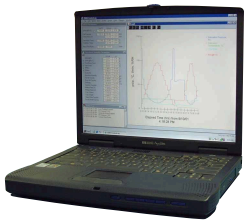
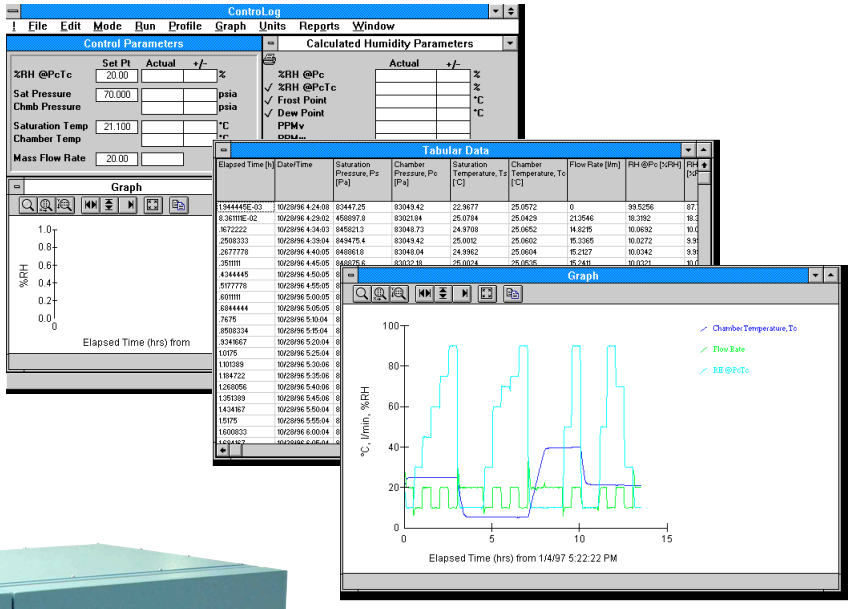
ControLog™

FOR THE

MODEL 2500 HUMIDITY GENERATOR





THUNDER SCIENTIFIC CORPORATION

ControLog for the Model 2500 (with 9800 Data Acquisition)

Reference Manual

Thunder Scientific Corporation

Document Edition 4
Software Revision 3.5.3

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Rev. 10/95

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Contents

1

Getting Started

This section will provide you with enough information to quickly install ControLog™ and begin using it right away with your Model 2500 Humidity Generator. With an example to guide you through startup and shutdown of the generator, you will gain familiarity with the use of ControLog.

The remainder of this manual is intended to provide you with a basic understanding of the many features of the ControLog software. However, fundamental operation of the Model 2500 is assumed, and may be found in the Operation and Maintenance Manual provided with the generator.

Installing ControLog

a. Insert the ControLog distribution disk into the appropriate disk drive. Locate and launch the program labeled Setup.exe.

b. Follow the on screen directions. The setup program automatically installs all required files on to your hard drive.

c. Once the installation is complete, remove and store the distribution disks.

What Happens During Installation

The installation process creates some new directories on your hard drive. The following is a list of default directories created, assuming you choose the defaults recommended by the installation program.

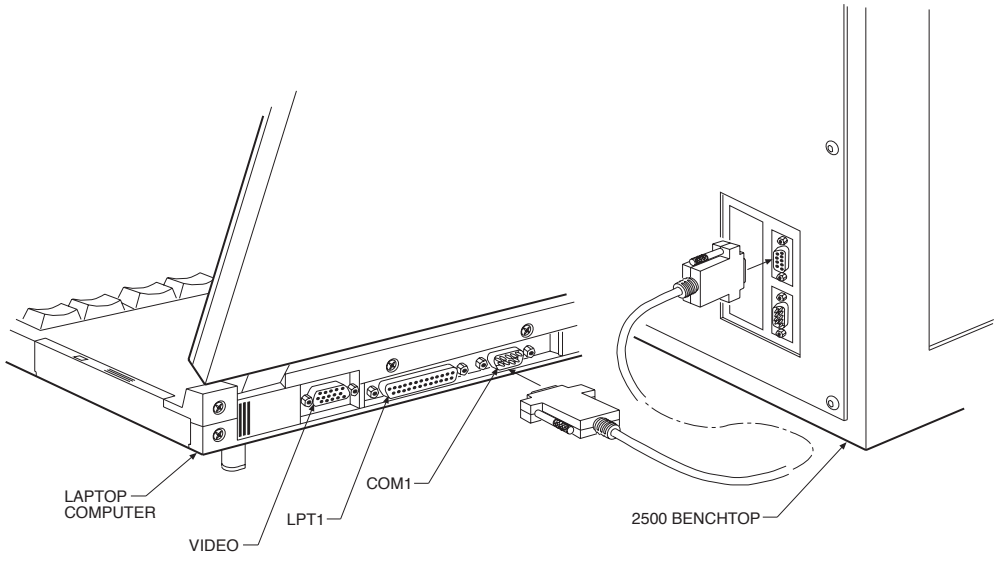
The installer also places ControLog and several other supporting files on your hard drive. Since some of the supporting files are also used by programs other than ControLog, files already existing on the hard drive with newer dates than those on the installation disks will not be overwritten, and the newer versions will remain.

- *c:\Program Files\2500 ControLog*
- *c:\Program Files\2500 ControLog\datafiles*
- *c:\Program Files\2500 ControLog\profiles*
- *c:\Program Files\2500 ControLog\rptfiles*
- *c:\Program Files\2500 ControLog\sysfiles*

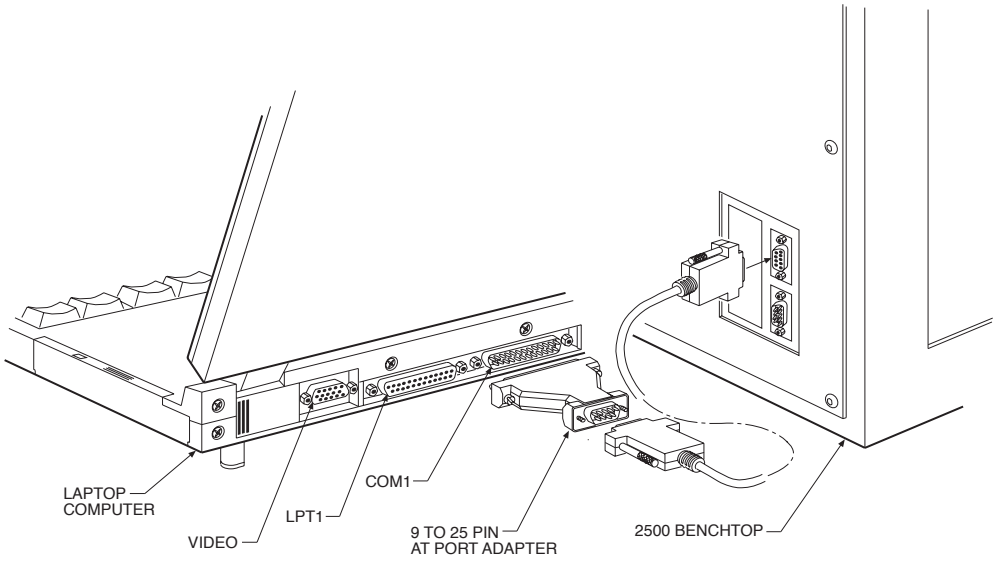
Connecting the Computer

ControLog communicates with the 2500 through an RS-232 communication connection on COM1, COM2, COM3, or COM4. When using the DA9800, connect the 2500 to COM1, as the DA9800 already occupies COM3 and 4.

a. Using the 9 pin extender cable provided, connect the computer's 9 pin male serial port connector to the 9 pin female console port connector of the Model 2500 (upper connector, left side). If your cable ever becomes damaged or lost, you can replace it with a standard 9 pin male to female serial cable (Radio Shack part number 26-117).



b. If your computer's serial port has a 25 pin connector, then you will also need a *25 pin female to 9 pin male AT port adapter* which converts your 25 pin connector to the newer 9 pin AT style and pinout (Radio Shack part number 26-287).



