, along with other necessary calibration data; then click OK.

If a standard viscosity has NOT been entered (or if the default viscosity value of 1.000 has not been accepted by the user), a yellow arrow (current sample) or red circle caution symbol will appear to the left of the sample ID:




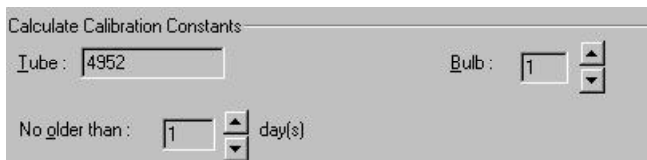
CAUTION


Make certain to enter the correct standard viscosity BEFORE running the standards. Incorrect data entry may skew future calibration results.

5. Click Run to test the standards.
6. When testing is completed, use the VISCPRO® software to log on as a Manager (Main/Log In) in order to access the calibration menu.
7. Select the desired PolyVISC instrument from the Configure menu; then select Calibration to open the Calibration window.





8. Use the spin controls  to select the desired Bulb for calibration.



9. Select the date range for acceptable calibration data by using the No older than [x] days spin controls  to set the date search parameters (if “1” is selected, only data from the standards run on yesterday and today’s date will be listed). Any check standards from the time frame you specified which are appropriate for calibration calculations will appear in the window list box.

Selecting samples

10. Select (or deselect) the specific sample entries you desire to use for calibration from the displayed list by clicking on them. To select a range of samples, highlight the first sample and click on the last sample while simultaneously pressing the  key. To select several individual samples for calculation, hold down the  key and click on each of the desired samples.
11. When the desired samples have been selected, click on **Calculate New Constants**. The new constant(s) for that bulb, **C** and **E**, will be displayed in their respective fields at the bottom of the window.
- You may evaluate the accuracy of the new calibration constants by comparing the known viscosity for the standard with the calculated viscosity for each standard selected for the new calibration. This difference is displayed as a percentage in the last column (% Diff) of the updated sample list box.
12. If the new calibration constants are acceptable, click on **Update tube** to save the constants for the current instrument. If the difference is not within acceptable limits, refer to Chapter 5 for PolyVISC maintenance/service information.
13. Repeat steps 8-12 for all the viscometer tubes and timing bulbs. When the proper constants for all the timing bulbs of all the viscometer tubes have been determined, close the **Calibration** window.
14. Test several standards to verify a successful calibration.

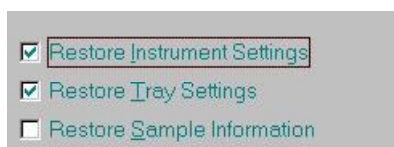
Saving a calibration

When calibration is complete, the calibration information is saved to the current instrument configuration and will be displayed in the Tray Settings: Tube window. This calibration information will remain in effect until the instrument is recalibrated at that same temperature, or until instrument and tray settings from a previously-saved instrument configuration are restored.

To avoid losing valid calibration data, **CANNON**[®] recommends saving the instrument configuration immediately after completing a new calibration (see *Save Instrument* in Chapter 4). The name for the instrument configuration should identify the specific instrument, the calibration date, the tube serial number, and the temperature:

EXAMPLE: PVunit 2; 10/20/00, #1483-40°

After the instrument configuration has been saved, calibration data may be restored at any time using the View Instrument option from the Main menu. The Restore Instrument Settings and Restore Tray Settings check boxes must both be selected to restore calibration data:



NOTE The Restore Instrument Settings and Restore Tray Settings options are security-protected at the Manager level.

PolyVISC calibration equations

Viscosity calculation equation In the PolyVISC, viscosity is calculated by using the viscosity calculation equations as described in ASTM Methods D 445 and D 446. Because samples running in the PolyVISC can have short flow times, the kinetic energy correction term (E / t^2) is used as prescribed in the aforementioned ASTM methods. The VISCPRO[®] software for Windows[®] 95/98/NT[®] performs all necessary calculations to derive constants **C** and **E**. These constants are used by the software when determining values for kinematic viscosity using sample drop times measured by the PolyVISC.

EXAMPLE: Kinematic Viscosity equation: $v = Ct - E/t^2$
 Where: v = kinematic viscosity (cSt)
 C = calibration constant (cSt/s)
 E = kinetic energy correction (cSt·s²)
 t = flow time (seconds)



NOTES When calibrating the PolyVISC, the operator should analyze the viscosity standard using double determinations to obtain two flow times for each standard. The **average** of the two flow times is used as input data for the calibration program. If the flow times are not within the percentage difference (%Diff) specified, the sample will not be included in the calibration.

Updating tube constants

Once the Update tube button is pressed, the updated calibration constants are associated with the selected instrument, and will remain the same regardless of the instrument configuration defined for that instrument.

You must click Update tube before changing bulbs if you wish to save the new calibration constants for that bulb.

Manually entering constants

Calibration constants may also be added manually from the Calibration window. Input the desired values for C and E in the indicated fields and then press the - key combination. The % Difference will be recalculated and new values displayed in the text box.

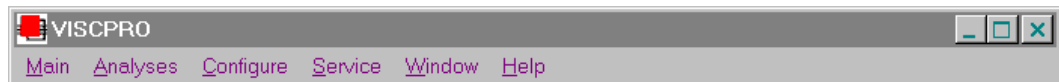
Default constant values

If constants have not been calculated for the tube, a default value of “1” for the tube calibration constant and a default value of “0” for the kinetic energy correction constant will be automatically stored by the VISCPRO software. Subsequent viscosity analyses performed on data from the uncalibrated tube will not incorporate the constants into the viscosity equations. The resulting relative viscosity equation, for example, will be a simple ratio of the drop times (and density, if applicable) of the sample to the solvent blank.

USING THE PolyVISC SOFTWARE

VISCPRO® generic instrument interface

Your software for Windows® 95/98/NT® is comprised of a generic instrument interface (VISCPRO®) and a collection of instrument/analysis-specific modules. This chapter of the manual will explain the software options for the VISCPRO® program and other modules commonly bundled with the instrument software. Additional software modules, customized software, and any documentation for add-on software options, are provided separately.



VISCPRO® primary display menu options

HELP system

Your software supports a complete HELP system. To access HELP for the software, click the HELP option from the VISCPRO® primary display. For context-sensitive HELP support for your interface, press **[F1]** or click on the HELP buttons provided.

NOTE

Because the VISCPRO® software is security-protected, some documented menu options may not be visible to technician-operators.

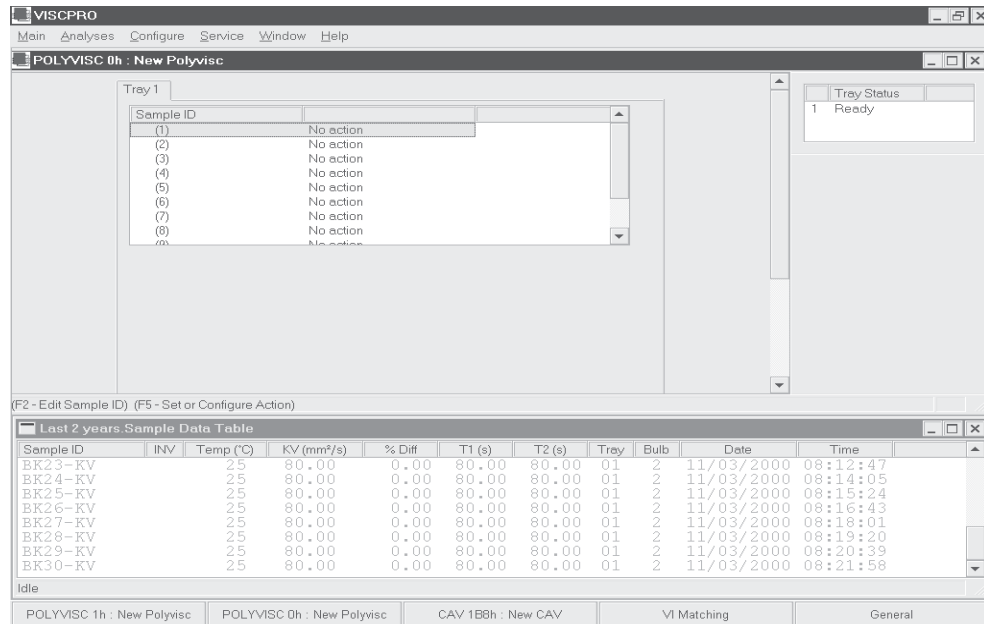
Main options

View Instrument...

The View Instrument option opens the View Instrument window which permits you to view existing instruments and configurations. You may also select and restore elements from saved configurations for on-line instruments.

The View Instrument window is comprised of:

- Two list boxes (Available Instruments and Saved Configurations)
- Restore ... check boxes (the Restore Instrument Settings and Restore Service Settings options are password-protected managerial/service functions)
- Five button options (OK, Cancel, Refresh (screen refresh), Delete and Help).



The View Instrument window

Available Instruments: The Available Instruments list box in the View Instrument window displays a list of all on-line instruments. To view and/or select saved configuration options for an on-line instrument, you must first click on the desired instrument from the list of available instruments.

NOTE

To access the Instrument View window to enter sample information for the selected instrument WITHOUT restoring a saved configuration, click on the desired instrument, then click OK without checking any of the Restore options. The last-used configuration for that instrument will be retrieved.

Saved Configurations: The Saved Configurations list box (located directly under the Restore . . . check boxes) allows you to make changes to the current configuration for any online **CANNON**[®] instrument by restoring any or all elements (Instrument, Tray or Sample) from a saved configuration. To restore saved configuration settings, select the instrument from the Available Instruments window and then click on the desired configuration from the list of saved configurations. Then click on the desired Restore ... options (see below) and click OK.

NOTE

If you wish to permanently delete a saved Configuration, highlight it and click the DELETE button or press the **Delete** key. Click Yes at the Confirm Delete prompt to immediately and permanently delete the configuration.

Restore ... : The Restore check boxes allow you to restore Instrument, Tray or Sample information from the saved configuration for the selected instrument.

Click the **Restore Instrument Settings** check box if you want to restore all Instrument Settings for the highlighted saved configuration (see *Instrument Settings* section in this chapter). Instrument settings apply to the instrument as a whole.

Click the **Restore Tray Settings** check box if you want to restore all tray settings for the highlighted saved configuration (see *Tray Settings: ...* sections in this chapter). Tray configuration settings apply to the viscometer tube in use.

Click the **Restore Sample Information** check box if you want to restore all sample ID information for the highlighted saved configuration. Sample information includes individual sample IDs and actions.

View Instrument window button options:



Opens the Instrument View window for the selected instrument and restores any selected configuration settings.



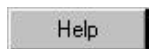
Closes the View Instrument window.



Updates the Available Instruments list box to include instruments which may have come online since the software was loaded.



Permanently and immediately deletes the highlighted instrument configuration (functions only when a configuration is selected).



Accesses context-sensitive help.

Save Instrument...

The **Save Instrument** option opens the **Save Instrument** window. The **Save Instrument** window permits you to save all current instrument information (including calibration) for any selected instrument, including **Instrument Settings**, **Tray Settings** and **Sample settings**, to the database. Once saved, the instrument information may be restored at any time using the **Restore** options from the **View Instrument** window.

Save Instrument procedure

To use the **Save Instrument** window, select the desired instrument by clicking on the instrument name in the **Available Instruments** list box. Then enter a name for the configuration in the **Save As:** field.

NOTES

The name for the instrument configuration should identify the specific instrument, the calibration date, the tube serial number, and the temperature:

EXAMPLE:

PVunit 2; 10/20/00, #1483-40C

If you wish, you may choose to overwrite an existing configuration with current settings by clicking on the name of the existing configuration in the Configuration list box. The Configuration name will be transferred to the Save As: field.

Click OK to save the configuration. To exit the Save Instrument window without saving the configuration, click Cancel.

Poll for Instruments

The Poll for Instruments option queries the hardware interface to establish communications with **CANNON**[®] instruments attached to the host computer.

Polling procedure

Click the Poll for Instruments option to establish a computer connection with instruments which may have come “on line” after the software has been in operation. When the connection has been verified by the controlling software via the hardware interface, the instrument name will be added to the status bar at the bottom of the VISCPRO[®] window.

Security options

The VISCPRO[®] application offers a level-based security system with a log in procedure. This system ensures that available software functions are appropriate for the security level of the user.

Initial security settings will be completed during PolyVISC installation. Following installation, security options may be accessed and changed from the VISCPRO[®] Main menu by individuals who have the manager password.

Each user can be assigned a security level, which is used to determine permitted operations. Three security levels are defined by the software: *Technician* (least privileged), *Manager* (intermediate privilege), and *Service* (maximum privilege—reserved for **CANNON**[®] Instrument Company service personnel).

Different security levels offer different PolyVISC use options. Technicians are permitted to access operational features required for testing samples and performing other routine operations. Managers may access advanced configuration and reporting options. The Service level permits access to all instrument and security parameters.

Initial security setup

The VISCPRO[®] software installation creates a security account for one manager with a blank password. After VISCPRO[®] installation, a password should be assigned for the manager using the **Change Password** menu option from **Main** (see below). Managers may add or change accounts for technician status personnel.

Log In...

Use the **Log In** feature to identify the PolyVISC operator and/or access security functions.

NOTE

Once an operator is logged in, that operator's name is associated with any sample data obtained during that VISCPRO session. The operator name may be included in analyses.

Procedure

1. Click Log In from Main.
2. Select the desired name from the drop-down list box.
3. Type the desired password in the Password field for the individual selected.
4. Click OK.

Change Password...

Use the Change Password feature to change the current user password.

Procedure

1. Log in to the VISCPRO® software using the Log In command from Main.
2. Select Change Password from the Main menu options.
3. Type in the new password in the Password field.
4. Retype the password in the Confirm Your New Password field.
5. Click OK to save the new password and close the Change Password window.

Update User Information...

Use the Update User Information feature to update the security list of authorized PolyVISC technicians and managers. User information can only be updated by an individual logged in with a higher security clearance than the user for which information is to be altered. **Manager** status is necessary to change **Technician** information. **Service** status is necessary to change **Manager** information. To obtain **Service** status, it is necessary to select user **CANNON Instrument Company** from the **Log In** window and to type in the current **CANNON®** password. For the current password (updated daily), call **CANNON®** at (814) 353-8000.

Procedure

1. Click Log In from Main.
2. Select your Manager or Service level user name from the User Name list box. Input the correct password in the appropriate field.
3. Click OK.
4. Click Update User Information from Main.
5. Select the desired user from the User Name list box.

NOTE

To delete a user, just click Remove User after selecting the user name. The account will be immediately and permanently removed.

6. Enter and verify the desired password, and select user security status using the appropriate list boxes.

7. Retype the password in the **Confirm Password** field.
8. Click **Add or Update User** to save your changes.
9. Click **Done** to exit the **Change User List** window.

Log Out

To use the **Log Out** feature, click **Log Out** from **Main**. The current user will be logged out of the security list of authorized PolyVISC technicians and managers. The software will automatically reset to the lowest security level. Any ongoing test operations will continue.

Print/Print setup options

Print...


Ctrl+P

Select the **Windows® Print** option to access the **Windows® print** window. Then select print options for the currently-active analysis/report (see *Analysis options*).

Print Setup...

Select the **Windows® Print Setup** option to access the print setup window. Check your printer driver documentation for additional information on print setup options.

Exit

Select the **Exit** option to exit the instrument software. Or you may click  on the application title bar.



CAUTION

Exiting the application aborts current tests. It is the responsibility of the user to restore the PolyVISC to a safe state using Wash service functions from the Service menu before resuming PolyVISC testing.

Analyses options

Data obtained from all instruments during sample testing is stored in the central VISCPRO® database. To view data, you must create an analysis configuration requesting the desired sample information in the desired format. Analysis configurations can be saved and later restored. The analysis configuration options provide powerful tools for reporting sample information. Refer to Chapter 6 of the manual for general information on using the analysis options. For specific information regarding the individual analysis packages shipped with your software (e.g., *Sample Data Table*, *Error Data Export*), consult the manual chapter for that particular analysis. Each analysis generates a report based on instrument data in the VISCPRO® database.

Analysis types

Available analyses include:

- **Error Data Export and Sample Data Export** analyses—configures data for output to a file, parallel port, printer or serial port.
- **Error Log Table**—lists error messages and related data.
- **Sample Data Table**—displays test information.
- **Check Standard Data Table**—displays check standard information.
- **Polymer Data Table**—displays test information.

Analyses menu options

The following VISCPRO® menu options are used to create and manage analyses:

- **View Analysis**—opens the Choose Analysis window. See *View Analysis*, below, for more details.
- **Report Title**—opens the Designate Report Title window. Permits data entry of up to three lines of text for the report title.
- **Configure Analysis**—Accesses Configuration options. For information on configuring analyses, consult Chapter 6 and the manual chapter corresponding to the particular analysis.
- **Save Configuration**—Opens the Save Configuration window. Type the desired file name in the **Save As:** field and click **OK** to save the configuration.

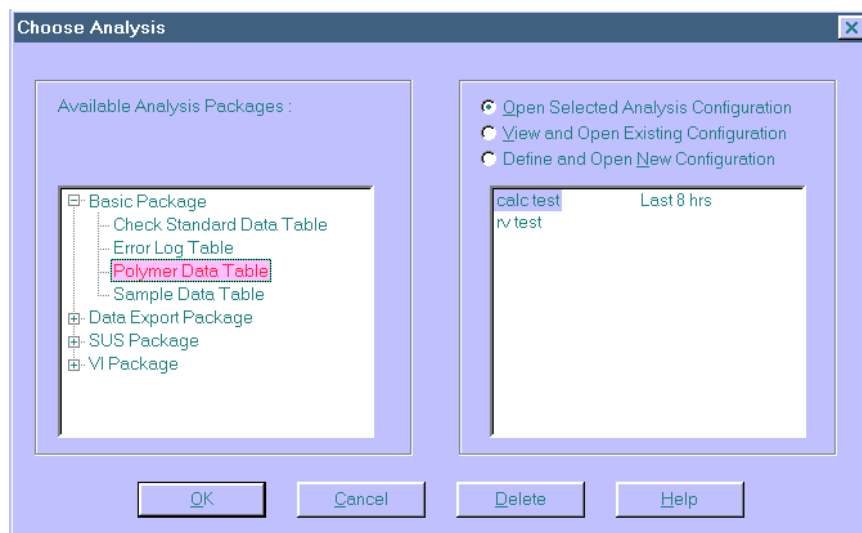
NOTE

The Configure Analysis and Save Analysis options are only available from the Analyses menu when an analysis window is open.

View Analysis ...




Select **View Analysis** to select an analysis from a list of available analyses or define a new analysis.

To display an analysis, click the **View Analysis** option from the Analyses menu. The **Choose Analysis** window will appear. The **Choose Analysis** window provides a list of available analyses in a list box on the left side of the window. The analyses are organized into similar groups using a directory tree structure.



The Choose Analysis window

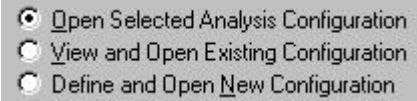
NOTE

“Unopened” report directories identified with the  symbol contain one or more analysis packages. Click on the  to reveal or  to conceal the list.

Select the desired analysis from the directory tree. After an analysis has been selected, you can configure the analysis to display the information you want from the central VISCPRO® database. The Choose Analysis window provides three options for doing this:

Click the appropriate radio button . Then select the desired saved configuration (if any) and click OK:

- **Select Open Selected Analysis Configuration** if you wish to create and display the selected analysis using the saved configuration highlighted in the list box on the right side of the Choose Analysis window.



Radio button options for analysis configuration

- **Select View and Open Existing Configuration** if you wish to open the configuration window for the analysis configuration highlighted in the list box on the right side of the Choose Analysis window.
- **Select Define and Open New Configuration** to open the configuration window using default settings for the selected analysis.

NOTE

For more information on defining and using configurations, see Chapter 6.

Window options

The Window menu provides options for scaling and arranging multiple windows/icons for screen display. In VISCPRO® you can also save and restore a specific window configuration.

Arrange Icons

Select this Windows® display option to arrange any minimized analysis/report or instrument windows at the bottom of the primary application window.

Cascade

Select this Windows® display option to re-size and regroup all open windows in an overlapping format which provides more space for the active window.

Tile

Select this Windows® display option to re-size and regroup all open windows to view multiple on-screen reports/instruments. You may select *horizontal* or *vertical* tiling for more convenient viewing of data.

Save Window Layout

Select this security-protected Manager-level function to save the current VISCPRO® screen configuration, including any currently-open analyses and Instrument View windows. To restore the saved configuration to the VISCPRO® display, click Restore Window Layout (see below).

Restore Window Layout

This function restores the saved VISCPRO® screen configuration. Any currently-open analysis windows will be closed before the saved configuration is loaded. Also note that currently-open Instrument View windows may be obscured by the restored configuration. To view these obscured windows, click Window from the VISCPRO® primary display and select the desired instrument view. Restoring a saved window configuration does not affect current PolyVISC sample testing operations.

PolyVISC module menu options

In addition to the general VISCPRO® menu functions available for a variety of **CANNON**® instruments, a unique software application module for each instrument type generates additional user interface options. The module determines the characteristics, function and appearance of VISCPRO® software menus and windows. The PolyVISC software module generates menu choices from the VISCPRO® primary display. These menu choices (under the **Configure** and **Service** headings) access important PolyVISC configuration and operation options.

Configure options

The **Configure** menu provides the user with a powerful tool for description of PolyVISC instrument capabilities, and for customizing PolyVISC test procedures. Once configuration settings have been determined for optimum performance, the settings can be saved and restored using the **Main** menu **Save Instrument** and **View Instrument** functions.

A **CANNON**® representative will assist in determining initial configuration settings during the PolyVISC installation procedure. Additional configurations may be created to enhance test performance with different types of samples.

Configuration settings will need to be updated when instrument specifications or components change (bath temperature, viscometer tubes, etc.).

Each of the configuration menus is explained in detail in the following sections. To access the configuration options, click **Configure** from the VISCPRO® primary display and select the desired instrument.

Print Instrument and Tray Settings

Print instrument settings

The **Print Instrument and Tray Settings** option prints instrument and tray settings. When you select this option, a standard **Print** window is opened. Select the desired print settings and click **OK** to print out a hard copy of the instrument and tray settings.

NOTE

CANNON® Instrument Company recommends retaining a printout of current settings at all times for diagnostics, verification and record-keeping purposes.

