Foreword:

Thank you for purchasing a miniPV-series viscometer-part of the popular CANNON minAV family. This ADDENDUM to the current miniAV or miniAV-X Instruction & Operational Manual is intended to provide the operator with information on the few operational differences between the miniAV and the miniPV. ***Please note the following sections of the miniAV manuals where users of a miniPV-series viscometer will need to refer to this addendum***

Note: for ease of reading, all miniPV-series viscometers will be referred to as simply "miniPV" in this addendum.

miniPV-X

- Section 1 Introduction
- Section 1 Measuring Viscosity
- Section 2 Testing Samples
- Section 4 VISCPRO Polymer Equations
- Section 4 View Analysis
- Section 4 Testing Samples- Software options
- Polymer Data Table and Data Export Analyses
- Polymer Intrinsic Viscosity Report

miniPV-HX

SECTION 1:
miniPV Function:

The miniPV is a fully automated kinematic viscometer specially designed to handle the unique needs of polymer analysis laboratories for viscosity determination of polymer solutions. The miniPV instrument may be used for determination of the relative, inherent, and reduced viscosity of polymers. Viscosity and Intrinsic values can also be reported and the intrinsic viscosity can be determined by two single-point methods or the more rigorous Huggins-Kraemer analysis. At the core of the instrument resides the miniAV foundation-providing a familiar system and software user interface. The miniPV differs from the miniAV in the following ways:

- Special coating
- Analysis
- Software

Measuring Viscosity:

Relative viscosity ($ή_r$), 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, ή, to the viscosity of the solvent, $ή_S$, that is, $ή_r = ή/ή_S$."

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 MiniPV 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 ($ή_{inh}$) is the ratio of the natural logarithm (ln) of the relative viscosity (h_r) to the mass concentration of the polymer (c) in g/cm^3, g/dl or g/ml , as expressed by the equation: $ή_{inh} = \ln ή_r/c$.

Reduced viscosity

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

Instrinic 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.

Adjusted Relative viscosity

The adjusted relative viscosity (ARV) is only applicable to Solution Relative Viscosity samples. The ARV Factor is simply a constant that is stipulated in the viscosity action window.

SECTION 2:

Testing Samples:

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 Blank (Solvent) 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,

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: 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.

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:

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 miniPV using the Determine Solvent Viscosity sample action. Follow the procedure for testing samples

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 miniPV. The blank must be tested at the same temperature intended for the solution

NOTES

In some MiniPV 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 MiniPV 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 have 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 MiniPV. 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.

The PolyVISC SPS Solution Preparation System from Cannon Instrument Company is a semi-automated solution preparation system that can be used with the minPV instruments. Contact Cannon for more information.

SECTION 4:

VISCPRO® Polymer 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, n, is defined by the equation: n = Ctr - Er/t2
Where:

C	=	tube calibration constant (cSt/s)
t	=	flow time (seconds)
r	=	is the solution (or solvent) density (g/ml)
E	=	kinetic energy correction constant (cSt·s2)

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 r = "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, *v*, is defined by the equation: $v = Ct - E/t^2$

Where:	*v*	=	kinematic viscosity (cSt)
	C	=	tube calibration constant (cSt/s)
	E	=	kinetic energy correction constant ($cSt \cdot s^2$)
	t	=	flow time (seconds)

Relative Viscosity is defined by the equation:

$$n_{rel} = \frac{\rho_1 (C_1 t_1 - E_1/t_1^{\,2})}{\rho_0 (C_0 t_0 - E_0/t_0^{\,2})}$$

Where: ρ = density

1. The tube calibration constants (C) are only factored into the relative viscosity equation if constant actual 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 (ρ | 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 (ρ = "1", C = "1", E = "0"), the relative viscosity equation simplifies to t_1/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 g/dL

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

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

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

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

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

Schulz-Blaschke equation for Staudinger Index:

$$\eta_S = \frac{100 \cdot (\eta_{rel} - 1)}{c(1 + K_s(\eta_{rel} - 1))}$$

Where:

η_S = the Staudinger Index in mL/g
c = concentration in g/dL
K_s = Shulz constant

NOTE

The Shultz constant is entered as the ARV Factor using the Multiply ARV option, along with the concentration value, in the Viscosity Action Window when the sample is run. The concentration is entered in g/dL.