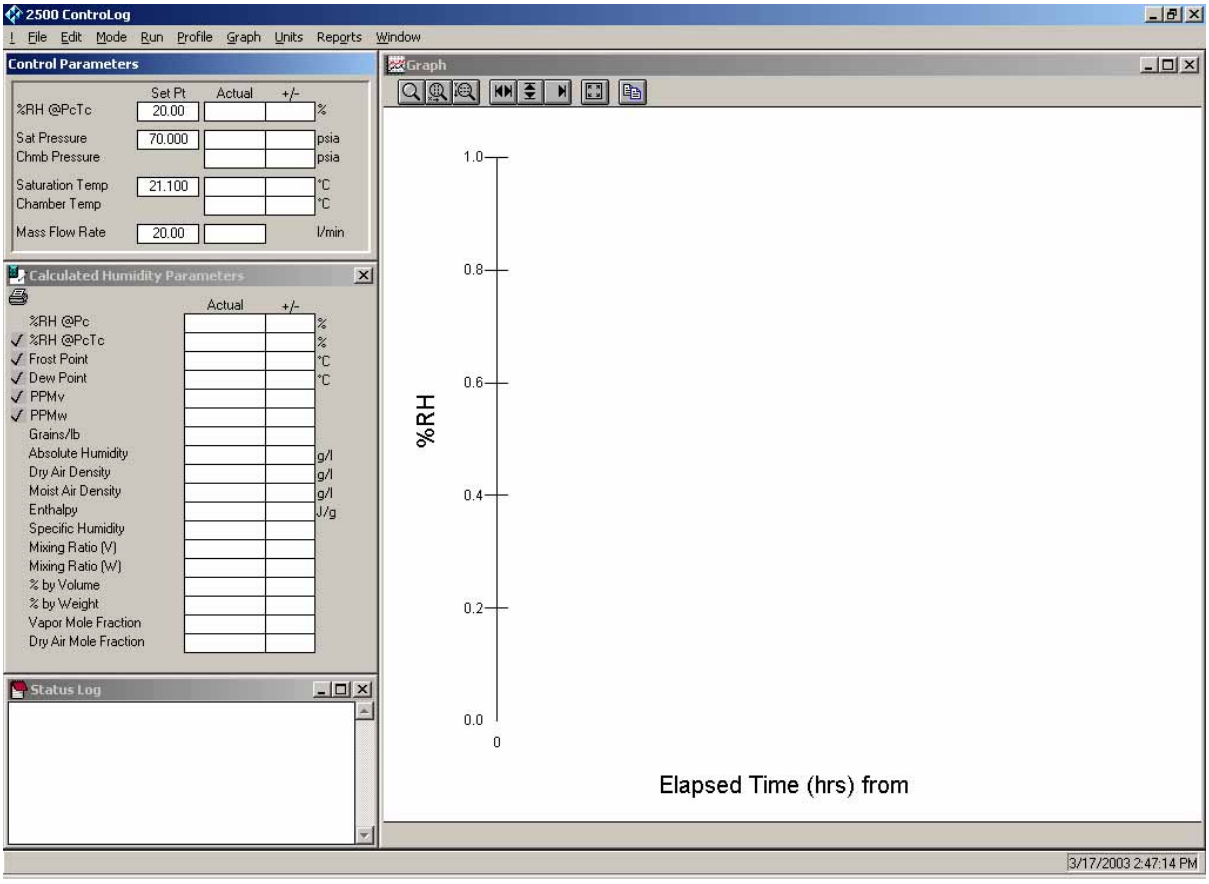
Starting ControLog

This section is intended to quickly familiarize you with the operation of ControLog. If used with a DA9800 Acquisition System, please turn the power to the HP34970A's OFF. This will prevent any initial confusion about its use, as the data acquisition system will be discussed in detail in a later section. At startup, ControLog will detect that the data acquisition system is unavailable and will automatically revert to the simpler operational mode discussed in this section.

a. Ensure that the computer's serial port is properly connected to the 2500.

b. From Windows 95 or NT click **Start**, then locate and click on **2500 ControLog** in the **Programs** menu.

c. Once loaded and initialized, the following screen appears. Depending on your screen resolution, the location of the four windows may be different from that shown below.



The ControLog program always powers up showing the four most commonly used windows; Control Parameters, Calculated Humidity Parameters, Graph, and Status Log.

The **Control Parameters** window is similar to the display of the 2500 and reflects the current set points and actual operating values.

The **Calculated Humidity Parameters** window lists the current humidity value expressed in a variety of different ways.

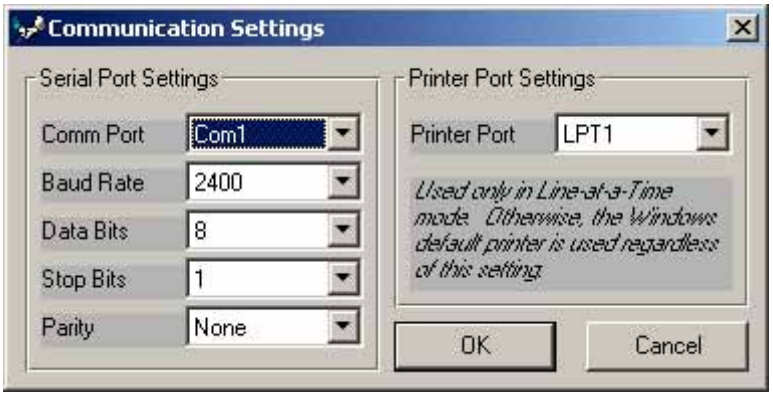
The **Graph** window is used to display a graph of any of the operating parameters of the 2500 against time. Since all system data is stored automatically at regular intervals during a run, any of the parameters may be graphed at any time

The **Status Log** window contains a chronology of system events such as startups, shutdowns, setpoint changes, and system errors.

Setting the Communication Parameters

In order for ControLog to be able to communicate with the 2500, the COM port must be properly selected and the serial communication parameters must match those of the humidity generator. ControLog initially defaults to COM1, 2400 baud, 8 data bits, 1 stop bit, no parity. Since any change made to these settings is remembered by the system, they only need to be set once.

a. Select **Communication Settings** from the **!** menu (left of the File menu). The following window appears.



b. In the Serial Port Settings area, select the Comm Port which is currently connected to the 2500. If using the computer in the DA9800, set the Comm Port to COM1.

c. Set the Baud Rate, Data Bits, Stop Bits, and Parity to match the current Console Port Parameters of the 2500. *For information regarding the Console Port Parameters of the 2500, refer to the Operation and Maintenance Manual section 3.3 Editing System Coefficients and Parameters, and section 3.3.2.5 Console Port Parameters.*

d. Click **OK**. The Comm Port selected will be initialized with the Baud Rate, Data Bits, Stop Bits, and Parity settings. If successful, the Communication Settings window will close. If for some reason the Comm Port is unavailable or fails initialization, then an error message will appear and the Communication Settings window will remain open. If this occurs, change the settings and try again.

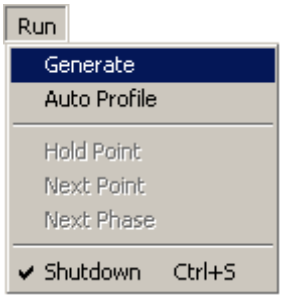
Initiating Generate Mode

This example will illustrate how to start the generator, generate a few Relative Humidity Points, and then shutdown the system. Generate mode is a manual operation mode where the system responds immediately to any setpoint change requests, then continues at that setpoint until you manually change it.

For the purposes of this example, assume that the first point to be generated is 30% Relative Humidity, with a 10 liter per minute flow rate, at a test temperature of 21.1°C.

Start the Generate Mode

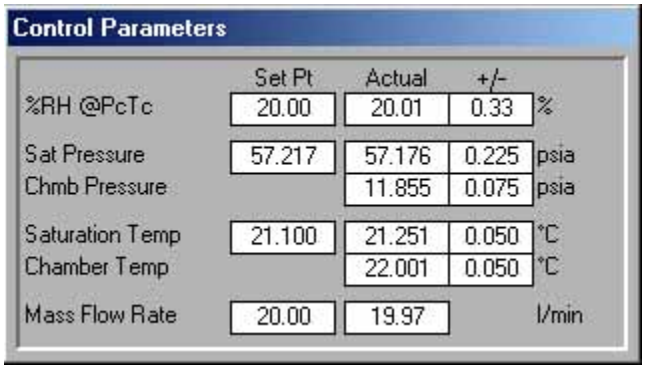
a. Select **Generate** from the **Run** menu



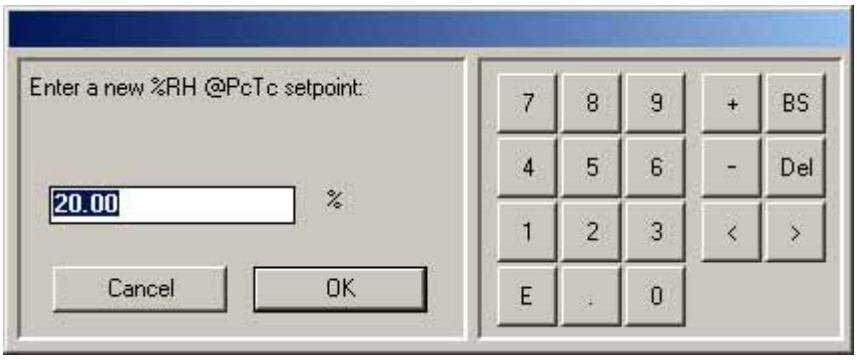
When Generate mode begins, all fields on the Control Parameters window and the Calculated Humidity Values window begin to update, and the Status Log shows the time that the Generate mode was started.