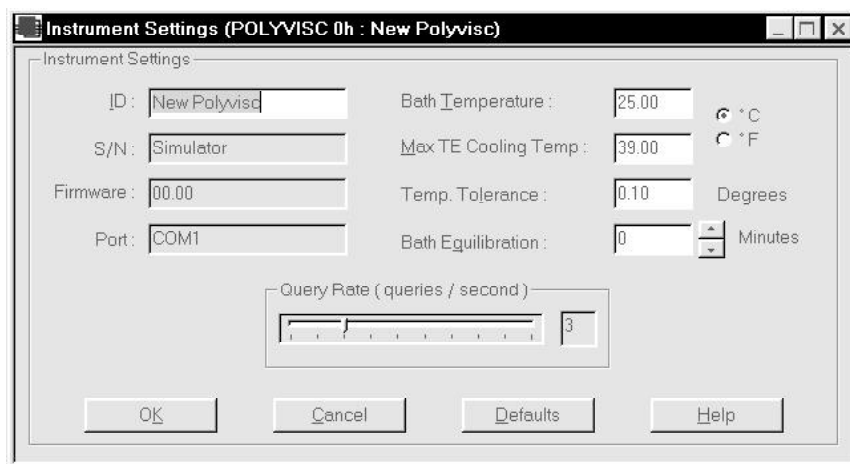
Instrument Settings

Instrument Settings...

Select Instrument Settings to open the Instrument Settings window, which provides features for describing the PolyVISC and controlling the instrument. These settings apply to the instrument as a whole.

ID :

Use the ID field to input instrument identification information using up to 30 alphanumeric characters.



The PolyVISC Instrument Settings window

S/N :

The S/N: field (non-editable) displays the instrument serial number stored by the operational firmware of the PolyVISC.

Firmware :

The Firmware: field (non-editable) displays the current firmware version for your PolyVISC instrument.

Port :

The Port: field (non-editable) displays the current computer serial port used to transfer data from your PolyVISC instrument.

Bath Temp: °C °F

Select the desired unit of temperature measurement by clicking on the corresponding radio button. Then input the desired temperature for the PolyVISC Instrument in the Bath Temp: field.



CAUTION

Changing bath temperature may necessitate removing the reference thermometer from the AIRBATH. See Inserting/removing the reference thermometer in Chapter 2 for information on the procedure.


Max TE Cooling Temp:

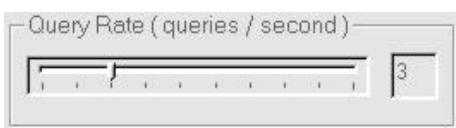
Click in the field and type the maximum temperature at which thermoelectric cooling will be enabled. Values between 25° and 50°C are acceptable.

Temp. Tolerance: Degrees

Click in the field and type the maximum allowable temperature variation allowed during PolyVISC testing to the nearest 0.01 degree.

Bath Equilibration: Minutes

Click on the  arrows to select the number of minutes for the samples to soak prior to introduction of the first sample in the test series. Note that bath equilibration does not begin until the bath has reached the target temperature.

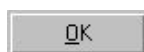


Click and drag the slider bar to adjust to rate of status queries to the Polyvisc instrument from 1 to 10 per second. The default rate is 10 per second (fastest rate). Higher query rates provide better status monitoring on the screen.

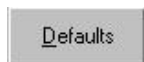
NOTE

If multiple PolyVISC machines are networked to the same computer, a faster query rate may cause a backup and delay in the serial command queue. The rate should be decreased if the user notices an appreciable delay in instrument response to software commands (Run, Abort, etc.)

Instrument Settings window button options:



saves the current instrument settings and exits the Instrument Settings window.



restores the default configuration settings for several instrument options



closes the Instrument Settings window without saving any configuration changes.

Tray Settings: Tube

Use the Tray Settings: Tube window (see diagram, next page) to describe and control test parameters for each individual viscometer tube. Use the instructions below as a reference when altering default settings. When you have achieved the desired configuration, apply the settings to the current instrument by clicking OK. To exit the configuration screen without saving your changes, click Cancel. To restore software defaults, click Defaults.

Tube S/N :

Use the S/N: field to input the identifying tube serial number (you may wish to use the serial number handwritten on the viscometer tube).

Wet Tube

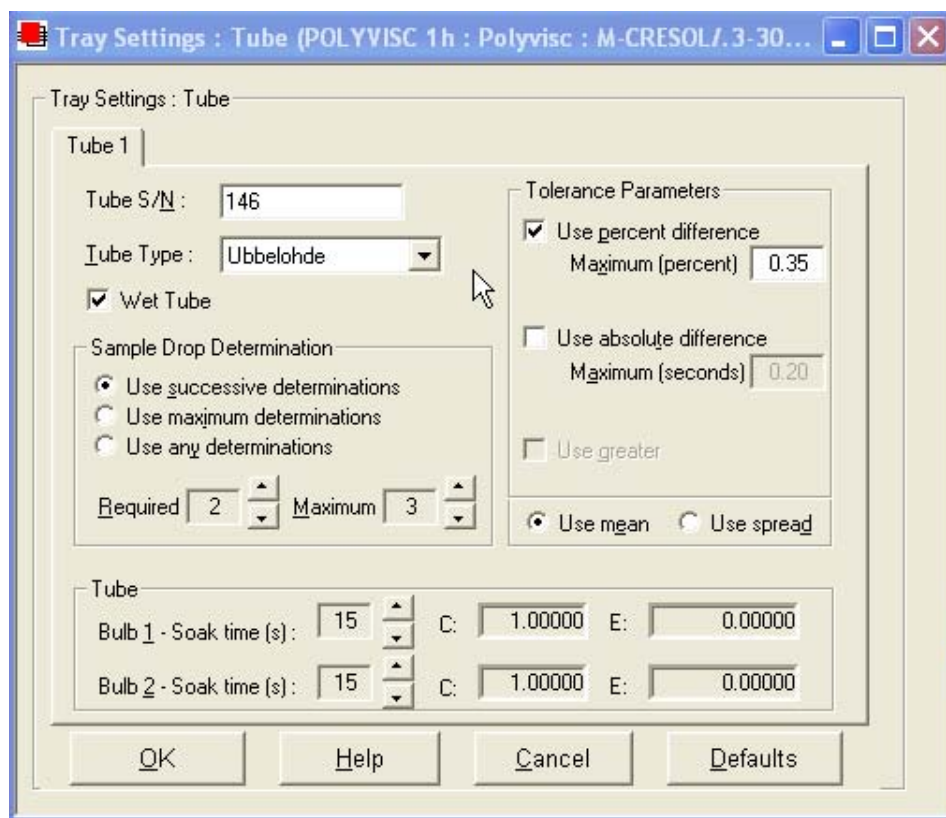
Click in the Wet Tube check box to enable an additional untimed sample drop at the beginning of each sample run.

Tube Type :

Select the correct Tube Type from the dropdown box. The Atlantic type is essentially a single long tube and capillary. The Ubbelohde-type tube design incorporates a vent tube near the bottom.

NOTES

For reporting and calibration purposes, tube serial numbers should be unique for all instruments controlled by the VISCPRO® software.



The Tray Settings: Tube window

Required Maximum

Selecting sample run required and maximum determination settings

Determinations

Select the determination option by clicking on the radio button corresponding to the appropriate determination method (Use successive determinations, Use maximum determinations or Use any determinations).

Select the number of Required determinations by clicking on the spin controls (values from 1 to 4 are acceptable). In the same manner, select the Maximum number of determinations which can be run for the tube samples (values from 1 to 20 are acceptable).

The screenshot shows two panels from the software interface. The 'Sample Drop Determination' panel has three radio buttons: 'Use successive determinations', 'Use maximum determinations', and 'Use any determinations' (which is selected). Below these are two spin controls: 'Required' set to 2 and 'Maximum' set to 6. The 'Tolerance Parameters' panel has three checkboxes: 'Use percent difference' (checked), 'Use absolute difference', and 'Use greater'. Below these are two input fields: 'Maximum (percent)' set to 0.35 and 'Maximum (seconds)' set to 0.20. At the bottom of this panel are two radio buttons: 'Use spread' and 'Use mean' (which is selected).

Determination options

NOTES

The PolyVISC determines the sample flow time by averaging the values of the sample runs which correspond to the chosen criteria.

Tolerance options

If the Always perform maximum determinations radio button is selected, the last flow times will be used for the viscosity determination.

Tolerance parameters

Determine if the tolerance for differences between sample run times (determinability) is going to be decided by the absolute difference in drop time values (in seconds) or by the percentage difference between the drop times. Click on the appropriate check box to select your choice(s).

Enter the maximum acceptable difference in calculated results when using multiple determinations (the default percent difference value is 0.35 percent and the default absolute difference value is 0.2 seconds).

Use greater

If both tolerance options are selected, the VISCPRO software will apply both criteria *unless* the Use greater option is checked. If Use greater is checked, then the software will apply the less exacting tolerance value when calculating/evaluating test results.

Use spread Use mean

The Use spread and Use mean radio button options determine the manner in which the VISCPRO mathematically determines which sample tests have met tolerance parameters. Testing is continued until a group of samples meets the tolerance parameters and the rules for sample drop time determination (see *Determinations*, previous page).

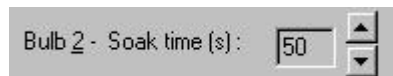
Use spread

The Use spread option compares the individual drop time values for each test sample with the individual drop time values of the other samples. If a

sample deviates from tolerance parameters when compared with any other sample in a grouping, the sample is eliminated from consideration.

Use mean

The **Use mean** option compares the individual drop time values for each test sample with the mean (average) drop time represented by all samples in the group. If any sample in the group deviates from the mean by a value greater than the value specified in the tolerance parameters, the group is eliminated from consideration.



Soak time

Input the desired sample soak times for each bulb of the viscometer tube. The soak time is the length of time in which the sample will remain in the viscometer tube before being dropped. The soak time is important to ensure temperature equilibration of the sample. Values between 5 and 255 seconds are acceptable.

NOTE

Settings for soak times may need to be reconfigured when the bath temperature setting is changed.



Constants (C and E)

The **Tray Settings: Tube** screen displays the calibration constants (**C** and **E**) for each bulb of the viscometer tube. These values cannot be edited from the **Tray Settings: Tube** screen. For information on determining bulb constants for viscometer tubes, see *Calibration* later in this chapter.

NOTE

When you have completed the configuration and saved the current tray settings, you may wish to permanently store the current instrument settings using the Save Instrument option from Main (see Main options).

Tray Settings: Wash

Tray Settings: Wash ...

Use the **Tray Settings: Wash** option from the **Configure** menu to determine wash settings.

Default Wash settings

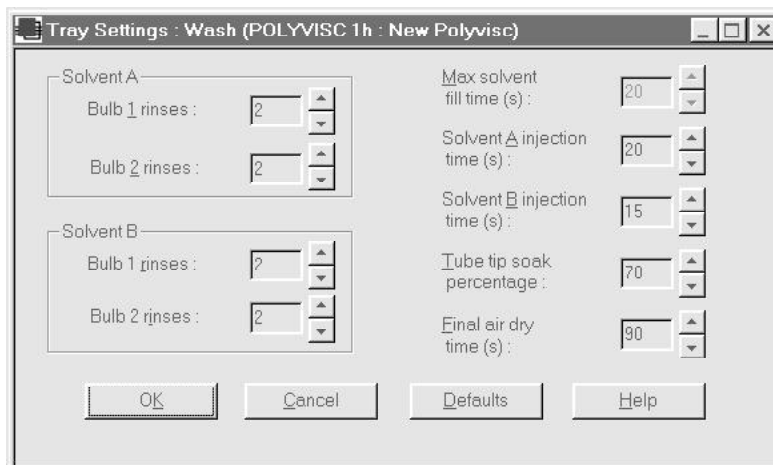
The VISCPRO® software provides default values for rinse cycles. Unique application may require different settings for effective tube washing.

Solvent rinse settings

The solvent rinse settings determine the number of rinse cycles performed by the PolyVISC instrument after each test. Rinses are set independently for the Wash solvent (Solvent A) and (if applicable) the Dry solvent (Solvent B), and for each bulb of the viscometer tube. The PolyVISC automatically selects the user rinse option based on the solvent in use and the bulb that the sample was tested in.

Max solvent fill time (s)

The Max solvent fill time(s) setting determines the maximum amount of time that solvent from the solvent container(s) will be drawn into an internal solvent reservoir bulb in preparation for tube washing. This option is a safety feature that prevents the reservoir from overflowing in the event of a solvent level detection sensor failure. To set a new Max solvent fill time for the current solvent, open the Wash service option from the Service window and click the Set Max fill time button. Solvent from the container will be drawn into the solvent system until the solvent level detection sensor is triggered. The new Max fill time will automatically be updated in the Tray Settings: Wash window.



The Tray Settings: Wash window

Solvent injection time(s)

The Solvent injection time(s) setting determines the amount of time that pressurized air will inject solvent from a reservoir bulb into the viscometer tube during each rinse cycle. It is desirable to inject solvent until the reservoir has been depleted. Select a value from 1 to 90 seconds for this option.

Tube tip soak time

The Tube tip soak time setting adjusts the amount of time that the tube tip will remain immersed in solvent in the solvent wash station during the solvent rinse(s). A higher setting delays the beginning of the solvent purge procedure that empties the wash station contents into the waste container. Select a value from 5 to 255 for this option.

Final air dry time(s)

The Final dry time(s) setting determines the amount of time forced air is channeled through the viscometer tube to dry it at the conclusion of all solvent rinse cycles. Select a value from 30 to 240 seconds for this option.

NOTE

After you have completed the configuration and applied the new wash settings to the current instrument by clicking OK, it is advisable to save the current instrument settings using the Save Instrument option from the Main menu. Saved settings may be restored at any time. Current settings are only valid until changed by the user or until a previously saved instrument is restored.

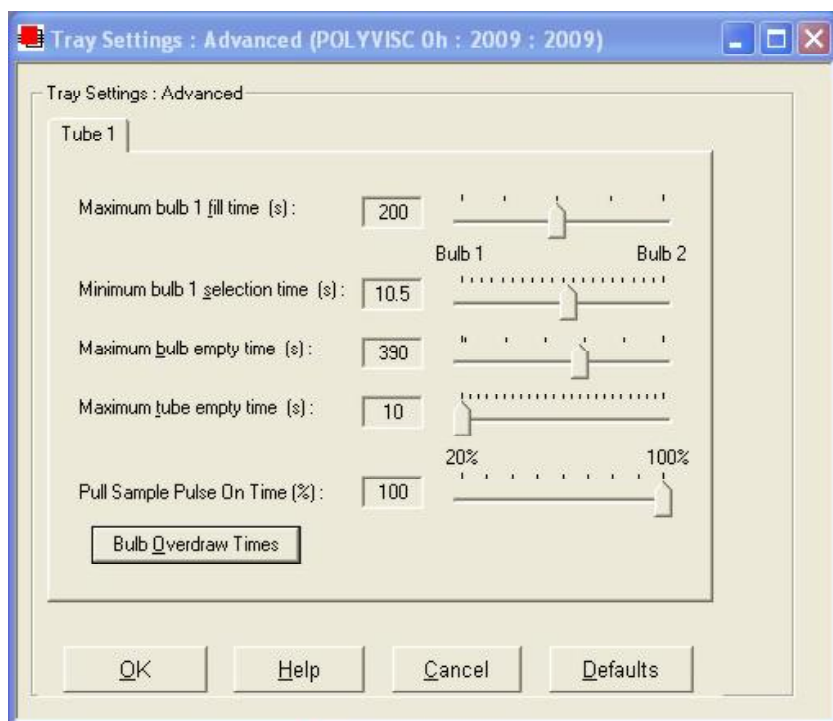
Tray Settings: Advanced

Advanced configuration

Select the Tray Settings: Advanced option to open a window used to define additional operational parameters for sample testing with the PolyVISC instrument. Access to this window is reserved for Manager-level personnel by the security system. Advanced settings may need to be adjusted whenever the viscometer tube is changed.



CAUTION Changing advanced settings can adversely affect performance of the PolyVISC unit. Use caution when adjusting advanced settings.



The Tray Settings: Advanced window



Maximum bulb 1 fill time(s): Adjust this setting to select the desired maximum fill time for bulb one. Acceptable values are between 20 and 400 seconds.



Min. bulb 1 selection time(s): Adjust this setting to select the desired minimum time permitted for selection of bulb one for sample testing. Acceptable values are between 1 and 20 seconds.



Maximum bulb empty time(s): Adjust this setting to select the maximum drop time permitted for the test before the software will abort the sample run. Acceptable values are between 90 and 600 seconds.



Maximum tube empty time(s): Adjust this setting to select the sample recovery time (the amount of time between the conclusion of the sample run and the initiation of the wash cycle). Acceptable values are between 5 and 125 seconds.



Pulse ON (Ubbelohde only) Adjust this setting to select the time percentage that the vacuum system will operate to draw sample into the viscometer. A higher setting will draw sample more consistently and quickly. The midpoint setting is optimal for most samples with viscosities in the tube range. Use lower settings if you notice bubbling, particularly with lower viscosity samples.

When you have selected the desired tray settings, save the current instrument settings by clicking **OK**. To exit the configuration screen without saving your changes, click **Cancel**. To restore software defaults, click **Defaults**.

Bulb overdraw

Use the **Bulb Overdraw** button/window to set the amount of time in seconds that the instrument will draw sample **AFTER** the sample meniscus has covered the target sensor in the viscometer tube. More viscous materials may require a larger overdraw time to ensure that the sample meniscus does not dip below the target sensor during temperature equilibration.

Proper adjustment of the overdraw can maximize efficiency of the test cycle. Too much overdraw can contaminate vacuum lines and interfere with pump operation. Too little overdraw can interfere with the initiation of sample testing following the temperature equilibration period. Note that lighter oils will be pulled higher in the bulb.

Saving an instrument configuration

Whenever you have altered the current instrument, tray or sample settings, you may wish to save the resulting settings as a new or existing configuration. To save current settings, use the **Save Instrument** option:

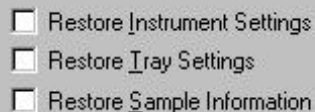
Procedure

1. From the VISCPRO® primary menu options, select **Main**.
2. Click on **Save Instrument**. The **Save Instrument** window will appear.

3. Select the instrument for which the current settings should be saved.
4. Type a name for the new configuration in the **Save As:** box. Or double-click an existing configuration from the configuration list box.
5. Click **OK** to save the configuration. Or click **Cancel** to exit the **Save Instrument** window without saving your changes.

Restoring instrument settings from a saved configuration

There are several options for restoring instrument settings from a saved configuration. These restore options are individually selectable from the **View Instrument** window, accessed from the **Main** menu options.



NOTE

*The Restore Instrument Settings and Restore Tray Settings options are only available if you are logged in as a manager or **CANNON**® Instrument Company service personnel.*

Restore procedure

To restore instrument settings from a saved configuration:

1. Click on **View Instrument** from the **Main** menu options.
2. Select the desired instrument from the left list box.
3. Select the desired saved configuration from the right list box.
4. Use the check boxes to select the desired configuration elements to be restored.
 - **Restore Service Settings** is a security-protected option that restores service settings from the saved configuration. You must be logged in as **CANNON** Instrument Company personnel to access this option.
 - **Restore Instrument Settings** restores instrument properties from the saved configuration. You must be logged in as a **Manager** to access this option.
 - **Restore Tray Settings** restores tube/tray/wash properties from the saved configuration. You must be logged in as a **Manager** to access this option.
 - **Restore Sample Information** restores all sample ID setup information for the **Instrument View** window from the saved configuration.

- Click OK. If you clicked the check box to restore instrument, tray or sample settings, the current instrument will be updated with the selected settings.


NOTE

If you have updated the settings, you may wish to save the current instrument/tray/sample configuration by selecting Save Instrument from the Main menu, inputting the configuration name in the Save As: text box, and clicking OK.

Calibration


For information regarding the PolyVISC calibration procedure, see Chapter 3, *Calibrating the PolyVISC*. The Calibration window, accessed from the Configure menu, provides controls for calibrating each tube associated with your instrument. You must be logged onto the system as a manager to access these security-protected calibration functions. The Calibration window options are described briefly in this section:

Calibration constants

Calibration constants are determined individually for each bulb of each tube. Data for automatic calculation of tube calibration constants is derived from check standards run using that tube. Use the spin controls  to display current constants and valid check standard data available for calibration of each bulb.



The Calibration window

Date selection: The calibration program uses data from previously-run check standards to determine the calibration constants. To select the desired standard data, use the No older than [x] days spin controls  to set the date parameters for the database search (if “1” is selected, only the standards run on yesterday and today’s date will be used).

Bulb selection: Viscometer bulbs are numbered from the bottom to the top of the viscometer tube. Use the spin controls to select the correct bulb for calibration. After the bulb is selected, valid calibration data available for the currently-selected bulb will be displayed in the text box.

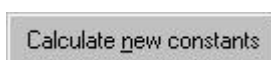
NOTES

Data derived from at least two different standards for each bulb at the calibration temperature should be available for the most accurate calibration calculations to be performed.

Only data for check standards that were run at the current instrument operating temperature will be available for calibration. To calibrate at other temperatures, you must first change the desired AIRBATH temperature in the Instrument Settings window.

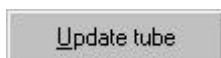
Data selection: Test data from standards run with the PolyVISC within the specified Date parameter will be displayed in the list box.

To select and deselect the data from the sample runs to be used for the calibration, press and hold the **Ctrl** key and click on the samples to highlight those you wish to include in calibration calculations (the default is all selected). After you have selected the desired data, release the **Ctrl** key and click Calculate new constants to update values for C and E:



Click on Calculate new constants to update values for C and E.

You may evaluate the accuracy of the new calibration constants by comparing the known viscosity for the standard with the calculated viscosity for each standard selected for the new calibration. The difference in these values is displayed as a percentage in the last column (% Diff) of the updated sample list box.



When you are satisfied with calculation results, click on Update Tube to save calibration values for the current configuration. Then use the Print button to print a hard copy of calibration results.

If the difference is still too great, repeat the calibration process until the difference falls within acceptable limits (refer to the precision statement in ASTM D 445 Annex A1).

NOTE

You must click Update tube before changing bulbs if you wish to save the new calibration constants for that bulb. Once the Update tube button is pressed, the updated calibration constants are associated with the selected instrument, and will remain the same regardless of the instrument configuration defined for that instrument.


Service menu options

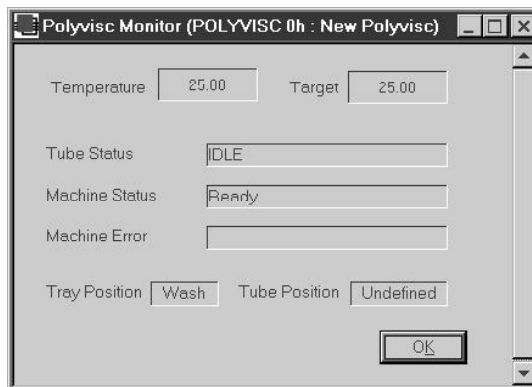
To access the service options, click **Service** from the VISCPRO® primary display and select the desired instrument.