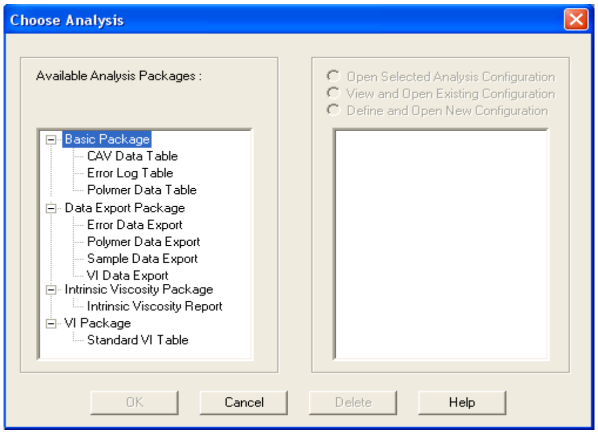
NOTE

The Solomon-Ciuta, Billmeyer, and Schulz-Blaschke equations are single-point intrinsic viscosity calculations.

K-Value equation after Fickentscher:

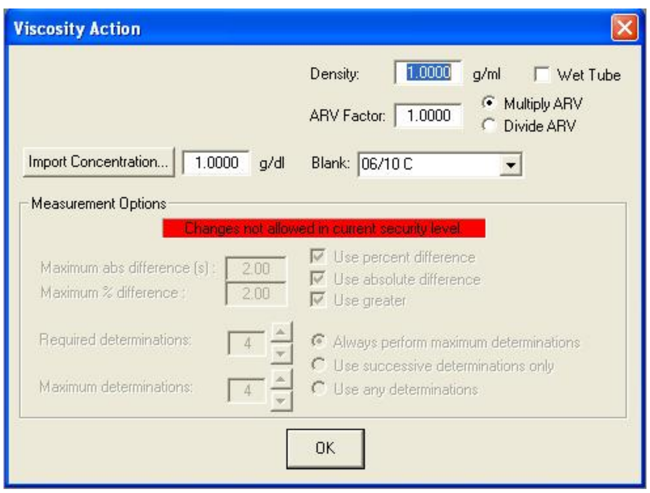
$$K = \frac{a - \sqrt{a(1 + \frac{2}{c} + 2 + a)}}{0.15 + 0.3c}$$

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



View Analysis:

The Choose Analysis window provides one additional available analyses in the list on the left side of the window, the. Intrinsic Viscosity Package The Polymer Intrinsic Viscosity Report is available under the analyses heading and 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.



Viscosity Action for Standards:

The Viscosity Action window for solution is identical to the Viscosity Action window for measurent of kinematic viscosity except that there is additional fields provided for input. For more information refer to the ViscPRO II software helpfiles.

Density: Input the density of the sample.

ARV Factor: This factor, which is stipulated in the Viscosity Action Window, is currently used in two applications.

1. For calculation of the Adjusted Relative Viscosity (ARV or FAV). The user may choose to multiply or divide the RV by the given ARV Factor by choosing one of the radio buttons to the right of the factor.
2. As the Schulz constant used in the Schulz-Blaschke determination of the Staudinger Index. The *Multiply ARV* radio button should be selected for this use.

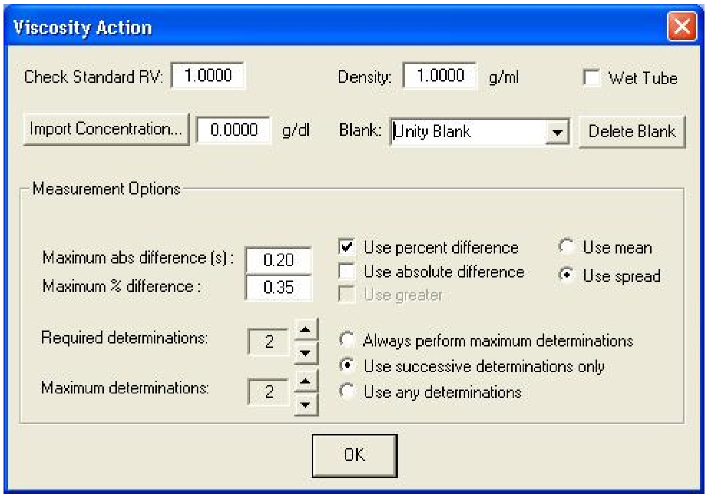
Import Concentration: Click to access concentration data files created by SPS. Then input the index # and the data filename in the appropriate fields and click OK to import data.