Change the Setpoints

b. Click on the %RH Setpoint field of the Control Parameters window.

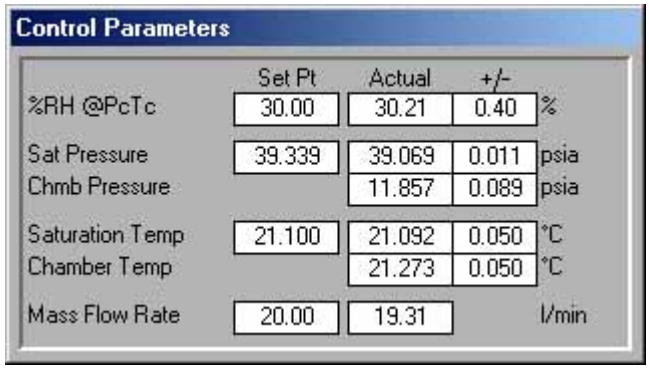


The following dialog box will appear.



c. Using either the on screen keypad or the keyboard, enter a setpoint value of 30. Then click **OK**.

Notice that the %RH setpoint field updates to the new value and the values in the Actual column begin moving toward the new setpoint.

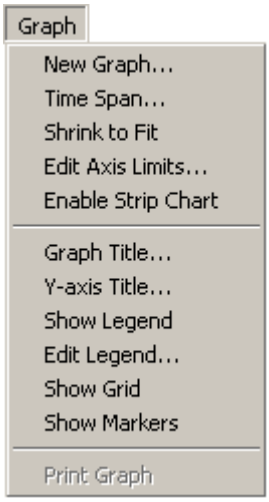


d. Change the flow setpoint to 10 by clicking on the flow setpoint field and entering a new value just as you did previously.

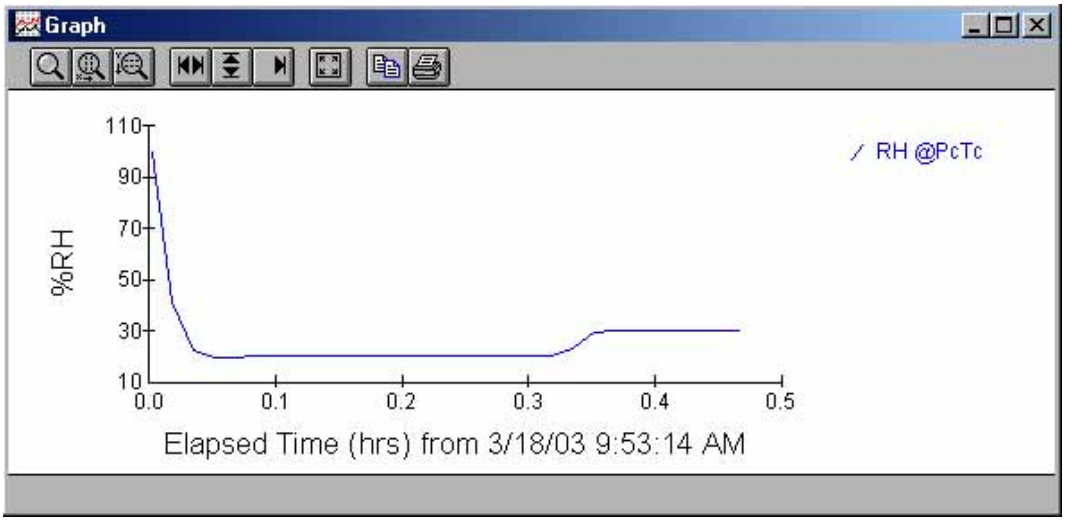
e. Verify the setpoint value for saturation temperature is set correctly. Change it if needed using the same method.

Display a Graph

f. Select **Enable Strip Chart** from the **Graph** menu to see a real time graph of the system performance.



Within a few minutes the graph will begin updating (once there are at least two or three data points to display). The graph continues to show a history of generated Relative Humidity vs. elapsed time. By default, the data used to draw the graph is initially set to a data storage interval of one minute. The graph will therefore update at this frequency.



Changing the %RH Setpoint

Once the %RH has stabilized at 30% for a while, change to a 50% Relative Humidity setpoint.

a. Click on the %RH setpoint field.

b. Enter 50 as the new setpoint.

c. Click **OK**.

Allow the system to stabilize at the new %RH. The graph should continue to update indicating the current %RH being generated.

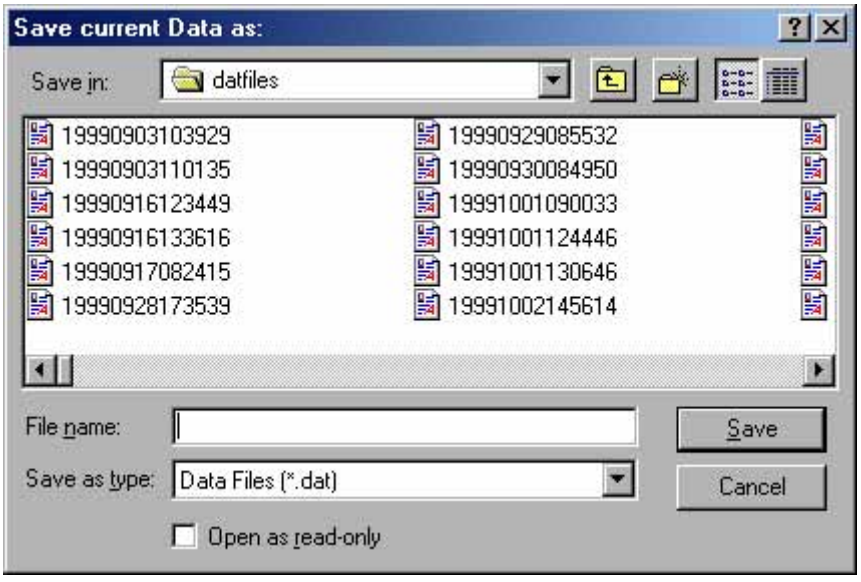
Shutdown

Performing a shutdown causes the generator to vent the saturation pressure to ambient, turns off the refrigeration compressor and fluid pump, then disables the generator's control routines. Now that this trial run is complete, the system is ready to be shutdown.

a. Select **Shutdown** from the **Run** menu.

Once the generator is shut down, the system may prompt you to save the system data which was acquired during the run.

b. Choosing **`Yes`** and supplying a valid filename causes the data to be stored to disk for later use.



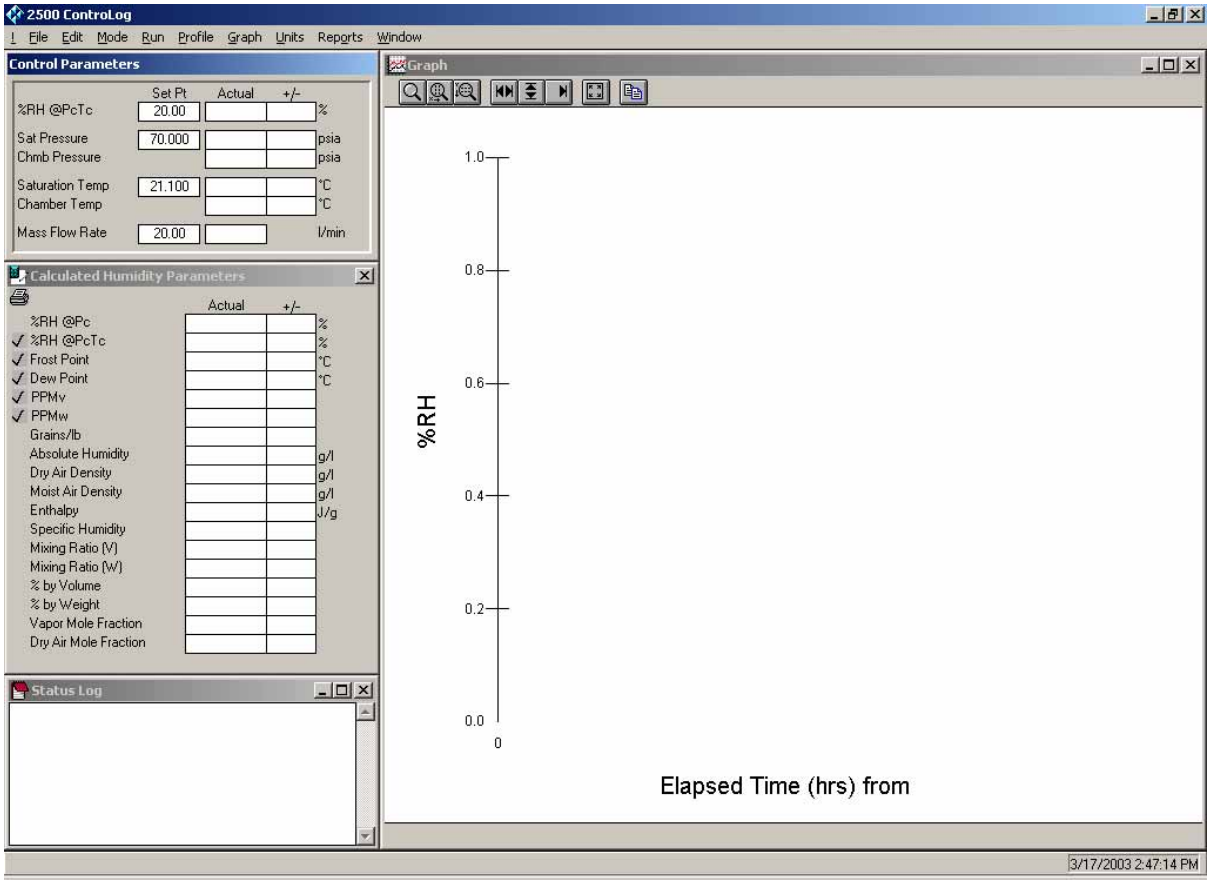
Although files may be stored with any extension (or none at all), a *.dat* extension is recommended for data files. By default, the files will be stored in the *c:\Program Files\2500 ControLog\datafiles.*