Diagnostics...

The **Diagnostics** window permits the user to view current operational values for the PolyVISC instrument. These settings may be helpful to **CANNON**[®] technical personnel when troubleshooting difficulties with the PolyVISC.

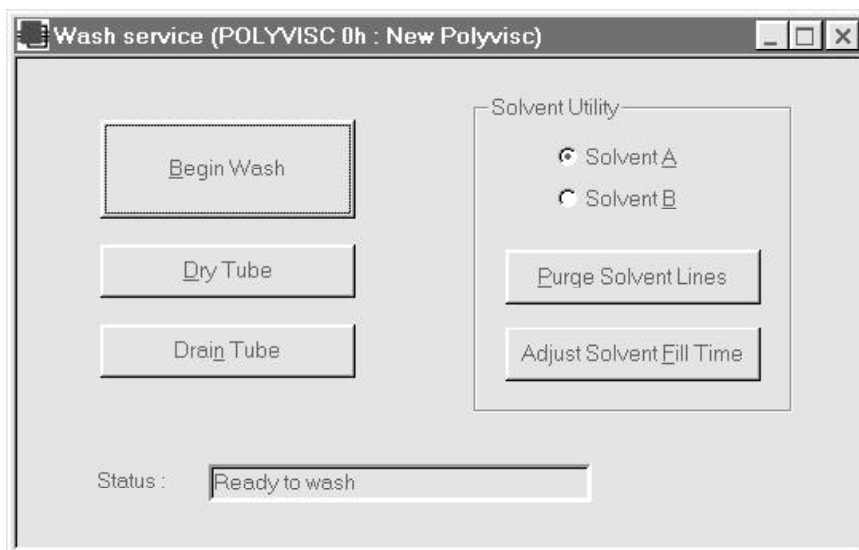
Polyvisc Monitor...

The PolyVISC monitor provides a view of current machine operating parameters, including current and target temperature readings, tube status, machine status, machine error (if any), tray position, and tube position. This window is for viewing and diagnostic purposes only—no actions may be performed by the software. Click **OK** or  to close the window.



Wash viscometer tube...

Select **Wash** service to open the **Wash service** window.



Click the appropriate button to initiate the desired action (tube washing, draining, drying, solvent line purge, or **Set Max fill time** option). The **Status:** indicator will display and update current actions. Click **Abort** if it is necessary to terminate the action before it is completed.

Begin Wash initiates the wash cycle.

Dry Tube initiates the dry cycle.

Drain Tube permits tube contents to drain into the sample vial under gravity.

Purge Solvent Lines clears solvent lines for the selected solvent with pressurized air. Solvent is returned to the solvent container.

Set Max fill time initiates a timed solvent system fill procedure. At the conclusion of the cycle, the Solvent Max Fill Time value in the Tray Settings: Tube window is automatically updated to account for the viscosity of the current solvent.

NOTES

The Set Max fill time actions should *always* be performed:

- 1) each time a new solvent is introduced into the solvent system and
- 2) each time the front panel vacuum or pressure settings are changed.

Wash service operations cannot be executed if the tube is currently running a sample.



CAUTION

The Wash service window functions override the normally automatic PolyVISC software tube maintenance operations. Verify that the tube is clean and dry before initiating computer-controlled sample testing.

Temperature Calibration...

Periodically, the temperature control accuracy of the PolyVISC should be verified using a reference thermometer for that temperature. If the reference thermometer temperature reading does not correspond to the temperature reading displayed in the Instrument View window, it may be necessary to calibrate temperature. The PolyVISC temperature calibration can be accomplished whenever the bath temperature is stable for any given target temperature (Celsius or Fahrenheit) within the range of the bath. The Temperature Calibration option from the Service menu permits the user to input data from the reference thermometer into the VISCPRO software. VISCPRO then resets temperature control parameters through the use of temperature offsets.

Temperature calibration options

The PolyVISC senses temperature with an RTD (Resistance Temperature Device). Electronic feedback from the RTD probe is processed by the PolyVISC temperature control system. Accuracy of temperature control is further enhanced by an adjustable general bath offset and individual offsets at desired control temperatures.

Individual BIN settings

For every whole degree Celsius, a calibration “BIN” exists in nonvolatile memory within the temperature control system. The “reference actual temperature” is entered by the user as the actual temperature of the bath according to the user’s temperature reference standard and is stored by the bath in this memory as a correction factor and used whenever that particular target temperature is entered. Fractional degrees will use the closest whole number bin.

General bath offset

The general bath offset is usually calculated at a median test temperature. The offset is applied for all bath temperatures.

Calibration procedure

To complete a temperature calibration, complete the temperature calibration procedure described in Chapter 3.

Clearing temperature offsets

To “Zero” bath offsets, use the Zero Current Temperature Offset option from the Service menu. Select the desired option using the radio buttons.



CAUTION

If the general bath offset is cleared, all individual offsets will need to be reset using the temperature calibration procedure.

Tube and Tray Positioning...

The Tube and Tray Positioning option assists the user in diagnostics involving carousel and tube actions. It may also be used in removing/replacing the viscometer tube in the AIRBATH. For more information on this option see *Changing the viscometer tube* in Chapter 5.

Testing samples—software options

This section of the manual provides information on using the software to perform common PolyVISC operations. For a step-by-step procedure detailing both hardware and software operations involved in sample testing, refer to Chapter 2.

Entering sample ID information

Procedure

1. From the VISCPRO® primary menu options, click on Main.
2. Select View Instrument from the menu options.
3. Select the desired instrument from the list box on the left side of the View Instrument window and (if necessary) select a preset instrument configuration from the list box on the right side of the window.

NOTES

If you do not see the desired instrument listed in the left list box, make certain that the instrument is turned on and is online (verify cable connections to the computer). Then click the Refresh button from the View Instrument window to scan for additional online instruments.

If you are restoring a saved configuration, select the elements of the configuration that you wish to apply to the current instrument (Instrument Settings, Tray Settings or Sample Information) by clicking on the check box to the left of the element. If no boxes are checked, no preset configuration information will be restored (the current configuration will be restored).

4. When you are done, click OK. The Instrument View window for the selected instrument will appear.
5. To input sample identification information for the samples to be run, click on the sample number in parentheses (or press **F2**) to access the sample ID field.
6. Enter the desired sample ID, using up to 21 alphanumeric characters; then press the **Tab** or **Enter** key.

Selecting sample actions

7. Whenever a new sample ID is entered, the sample action defaults to Measure Relative Viscosity. To access all sample action options, highlight the desired sample(s) and right-click the mouse or press **[F5]**. The Sample Action popup window will appear.
9. Select the desired sample action from the window by clicking on it.

Sample actions

- **No action**—clears action column for highlighted samples. No testing will take place for this tray position.
- **Determine solution relative viscosity**—measures relative viscosity of the sample.
- **Determine solvent viscosity**—measures absolute viscosity of the solvent.
- **Verify known RV**—compares the value obtained for the relative viscosity of the sample with a value input by the user.
- **Measure kinematic viscosity**—measures kinematic viscosity of the sample.
- **Verify known KV**—compares the value obtained for the kinematic viscosity of the sample with a value input by the user.
- **Configure**—permits adjustment of sample run specifications for selected individual samples/standards. The **Configure** options will vary depending on the selected sample action.
- **Delete**—Deletes currently-selected sample data. Samples in succeeding tray positions will be moved up to fill the empty “slot(s)”.
- **Insert At**—Inserts a sample field at the currently-selected location.
- **Copy all selected samples**—Copies highlighted samples.
- **Paste into selected samples**—Pastes copied sample(s) into sample list in place of currently highlighted sample(s).
- **Sequential Sample IDs**—Numbers the selected samples automatically.
- **Clear All Trays**—Clears sample data for all trays.

NOTE

*To select more than one sample at a time from the list box, highlight the first sample and then press the **[⇧ Shift]** key and click on the last sample, or just press and hold the **[Ctrl]** key and click on individual samples to be selected. When you have completed sample selection, right-click the mouse on any of the selected samples to select the desired sample action for all highlighted samples.*

- **Sequential Sample IDs**—creates a numeric sequence for the highlighted sample ID(s) in the list box. You have the option of selecting a standard alphanumeric prefix and/or suffix to accompany the sequence numbers, and you also can select the starting numeral in the sequence.

Procedure

1. To use the **Sequential Sample IDs** feature, highlight the desired sample tray location(s) in the list box.

2. Right-click any of the highlighted locations and select **Sequential Sample IDs** from the Sample Action popup.
3. Enter necessary information in the **Assign Sequential Sample IDs** window:

Prefix—Input a character string to be used as an identifier

Suffix—Input a character string to be used as an identifier

Starting ID—Input a number to start the numeric sequence

Number of Samples—Select the number of samples in the highlighted block which are to be sequentially numbered

Use as Format—If checked, this feature activates a fixed-width field option, including a “wraparound” function for sequential numbering like an odometer (if 001 was input for the starting ID, the sequence would restart at 001 every 1000 samples).

Assign Sequential Sample IDs window

4. When done, click OK.

NOTE

The VISCPRO® software “remembers” the last number in the last sequence and will place the next number in the sequence in the Starting ID field the next time the Sequential Sample IDs option is selected.

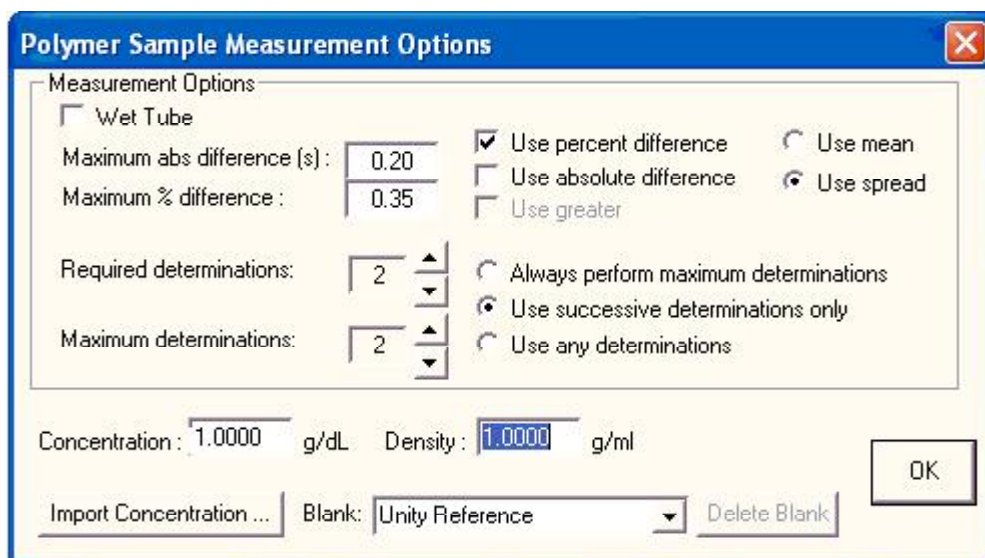
NOTE

If you have stored sample information in a saved configuration, you may restore sample information by clicking on View Instrument from the Main menu options, selecting the desired configuration from the list box in the View Instrument window, clicking on the Restore Sample Information check box, and then clicking OK.

The Sample Action popup

Polymer sample measurement options

The Polymer Sample Measurement Options window automatically appears whenever you select a polymer sample measurement option (Determine Solution Relative Viscosity, Determine Solvent Viscosity or Verify Known RV) from the Sample Action popup. The window permits you to set the measurement parameters for the sample as described below. For additional information about measurement options, refer to the section on Configuration/Tray Settings: Tube. Configuration settings from the Tray Settings: Tube window appear as defaults whenever the Polymer Sample Measurement Options window is opened.



Polymer Sample Measurement Options window

Wet Tube

The Wet Tube option is required for some manual viscosity determination protocols. If this option is checked, the PolyVISC automatic determination will be preceded by an untimed sample drop, coating the inside of the capillary with the sample material.

Maximum absolute difference

The Maximum abs[olute] difference option permits you to input the maximum acceptable deviation (in seconds) in flow times for multiple-drop samples (.20 is the default absolute difference allowable). Values from 0.01 to 99.99 are acceptable. If the difference between test viscosity values is greater than the acceptable deviation, the sample will be tested again until the deviation in viscosity readings is less than the Maximum abs[olute] Difference, or until the maximum number of determinations has been reached.

Maximum % difference

The Maximum % difference option allows you to input the maximum acceptable deviation, expressed as a percentage, for multiple-drop samples (.35 is the default percentage difference allowable). Values from 0.01 to 99.99 are acceptable. If the difference between flow times,

expressed as a percentage, is greater than the acceptable deviation, the sample will be tested again until the deviation is less than the **Maximum % Difference**, or until the maximum number of determinations has been reached.

Use absolute difference

The **Use absolute difference** option defines the tolerance for drop time variability of multiple-drop samples as the input value for **Maximum abs. difference**. Check this box to use the absolute difference value as a criterion for evaluation of multiple drop times. Sample drop times with an absolute difference exceeding the indicated value will not be used.

Use percent difference

The **Use percent difference** option defines the tolerance for drop time variability of multiple-drop samples as the input value for **Maximum % difference**. Check this box to use the Maximum percent difference value as a criterion for evaluation of multiple drop times. Sample drop times with a percent difference exceeding the indicated value will not be used.

Use greater

The **Use greater** option limits the application of tolerance parameters for multiple-drop samples. If both the **Maximum abs. difference** and **Maximum % difference** tolerance options are selected, the VISCPRO software will apply both criteria *unless* the **Use greater** option is checked. Then the software will apply only the less exacting tolerance value when calculating/evaluating test results.

NOTES

The PolyVISC determines the sample flow time by averaging the values of the sample runs which correspond to the chosen criteria.

If the Always perform maximum determinations radio button is selected, the last flow time(s) will be used for the viscosity determination.

Use mean

For multiple-drop samples, the **Use mean** option compares each new sample drop time value with the mean (average) for a group (or groups) containing that drop time and other drop times for the same sample. If a group of sample drop times matches user-selected tolerance criteria (percentage or absolute values or both), the sample results are valid and testing is complete for that sample.

Use spread

For multiple-drop samples, the **Use spread** option compares each new sample drop time value with the range (spread) for a group (or groups) containing that drop time and other drop times for the same sample. If a group of sample drop times matches user-selected tolerance criteria (percentage or absolute values or both), the sample results are valid and testing is complete for that sample.

Required determinations

For multiple-drop samples, use the spin controls to input the required number of sample drop times which must match drop time tolerance criteria.

Maximum determinations

The **Maximum determinations** option permits you to select from 1-20 iterations of the test using the same sample. The radio buttons permit selection from three different test methods:

- The **Always perform maximum determinations** option will calculate and report viscosity using the final sample determinations in the test sequence. No tolerance parameters are applicable when this option is selected.
- The **Use successive determinations only** option will calculate viscosity using the first successive determinations that fall within the selected tolerance options.
- The **Use any determinations** option will use the first drop times that are within the selected tolerance options as the basis for viscosity calculation. Any determinations in the drop time sequence that conform to required tolerance criteria will be used.

Concentration

Enter the concentration of the sample in this field.

Density

Enter the density of the sample in this field.

Import Concentration

If you are using the PolyVISC companion product, the SPS[®] Solution Preparation System, click the **Import Concentration** button to access concentration data stored by the SPS. Then input the index # and the data filename and path in the appropriate fields and click **OK** to import data. Consult your SPS manual for more information.

Blank

Click the drop-down box and select the desired solvent blank to be used for polymer analysis. If a new blank is to be used, type the name of the blank in the open field. See *Defining and using a solvent blank for RV analysis* in Chapter 2 for more information.

Kinematic viscosity measurement options

To measure kinematic viscosity using the PolyVISC[™], select the **Measure kinematic viscosity** option from the list of sample actions. The kinematic viscosity will be calculated from drop times using default criteria for testing and tolerance from the **Tray Settings: Tube** window. To customize test options for a single KV sample, right-click on the sample number and select **Configure** from the sample action options. Then input the desired testing options.

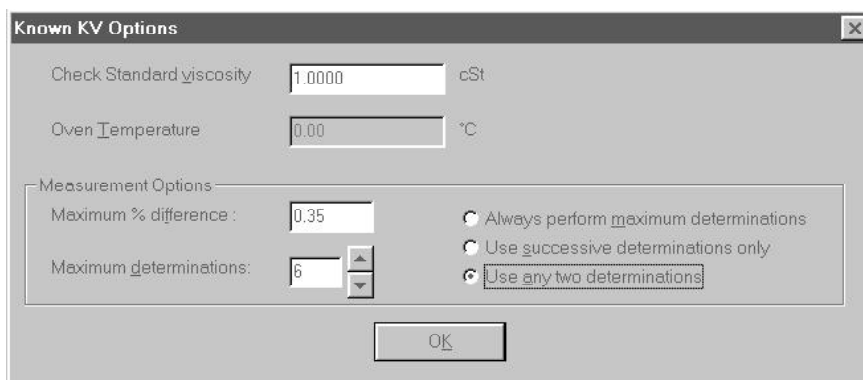
NOTE

For *kinematic* viscosity determination, only two successful determinations will be used for calculation regardless of the number selected for **Required Determinations** in the **Tray Settings: Tube** window.

Verifying known KV

To verify known KV using calibration standards, select the **Verify known KV** option from the list of sample actions. The **Known KV Options** window will appear.

The **Known KV Options** window permits you to set several test parameters. Default criteria for testing and tolerance are determined from the **Tray Settings: Tube** window. These options may be changed for individual samples as follows:



Known KV Options window

Measurement Options

The **Maximum % difference** option allows you to input the maximum acceptable deviation for multiple-drop samples (.35 is the default percentage difference allowable). Values from 0.01 to 99.99 are acceptable. If the difference between test viscosity values is greater than the acceptable deviation, the sample will be tested again until the deviation in viscosity readings is less than the Maximum % Difference, or until the maximum number of determinations has been reached.

The **Maximum determinations** option permits you to select from 1-20 iterations of the test using the same sample. The radio buttons permit selection from three different test options:

The **Always perform maximum determinations** option will calculate viscosity using the final sample determinations in the test sequence.

The **Use successive determinations only** option will calculate viscosity using the first two successive determinations that fall within the selected tolerance options.

The **Use any determinations** option will use the first two drop times that are within the selected tolerance options as the basis for viscosity calculation.

Copy & Paste Sample ID data entry options

The VISCPRO® Sample ID data entry screen supports Windows® Copy and Paste options.

Copying Sample IDs

To copy a Sample ID entry, including the configuration information, highlight the desired line(s) from the Sample List Box and right-click your mouse to access the Sample Action window. Then select **Copy All Selected Samples** from the menu options. OR you can use the **Ctrl-C** key combination.

Pasting Sample IDs

To paste Sample ID entry information into another tray/sample location, highlight the desired line(s) in the Sample List Box and right-click your mouse to access the Sample Action window. Then select **Paste Into Selected Samples** from the menu options. OR you can use the **Ctrl-V** key combination.

Copying/pasting multiple IDs You may copy or paste a block of (multiple) sample ID entries using the same procedure described above. When pasting multiple entries, make certain to select the same number of sample locations as were initially copied. If you select a larger number, only the original copied number of entries will be pasted. If you select a smaller number, information for the last sample(s) in the block will not be copied.

Inserting/deleting a sample ID in the test sequence

To insert a sample ID into an existing sample run test sequence, highlight the desired sample location in the sample run sequence and press **Insert**. *OR* highlight the desired ID number, click the right mouse button, and select **Insert At** from the **Sample Action** options. The existing sample entries will be moved down one position in the sequence and you can enter the new sample ID information at the cursor.



CAUTION

If the list box already contains a sample ID for every position on the tray, the sample data for the final position will be discarded when a position is cleared for new data.

To delete one or more sample IDs and move all remaining samples in the sequence up in position, highlight the sample ID(s) you wish to delete and press the **Delete** key. *OR* you may right-click in the highlighted block and select **Delete** from the sample action options window. The highlighted sample (or samples) will be deleted and any existing sample entries following the removed items will be moved up to take their place in the sample run sequence.

PolyVISC analysis modules

The VISCPRO[®] software is shipped with several analysis modules which can be used to create reports based on sample test data. For general instructions on using analyses, see Chapter 6, *Analysis Configuration Options*. For information on a specific analysis module included with your PolyVISC package, see the chapter on the particular analysis.

Inquiries regarding development of custom analysis modules may be directed to **CANNON[®]** Instrument Company.

Handling errors

VISCPRO[®] errors

The PolyVISC instrument software returns three types of errors during operation: bath errors, fatal errors and tray errors. Bath and tray errors are sample/tray specific, and may affect test results for a given sample. Such results will be indicated as invalid. Fatal errors may be hardware-related, and can produce a **FAULT** condition (see *Chapter 5, Handling fault conditions*).

OPERATING, MAINTAINING AND SERVICING THE PolyVISC

This chapter of the PolyVISC Instruction & Operation Manual contains information regarding the operation, service and maintenance of the PolyVISC instrument.

PolyVISC components

Viscometer unit

The PolyVISC viscometer unit consists of a cabinet which houses the insulated air bath. External to the bath in the upper part of the cabinet are the electronic components, regulators for air, solvent and vacuum, and the hardware used to monitor and control the apparatus. The PolyVISC air bath includes the viscometer tube(s), sample table, wash station, servo mechanism and additional hardware for automatic sample testing and viscometer tube cleaning.

Viscometer tube(s)

The PolyVISC is equipped with a removable borosilicate glass capillary viscometer tube with a wide viscosity range. The upper viscosity limit is up to 100 times the lower viscosity limit, depending on the tube type. Most PolyVISC viscometers are of the dual-bulb type.

Tube sensors

Each viscometer tube contains sensors for measuring the passing of the liquid meniscus. Optical sensors are standard with the PolyVISC instrument. Changes in light intensity with the passage of the sample meniscus trigger timing actions which are used as a basis for viscosity calculations.

Sample carousel

The PolyVISC can process up to 11 samples in sequence on the sample carousel. Samples are loaded into 20-ml vials; recommended sample volume is 7-14 ml depending on which tube the samples will be tested in.

Solvent system

The PolyVISC is equipped with a solvent system used to wash the viscometer tubes in-between test runs. The solvent system consists of the external solvent container, internal and external solvent lines, and the solvent waste container. Solvent and waste containers are maintained in a rack which should be located/mounted next to the unit. Note that the supplied polypropylene waste container may not be suitable for some solvents/samples.