The Viscosity Action window for Solvent known RV has the additional fields for input.

Check Standard RV: Input the known Relative Viscosity of the sample.

Blank: Input the name of the pure solvent blank to be used for calculation of relative viscosity. You may create a new name or select a previous blank from the list box.

Delete Blank: Deletes the selected solvent blank.



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 e 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: ((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

Configuring the Polymer Data Table

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 as follows:

Date/Sample filters Complete selection of Date/Sample filter options.

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 Table 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 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)
- Fickenstscher—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.

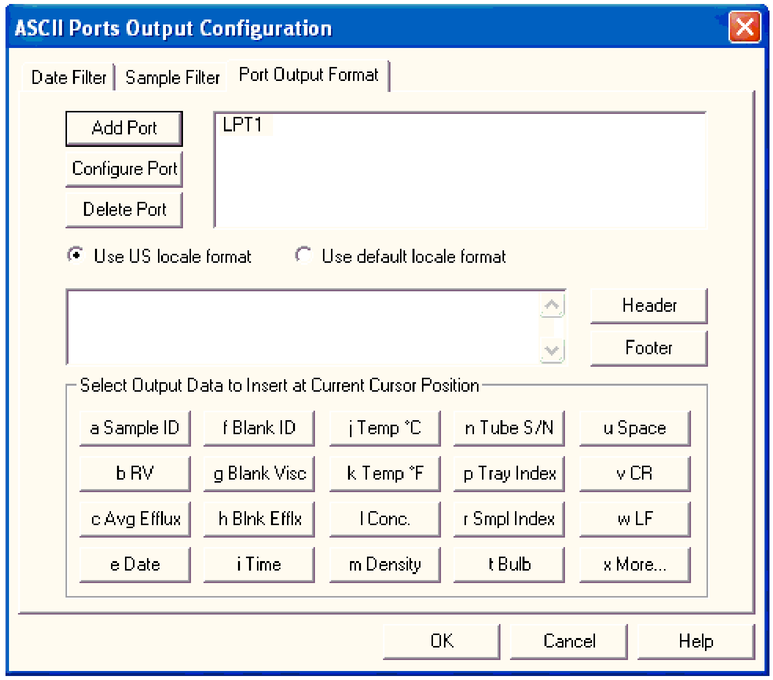
7. Click on the tab corresponding to the filter you wish to set and complete configuration options as follows:

Date/Sample filters

a. Complete selection of Date and Sample filter options.

Port Output Format filter

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



Port Output Format filter

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, 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.

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.*

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 (kinematic 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
- r2—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

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. 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 as follows:

Date/Sample filters

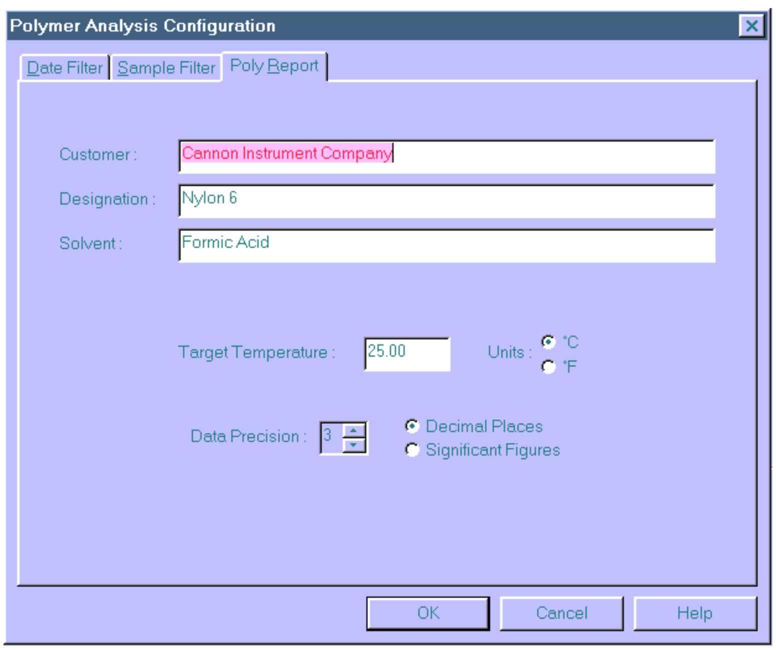
Complete selection of Date/Sample filter options.