When used with the DA9800 Data Acquisition System, automatic file saving is available with auto file naming using a time date stamp method. For instance, with auto file saving enabled, a file might be saved with a name such as S19980915175846.dat. The first 8 numeric digits represent the date in yyyymmdd format, the second six digits represent the time in 24 hour format, and the preceding s indicates that this is system data.

2

Windows

ControLog displays information in several different windows, all of which are moveable within the ControLog screen area, many of which are also resizeable.



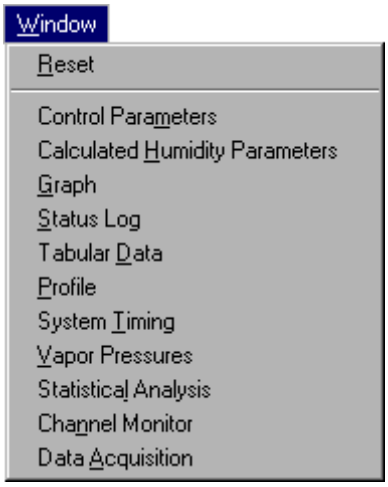
While only the windows of immediate interest are generally viewed on the screen at any one time, all available windows are listed and accessible through the **Window** menu, and may be viewed at any time, arranged in any manner.

Even though a particular window may not currently be visible, its display information is still being computed and updated continuously.

Note that since the Control Parameters window is of significant importance to the operation of the system, it does not have a close or minimize box and can't be put away.

Window Reset

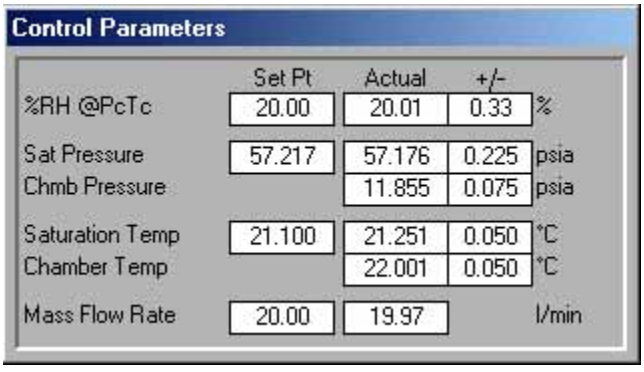
Selecting **Reset** from the **Window** menu restores the look of the screen to its power up default setting.



This operation hides all windows with the exception of more commonly used ones: Control Parameters, Calculated Humidity Parameters, Graph, and Status Log. These remaining windows are sized and arranged in a standardized format, depending upon you computer's screen resolution.

Control Parameters

The Control Parameters window contains all the control and measurement parameters critical to the operation of the humidity generator. Notice that each parameter consists of a brief title, unit of measurement, and the data values for Setpoint, Actual, and Error Estimate as applicable.



All parameters are listed in an order similar to the generator's display with the exception of the first listed parameter. The first parameter on the Control Parameters window is the active humidity control parameter. For instance, if ControLog were set to control the generator on dew point, then Dew Point would be listed as the first parameter rather than %RH.

In the Setpoint column, each of the system controlled parameters is listed. However, Sat Pressure can not be changed here, and is listed for information purposes only. If the system is to be controlled on Sat Pressure for any reason, refer to *Saturation Pressure Control Mode.*

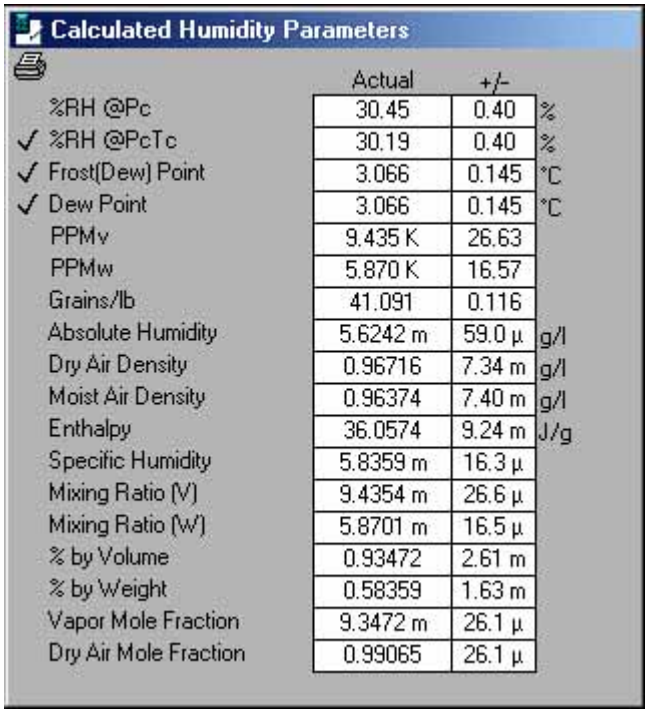
The Actual column lists instantaneous values for each of the systems measured temperatures, pressures, and flow. Note that the humidity control value at the top of the list is not a measured value but rather is a computed value based on the measurements of saturation and chamber temperatures and pressures.

The +/- Error Estimate column is a representation of the anticipated worst case error band of the system for each of the parameters listed at the current operating conditions. Pressure error band estimates are based upon expected performance of the pressure transducers in terms of % of full scale, % of reading, and hysteresis errors. Temperature error band estimates are based upon both a fixed error tolerance, which is constant across the entire scale, and self heating errors, which are dependent upon the applied temperature.

The temperature and pressure error estimates are then used to compute error band estimates for humidity at the current operating conditions. Since the generator does not depend upon flow for the computation of any of the temperature, pressure, or humidity values, no error estimate is computed for it.

Calculated Humidity Parameters

The Calculated Humidity Parameters window contains values of the currently generated humidity calculated from current system temperatures and pressures. An Error Estimate (explained in *Control Parameters*) is given for each value. A check mark in front of any item indicates that the item will be included in printed data when the printer is enabled.



	Actual	+/-	
%RH @Pc	30.45	0.40	%
✓ %RH @PcTc	30.19	0.40	%
✓ Frost(Dew) Point	3.066	0.145	°C
✓ Dew Point	3.066	0.145	°C
PPMv	9.435 K	26.63	
PPMw	5.870 K	16.57	
Grains/lb	41.091	0.116	
Absolute Humidity	5.6242 m	59.0 µ	g/l
Dry Air Density	0.96716	7.34 m	g/l
Moist Air Density	0.96374	7.40 m	g/l
Enthalpy	36.0574	9.24 m	J/g
Specific Humidity	5.8359 m	16.3 µ	
Mixing Ratio (V)	9.4354 m	26.6 µ	
Mixing Ratio (W)	5.8701 m	16.5 µ	
% by Volume	0.93472	2.61 m	
% by Weight	0.58359	1.63 m	
Vapor Mole Fraction	9.3472 m	26.1 µ	
Dry Air Mole Fraction	0.99065	26.1 µ	

%RH@Pc The %RH calculated at test chamber pressure, P_c, from saturation pressure, P_s, and saturation temperature, T_s. Percent Relative Humidity is the ratio of the amount of water vapor in a given sample to the maximum amount possible at the same temperature and pressure. **This value ignores possible temperature difference between saturation and chamber.**

%RH@PcTc The %RH calculated at test chamber pressure, P_c, and test chamber temperature, T_c, from saturation pressure, P_s, and saturation temperature, T_s. Percent Relative Humidity is the ratio of the amount of water vapor in a given sample to the maximum amount possible at the same temperature and pressure.