Computer/peripherals

An IBM® (or IBM®-compatible) computer using Windows® 95, 98, 2000 or NT®, and a printer are required to run the VISCPRO® controlling software, record viscosity data, and display and print reports.

VISCPRO® software

The VISCPRO® software automates nearly all aspects of the test procedure, including calibration, testing, and cleaning and drying of viscometer tubes. The VISCPRO® software also:

- allows for individualized programming of test and cleaning functions for each viscometer tube.
- stores test results in a database and provides analysis modules.
- permits fully-automatic and user-directed control of all PolyVISC functions.

Data from the VISCPRO® database can be made available to laboratory networks or a Laboratory Information Management System (LIMS) via a serial link to your computer.

Selecting viscometers

When selecting which viscometer to use for a test, note the physical characteristics of the sample and determine the approximate viscosity range. Refer to the table above when selecting a viscometer for sample testing. If the chosen viscometer is too small for the sample the drop times will be too long. If the viscometer is too large the drop times will be too short. Other ranges are available. Contact **CANNON®** for price and delivery information.

PolyVISC Compound Viscometer with Optical Sensors	
Compound Viscometer Size/Range (cSt)	Part # (optical sensors with holder)
0.14 - 14	P65.2200
0.3 - 30	P65.2201
0.5 - 50	P65.2202
1 - 100	P65.2208
3 - 300	P65.2203
8 - 800	P65.2204
16 - 1600	P65.2209
25 - 2500	P65.2205
75 - 7500	P65.2210
300 - 30000*	P65.2206
600 - 60000*	P65.2207
<i>*Extended range -Consult CANNON® for assistance if testing above 20,000 cSt</i>	



CANNON® PolyVISC™ Compound Tube with Optical Sensor

Changing the viscometer tube



WARNING

The viscometer tube or connecting tubing may contain solvent residue. Refer to the Material Safety Data Sheet (MSDS) provided with the solvent material, and exercise the necessary safety precautions when changing viscometers. Use extreme care when working with hazardous solvents.

Take appropriate precautions when handling AIRBATH components (sample vials, carousel, viscometer tube), especially if the PolyVISC instrument has been heated above 50°C. Do NOT change the viscometer tube when AIRBATH component temperatures exceed 70°C.

Procedure

To remove/replace the viscometer tube, detach the tubing connection to the upper capillary, lift up on the spring-loaded viscometer mounting latch, and rotate the top of the viscometer tube forward until it may be removed from the AIRBATH. Then insert the replacement tube and secure it to the tube rack with the latch. Restore the upper capillary tubing connection to complete the tube replacement.



CAUTION

When tube replacement is complete, make certain that the tubing connector has been securely inserted into the upper capillary of the replacement viscometer. Also make certain that the upper capillary is resting against the back of the viscometer tube rack. The sample may be pulled past the upper sensor if the center of the capillary is not aligned with the sensor on the rack.

NOTES

Calibration constants are unique for each viscometer tube. You must recalibrate the PolyVISC after changing viscometer tubes (see Chapter 3).

To facilitate tube removal, you may wish to lower the viscometer tube manually to its middle or lower position using the Service/Tube and Tray Positioning option from the VISCPRO® software. From the Service/Tube and Tray Positioning window, click the desired Target position, then click the Move tube to target button. Make certain to restore the tube to the Up position following tube replacement.

Adjusting the Rate valve

When sample viscosity and/or tube capillary size changes (as when changing/replacing a viscometer), the rate of sample flow in the capillary during testing may be affected. If excessive bubbling or a “geyser” effect is observed in the tube, adjust the Rate valve on the PolyVISC front panel to reduce the rate of vacuum buildup during charging of the viscometer. Turn the Rate knob clockwise to reduce the rate of vacuum buildup. For larger capillary tubes, it may be necessary to increase the rate.

Maintaining the solvent system

The PolyVISC requires solvent, which is used to wash the viscometer tubes after each sample analysis. The solvent system consists of the solvent containers, the solvent distribution and drain lines, and the waste container.

The user-supplied solvent container(s) provide the solvent necessary to clean the viscometer tubes before and after samples are tested. The solvent delivery lines distribute solvent to the viscometer tube(s). The drain lines collect the waste sample/solvent from the viscometer tubes, and transfer waste materials from the washing station to the waste container.

Solvents

The PolyVISC is capable of using many types of solvents. Solvents in the solvent system will encounter PTFE, PFA, Kel-F, 316 Stainless Steel, Borosilicate Glass and PTFE coated aluminum components. Do not use solvents which are incompatible with these components. Also note that the supplied waste container is polypropylene. This material may not be suitable for some solvents/samples.

Maintenance

The component materials of the PolyVISC™ have been optimized to provide compatibility with a wide range of chemicals. However, use of some chemicals in the instrument may require preventive maintenance intervals inside the normal 12-month product warranty. This maintenance may involve cleaning or replacement of fluid control valves and related tubing and interconnects, and is not covered under the normal warranty.



CAUTION

*The PolyVISC uses both a washing and a drying solvent for most applications. The solvents are selected by the user. Ensure compatibility of dual solvents at all times. If switching from one solvent to another with potential compatibility problems, make certain to empty the waste container and flush the solvent lines several times with a neutral solvent. **CANNON**® Instrument Company is not responsible for damage to the solvent system caused by a combination of user-selected solvents.*



WARNING

*Selection, handling and disposal of solvents are the responsibility of the user. **CANNON**® Instrument Company does not make specific solvent recommendations. Refer to the Material Safety Data Sheet (MSDS) provided with the solvent material, and exercise the necessary safety precautions. Use extreme care when working with hazardous solvents.*



CAUTION

*The polypropylene waste container provided by **CANNON**® with the PolyVISC unit may not be appropriate for some solvents/samples.*

Types of solvent

The solvent used in a particular viscometer tube must be able to dry at the test temperature of the tube (during the washing cycle). Choose the appropriate solvent accordingly.

Checking solvent levels

It is the responsibility of the operator to visually monitor the amount of solvent remaining in the solvent container. Check the solvent container liquid level frequently. When the solvent level drops to within 2.5-5.0 cm (1-2") of the bottom of the solvent container, it should be refilled.

Filling the solvent container(s)

Check the volume of the solvent container at the beginning of every work shift to avoid inadequate washing during testing.

Solvent fill procedure

1. Remove the solvent lines and (optional) lid from the user-supplied solvent container.

NOTE

If the solvent line passes through the lid of the solvent container(s), do not remove the line from the lid before unscrewing the filter from the end of the solvent line. Make certain to replace the filter before capping the solvent container.

**WARNING**

Use appropriate precautions when handling the solvent lines. Avoid spilling or splashing solvent. Always use appropriate MSDS procedures when handling hazardous solvents.

2. Refill the solvent container from the solvent source. Do not overfill!
3. Return the filter end of the PolyVISC solvent line to the solvent container.

**WARNING**

Waste sample/solvents can present possible environmental and health hazards. Dispose of all waste materials in accordance with environmental and safety regulations.

Emptying the waste container

Check the volume of the waste container frequently to avoid spillage/overflow.

Procedure

1. Disconnect the waste container from the drain lines.

**WARNING**

Use appropriate precautions when handling the drain tubes. Avoid spilling or splashing waste material collected in the tubes. Always use appropriate MSDS procedures when handling hazardous samples/solvents.

2. Pour the collected solvent/sample mixture out of the waste container into a proper waste storage container.
3. Securely reconnect the drain tubes to the waste container.



WARNING Waste sample/solvents can present possible environmental and health hazards. Dispose of all waste materials in accordance with environmental and safety regulations.

Dual-solvent washing

For testing heavy or hard-to-clean materials, **CANNON**[®] Instrument Company recommends a dual-solvent washing system. The dual-solvent washing process uses two different solvents. The first wash might ordinarily use a heavy solvent to clean the sample residue out of the viscometer tubes. The second wash might use a lighter solvent to remove any remaining sample/solvent residue and dry the viscometer tube. Test temperature(s) must be carefully considered when choosing solvents.



CAUTION Washing and drying solvents **MUST BE COMPATIBLE** since solvent residue will mix in the system. Additionally, any new solvents should be compatible with solvents previously used, since residue from original solvents may remain in the solvent lines and/or waste container.

Solvent wash by computer

The solvent wash may be initiated at any time during PolyVISC operation.

Procedure

1. If the desired tube is running, wait until the run is complete OR click the **Abort** button from the **Instrument View** window.
2. Proceed with the solvent wash by clicking on **Service/Wash service** from the **VISCPRO**[®] primary menu options and then selecting the proper tube to be washed from the tab options in the **Wash service** window.

NOTE

*If you want to save your sample before initiating the solvent wash, click **Drain to Sample Cup** and wait until the sample has drained before completing step 3.*

3. After you have selected the desired tube, click on **Begin Wash** to initiate the solvent wash. If it is necessary to shorten the wash cycle, click the **Abort Wash** tab option. If the wash cycle does not provide adequate time to dry the tube, you may have to adjust the wash configuration parameters. You can click **Dry Tube** after the wash cycle is complete to initiate an additional drying cycle.
4. To close the **Wash service** window, click **Done**.

Wash configuration options

Wash cycle options may be preset using the **Tray Settings: Wash . . .** option from the **Configure** menu. The configuration options permit you to select wash settings appropriate for the viscometer tube(s) you are using. You can then save the configuration settings for future use. The **Wash** options include:

- number of solvent rinse cycles for each bulb
- solvent fill time (in seconds)
- solvent injection time (in seconds)
- Tube tip soak percentage (in seconds)
- final air dry time (in seconds)

Rinse, fill and injection parameters may be set independently for Wash and Dry solvents. For more information on setting Wash options, see Chapter 4.

Ventilation

Most PolyVISC applications require installation in a vent hood. See APPENDIX A for notes on ventilation.

If solvent fumes are noticed around the instrument, immediately verify operation of the ventilation system. Follow all appropriate MSDS procedures when handling hazardous sample/solvent material.

Checking/correcting the AIRBATH[®] temperature

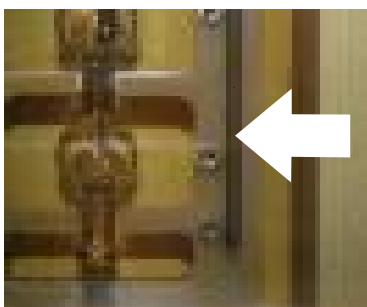
While the PolyVISC is operating, you may monitor the AIRBATH[®] temperature via your reference thermometer in the bath or via the VISCPRO[®] software temperature display in the Instrument View window. In the event of a discrepancy between the temperature reading of the reference thermometer in the AIRBATH and the temperature reading as displayed in the Instrument View window, you should correct the VISCPRO[®] temperature display by completing the temperature calibration procedure. This procedure is described in the previous Service menu options section of this manual.

NOTE

The AIRBATH temperature must be stable when completing the temperature calibration.

Installing the reference thermometer

The PolyVISC has been designed for compatibility with the ASTM type kinematic viscosity thermometers and the Ertco-Hartt RTD High Precision Digital Thermometer with 12" probe (1/4" diameter). To install the thermometer, first remove the cover to the thermometer access hole inside the Air Bath chamber. Then insert the thermometer into the guide tube through the aperture at the top of the PolyVISC unit. Also insert into the guide tube the appropriate shim for the selected thermometer. Adjust the height of the probe to ensure an accurate reading at or near the height of the viscometer tube sensors (see photo).



Temperature probe installed

NOTE

The thermometer can remain installed during measurements. If the thermometer is removed, the access hole cover should be replaced.

Handling fault conditions

The PolyVISC software will display a fault condition when hardware or communication problems are experienced that are incompatible with continued bath operation.

To resume normal operation when possible, remove power from the instrument. Then turn the power back on to initiate the automatic start-up self-test sequence. Note any unusual indications during start-up.

Adjusting vacuum and pressure

Vacuum and pressure are monitored and adjusted using the dials mounted externally on the front panel of the PolyVISC instrument. Use the front panel dials to increase (rotate clockwise) or decrease (rotate counterclockwise) the vacuum/pressure. See *Adjusting front panel pressure/vacuum settings* in Chapter 1 for more information on selection of appropriate settings.

Optimum pressure settings

The pressure regulator is used to determine the amount of pressure used to blow the washing solvent through the viscometer. The desirable pressure setting is dependent upon the nature of the solvent. If the setting is too high, the washing solvent will be blown out of the PTFE washing station, possibly contaminating surrounding samples. If the pressure setting is too low, the cleaning cycle may be compromised.

Optimum vacuum settings

The vacuum regulator is used to adjust the amount of vacuum that is used to pull the sample into the viscometer and to fill the 10-mL internal solvent reservoir with washing and rinsing solvent. Observe the front panel vacuum gauge as you make dial adjustments. Vacuum must be adequate to pull the sample to the upper capillary in a reasonable time. But if the vacuum is too high, the sample may be pulled into the capillary with a “geyser” effect which could prematurely trip the upper sensor and cause a malfunction in the analysis.

NOTE

Samples with extremely volatile components, such as crude oil, should be tested using the lowest practical vacuum setting.

Adjusting the Rate valve

For most samples, the **Rate** valve may be set full open. When sample viscosity and/or tube capillary size changes (as when changing/replacing a viscometer), the rate of sample flow in the capillary during testing may be affected. If excessive bubbling or a “geyser” effect is observed in the tube, adjust the **Rate** valve on the PolyVISC front panel to reduce the rate of vacuum buildup during charging of the viscometer. Turn



Rate valve (highlighted)

the **Rate** knob clockwise to reduce the rate of vacuum buildup. For larger capillary tubes, it may be necessary to turn the knob counterclockwise to increase the rate.

NOTE

Use of the RATE valve is often appropriate when there is a significant difference in viscosity or density between the solvents and the samples.

Preventive maintenance

The PolyVISC is a precision instrument, durably crafted for years of trouble-free operation. Because of the desirability of consistent viscosity measurements over time, preventive maintenance is limited primarily to cleaning and inspection procedures, rather than regular replacement of equipment items.

Solvent compatibility

The component materials of the PolyVISC™ have been optimized to provide compatibility with a wide range of chemicals. However, use of some chemicals in the instrument may require preventive maintenance intervals inside the normal 12-month product warranty. This maintenance may involve cleaning or replacement of fluid control valves and related tubing and interconnects, and is not covered under the normal warranty.

Following is a recommended PM schedule. For detailed descriptions of listed procedures, consult related sections of this manual.

Daily maintenance
Check liquid level in the waste bottle. Empty if necessary, using appropriate precautions for your solvent/samples.
Check the liquid level in the solvent container(s). Refill if necessary, using appropriate precautions for your Wash and Dry solvent(s).
Clean the sample carousel and internal surfaces of the Airbath, using appropriate procedures for handling solvents/samples in use.
Run a calibration standard for each bulb to be used for the day's testing. Calibrate if result variance warrants.
Occasional maintenance
Inspect viscometer tubes for cracks or occlusion.
Inspect the interface cables and visible solvent distribution and drainage lines and verify that they are undamaged and routed appropriately.
Check visible solvent distribution/drainage lines for leaks or obstructions.
Annual maintenance
Check/clean solvent filters at the end of the solvent distribution lines.

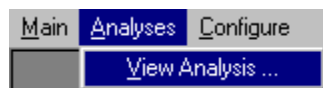
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ANALYSIS CONFIGURATION OPTIONS

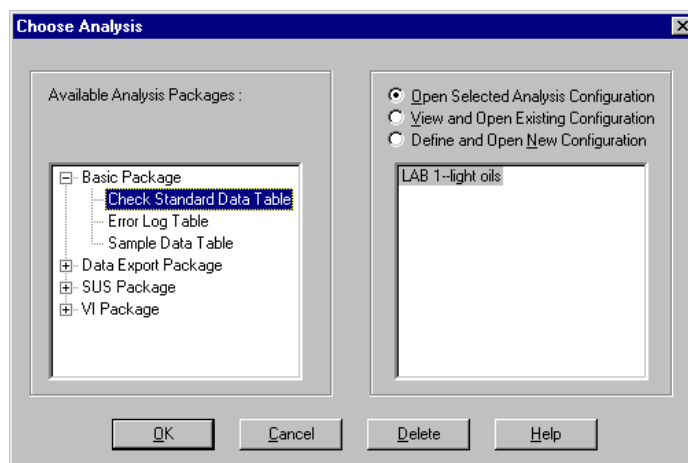
Data obtained from all instruments during sample testing is stored in the central VISCPRO® database. To view data, you must create an analysis configuration requesting the desired sample information in the desired format. Analysis configurations can be saved and later restored. The analysis configuration options provide powerful tools for reporting sample information. Analyses may be displayed on the computer screen, printed, or output via the computer RS-232 port.

Creating an analysis

1. Click Analyses from the VISCPRO® primary menu options.
2. Click View Analysis ... from the Analyses menu options. The Choose Analysis window will appear.




3. Highlight the desired analysis from the list of available analyses.



The Choose Analysis window

NOTE

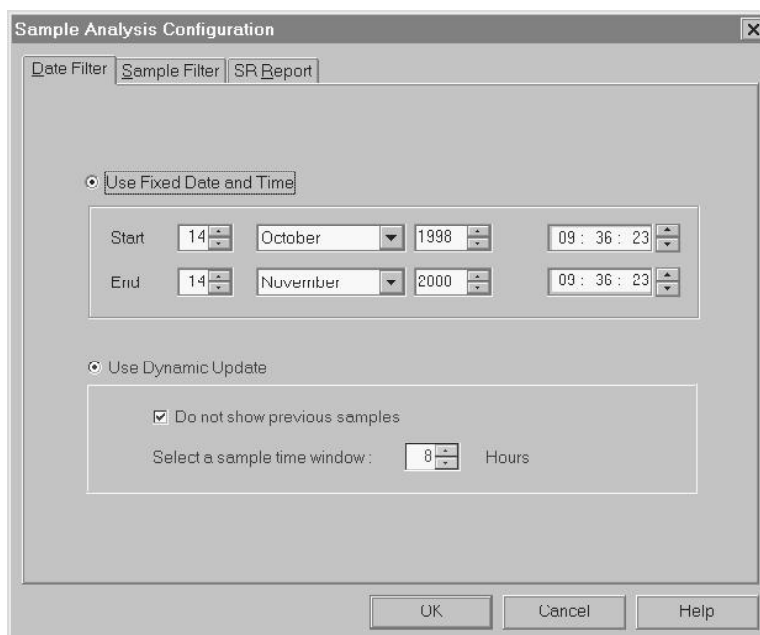
Use the directory tree structure to browse the report options. Click on the or icons to reveal/hide analyses.

- Click on the Define New Analysis radio button  (or verify that the option is selected).

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

- Click OK. The Configuration window will appear. The Configuration window consists of tabbed pages with filter options appropriate for the specific analysis.



The Sample Analysis Configuration window

- Click on the tab corresponding to the filter you wish to set and complete the configuration options. For further information on selecting Date, Sample and other Report options, see the following sections of this chapter.
- When you have completed the configuration, click OK. The program will prompt you to save the configuration.
- Click Yes to save the configuration. The Save Configuration window will appear. Type the name of the new configuration in the Save As: field. Or double-click the name of a preexisting configuration in the Existing Configurations list box to replace the existing configuration with the new configuration settings.
- Click OK. The analysis will be performed and displayed using the selected configuration settings.

NOTES


You may click Cancel from the Save Configuration window to exit without saving configuration changes.

You may display several analyses simultaneously by repeating the instructions above. Use the tiling options available from the Window menu to display multiple analyses in the desired window format (horizontal, vertical or cascade view options are available).

Sorting analysis data

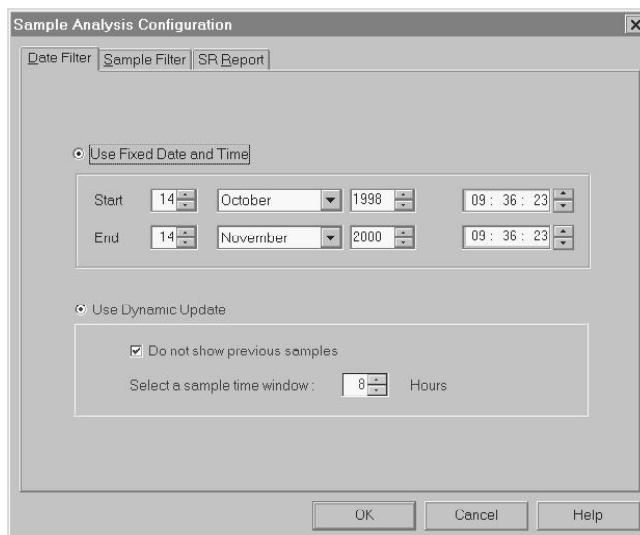
After you have displayed an analysis, you may sort alphanumerically by any of the table headings (the default sort for most reports is Time). To sort, simply click on the desired column heading. The table will be displayed with the new sort order.

NOTE



The Sort function is only available for an analysis when the Dynamic Update mode option is NOT selected. To restore sort functionality for an analysis, reconfigure the analysis by clicking Configure Analysis from the Analyses menu. Then access the Date filter options for the analysis and click the Use Fixed Date and Time radio button . Set the Date/Time parameters and click OK to create the new analysis.

Using the date filter

Use the date filter to select date/time parameters for the analysis. To use the date filter, click the Date Filter tab from the analysis configuration window:




Date filter options

To define a Fixed Date and Time, click the corresponding radio button . Then use the spin controls  and/or list box selection options to set

the appropriate date/time parameters. All samples tested after the start date/time and before the end date/time, inclusive, will be included.

To automatically update the report with sample data as tests are completed, click the **Use Dynamic Update** radio button. Click the **Do not show previous samples** box if you do not wish to display samples run prior to the time the analysis is opened.

Use the spin controls  to select the Sample Time Window (the desired range of recent samples to be included in the analysis). Data from samples tested within [x] hours will be displayed in the analysis. Note that the analysis sorting options are disabled if you are using Dynamic Update.