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.



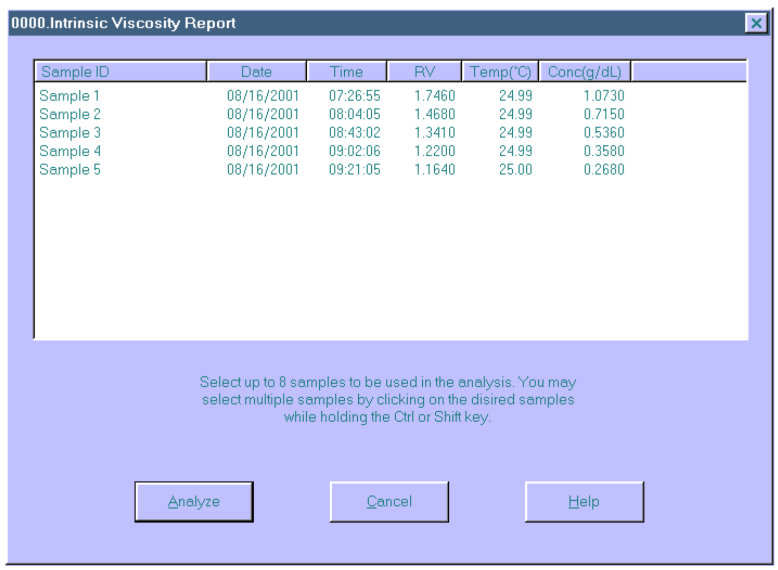
The Poly Report tab

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.

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.

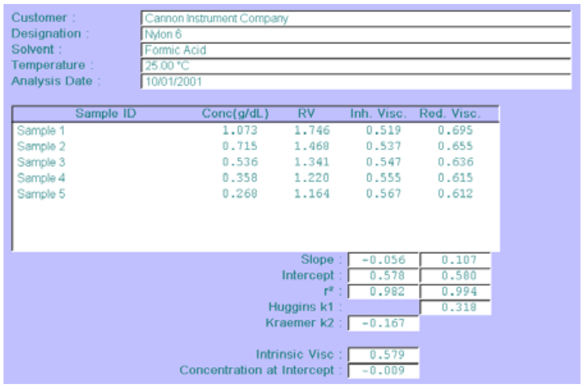
   When you click OK, the Intrinsic Viscosity Report window will appear. This window permits you to select the desired samples/data points for the calculation of inherent, reduced, and intrinsic viscosity.



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.

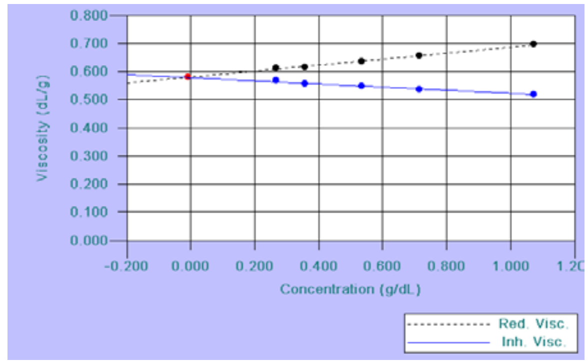


Customer : Cannon Instrument Company
Designation : Nylon 6
Solvent : Formic Acid
Temperature : 25.00 °C
Analysis Date : 10/01/2001

Sample ID	Conc(g/dL)	RV	Inh. Visc.	Red. Visc.
Sample 1	1.073	1.746	0.519	0.695
Sample 2	0.715	1.468	0.537	0.655
Sample 3	0.536	1.341	0.547	0.636
Sample 4	0.358	1.220	0.555	0.615
Sample 5	0.268	1.164	0.567	0.612

	Inh. Visc.	Red. Visc.
Slope :	-0.056	0.107
Intercept :	0.578	0.580
r² :	0.982	0.994
Huggins k1 :		0.318
Kraemer k2 :	-0.167	
Intrinsic Visc :	0.579	
Concentration at Intercept :	-0.009	

Intrinsic viscosity data display



Intrinsic viscosity graphical display