Frost Point The Frost Point temperature calculated at test chamber pressure, P_c, from saturation temperature, T_s, and saturation pressure, P_s. Frost Point Temperature is the temperature to which a gas must be cooled in order to just begin condensing water vapor in the form of frost or ice, and therefore only exists at values below 0.01 °C. When operating the system with indicated Frost Points above 0.01 °C, the values indicated are to be interpreted as Dew Points. However, Frost Point is not the same as Dew Point for values below freezing. Frost Point is independent of test chamber temperature.

Dew Point The Dew Point temperature calculated at test chamber pressure, P_c, from saturation temperature, T_s, and saturation pressure, P_s. Dew Point Temperature is the temperature to which a gas must be cooled in order to just begin condensing water vapor in the form of dew. Generally, Dew Point exists at temperatures above freezing. In many instances, Dew Point may actually exist at indicated values below freezing. However, it is important to note that Dew Point is not the same as Frost Point. Dew Point is independent of test chamber temperature.

PPMv Parts Per Million by Volume, PPMv, calculated from saturation temperature, T_s, and saturation pressure, P_s. Parts Per Million by Volume is a ratio of the number of molecules of water vapor to the number of molecules of the other constituents in the gas. Once established, PPMv is pressure and temperature insensitive, and is therefore independent of test chamber temperature and test chamber pressure.

PPMw Parts Per Million by Weight, PPMw, calculated from saturation temperature, T_s, saturation pressure, P_s, and the molecular weight of the carrier gas. Parts Per Million by Weight is a ratio of the weight of the water vapor in a sample to the weight of the remaining constituents in the gas. Once established, PPMw is pressure and temperature insensitive, and is therefore independent of test chamber temperature and test chamber pressure.

Grains/lb Grains per pound is calculated from saturation temperature, T_s, saturation pressure, P_s, and the molecular weight of the carrier gas. Grains per pound is a ratio of the weight, in grains, of water vapor to

the weight, in pounds, of the other constituents in the gas. (7000 grains = 1 pound). Once established, Grains/lb is pressure and temperature insensitive, and is therefore independent of test chamber temperature and test chamber pressure.

Absolute Humidity Absolute Humidity calculated from saturation temperature, T_s, saturation pressure, P_s, test chamber temperature, T_c, and test chamber pressure P_c. Absolute Humidity is the weight of the water vapor per unit volume of humidified gas.

Dry Air Density Partial Dry Air Density calculated from saturation temperature, T_s, saturation pressure, P_s, test chamber temperature, T_c, and test chamber pressure P_c. Dry Air Density is the *partial* density in weight per unit volume of only the dry air portion of a moist air sample. In other words, if the water vapor were removed from a fixed volume of air, the remaining dry air would exhibit this density.

Moist Air Density Moist Air Density calculated from saturation temperature, T_s, saturation pressure, P_s, test chamber temperature, T_c, and test chamber pressure P_c. Moist Air Density is the total weight per unit volume of a moist air sample. This density includes both the weight of the air and the weight of the water vapor.

Enthalpy Enthalpy calculated from saturation temperature, T_s, saturation pressure, P_s, test chamber temperature, T_c, and test chamber pressure P_c. Enthalpy is a measure of the amount of energy required to change a gas from one temperature/humidity value to another. In application, enthalpy is not used as an absolute value, but rather it is the difference in enthalpy between two distinct points which is of interest. The datum point which results in zero enthalpy was therefore arbitrarily chosen at a test temperature of 0 °C and 0 %RH. Applying enthalpy is a matter of computing the difference in enthalpy between two or more distinct data points.

Specific Humidity Specific Humidity calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Specific Humidity is a ratio of the weight of the water vapor to the total weight of the humidified gas. Specific Humidity is independent of test chamber temperature.

Mixing Ratio (V) Mixing Ratio by Volume calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Mixing Ratio by Volume is a ratio of the partial pressure of the water vapor to the partial pressure of the remaining constituents in the sample. Mixing Ratio by Volume is independent of test chamber temperature.

Mixing Ratio (W) Mixing Ratio by Weight calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Mixing Ratio by Weight is a ratio of the weight of the water vapor to the weight of the remaining constituents in the sample. Mixing Ratio by Weight is independent of test chamber temperature.

% by Volume Percent by Volume calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Percent by Volume is a ratio (expressed as a percentage) of the partial pressure of the water vapor to the total pressure of the sample. Percent by Volume is independent of test chamber temperature.

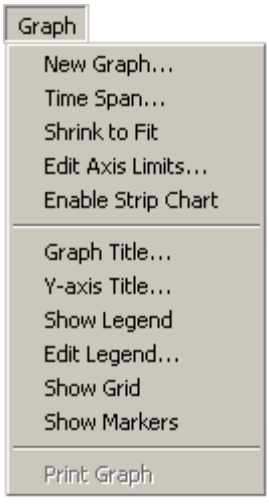
% by Weight Percent by Weight calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Percent by Weight is a ratio (expressed as a percentage) of the weight of the water vapor to the total weight of the sample. Percent by Weight is independent of test chamber temperature.

Vapor Mole Fraction Vapor Mole Fraction calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Vapor Mole Fraction is the mole fraction of water vapor in a sample.

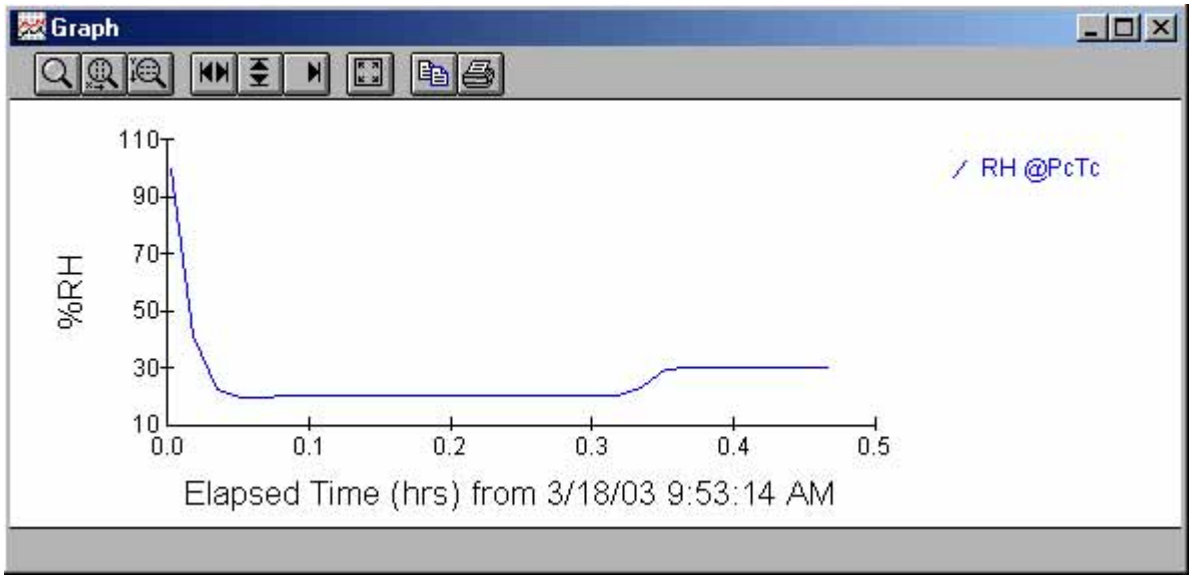
Dry Air Mole Fraction Dry Air Mole Fraction calculated from saturation temperature, T_s, saturation pressure, P_s, and test chamber pressure P_c. Dry Air Mole Fraction is the mole fraction of the dry air portion of a sample. The dry air portion is considered to be all constituents in a gas exclusive of the water vapor.

Graph

The Graph window is a powerful tool used to view previously generated data or to monitor the current data in real time using the strip chart feature. Graph features are accessed either through the **Graph** menu,



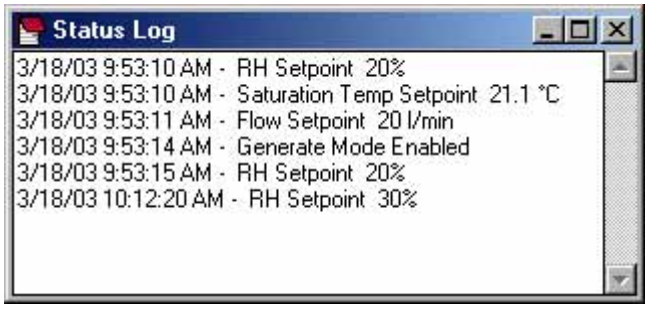
or from the toolbar at the top of the Graph window.