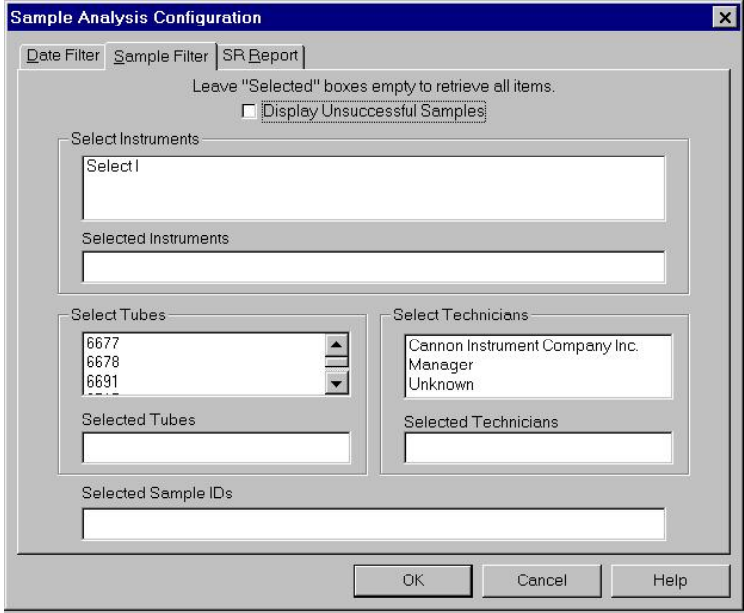
EXAMPLE

If the Do not show previous samples box was unchecked and a Sample Time Window value of 5 hours was selected, the analysis (when opened) would display data for all samples tested within the last five hours.

Using the sample filter

Use the sample filter to limit the analysis to samples which have been tested on certain instruments and tubes, or which have certain Sample ID characteristics.

To filter samples by instrument, tube serial number (S/N) or Sample ID, click the **Sample Filter** tab from the analysis configuration window.



The screenshot shows the 'Sample Analysis Configuration' dialog box with the 'Sample Filter' tab selected. The dialog has three tabs: 'Date Filter', 'Sample Filter', and 'SR Report'. Below the tabs, there is a text box with the instruction: 'Leave "Selected" boxes empty to retrieve all items.' and a checkbox labeled 'Display Unsuccessful Samples' which is currently unchecked. The main area is divided into four sections: 'Select Instruments' with a text box containing 'Select I' and an empty 'Selected Instruments' box below it; 'Select Tubes' with a list box containing '6677', '6678', and '6691' and an empty 'Selected Tubes' box below it; 'Select Technicians' with a list box containing 'Cannon Instrument Company Inc.', 'Manager', and 'Unknown' and an empty 'Selected Technicians' box below it; and 'Selected Sample IDs' with an empty text box below it. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

Sample filter options

Some (not all) analyses offer an option to display data for samples which did not complete successfully. Click the **Display Unsuccessful Samples** box if you wish to this data. Unsuccessful samples, which have no flow time, will be listed with a kinematic viscosity value of “0”.

Then select the desired instruments and tubes from their respective list boxes. To select a range of tubes/instruments, click on the first desired item and then hold down the **⇧ Shift** key while clicking on the last desired item in the sequence. To individually select tubes/instruments from the list boxes and add them to the analysis, hold down the **⌘ Ctrl** key while clicking on each desired tube/instrument.

To filter by Sample ID characteristics, place the pointer/cursor in the Sample ID field and type the desired sample IDs, or leave the field blank to include all sample IDs for the selected instruments/tubes. You may use wildcards (% , _ , #) to select a range of samples. For example, **S%** would include data from all samples starting with **S**. Both “_” and “#” are single-character wildcards. “_” will match any character, while “#” will include any single digit. To include multiple ID searches, delineate each with a comma (for example, **s%,n%** would search for all sample IDs beginning with “s” or “n”).

NOTE

If no instruments/tubes/Sample IDs are selected, the analysis will display data for ALL instruments/tubes/Sample IDs.

Using the report/port output filter

Use the Report or Port Output filter to determine which data will be calculated and/or included in the analysis, and/or in what sequence that data will be displayed. Report/Port Output filter options will vary depending on the nature of the analysis. For more information on Report/Port Output filter options, please see the chapter on the specific analysis.

Reconfiguring a displayed analysis

An on-screen analysis may be reconfigured using the same filtering tools available when creating a new configuration. To access configuration options for a displayed analysis:

1. Select **Analyses** from the **VISCPRO®** primary menu options.
2. Select **Configure Analysis** from the **Analyses** options.
3. Select the desired analysis from the available analyses. The **Sample Analysis Configuration** window will appear.
4. Reconfigure the analysis as desired by clicking the tabs to access the **Date**, **Sample** and **Report** filtering options (see previous sections). When done, click **OK**.

5. You will be prompted to save the new analysis configuration. After you make your selection(s), the analysis will be performed and displayed using the new configuration settings.

Resizing table columns

To resize columns from a displayed analysis for easier viewing/printing, move your mouse pointer/cursor to the border of the desired column heading. The mouse pointer will change to a bi-dimensional arrow.

Click and drag the edge of the heading to the new location and then release the mouse button. The entire column will be resized as you drag.

User column size settings will be maintained as long as the analysis window is open.

Saving a current analysis

To save a current analysis configuration:

1. Select **Analyses** from the VISCPRO® primary menu options.
2. Select **Save Analysis** from the **Analyses** menu options.
3. Select the desired analysis. The **Save Configuration** window will appear. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the Existing Configurations list box to replace the existing configuration with the new configuration settings.
4. Click **OK**.

NOTE

*You may click **Cancel** from the **Save Configuration** window to exit without saving configuration changes.*

Deleting an analysis configuration

You can delete an existing analysis configuration from the **Choose Analysis** window by highlighting the desired configuration in the list box and clicking the **Delete** button or pressing the **Delete** key. The configuration will be immediately and permanently deleted.

Printing an analysis

To print the complete analysis, select **Print** from the VISCPRO® Main menu while the analysis is being displayed. If multiple VISCPRO® windows are open, click the analysis window for the analysis you want to print to make it the active window before you select **Print**. Then

choose print options from the Windows® Print window and click OK to print the analysis. (Consult your Windows® manual and printer/print driver documentation for more information on print settings).

It is also possible to select individual or multiple samples from an analysis for printing (see next section).



NOTES


The font size for printed analyses will be automatically adjusted to fit data columns to the selected printer paper size. If the font is too small, or if columns of data are missing or truncated, try using print options to set your printer to print in landscape instead of portrait orientation.

The Print option from Main will not be accessible unless the analysis window is the active window.

Keystrokes for selecting data for printing

You can print data for a selected sample or samples from an on-screen analysis by highlighting the desired sample data and then using the Print option from the VISCPRO® Main menu.

To select data for a single sample, click on the line of data associated with the sample on the screen display. To print a sequential range of samples, highlight the first sample in the range, then hold down the  key and click on the last sample in the range. To individually select test data from the on-screen list box for printing, hold down the  key while clicking on each desired entry.

When all desired data has been selected, click on Print from the Main menu. Make certain that the Selection radio button  has been selected from the Print range options. Then click OK to print to the selected printer.

Exporting analysis data

The data export analyses included with the VISCPRO® software provide a convenient method for outputting sample data to laboratory collection systems or to an ASCII file.

There are three different data export analyses. For step-by-step instructions on exporting data from the VISCPRO® database, consult the appropriate manual chapter on the specific analysis:

- Error Data Export—(export of error information from all tests)
- Sample Data Export—(export of KV sample information—any samples tested with the Measure Kinematic Viscosity or Verify Known KV sample actions)
- Polymer Data Export—(export of polymer information—any samples tested with the Determine Solution Relative Viscosity, Determine Solvent Viscosity, or Verify Known RV sample actions)

Once the data has been exported, it can be manipulated using database/spreadsheet software packages such as Excel[®], Access[®] or Quattro Pro[®]. These packages provide additional tools for configuration of report data for such functions as:

- Statistical Process Control
- Long-term Monitoring of Daily Check Standards

CAV DATA TABLE

The PolyVISC CAV Data Table analysis is designed to permit convenient viewing of data collected from samples which have been tested using the Measure Kinematic Viscosity or Verify Kinematic Viscosity sample action options.

The PolyVISC CAV Data Table analysis displays sample data in a tabular format. In addition to Sample identification (ID), the following data may be included:

- INV—Invalid test indication (flow time out of tolerance)
- Tol[erance]—Acceptable difference in multiple test results for the same sample
- Date—Date the sample was measured
- Time—Time the sample was measured
- Tube S/N—Tube serial number (from *Instrument Settings*)
- Tray [Index]—Position of the sample tray in the numeric sequence (left to right)
- Sample Indx.—Position of the sample in the sample tray
- Bulb No.—Bulb number (the bulb in which the sample was run—#1 is the bottom bulb)
- Technician—The technician logged on to VISCPRO at the test time
- Instrument Type—Instrument type (CAV, CCS, etc.)
- Instrument ID—Instrument Identification (from *Instrument Settings*)
- KV—Average kinematic viscosity (calculated from flow times)
- Known KV—Known kinematic viscosity of the viscosity standard
- % Diff KV—Percent difference between the measured KV and the known KV for viscosity standards
- Temp[erature]—Average bath temperature
- T1-T4—Bath temperature during each sample drop
- % Diff (Mean)—For multi-drop samples: ((maximum drop time - minimum drop time) / average drop time) * 100
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Maximum drop time = 80.5
 Minimum drop time = 80.3
 $((80.5 - 80.3)/80.425) * 100 = 0.2487$
- % Diff (Spread)—For multi-drop samples: ((maximum drop time - minimum drop time) / maximum drop time) * 100
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Maximum drop time = 80.5
 Minimum drop time = 80.3
 $((80.5 - 80.3)/80.5) * 100 = 0.2484$

- **Abs. Diff (Mean)**—For multi-drop samples: the absolute value of the difference between the accepted drop time value furthest from the average drop time and the average drop time value itself.
EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
Average drop time = 80.425
Furthest drop time from average = 80.3
 $|80.3 - 80.425| = 0.125$
- **Abs. Diff (Spread)**—For multi-drop samples: maximum drop time - minimum drop time
EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
Maximum drop time = 80.5
Minimum drop time = 80.3
 $80.5 - 80.3 = 0.2$
- **{1,10} Efflux%**—For multi-drop samples: displays the first 10 sample efflux times
- **{1,20} Efflux%**—For multi-drop samples: displays the first 20 sample efflux times
- **Avg Efflux%**—The average efflux time for efflux values used for viscosity calculation
- **C, E**—The calibration constants used for this determination
- **SUS**—Saybolt Furol Seconds calculation
- **% KE**—Percent contribution of the kinetic energy correction to the measured viscosity.

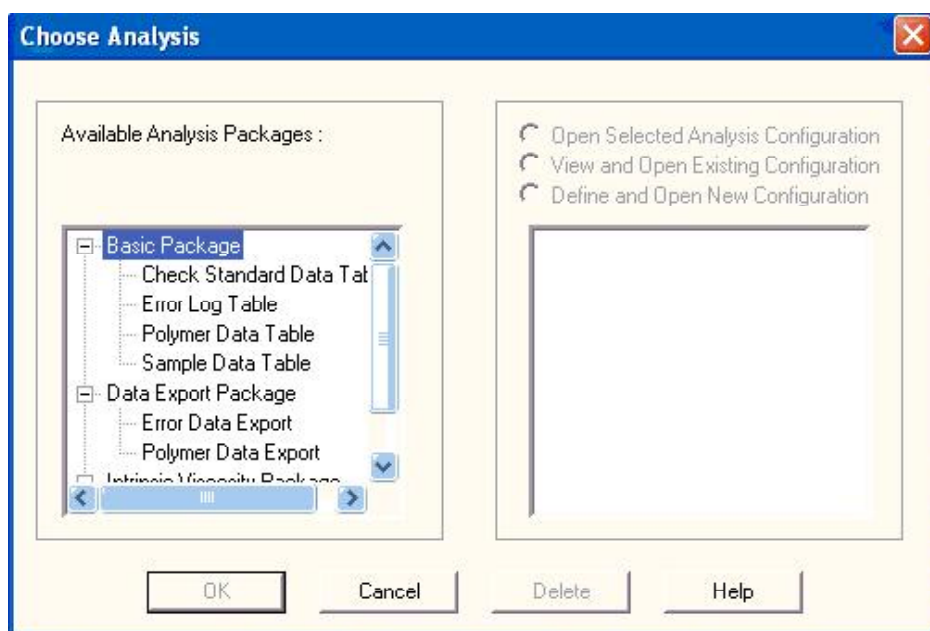
Reporting options

The sample analysis can present data for samples residing in the database. Several powerful filters may be used to create useful reports. These filters may be used by making selections from the tabbed property sheets found in the **Sample Analysis Configuration** window. Once the appropriate filters have been designated, the resulting report configuration can be saved for future use.

Configuring the Sample Data Table

For general information on using analyses, see Chapter 6. To access and configure the Sample Data Table, follow the procedure below:

1. Select **Analyses** from the **VISCPRO®** primary menu options.
2. Select **View Analysis ...** from the **Analyses** menu. The **Choose Analysis** window will appear.
3. Double-click **Basic Package** from the list of **Available Analysis Packages**.
4. Select **Sample Data Table** from the **Basic Package** report options.



The Choose Analysis window

- Click on the Define and Open New Configuration radio button  (or verify that the option is selected).

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

- Click OK. The Sample Analysis Configuration window will appear.

The Sample Analysis Configuration window consists of three tabbed pages:





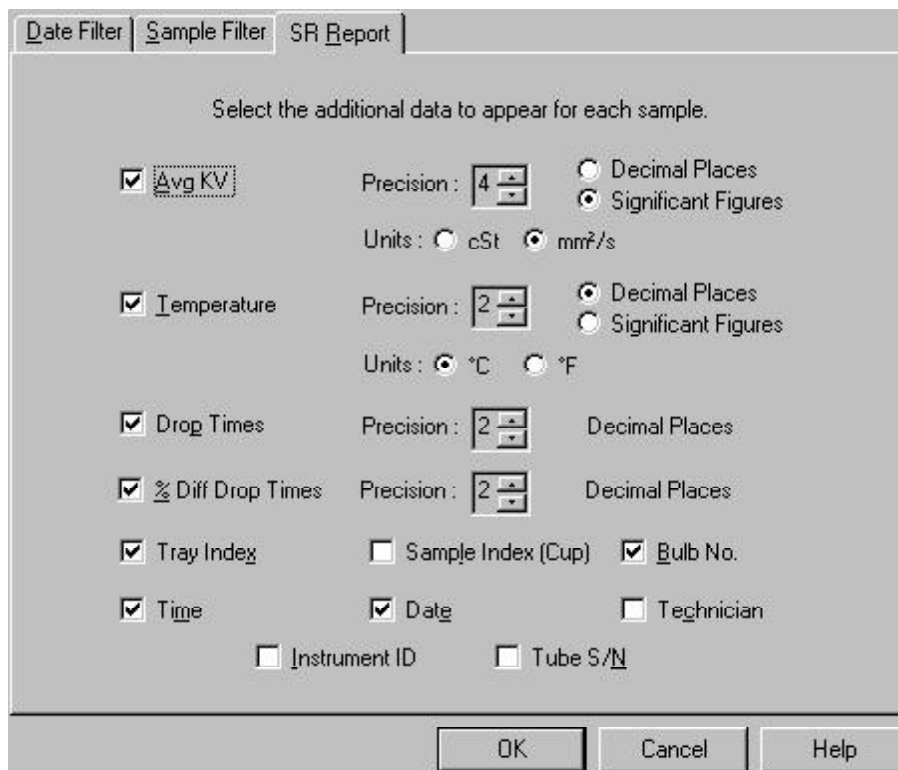
- **Date Filter**—allows you to select date/time parameters for the analysis
 - **Sample Filter**—allows you to select which tubes/technicians/tests will be included in the analysis.
 - **SR Report**—allows you to select what sample data will appear in the Sample Data Table and how the data will be displayed
- Click on the tab corresponding to the filter you wish to set and complete configuration options per the instructions below:

Date/Sample filters

Complete selection of Date/Sample filter options per the instructions in Chapter 6.

SR Report filter

To adjust other sample run (SR) report options, click **SR Report**. Then use the check boxes to select which fields to include in the report. After individual options have been selected, use the related spin controls  and radio buttons  to determine the appearance of data for kinematic viscosity, temperature and drop times.



Select the additional data to appear for each sample.

Avg KV Precision : 4 Decimal Places
 Significant Figures
Units : cSt mm²/s

Temperature Precision : 2 Decimal Places
 Significant Figures
Units : °C °F

Drop Times Precision : 2 Decimal Places

% Diff Drop Times Precision : 2 Decimal Places

Tray Index Sample Index (Cup) Bulb No.

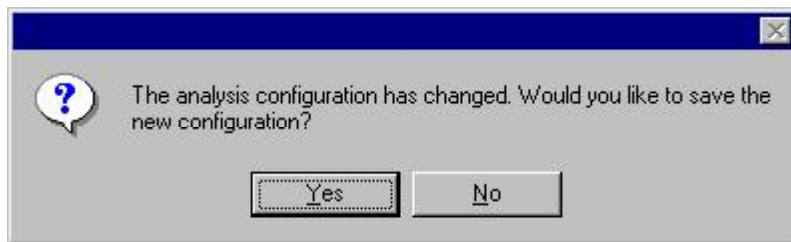
Time Date Technician

Instrument ID Tube S/N

OK Cancel Help

SR Report data filter options

- When you have completed the configuration, click **OK**. The program will prompt you to save the configuration.



- Click **Yes** to save the configuration. The **Save Configuration** window will appear.



The Save Configuration window

10. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the **Existing Configurations** list box to replace the existing configuration with the new configuration settings.
11. Click **OK**. The analysis will be performed and displayed using the selected configuration settings.

NOTES

You may click Cancel from the Save Configuration window to exit without saving configuration changes.

You may display several analyses simultaneously by repeating the instructions above. Use the tiling options available from the Window menu to display multiple analyses in the desired window format (horizontal, vertical or cascade view options are available).

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POLYMER DATA TABLE and DATA EXPORT ANALYSES

Polymer Data Table analysis

Reporting options

The Polymer Data Table analysis is derived from sample data in the VISCPRO® database. Several powerful filters may be used to create useful reports. These filters may be used by making selections from the tabbed property sheets (Date, Sample and Poly Report) found in the Polymer Analysis Configuration window. Once the appropriate filters have been designated, the resulting report configuration can be saved for future use. The Polymer Data Table analyses display data collected from samples which have been tested using the Determine ... Viscosity sample action options (Determine Solution Relative Viscosity and Determine Solvent Viscosity).

Report format

The Polymer Data Table analyses display the sample data in a tabular format, and may include the relative viscosity ratio of the dilute solution sample to the selected solvent blank. Additional options permit display of values for inherent and reduced viscosity, and single-point intrinsic viscosity as calculated using Solomon-Ciuta and/or Billmeyer equations. A K-value may also be calculated using the Fickentscher equation.

NOTE

No output is provided for unsuccessful or invalid (INV) samples (kinematic viscosity="0").


In addition to Sample identification (ID), the following data may be included:

- INV—Invalid test indication (the sample will need to be tested again)
- Date—Date the sample was measured
- Time—Time the sample was measured
- Tube S/N—Tube serial number
- Tray—Tray the sample was measured in (always "1" with PolyVISC)
- Smpl Index—Position of sample in sample carousel (1-11)
- Bulb—Bulb the sample was measured in
- Technician—Technician logged in at the time the sample run was completed
- Instrument Type—Instrument Type (from *Instrument Settings*)
- Instrument ID—Instrument Identification (from *Instrument Settings*)
- Blank ID—ID for solvent blank used in RV calculation

- RV—Relative viscosity of the sample (calculated)
- Known KV—Known relative viscosity as input by the user
- Temp—Actual average bath temperature
- T1/2/3/4—Drop time(s) for sample
- Avg Efflux—Average efflux time as calculated from individual times
- Density—Density of sample (as input by the user)
- Conc—Concentration of sample (as input by the user)
- Blank Visc.—The viscosity of the pure solvent
- Blank Avg Efflux—Average efflux time for blank as calculated from individual times
- Red. Visc.—Reduced viscosity calculation
- Inh. Visc.—Inherent viscosity calculation
- Billmeyer—Single-point intrinsic viscosity as calculated using the Billmeyer equation
- Sol-Ciuta—Single-point intrinsic viscosity as calculated using the Solomon-Ciuta equation
- Fickentscher—K-value as calculated with the Fickentscher equation
- % Diff (Mean)—For multi-drop samples: $((\text{maximum drop time} - \text{minimum drop time}) / \text{average drop time}) * 100$
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Maximum drop time = 80.5
 Minimum drop time = 80.3
 $((80.5 - 80.3) / 80.425) * 100 = 0.2487$
- % Diff (Spread)—For multi-drop samples: $((\text{maximum drop time} - \text{minimum drop time}) / \text{maximum drop time}) * 100$
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Maximum drop time = 80.5
 Minimum drop time = 80.3
 $((80.5 - 80.3) / 80.5) * 100 = 0.2484$
- Abs. Diff (Mean)—For multi-drop samples: the absolute value of the difference between the accepted drop time value furthest from the average drop time and the average drop time value itself.
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Average drop time = 80.425
 Furthest drop time from average = 80.3
 $|80.3 - 80.425| = 0.125$
- Abs. Diff (Spread)—For multi-drop samples: maximum drop time - minimum drop time
 EXAMPLE: Four drop times: 80.3, 80.4, 80.5, 80.5
 Maximum drop time = 80.5
 Minimum drop time = 80.3
 $80.5 - 80.3 = 0.2$
- {1,10} Efflux%—For multi-drop samples: displays the first 10 sample efflux times
- {1,20} Efflux%—For multi-drop samples: displays the first 20 sample efflux times

Configuring the Polymer Data Table

For general information on using analyses, see Chapter 6. To access and configure the Polymer Data Table, follow the procedure below:

1. Select **Analyses** from the VISCPRO® primary menu options.
2. Select **View Analysis ...** from the **Analyses** menu. The **Choose Analysis** window will appear.
3. Double-click **Basic Package** from the list of **Available Analysis Packages**.
4. Select **Polymer Data Table** from the **Basic Package** report options.
5. Click on the **Define and Open New Configuration** radio button  (or verify that the option is selected).

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

6. Click **OK**. The **Polymer Analysis Configuration** window will appear.

The **Polymer Analysis Configuration** window consists of three tabbed pages:

- **Date Filter**—allows you to select date/time parameters for the analysis
 - **Sample Filter**—allows you to select which tubes/technicians/tests will be included in the analysis.
 - **Poly Report**—allows you to select what sample data will appear in the **Polymer Data Table** and how the data will be displayed
7. Click on the tab corresponding to the filter you wish to set and complete configuration options per the following instructions:


Date/Sample filters

Complete selection of Date/Sample filter options per the instructions in Chapter 6.

Poly Report filter

To select other report options, click **Poly Report**. This report page uses a convenient “spreadsheet” type interface that allows you to select reporting options and format output quickly and easily. To add data types and column headings to the report, click the left-hand “cell” in the **Poly Report**, and a list of data types will appear. Scroll down through the list and click on the desired field to add the data type to the report. Repeat the process until all desired elements have been added to the report. Note that some options have related default values in the **Precision**, **Format**, and **Units** columns.