Use of the graph is fully explained in *Graphing*.

Status Log

The Status Log contains chronological information about the system status, logging changes in operational modes, changes in setpoint, and runtime errors due to communication or mechanical difficulties the generator encounters.

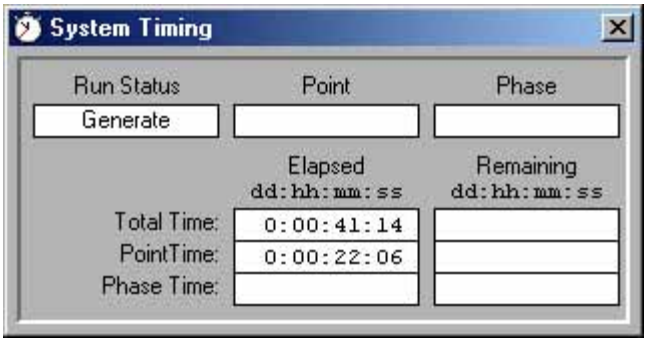


To print the contents of the status log, select **Print Status Log** from the **File** menu.

Should the status log become very large, the entire log may be cleared by selecting **Clear Status Log** from the **File** menu.

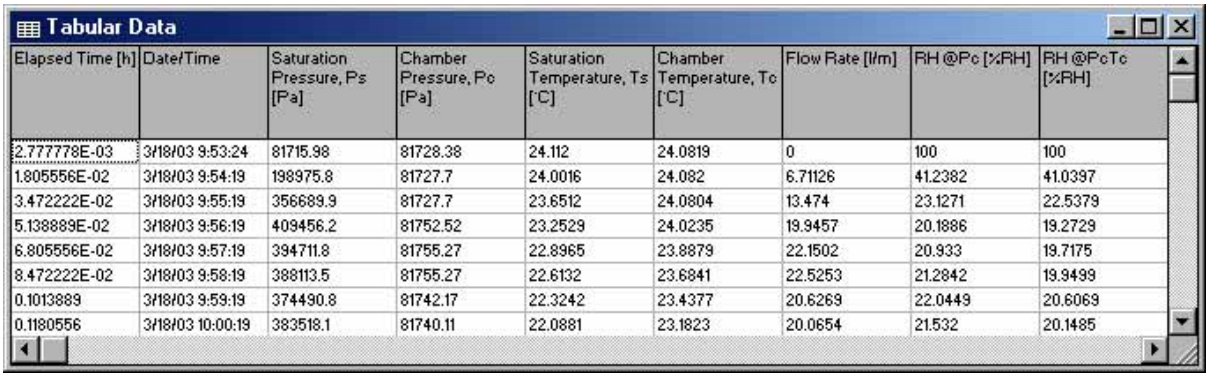
System Timing

The System Timing window shows information about the current operating mode (Generate or Auto) and the timing associated with it such as the amount of run time elapsed at the current humidity conditions. This window may be shown at any time by selecting **System Timing** from the **Window** menu.



Tabular Data

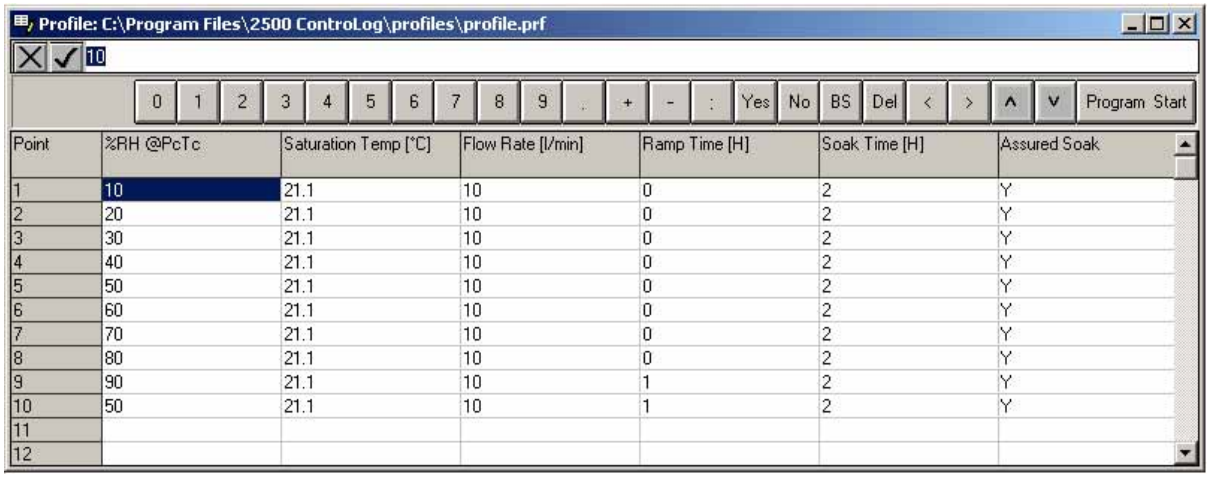
The Tabular Data window contains a spreadsheet type view of actual system data including both system control parameters (Saturation Temperature, Saturation Pressure, Flow, etc.) and calculated humidity parameters (%RH, Frost Point, Dew Point, etc.) Tabular data is always stored in SI units regardless of the setting of the system units. For a further discussion of the Tabular Data information, refer to *Data Storage & Retrieval.*


Tabular Data

Elapsed Time [h]	Date/Time	Saturation Pressure, Ps [Pa]	Chamber Pressure, Pc [Pa]	Saturation Temperature, Ts [°C]	Chamber Temperature, Tc [°C]	Flow Rate [l/m]	RH @Pc [%RH]	RH @PcTc [%RH]
2.777778E-03	3/18/03 9:53:24	81715.98	81728.38	24.112	24.0819	0	100	100
1.805556E-02	3/18/03 9:54:19	198975.8	81727.7	24.0016	24.082	6.71126	41.2382	41.0397
3.472222E-02	3/18/03 9:55:19	356689.9	81727.7	23.6512	24.0804	13.474	23.1271	22.5379
5.138889E-02	3/18/03 9:56:19	409456.2	81752.52	23.2529	24.0235	19.9457	20.1886	19.2729
6.805556E-02	3/18/03 9:57:19	394711.8	81755.27	22.8965	23.8879	22.1502	20.933	19.7175
8.472222E-02	3/18/03 9:58:19	388113.5	81755.27	22.6132	23.6841	22.5253	21.2842	19.9499
0.1013889	3/18/03 9:59:19	374490.8	81742.17	22.3242	23.4377	20.6269	22.0449	20.6069
0.1180556	3/18/03 10:00:19	383518.1	81740.11	22.0881	23.1823	20.0654	21.532	20.1485

Profile

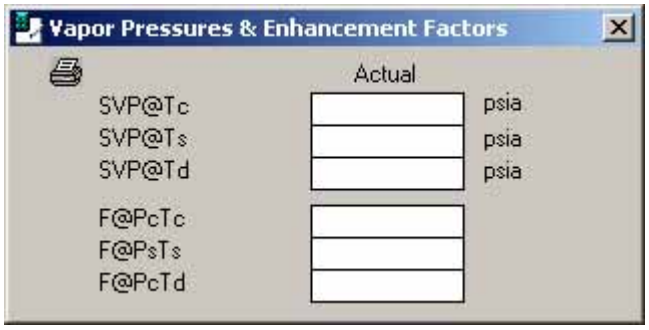
A Profile is a list of humidity, temperature, flow, and time parameters that are used during automated control of the 2500 Generator. The Profile essentially programs the computer/controller operations. The profile form stores this user entered information. Further discussion of the Profile form is found in *Auto-Profiling*.



Point	%RH @PcTc	Saturation Temp [°C]	Flow Rate [l/min]	Ramp Time [H]	Soak Time [H]	Assured Soak
1	10	21.1	10	0	2	Y
2	20	21.1	10	0	2	Y
3	30	21.1	10	0	2	Y
4	40	21.1	10	0	2	Y
5	50	21.1	10	0	2	Y
6	60	21.1	10	0	2	Y
7	70	21.1	10	0	2	Y
8	80	21.1	10	0	2	Y
9	90	21.1	10	1	2	Y
10	50	21.1	10	1	2	Y
11						
12						

Auxiliary Parameters

The Auxiliary Parameters window contains values of vapor pressure and enhancement factors calculated from current system temperatures and pressures. A check mark in front of any item indicates that the item will be included in printed data. This window may be shown at any time by selecting **Vapor Pressures** from the **Window** menu.