Changing default values

To change the default settings, click in the appropriate column, then click again in the column to either enter an acceptable value via the keyboard (the acceptable range will be displayed in the popup window) or to access the spin controls  for selection options. If using the spin controls, click the desired option to select it.

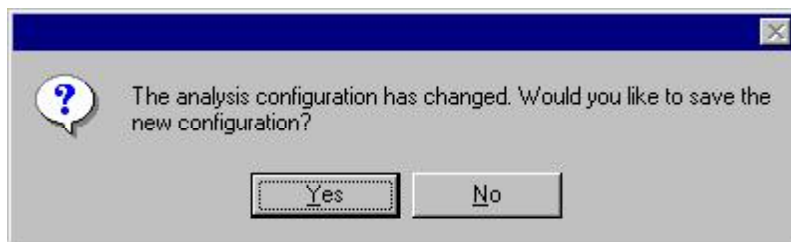
Deleting rows

To delete a data type/heading from the Table, click anywhere in the row and press the **Delete** key. Or right-click in the **Column Name** column for the data type you would like to delete and select the **Delete** option.

Inserting rows

To insert a row of data in the table, right-click in the **Column Name** column at the place you would like to insert the row. Then select **Insert New** to insert a new column in the report. Select the desired data type from the options revealed in the drop-down menu.

8. When you have completed the configuration, click **OK**. The program will prompt you to save the configuration.



9. If you wish to save the configuration, click **Yes**. The **Save Configuration** window will appear. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the **Existing Configurations** list box to replace the existing configuration with the new configuration settings. Then click **OK**. The saved analysis will be displayed using the selected configuration settings. Click **NO** to display the configuration without saving it.

Polymer Data Export analysis

The VISCPRO® Polymer Data Export Analysis provides a convenient operator interface for configuring polymer sample test information from the sample database for serial output and exporting it in ASCII text format. The port output filters (**Date**, **Sample** and **Port Output Format**) permit the user to select and output desired data to a file, LPT port or serial port in whatever format is desired.

NOTE

Once the port output analysis has been generated, it cannot be reconfigured like other VISCPRO® analyses. This prevents duplicate data from being resent to network collection systems your lab may have in place. To re-send data to the serial port, close the analysis window (you may save the configured analysis if you desire) and then recreate the analysis .


Available data for analysis

In addition to the serial transmission, the analysis displays requested sample data on the computer screen in a tabular format. The following data may be included:

- Sample ID—Sample ID for sample
- RV—Relative Viscosity for sample
- Avg. Efflux—Average efflux time for sample drops
- Date—Date when the test was completed
- Blank ID—The Sample ID of the solvent blank used for RV calculation
- Blank Visc—The viscosity of the solvent blank used for RV calculation
- Blnk. Efflx—The average efflux time for the solvent blank used for RV calculation
- Time—Time when the test was completed
- Temp °C—Bath temperature in degrees Celsius during the test
- Temp °F—Bath temperature in degrees Fahrenheit during the test
- Conc.—Concentration of the sample solution
- Density—Density of the sample solution
- Tube S/N—Tube serial number
- Tray Index—Number of carousel/tray (always “1”)
- Smpl Index—Sample placement on carousel (position 1-11)
- Bulb—Number of bulb in which sample was tested (“1” is lower bulb, “2” is upper bulb)
- Delay—The delay time prior to serial transmission of test data following creation of the Port Output Analysis
- InstrType—Instrument Type (PolyVISC, CAV, etc.)
- InstrID—User-determined ID (from *Instrument Settings* window)
- ASCII Codes—Permits addition of user-selected ASCII codes to analysis
- Flowtime 1/2/3/4—Sample efflux time
- Technician—ID of Technician logged into the VISCPRO software at the time of the test
- Known RV—Known relative viscosity of the sample (if known)
- Red. Visc.—Reduced viscosity (calculated)
- Inh. Visc.—Inherent viscosity (calculated)
- Billmeyer—Single-point reduced viscosity (calculated with Billmeyer equation)
- Sol-Ciuta—Single-point reduced viscosity (calculated with Solomon-Ciuta equation)

- Fickentscher—K-value for viscosity (as calculated with Fickentscher equation)
- Viscosity—Absolute viscosity of the sample
- Space—Inserts a blank space (formatting option)
- CR—Inserts a carriage return code (formatting option)
- LF—Inserts a line feed code (formatting option)
- Next/Previous—Displays more button options

Configuring the Polymer Data Export Analysis

1. Select Analyses from the VISCPRO® menu options.
2. Select View Analysis from the Analyses menu options
3. Double-click Data Export Package from the list of available analysis types.
4. Select the Polymer Data Export Analysis option.
5. Click the Define and Open New Configuration radio button  to define a new analysis configuration.

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

6. Click OK. The Port Output Configuration window will appear.

The Port Output Configuration window consists of three tabbed pages:



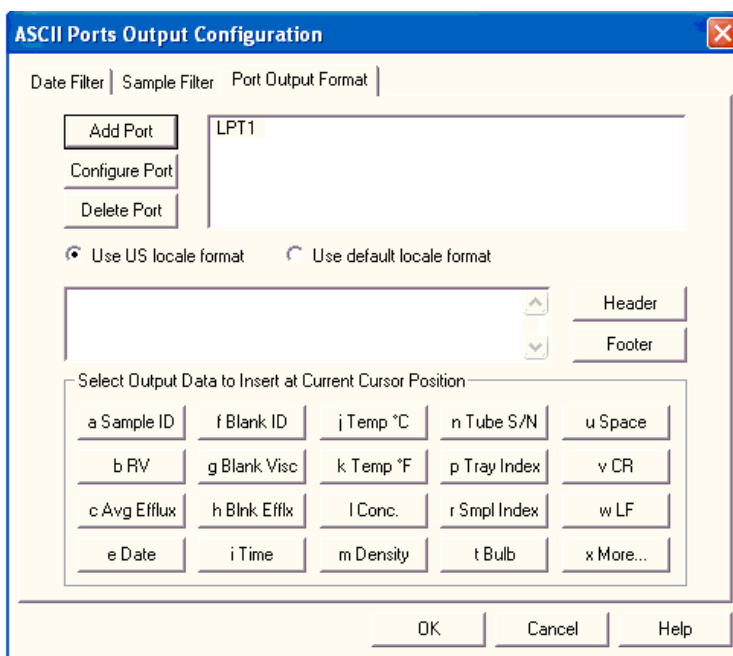
- **Date Filter**—allows you to select date/time parameters for the analysis.
 - **Sample Filter**—allows you to select which tubes/technicians/tests will be included in the analysis.
 - **Port Output Format**—allows you to select the output port(s), what sample data will appear in the output analyses, and how the data will be displayed/sent.
7. Click on the tab corresponding to the filter you wish to set and complete configuration options per the following instructions:

Date/Sample filters

- a. Complete selection of Date and Sample filter options per the instructions in Chapter 6.

Port Output Format filter

- b. To adjust other analysis configuration options, click the Port Output Format tab:




Polymer Port Output Format options

Adding ports

- c. Click Add Port from the Port Output Format button options to open the Select Port window. Select the desired serial port(s) and/or files for output and verify the configuration settings for each. Then Click OK. Added ports will be displayed in the port list box.

NOTE

If you select NEW FILE for output, click the  button to open the Windows Save As: box. Select the desired directory and type the desired file name in the File Name: text box. If you select an existing file, ASCII port analysis data will be appended to the file.

Make certain that you have selected the desired port for configuration by clicking on the port name in the Add Port list box **prior** to selecting output data and formatting options for that port. **OUTPUT FOR EACH ADDED PORT MUST BE CONFIGURED SEPARATELY** (see following note).

Configuring output

- d. Select the desired port/file for configuration by clicking the name of the port/file in the port list box. Then click the radio button corresponding to the desired locale format (U.S. or local). Your choice will determine the formatting of numeric data and dates.

Delaying serial output


- e. You may delay data transmission of serial output for a time parameter you specify by clicking the Delay button to insert the delay code into the Configuration list box, Header or Footer. The Delay Configuration window will appear. To set the time of the Delay, type a numeric value in the appropriate field, and click on one of the radio buttons to select the correct unit of time. Then click OK.

of the Delay, type a numeric value in the appropriate field, and click on one of the radio buttons to select the correct unit of time. Then click OK.

Selecting output data

- f. Click the buttons corresponding to the data types you wish to output on the report. As you do so, the appropriate coding for the output analysis will be inserted in the text box.

NOTE

For some data output options, you will need to select the desired output field length using the spin controls  provided in the Format Data Output window. Experienced users may type code directly into the text box by placing the cursor at the appropriate point. The text box information may also be manipulated using the mouse click-and-drag technique to highlight data and then using standard Windows® cut (Ctrl-X), copy (Ctrl-C), and paste (Ctrl-V) keyboard combinations. In this way, formatting data can easily be copied from one port configuration to another.

Adding a header

- g. If you would like to include a header at the beginning of the analysis, click the **Header** button and add the desired text string via the keyboard. Format the entry as desired using the Carriage Return (CR) and Line Feed (LF) options as necessary to indicate line breaks. Then click OK.

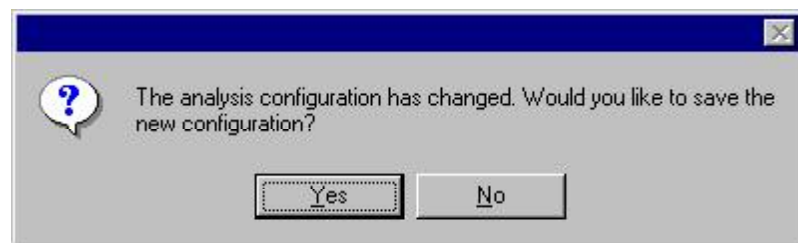
Adding a footer

- h. If you would like to include a footer at the end of the analysis, click the **Footer** button and add the desired text string via the keyboard. Format the entry as desired using the Carriage Return (CR) and Line Feed (LF) options. Then click OK.

NOTE

If you have selected the Dynamic Update option using the Date tab options, you will not be able to enter Footer information for the analysis.

8. When you have completed the configuration, click OK. Serial data will be routed to the appropriate ports/files and you will be prompted to save the configuration.



9. If you do not wish to save the configuration, click **No**. The analysis will be displayed and the data will be sent to the selected ports. If you wish to save the configuration, click **Yes**. The **Save Configuration** window will appear. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the **Existing Configurations** list box to replace the existing configuration with the new configuration settings. Then click **OK**. The saved analysis will be displayed using the selected configuration settings, and the data will be sent to the selected ports.

NOTES

You may click Cancel from the Save Configuration window to exit without saving configuration changes.

The Port Output Analysis cannot be reconfigured. This avoids duplication of output data for data collection devices your facility may have in place. You may still view configuration options for a displayed analysis by selecting Configure Analysis from the Analyses menu and choosing the correct analysis.

Re-sending export data

To re-send Port Output Analysis data for a displayed analysis, first save the analysis by clicking Analyses/Save Configuration, selecting the desired analysis, typing the analysis name in the Save As: list box and clicking OK. Then close the Port Output Analysis window and re-select Port Output Analysis by clicking Analyses/View Analysis from the primary menu options. Then click on the desired configuration from the list of saved configurations and click OK.

Exporting specific sample data

To re-send data from specific samples, use Sample Filter options, including wildcard characters if desired, to reconfigure the analysis to send only the necessary data.

Port selection

Make certain that you have selected the desired port for configuration by clicking on the port name in the Add Port list box **prior** to selecting output data and formatting options for that port. **OUTPUT FOR EACH ADDED PORT MUST BE CONFIGURED SEPARATELY.**

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POLYMER INTRINSIC VISCOSITY REPORT

Polymer Intrinsic Viscosity Report

Reporting options

The Polymer Intrinsic Viscosity Report calculates and displays inherent, reduced and intrinsic viscosity using data collected from samples which have been tested using the Determine Solvent Viscosity sample action option.

The Polymer Intrinsic Viscosity Report is derived from sample data in the VISCPRO® database. Several powerful filters are used to select desired data. These filters may be used by making selections from the tabbed property sheets (Date, Sample and Poly Report) found in the Polymer Analysis Configuration window for the report. Once the appropriate filters have been determined, the resulting report configuration can be saved for future use.

Report format

The Polymer Intrinsic Viscosity Report displays the sample data in both tabular and graphic formats.

NOTE


No output is provided for unsuccessful or invalid (INV) samples (viscosity="0").

The following data is included in the report:

- Sample ID—Sample identification
- Conc(g/dl)—Concentration (in grams per deciliter)
- RV—Relative viscosity,
- Inh. Visc.—Inherent viscosity
- Red. Visc.—Reduced viscosity
- Slope—Slope of the “best fit” lines calculated from data points derived from inherent and reduced viscosity
- Intercept—Value for the point on the “best fit” line at 0.00 concentration
- r^2 —the R-squared value for each line
- Huggins k1—Value for reduced viscosity
- Kraemer k2—Value for inherent viscosity
- Concentration at intercept—Value for concentration at the intercept of “best fit” lines for reduced/inherent viscosity

Configuring the Polymer Data Table

For general information on using analyses, see Chapter 6. To access and configure the Polymer Data Table, follow the procedure below:

1. Select **Analyses** from the VISCPRO® primary menu options.
2. Select **View Analysis ...** from the **Analyses** menu. The **Choose Analysis** window will appear.
3. Double-click **Intrinsic Viscosity Package** from the list of **Available Analysis Packages**.
4. Select **Intrinsic Viscosity Report** from the **Intrinsic Viscosity Package** report options.
5. Click on the **Define and Open New Configuration** radio button  (or verify that the option is selected).

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. Skip to step 10 to complete the Intrinsic Viscosity Report configuration.

6. Click **OK**. The **Polymer Analysis Configuration** window will appear.

The **Polymer Analysis Configuration** window consists of three tabbed pages:

- **Date Filter**—allows you to select date/time parameters for the analysis
 - **Sample Filter**—allows you to select which tubes/technicians/tests will be included in the analysis.
 - **Poly Report**—allows you to enter report-specific data (see below).
7. Click on the tab corresponding to the filter you wish to set and complete configuration options as follows:

Date/Sample filters

Complete selection of Date/Sample filter options per the instructions in Chapter 6.

Poly Report filter

To select other report options, click the **Poly Report** tab. This report page permits the user to input identifying labels for the report (**Customer**, **Designation**, and **Solvent**), specify the temperature of the desired sample tests, and determine the level of precision desired for display of the analysis.

Changing default values

To change the **Customer**, **Designation**, or **Solvent** headings for the report, click in the appropriate field, then input the desired information via the keyboard.

The screenshot shows the 'Polymer Analysis Configuration' dialog box with the 'Poly Report' tab selected. The fields are filled with the following information:

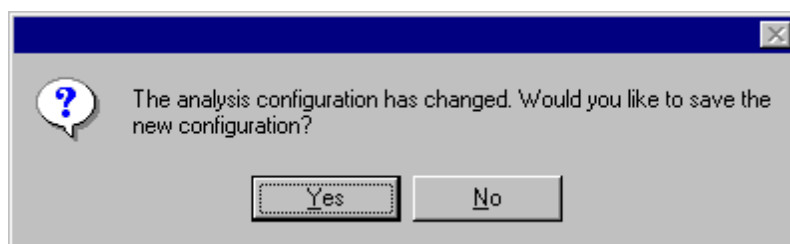
- Customer: Cannon Instrument Company
- Designation: Nylon 6
- Solvent: Formic Acid
- Target Temperature: 25.00
- Units: °C, °F
- Data Precision: 3 (spin control)
- Display Options: Decimal Places, Significant Figures

Buttons at the bottom: OK, Cancel, Help.

The Poly Report tab

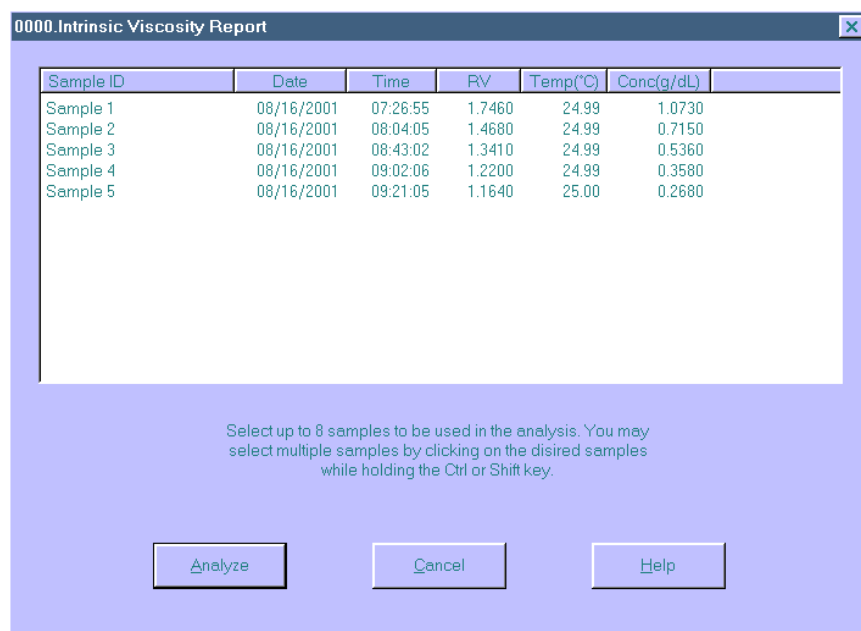
Input the desired value for **Target Temperature** (your selection will determine which sample data can be included in the report) and select the correct temperature scale by clicking on the radio button options for Fahrenheit or Celsius. Select the desired **Data Precision** for the report display by clicking the spin controls . Then click the radio button corresponding to your choice for display of **Decimal Places** or **Significant Figures**.

- When you have completed the configuration, click **OK**. The program will prompt you to save the configuration.



- If you wish to save the configuration, click **Yes**. The **Save Configuration** window will appear. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the **Existing Configurations** list box to replace the existing configuration with the new configuration settings. Then click **OK**. The saved analysis will be displayed using the selected configuration settings. Click **No** to display the configuration without saving it.

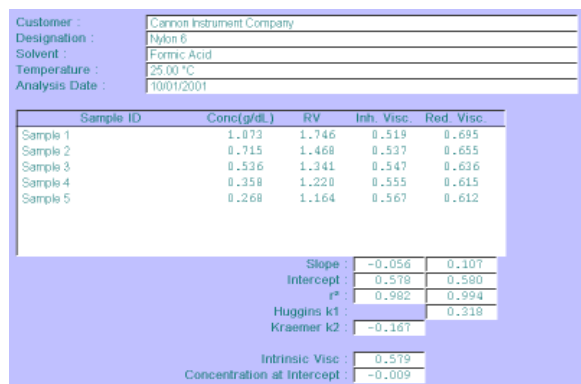
When you click OK, the Intrinsic Viscosity Report window will appear. This window permits you to select the desired samples/data points for the calculation of inherent, reduced, and intrinsic viscosity.



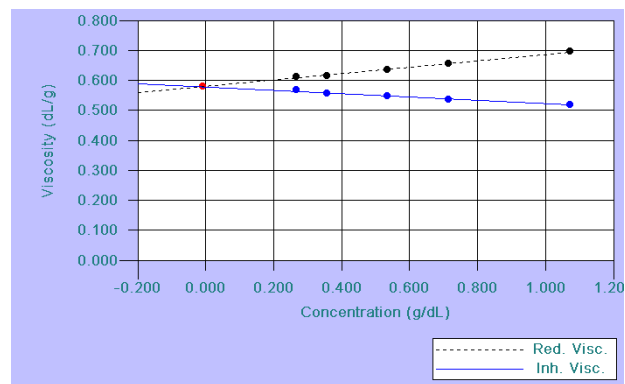
10. Select sample data to include in the report by clicking in the text box to highlight desired samples. Then click **Analyze** to perform calculations for determination of viscosity. The report will be displayed with graphical and tabular data.

NOTE

To select multiple samples, hold down the **Ctrl** key and click on the desired samples. To quickly select a sequential range of samples from the list, hold down the **Shift** key and click the top and bottom sample in the group.



Intrinsic viscosity data display



Intrinsic viscosity graphical display

ERROR DATA EXPORT ANALYSIS

The VISCPRO® Error Data Export analysis compiles error information from the sample database for serial output and exports it in ASCII text format. The port output filters (Date, Error and Error Report) permit the user to select and output desired data to a file, LPT port or serial port in whatever format is desired.

NOTE

Once the port output analysis has been generated, it cannot be reconfigured like other VISCPRO® analyses. This prevents duplicate data from being resent to network collection systems your lab may have in place. To re-send data to the serial port, close the analysis window (you may save the configured analysis if you desire) and then recreate the analysis .

Available data for analysis

In addition to the serial transmission, the analysis is displayed on the computer screen in a tabular format and may include the following data:

- Error—Error description
- Date—Date when the test was completed
- Time—Time when the test was completed
- Error Source—Source for the error message (instrument or other)
- Instr ID—Identification of the instrument associated with the error (if applicable)
- Sample ID—Identification of the sample associated with the error (if applicable)
- Bulb No.—Bulb number associated with the error
- Tray Index—Position of the sample tray associated with the error (trays are numbered sequentially from left to right)
- Sample Index—Position of the sample associated with the error (samples are numbered sequentially beginning at the rear of the tray)
- Technician—The name of the technician who was logged on at the time the error occurred (if applicable)
- Formatting Options (Space, Carriage Return, Line Feed) and ASCII Codes—Permits additional user-controlled data formatting

Configuring the Error Data Export analysis

1. Select Analyses from the VISCPRO® menu options.
2. Select View Analysis from the Analyses menu options
3. Double-click Data Export Package from the list of available analysis types.
4. Select the Error Data Export analysis option.

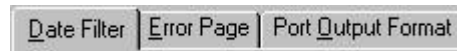
5. Click the Define and Open New Configuration radio button  to define a new analysis configuration.

NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

6. Click OK. The Port Output Configuration window will appear.

The Port Output Configuration window consists of three tabbed pages:



- **Date Filter**—allows you to select date/time parameters for the analysis (see Chapter 6 for more information)
- **Error Page**—allows you to filter errors by source and by technician.
- **Port Output Format**—allows you to select the output port(s), what sample data will appear in the output analyses, and how the data will be displayed/sent.

7. Click on the tab corresponding to the filter you wish to set and complete configuration options per the following instructions:



Date filter

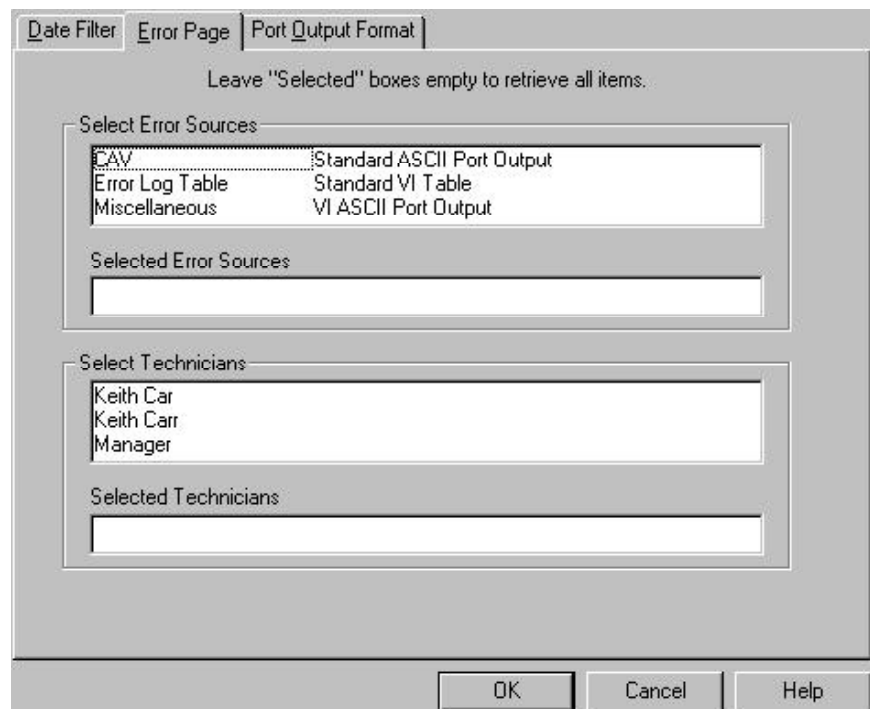
- a. Use the **Date Filter** to select the appropriate date/time parameters for the analysis. See Chapter 6 for more information on using the **Date Filter**.

Error Page filter

- b. Use the **Error Page** tab to limit the analysis to errors which have been associated with certain instruments or analyses, or which are associated with certain technician names.

To filter errors by source or technician name, click the **Error Page** tab from the analysis configuration window (see Figure, next page).

Then select the desired error sources/technicians from their respective list boxes. To select a range of sources/technicians, click on the first desired item and then hold down the  **Shift** key while clicking on the last desired item in the sequence. To individually select sources/technicians from the list boxes and add them to the analysis, hold down the  **Ctrl** key while clicking on each desired tube/instrument.



The Error Page tab

You may also type filter information directly into the **Selected . . .** list boxes. Position the cursor in the desired field and use the keyboard to input entries. You may use wildcards (% , _ , #) to select a range of samples. For example, **S%** would include data from all samples starting with **S**. Both “_” and “#” are single-character wildcards. “_” will match any character, while “#” will include any single digit.

NOTE

If no error sources/technicians are selected, the analysis will display data for ALL error sources/technicians.

Port Output Format filter

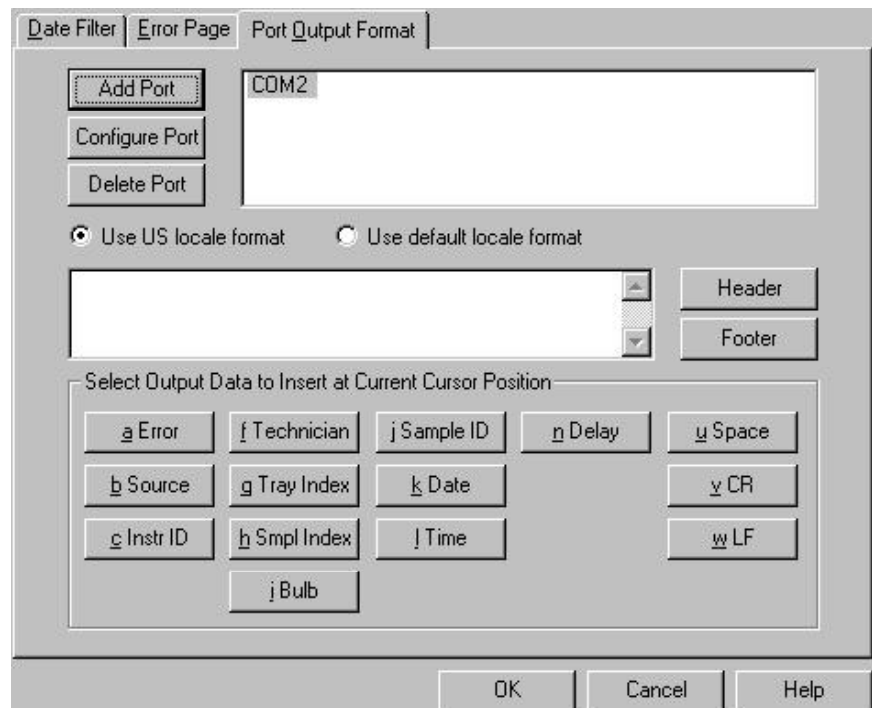
- c. To adjust other analysis configuration options, click the **Port Output Format** tab (see Figure, next page):

Adding ports

Click **Add Port** from the **Port Output Format** button options to open the **Select Port** window. Select the desired serial port(s) and/or files for output and verify the configuration settings for each. Then Click **OK**. Added ports will be displayed in the port list box.

Configuring output

- d. Select the desired port/file for configuration by clicking the name of the port/file in the port list box. Then click the radio button corresponding to the desired locale format (U.S. or local). Your choice will determine the formatting of numeric data and dates.



Error Ports Output Configuration options


Delaying serial output

- e. You may delay data transmission of serial output for a time parameter you specify by clicking the **Delay** button to insert the delay code into the **Configuration** list box, **Header** or **Footer**. The **Delay Configuration** window will appear. To set the time of the **Delay**, type a numeric value in the appropriate field, and click on one of the radio buttons to select the correct unit of time. Then click **OK**.

Selecting output data

- f. Click the buttons corresponding to the data types you wish to output on the report. As you do so, the appropriate coding for the output analysis will be inserted in the text box.

NOTE

For some data output options, you will need to select the desired output field length using the spin controls  provided in the Format Data Output window. Experienced users may type code directly into the text box by placing the cursor at the appropriate point. The text box information may also be manipulated using the mouse click-and-drag technique to highlight data and then using standard Windows® cut (Ctrl)-X, copy (Ctrl)-C, and paste (Ctrl)-V keyboard combinations. In this way, formatting data can easily be copied from one port configuration to another.

Adding a header

- g. If you would like to include a header at the beginning of the analysis, click the **Header** button and add the desired text string via the keyboard. Format the entry as desired using the Carriage Return (CR) and Line Feed (LF) options as necessary to indicate line breaks. Then click **OK**.

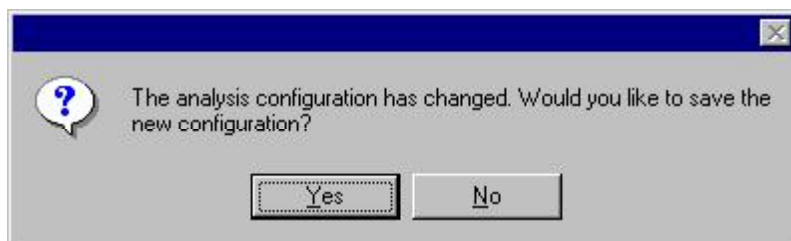
Adding a footer

- h. If you would like to include a footer at the end of the analysis, click the **Footer** button and add the desired text string via the keyboard. Format the entry as desired using the Carriage Return (CR) and Line Feed (LF) options. Then click OK.

NOTE

If you have selected the Dynamic Update option using the Date tab options, you will not be able to enter Footer information for the analysis.

8. When you have completed the configuration, click OK. Serial data will be routed to the appropriate ports/files and you will be prompted to save the configuration.



9. If you do not wish to save the configuration, click No. The analysis will be displayed and the data will be sent to the selected ports. If you wish to save the configuration, click Yes. The **Save Configuration** window will appear. Type the name of the new configuration in the **Save As:** field. Or double-click the name of a preexisting configuration in the **Existing Configurations** list box to replace the existing configuration with the new configuration settings. Then click **OK**. The saved analysis will be displayed using the selected configuration settings, and the data will be sent to the selected ports.

NOTES


You may click Cancel from the Save Configuration window to exit without saving configuration changes.

The Port Output Analysis cannot be reconfigured. This avoids duplication of output data for collection devices your facility may have in place. You may still view configuration options for a displayed analysis by selecting Configure Analysis from the Analyses menu and choosing the correct analysis.

Re-sending export data

To re-send Port Output Analysis data for a displayed analysis, first save the analysis by clicking Analyses/Save Configuration, selecting the desired analysis, typing the analysis name in the Save As: list box and clicking OK. Then close the Port Output Analysis window and re-select Port Output Analysis by clicking Analyses/View Analysis from the primary menu options. Then click on the desired configuration from the list of saved configurations and click OK.

Exporting specific sample data To re-send data from specific samples, use Sample Filter options, including wildcard characters if desired, to reconfigure the analysis to send only the necessary data.

If you select NEW FILE for output, click the  button to open the Windows Save As: box. Select the desired directory and type the desired file name in the File Name: text box. If you select an existing file, ASCII port analysis data will be appended to the file.

Make certain that you have selected the desired port for configuration by clicking on the port name in the Add Port list box **prior** to selecting output data and formatting options for that port. **OUTPUT FOR EACH ADDED PORT MUST BE CONFIGURED SEPARATELY.**

ERROR LOG TABLE ANALYSIS

The Error Log Table is designed as a troubleshooting tool to display error messages generated by the software during automatic processing of sample data.

The Error Log Table displays data in a tabular format. In addition to an error description, the following data may be included:

- Time at which the error occurred
- Severity of error
- Instrument source (if applicable)
- Source identification (ID) (if applicable)
- Tray associated with the error (if applicable)
- Sample placement in the tray (if applicable)

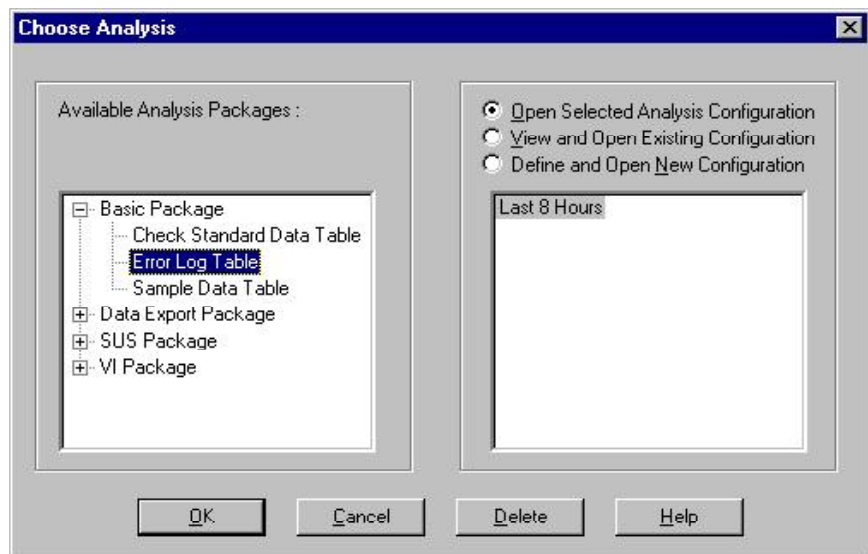
Reporting options

The Error Log analysis can present data for any errors encountered during sample runs for which data resides in the database. Several powerful filters may be used to create useful Error Log reports. These filters may be used by making selections from the tabbed property sheets found in the Error Log Configuration window. Once the appropriate filters have been designated, the resulting report configuration can be saved for future use.

Configuring the Error Log analysis

For general information on using analyses, see Chapter 6. To access and configure the Error Log Table, follow the procedure below:

1. Select **Analyses** from the VISCPRO® primary menu options.
2. Select **View Analysis ...** from the **Analyses** menu. The **Choose Analysis** window will appear.
3. Select the **Error Log Table** from the list of analyses included in the Basic Package.



Choosing the Error Log analysis

4. Click on the Define and Open New Configuration radio button (or verify that the option is selected).

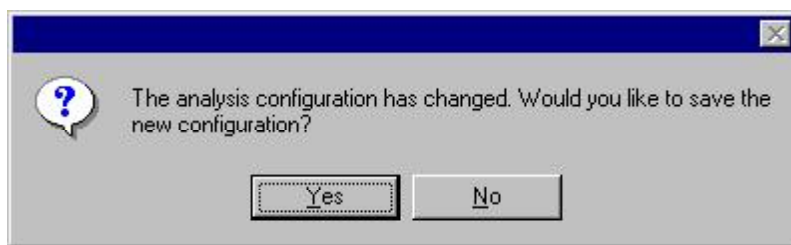
NOTE

If you have already configured and saved an analysis, its name will appear in the list box on the right side of the window. If you click on an existing configuration and click OK, the analysis will be performed using the selected configuration settings. It will not be necessary to complete the remaining steps in this procedure.

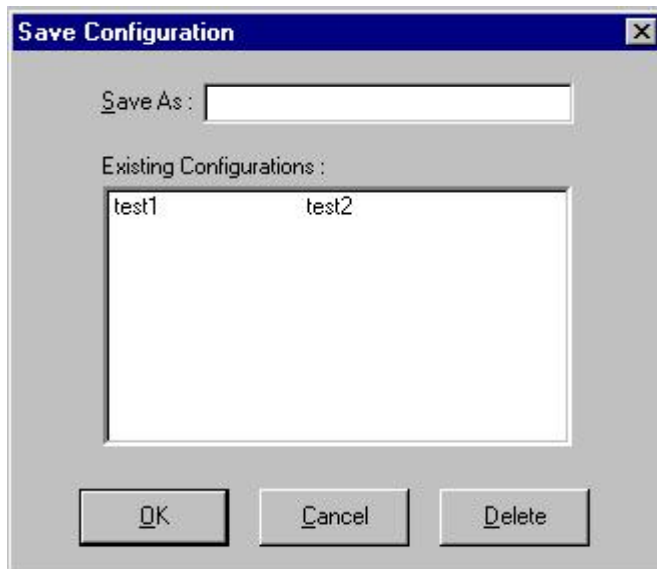
5. Click OK. The Error Log Configuration window will appear.

The Error Log Configuration window consists of tabbed pages with filter options.

- **Date Filter**—allows you to select date/time parameters for the analysis
 - **Sample Filter**—allows you to select which tubes/technicians/tests will be included in the analysis.
 - **Error Filter**—allows you to select what sample data will appear in the Error Log Table and how the data will be displayed
6. Click on the tab corresponding to the filter you wish to set and complete configuration options. Use the check boxes to select which fields to include in the report. After individual options have been selected, use the related spin controls and radio buttons to determine the appearance of data.
 7. When you have completed the configuration, click OK. The program will prompt you to save the configuration.



8. Click Yes to save the configuration. The Save Configuration window will appear.



The Save Configuration window

9. Type the name of the new configuration in the Save As: field. Or double-click the name of a preexisting configuration in the Existing Configurations list box to replace the existing configuration with the new configuration settings.
10. Click OK. The analysis will be performed and displayed using the selected configuration settings.

NOTES

You may click Cancel from the Save Configuration window to exit without saving configuration changes.

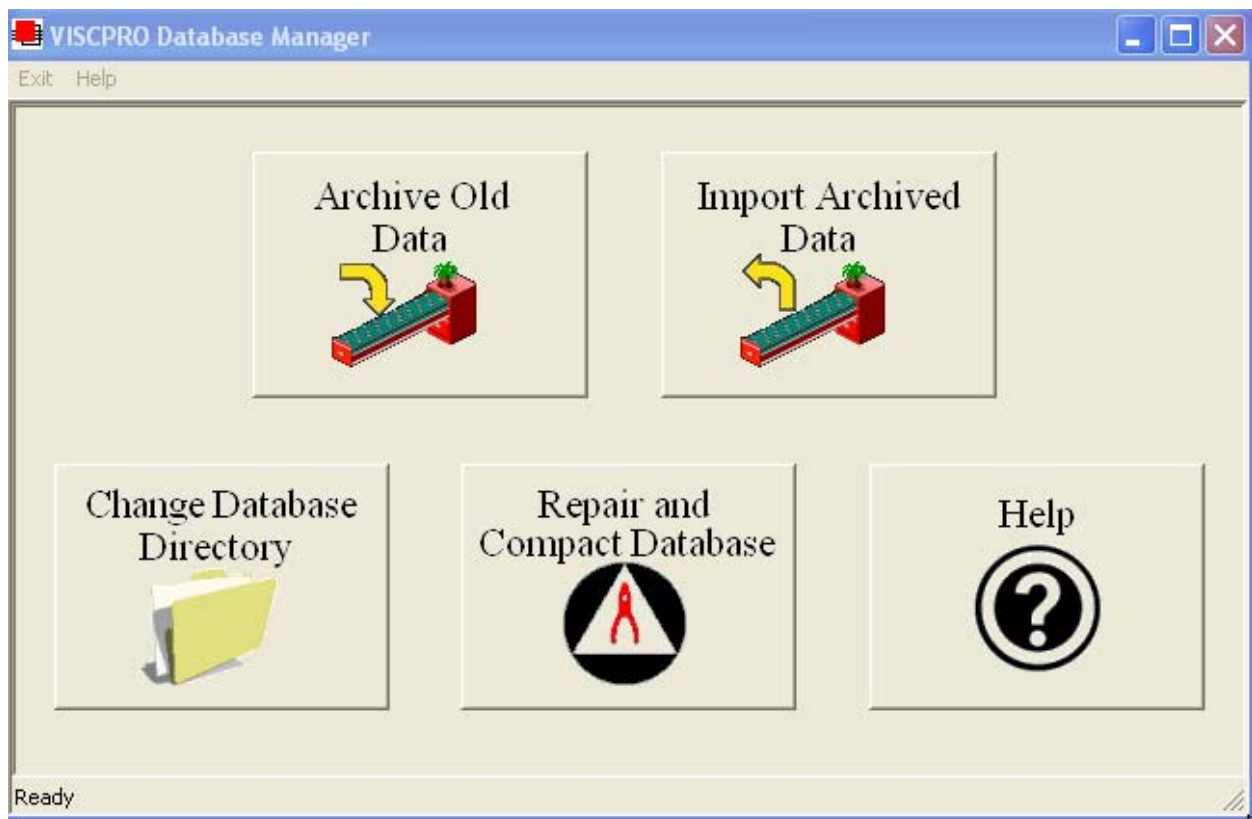
You may display several analyses simultaneously by repeating the instructions above. Use the tiling options available from the Window menu to display multiple analyses in the desired window format (horizontal, vertical or cascade view options are available).

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USING THE DATABASE MANAGER

The Database Manager is a separate software program which is automatically installed in the same directory as your VISCPRO® software. The Database Manager provides options for managing the VISCPRO® database, including functions for:

- archiving old data
- importing archived data to the working database
- changing the database directory
- repairing/compacting the database
- converting old data (<v1.08) to the newest database format



The Database Manager interface

Starting the program

To start the Database Manager software:

1. Exit the VISCPRO® application. Then click on the Windows® Start bar.
2. Select Programs/VISCPRO/VISCPRO Database Manager from the list of options.


Archiving old data

When to archive

Data from the VISCPRO® database should be regularly archived in order to maintain the size and utility of the database file and to provide an additional level of security for your test data. The archive program allows you to back up existing data and/or remove it from the working database.

One recommended archive strategy would be to archive data older than 60 days at the end of each month, removing it from the working database. This will result in a working database of manageable size and a series of archive files, each containing a month of data. If necessary, archive materials could be temporarily imported into the working database for historical reporting.

Archive procedure

1. Select **Archive Old Data** from the **Main** menu. A Windows® **Save As ...** window will appear.
2. Use the Windows® controls to select the drive and directory (folder) you wish to use for the archive file.
3. Enter the name of the archive file into the **File name** text box.
4. Use the spin controls  to select the desired date. Data from sample runs completed prior to that date will be copied to the archive file.

NOTE

*If you would like to remove archive data from the working database, click the **Remove Archived Data** check box.*

5. Click **Save** to copy archive information to the selected archive file. Or click **Cancel** to exit the **Save As** archive window without saving data to the archive file.

NOTE

VI matching with the VISCPRO® software requires that both members of the matched pair be present in the working database. Try to avoid splitting these matched pairs when archiving old data. If you are performing VI analyses, make certain that test data for both members is present.

Changing the database directory

Changing the database location can facilitate its use by multiple networked computers. As the database grows, it may be desirable to relocate it to a different directory or hard drive. The **Change Database Directory** option does not physically transfer the database files from one location to another. Rather, it allows the user to select the location for the

working database. The database must first be archived (see previous page) or copied to the desired location BEFORE using Change Database Directory.

Change . . . procedure

1. Select Change Database Directory from the Main menu. A Browse ... window will permit you to select the correct location for the database (SAMPLES.mdb) file.

NOTE

The current database directory is indicated at the top of the window.

2. Select the correct drive and use the Windows® controls to select the directory (folder) you wish to identify as the database location.
3. Click on OK to confirm database directory selection. Or click Cancel to close the window without selecting a directory.

NOTES

You may only select a directory which contains a valid working database (SAMPLES.mdb) file.

Click Network to access network map options. See your Windows® documentation for additional information.

Importing archived data

1. Select Import Archived Data from the Main menu. An import window will appear.
2. Use the Windows® controls to select the directory (folder) of the archive file to be restored to the working database.
3. Enter the name of the archive file into the File name text box.
4. Click Open to copy information from the selected file to the working database. Or click Cancel to exit the import window without importing archive data.

Repairing/compacting the database

Select **Repair and Compact Database** from the **Main** menu. The database will be automatically updated.

NOTE

CANNON[®] recommends that the *Repair and Compact Database* utility be run at least once a week if possible to provide additional stability for the database.

Converting old data

Converting Old Data is a function which is performed only when upgrading to the current **VISCPRO**[®] version from v1.07 and previous. This function is a one-time operation, performed immediately following the **VISCPRO**[®] upgrade, that converts the current database to a format fully compatible with the new **VISCPRO**[®] software module.

NOTE

*To determine your current software version, load the **VISCPRO**[®] program and click Help/About. The version # will be displayed in the About... box.*

To convert old data, select **Convert Old Data** from the **Main** menu. The older sample database file (v1.07 and previous) will be updated to the newest database format.

A backup copy of the database in the previous version format (CVXXXXXX.MDB, where “x” stands for a randomly-generated number or letter) will be created in the current **SAMPLES**.mdb directory.

Exit

When you have completed database management procedures, click **Exit** from the **Main** menu to exit from the Database Manager program.