SVP@Tc The Saturation Vapor Pressure calculated at test chamber temperature, $e(T_c)$, is the maximum allowable vapor pressure in a sample of gas at that temperature. For $T_c \geq 0.01$ °C, vapor pressure is computed with respect to water. For $T_c < 0.01$ °C, vapor pressure is computed with respect to ice.

SVP@Ts The Saturation Vapor Pressure calculated at saturation temperature, $e(T_s)$, is the maximum allowable vapor pressure in a sample of gas at the saturation temperature. For $T_s \geq 0.01$ °C, $e(T_s)$ is computed with respect to water. For $T_s < 0.01$ °C, $e(T_s)$ is computed with respect to ice.

SVP@Td The Saturation Vapor Pressure calculated at dew point temperature, $e_w(T_d)$, with respect to water, is commonly referred to as the dew point vapor pressure. For $T_d<0.01$ °C, this vapor pressure may also be computed at the frost point temperature, T_f, with respect to ice. While $e_w(T_d)$ is vapor pressure with respect to water at the dew point temperature, and $e_i(T_f)$ is vapor pressure with respect to ice at the frost point temperature, then for $T_d < 0.01$ °C, $e_w(T_d)=e_i(T_f)$ even though $T_d \neq T_f$.

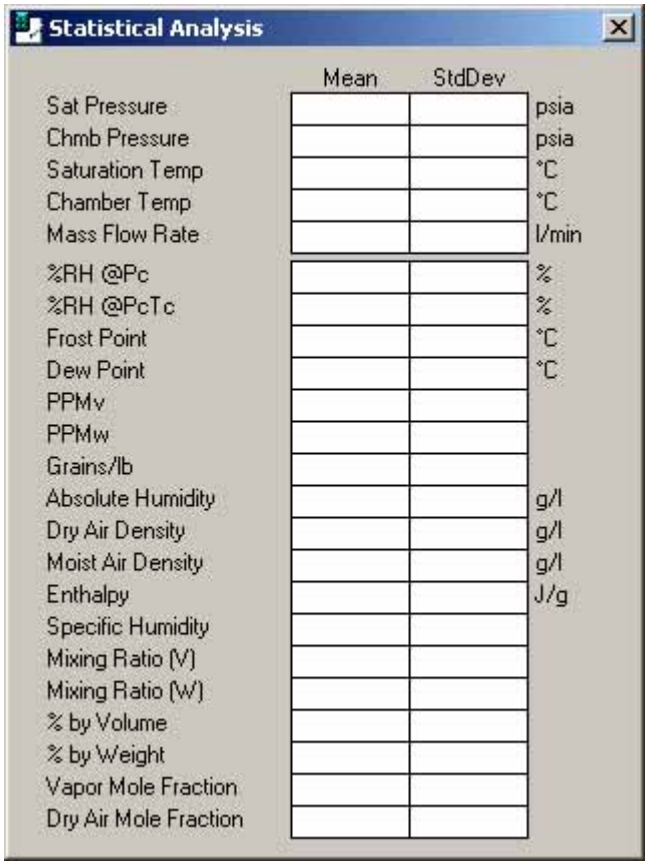
F@PcTc The Enhancement Factor calculated at test chamber pressure, P_c and test chamber temperature, T_c.

F@PsTs The Enhancement Factor calculated at saturation pressure, P_s and saturation temperature, T_s.

F@PcTd The Enhancement Factor calculated at test chamber pressure, P_c and dew point temperature, T_d.

Statistical Analysis

The Statistical Analysis window provides a method to monitor the stability of the generator. The statistical mean and standard deviation are calculated for each of the parameters listed and are updated and displayed continuously in real time.



Both the mean and standard deviation are computed from a fixed size moving data set which contains only the most recent data.

To change the size of the data set, click on either the **Mean** or **StdDev** column headers while holding the *Control* key. A dialog box appears prompting for a new data set size.

3

Generating

Generate mode is used to operate the system when exact humidity points or associated time intervals have not been determined, when data must be viewed and/or verified manually before proceeding to the next humidity point, or when you just wish to have more immediate control over the humidity.

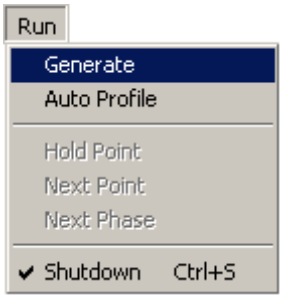
When in the Generate mode of operation, the system will control at the currently entered setpoint indefinitely. Any time that a setpoint is changed, the system immediately begins adjusting to that new value, then again controls it at that new point indefinitely. Generate mode offers the flexibility to change the setpoint at any time, and does not force you into any set sequence or for any prescribed amounts of time.

The Generate mode also allows you to change the humidity control mode at any time. For instance, the system may be controlling %RH, then immediately switched to a dew point control mode.

It is assumed in this section that either the 9800 Data Acquisition System has already been configured (see 9; *Data Acquisition*) or it was OFF while ControLog was started.

Startup

To start the system in the Generate mode, select **Generate** from the **Run** menu.



When **Generate** is selected, the 2500 is then instructed to startup and initiate the generation process. The Generate menu item is designated with a check mark, indicating the generate process is active.

When Generate mode begins, all fields on the Control Parameters window and the Calculated Humidity Values window begin to update, and the Status Log shows the time that the Generate mode was started.

Also notice that all of the listed in the Control Parameters window were sent to the 2500 and it controls at those values.

What Happens in Generate

When the system is placed into Generate mode, gas flows from the gas supply and flow control valve, through the presaturator, through the saturator, through the expansion valve to the test chamber. It then flows through the test chamber to the gas exhaust outlet.

The temperature of the fluid medium surrounding the chamber is controlled at the saturation setpoint temperature. Since this fluid medium is common to the chamber and saturator, both the chamber and saturation temperatures converge toward this value.

Special Considerations in Generate

To prevent condensation on a cold device under test when transitioning upward in temperature, lower the humidity setpoint prior to changing the saturation temperature setpoint. Since it is not always easy to remember which temperature direction causes this problem, the general rule of thumb is to make temperature transitions at moderate to low humidities only (near 20 or 30 %RH).

Since the generated Relative Humidity is relative to the measurement of the test chamber temperature, place the chamber temperature probe as close as possible to the humidity sensing element of the device. Heat loads in the chamber will cause temperature gradients resulting in humidity gradients within the chamber. Keep heat loads to a minimum if possible.

Generate may be initiated regardless of the current operating mode. In other words the system may be freely switched to Generate mode from either Auto Profile or Shutdown.

If ControLog recognizes that the 9800 Data Acquisition System is connected and powered on, the Generate mode cannot be enabled until after the Data Acquisition System has been configured. See *Data Acquisition*.

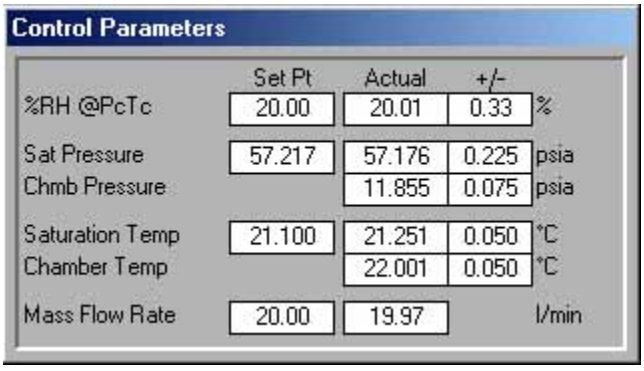
If the 2500 was already running when **Generate** was initiated, ControLog reads the 2500's current setpoint values rather than using those in the Control Parameters window. However, if ControLog initiated **Generate** while the 2500 was stopped, the setpoint values are sent from the Control Parameters window to the 2500.

Setpoints

Setpoints which may be changed are listed in the **Set Pt** column of the Control Parameters window. Editable setpoints in addition to the top listed humidity parameter include Saturation Temp, and Mass Flow Rate.

To Change Setpoints

a. With ControLog in the Generate mode and the 2500 running, click once on the desired setpoint entry field.



A dialog box appears on the screen with a prompt such as **Enter a new %RH setpoint:**

b. Using either the keyboard or the on-screen keypad, enter the desired value in the units indicated in the dialog box.

c. After entering the new value, select **OK**. The value you entered should be displayed in the appropriate setpoint entry field. (Selecting **Cancel** will abort the setpoint entry procedure.)

What Happens When Changing Setpoints

Setpoints within legal limits are accepted. If an entry is invalid due either to mistakes in setpoint entry or out of range conditions, both ControLog and the 2500 will retain the original setpoint value.