REPLACEMENT PARTS

A current list of PolyVISC replacement parts and service kits may be requested from **CANNON**[®] Instrument Company.

Some replacement parts are initially provided with your PolyVISC instrument. It may be desirable for some users to maintain additional components in inventory. Consult with a representative of the **CANNON**[®] Technical Services division for suggestions regarding your particular application.

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WARRANTY/RETURN INFORMATION

Products limited warranty

In addition to other manufacturers' warranties, **CANNON**[®] Instrument Company ("the Company") warrants all products (other than reagents and chemicals) delivered to and retained by their original purchasers to be free from defect in material and workmanship for one year from the date of the Company's invoice to the purchaser. For a period of one year from the date of such invoice, the Company will correct, either by repair or replacement at the Company's sole election, any defect in material or workmanship (not including defects due to misuse, abuse, abnormal conditions or operation, accident or acts of God, or to service or modification of the product without prior authorization of the Company) without charge for parts and labor. The determination of whether any product has been subject to misuse or abuse will be made solely by the Company.

The Company shall not be liable for any special, incidental, or consequential damages, or any damage to plant, personnel, equipment or products, directly or indirectly resulting from the use or misuse of any product sold by the Company except as set forth in and limited by the foregoing warranties. Representations and warranties made by any person, including dealers and representatives of the Company, which are inconsistent, in conflict with, or in excess of the terms of this warranty shall not be binding upon the Company unless placed in writing and approved by an officer of the Company.

Reagent and chemical warranty

CANNON[®] Instrument Company ("the Company") warrants all reagents and chemicals sold by the Company and delivered to and retained by their original purchasers to conform to the weight, specifications and standards stated on the package. The Company will, at its sole option, either replace or refund the price (net of freight, handling charges and taxes), of any reagent or chemical sold by the Company which does not conform to such weight, specifications and standards upon the prompt

Returning a product to CANNON®

Procedure

Before returning a **CANNON®** product for repair or service, make every attempt to identify the problem. If, after careful checking, the problem remains unidentified or unsolved, telephone **CANNON®** Instrument Company (or the local service agent) to consult with a product specialist. If the specialist cannot recommend a simple solution or repair, **CANNON®** will authorize the return of the product through the issuance of a Return Authorization number (RA).

CANNON® Telephone Number	814-353-8000
CANNON® Fax Number	814-353-8007

Products returned to **CANNON®** must be carefully packed. Ship prepaid to the following address:

CANNON Instrument Company
 ATTN: Return Authorization # _____
 2139 High Tech Road
 State College, PA 16803 USA

Please include the following:

Required information

- The Return Authorization number (RA).
- The name and telephone number of the person at your company to contact regarding the product.
- Shipping and billing instructions for the return of the product to your location.
- A detailed explanation of the reason for the return.

If the product is not covered by warranty, the customer will be provided with an estimate of the repair costs and asked for approval before any repairs are made. The customer will be required to issue a purchase order for the cost of the repairs.

Hazardous materials

Stringent government regulations restrict the shipment of mercury. Please contact **CANNON®** before returning a product that could possibly contain mercury.

Shipping notification

Products returned without prior notification (by either telephone or fax), or without Cannon's authorization, will not be accepted.

The customer may be billed a testing fee if a product is returned to **CANNON®** and found to be working properly.

APPENDIX A—PolyVISC INSTALLATION NOTES

Assembly diagram

An assembly diagram with additional installation notes has been provided on a separate sheet. You may also refer to the photography and diagrams throughout this *Guide*.

Using the checklist

This chapter uses a checklist format to detail the required utilities, accessories, clearances, personnel and training issues to be considered prior to, and during installation of the PolyVISC instrument in your facility. Please review the checklist carefully and address any outstanding issues to facilitate a successful installation.

Required utilities for PolyVISC installation

The following utilities must be supplied by the PolyVISC user:

1. Electrical power

MAINS~

The PolyVISC is designed to operate from several world AC power sources. However, voltage and frequency requirements are specified by the PolyVISC user when the PolyVISC is ordered. The exact power requirements for the PolyVISC are indicated on the label on the rear panel of the Bath Unit. Consult **CANNON®** with any questions regarding power requirements.



CAUTION

Proper electrical grounding is extremely important. The PolyVISC is supplied with a power cord with an integral safety ground which must be connected to an AC mains receptacle with an earth ground.

2. Sample/waste disposal

The customer must provide for the containment and disposal of all used solvents and waste oils. Collection, storage, and disposal of all waste from the PolyVISC is the responsibility of the customer, and must be done in accordance with all local safety and environmental regulations.

3. Ventilation

Ventilation is required for safe handling of PolyVISC samples and solvents. Installation in a vent hood is required for most applications.



CAUTION *The PolyVISC must be operated with ventilation precautions appropriate for your facility and the sample materials and solvents being used. Follow all MSDS procedures when handling hazardous materials. If any solvent vapors are detected around the PolyVISC, verify the operation of the ventilation system.*

4. **Laboratory environment**

It is important that the PolyVISC be kept in a suitable laboratory environment. The room temperature of the laboratory must be maintained between 15°C and 27°C (60-80°F). The laboratory must be free of dust and dirt, which could possibly taint the samples. The laboratory must be equipped with all of the standard safety features normally associated with use of solvents, corrosives, etc.

Additional installation requirements

1. **Size**

PolyVISC UNIT—Principal crate containing the PolyVISC:	
Dimensions Crated	32 inches (81 cm) high 28 inches (71 cm) wide 42 inches (107 cm) long
Dimensions Unpacked	(see enclosed diagrams)
Weight Crated	225 lbs. (102 kg)
PolyVISC ACCESSORIES—Crate containing accessory product:	
Dimensions Crated	23 inches (58 cm) high 19 inches (48 cm) wide 27 inches (69 cm) long
Dimensions Unpacked	(varies)
Weight Crated	45 lbs. (20 kg)

Entrance and handling equipment must be able to accommodate these dimensions. The principal crate is shipped with the instrument in a vertical position. The assistance of 2 persons, in addition to the Service Engineer, will be needed to unpack the instrument crate and position the PolyVISC during installation. Size and number of other cartons shipped will vary with each order. In order insure a timely installation it is advisable that the crate(s) be moved to the location of the actual installation before the arrival of the Service Engineer.

2. **Personnel and training**

It is advisable that the personnel who will be responsible for maintaining the instrument be present during assembly and power up (approximately 1-2 days, depending on installation configuration). Training normally begins with calibration on the second day. During this time, the operating technician's presence will be necessary. Training and calibration will require 2-3 days. The customer should be prepared to supply typical samples for running tests during the training process.

3. ___ Solvents

CANNON[®] Instrument Company does not specify or recommend the type of solvents to be used with the PolyVISC. Any solvent used with the PolyVISC must effectively clean the viscometer tubes, dry by evaporation with compressed air and be compatible with valves and materials in the PolyVISC. Solvents and test materials are the responsibility of the customer and must be handled in accordance with environmental regulations and the customer's safety policies. Adequate quantities of solvent for multiple PolyVISC tests are needed during the installation and training period. If the PolyVISC is configured for dual solvent operation, ensure that adequate quantities of both solvents are available. See Chapter 1 for more information on handling of solvents for use with the PolyVISC instrument.

4. ___ Computer

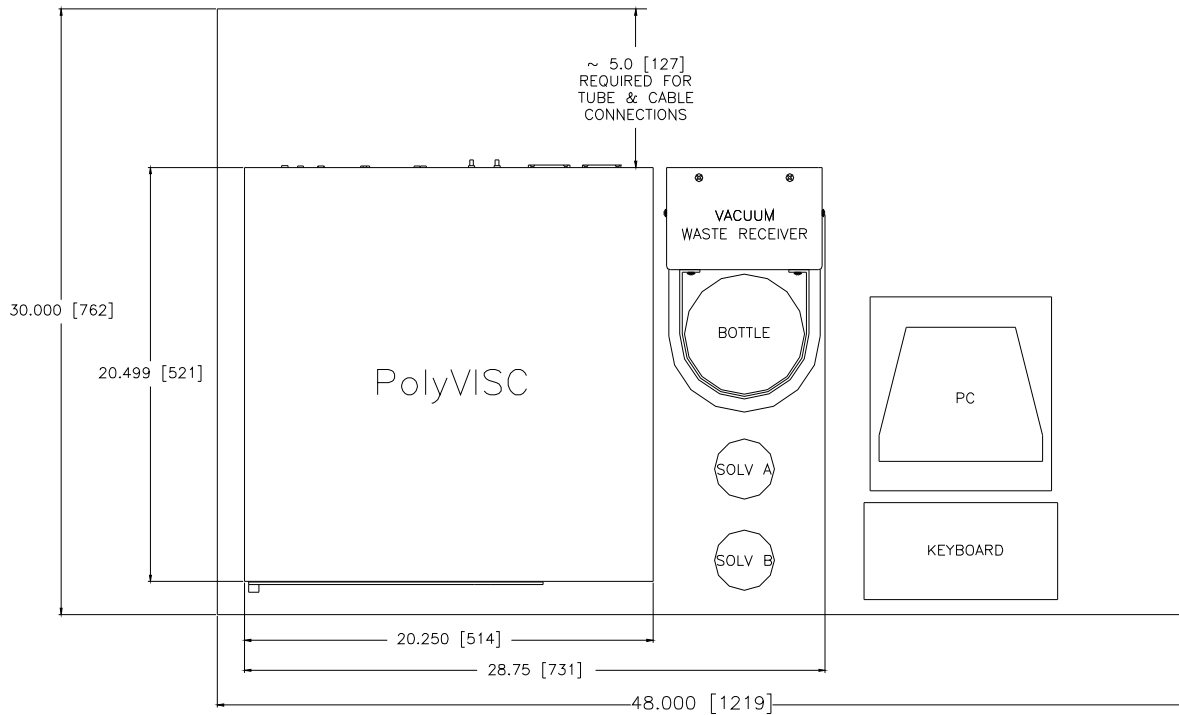
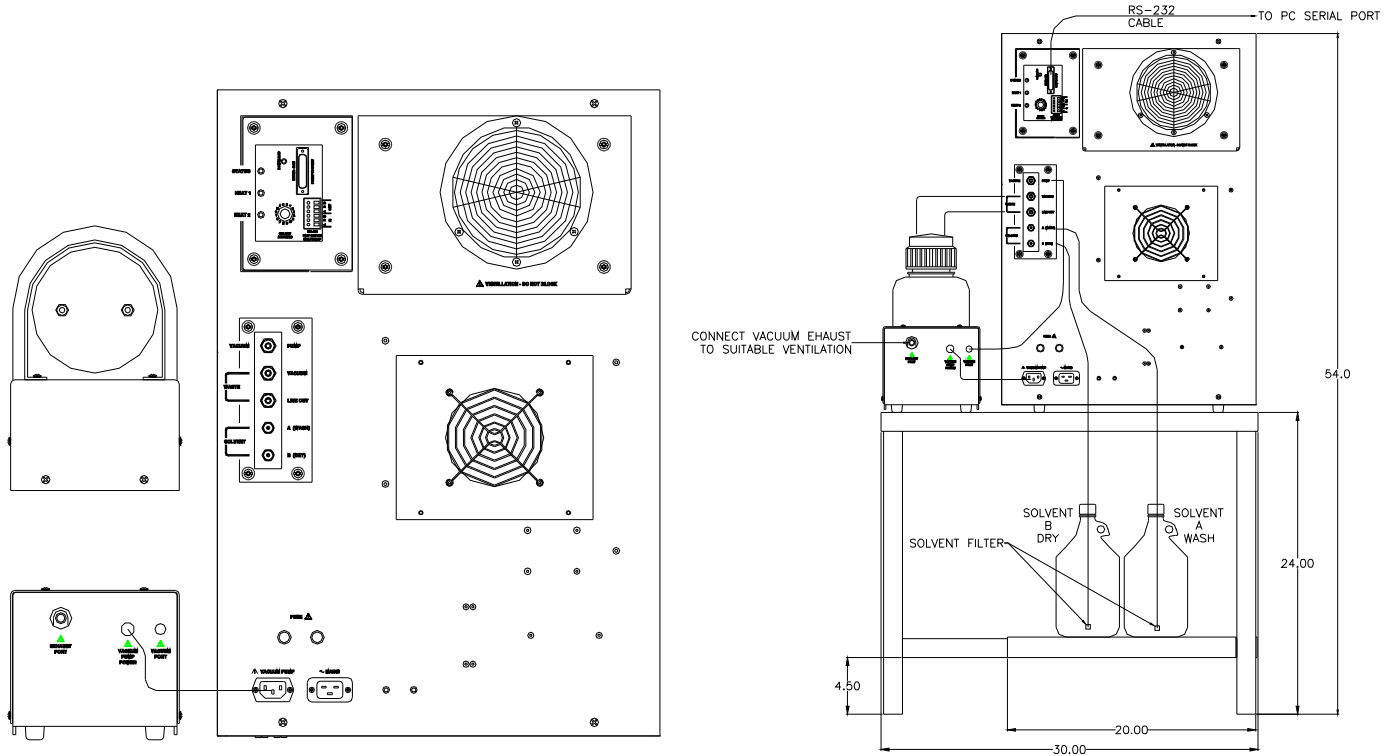
In the event that the controlling computer is not supplied by **CANNON**[®], the following minimum configuration is necessary:

IBM-compatible computer with pentium processor and Windows[®] 95/98 or NT[®] installed and operating normally • SVGA compatible display • 32 MB RAM • 200 MB hard disk space • CD-ROM drive • RS-232 serial port

Arranging components

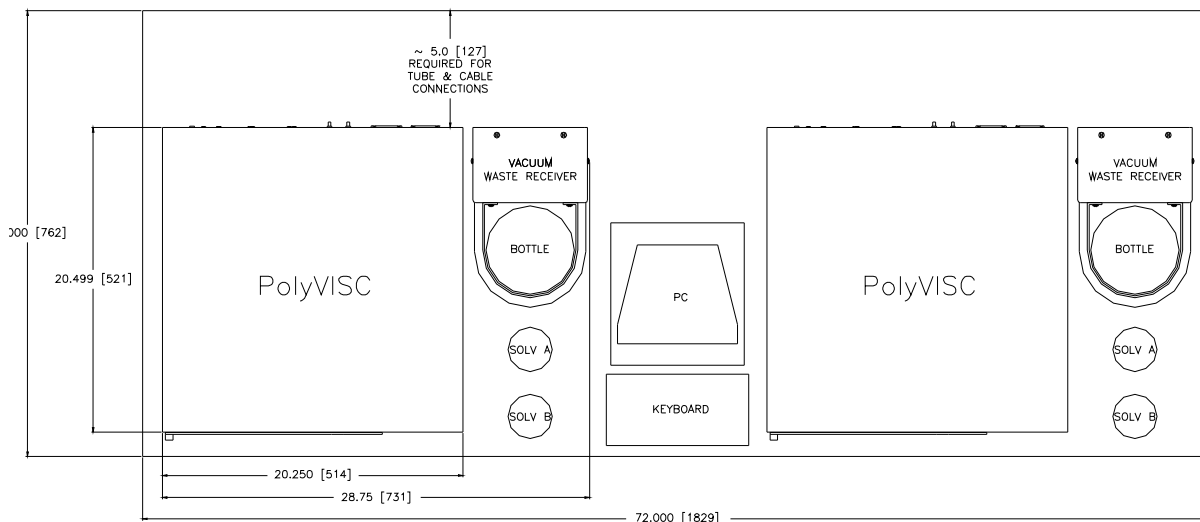
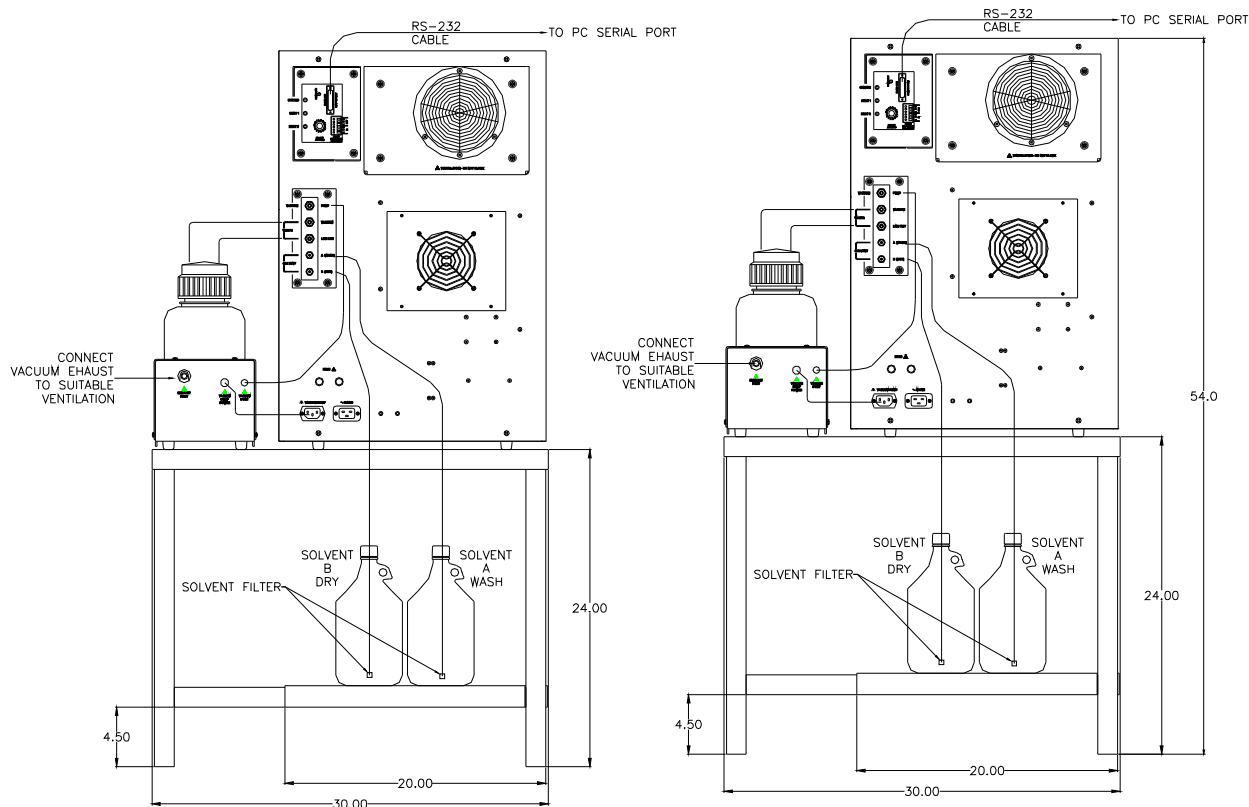
PolyVISC components should be placed adjacent to each other during setup and as close to their final positions as possible. Note that access to the front and rear of PolyVISC components will be necessary during setup. If you are completing a multiple unit configuration, refer to the following diagrams in this APPENDIX for further information on setup options.

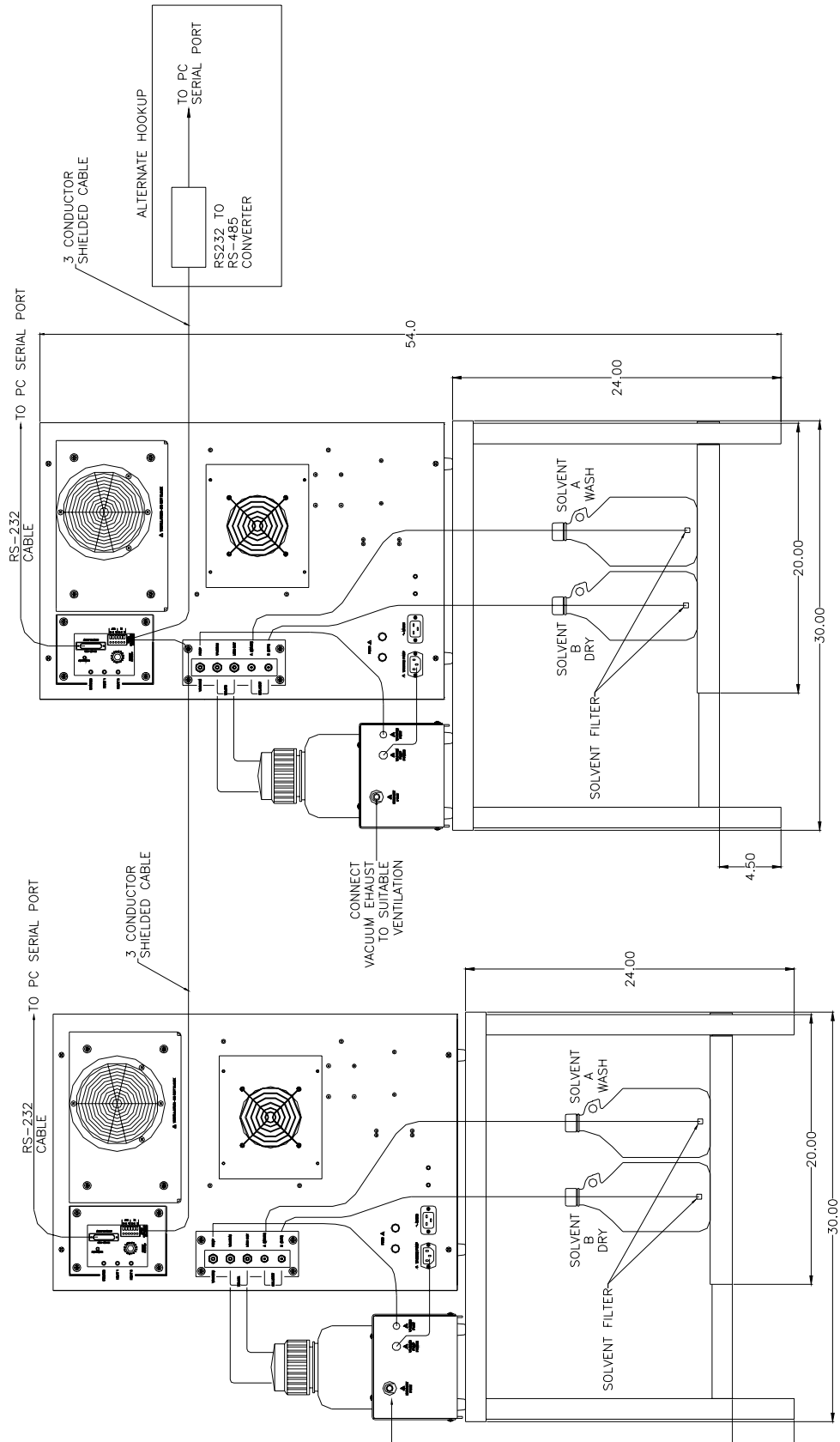
Single-Unit installation



PolyVISC twin installation

(continued next page)





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