Editing the **Saturation Temp** setpoint sets the temperature of the fluid medium which flows around and through the saturator and around the test chamber. Note that some instruments installed in the test chamber may produce a heat load, causing a temperature difference between the saturation temperature and the actual chamber temperature.

When using ControLog with the 9800 Data Acquisition System, current channel readings are stored prior to the setpoint change. For a further description of the data storage process, see *Data Acquisition*.

Special Considerations When Changing Setpoints

Setpoint changes made from the front panel of the Benchtop will be ignored when ControLog is executing an Auto Profile (see *Auto Profiling*).

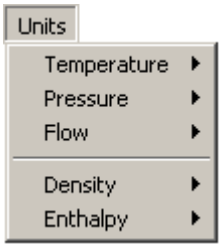
A Saturation Pressure setpoint may only be entered if saturation pressure is the current humidity control mode. In all other humidity control modes, saturation pressure setpoint is automatically determined by ControLog in order to achieve the desired humidity output.

Units

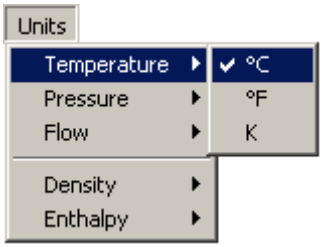
The **Units** menu is used to select desired engineering units for display, printing, and graphing purposes. The current engineering units are indicated with a check mark.

To Change Units

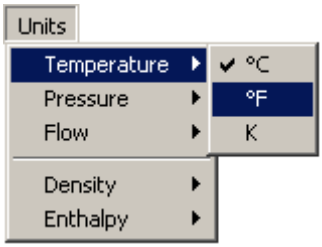
a. Pull down the units menu.



b. Select the units type to change.



c. From the sub menu, select the desired units.



d. A √ will be placed in front of the currently selected units and all displayed values of that type will change.

What Happens When Changing Units

The units labels on the affected control and humidity parameter items update to reflect the new units selection.

All affected data values in the fields on the Control, Calculated Humidity Parameters, Auxiliary Parameters and Statistical Analysis screens will update within a few seconds to reflect the change.

If a selected graph item is affected, changing units will update the y-axis values to reflect the change.

If the printer is enabled and the current data page is not complete, an END OF FORM will be sent to the printer to allow a new header with the correct units to be printed.

Special Considerations When Changing Units

Changing units may cause the values that are displayed to become very large or very small. In order to maintain significant digits, values are displayed in a modified scientific notation form.

$$\begin{aligned} M &= 10^{6} \\ K &= 10^{3} \\ m &= 10^{-3} \\ \mu &= 10^{-6} \\ n &= 10^{-9} \end{aligned}$$

This notation is only used for display and printing purposes, not for entry of data or, or for data storage. For these cases, standard scientific notation (1.23E3, 1.23E-3, etc.) is used.

Data shown on the Tabular Data window and data stored to disk will *always* be in SI units regardless of the units selected.

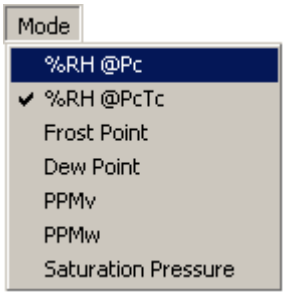
ControLog units neither affect, or are affected by, the currently selected units of the 2500 itself.

Control Modes

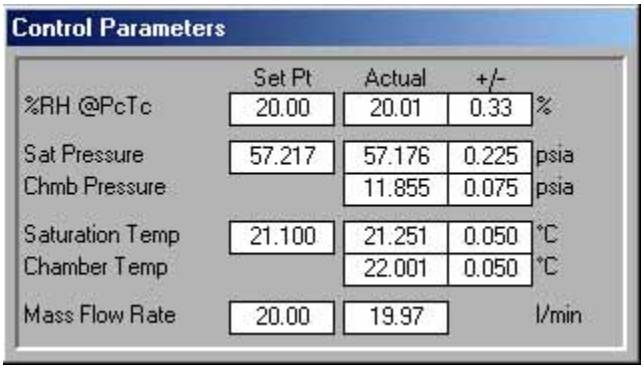
ControLog may be operated in one of several possible Humidity Control modes as listed in the Mode menu.

Changing the Humidity Control Mode

To select a new humidity control mode, choose the desired mode from the **Mode** menu.



The Control Parameters window changes to reflect the new Humidity Control mode selected, and the setpoint value is changed to the equivalent of the previous humidity setpoint.



%RH@Pc Control Mode

%RH@Pc is controlled at a constant value by varying saturation pressure, P_s, to compensate for any changes in test chamber pressure, P_c. While %RH@Pc is held constant, all other humidity parameters may vary.

%RH@PcTc Control Mode (power-up default)

%RH@PcTc control mode is the one most often used, and is the power-up default mode of the generator.

%RH@PcTc is controlled at a constant value by varying saturation pressure, P_s, to compensate for any changes in saturation temperature, T_s, test chamber temperature, T_c, or test chamber pressure, P_c. While %RH@PcTc is held constant, all other humidity parameters may vary.

Frost Point Control Mode

Frost Point is controlled at a constant value by varying the saturation pressure, P_s, to compensate for changes in either saturation temperature, T_s, or test chamber pressure, P_c. While Frost Point is held constant other humidity parameters may vary.

Frost Point is independent of test chamber temperature.

Dew Point Control Mode

Dew Point is controlled at a constant value by varying saturation pressure, P_s, to compensate for any changes in either saturation temperature, T_s, or test chamber pressure, P_c. While Dew Point is held constant, other humidity parameters may vary.

Dew Point control mode is valid both above and below 0 °C, and Dew Point is independent of test temperature.

PPMv Control Mode

PPMv is controlled at a constant value by varying saturation pressure, P_s, to compensate for any changes in saturation temperature, T_s. While PPMv is held constant, other humidity parameters may vary.

PPMv is independent of test chamber pressure and temperature.

PPMw Control Mode

PPMw is controlled at a constant value by varying saturation pressure, P_s, to compensate for any changes in saturation temperature, T_s. While PPMw is held constant, other humidity parameters may vary.

PPMw is independent of test chamber pressure and temperature.

Saturation Pressure Control Mode

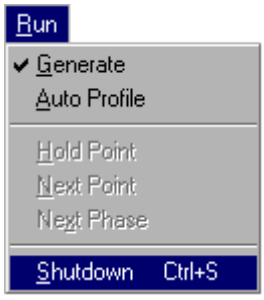
Saturation Pressure, P_s, is controlled at a constant value independent of any other pressure, temperature, or humidity value. While saturation pressure is held constant, all humidity parameters may vary.

Shutdown

The Shutdown mode is used to stop the system and place it in a depressurized, idle, no gas flow state.

Initiating a Shutdown

To shut the system down, select **Shutdown** from the **Run** menu.



What Happens during Shutdown

A Shutdown causes all gas flow to stop, saturation pressure to vent to ambient, pump and compressor to stop, and all heating and cooling to cease.

If the Shutdown was caused by a system malfunction, or the system discovered a malfunction during shutdown, then an entry is made to the Status Log indicating the nature of the error.

Special Considerations during Shutdown

A Shutdown, if followed later by a Generate or Auto Profile causes all system data to be reinitialized. Prior to reinitialization, an opportunity is provided via prompt to save any unsaved data. If the data was saved upon Shutdown, then no additional prompt is required and the data reinitializes automatically.

With the Data Acquisition option, automatic naming and saving of data files is available. Refer to *Data Acquisition*.

4

Data Storage & Retrieval

ControLog stores system data and other calculated parameters to the tabular data window and a temporary data file *\sysfiles\sys.dat.* The data is always stored in SI units. This same data is also stored in the tabular data window for use by ControLog's graph.

The items stored consist of elapsed time, date/time, and the measured system parameters in addition to the calculated humidity parameters and some additional system parameters. If the 9800 Acquisition is enabled, its data is also stored.

The difference between the tabular data window and the temporary data file is the storage capacity. The tabular data window will contain only the most recent 1000 lines of data while the data file is only limited by the available space on the hard drive. The graph can only access the latest 1000 lines of data as currently listed in the tabular data window.

The tabular data window and the temporary data file are cleared at the beginning of each new run (i.e. from a shutdown condition).

Data Storage Interval

Storing and maintaining data can become a time consuming process. The more data that is stored in the tabular data window, the slower and less responsive the computer may seem. For this reason, some consideration should be given to the amount of data desired, the overall time span of the data (i.e. hours, days, possibly weeks), and ultimately the data interval.

The data storage interval determines how often the data is stored and also when data will be printed. ControLog's power-up default data interval is one minute.

a. Select **Data Storage Interval** from the **File** menu. The following dialog appears.

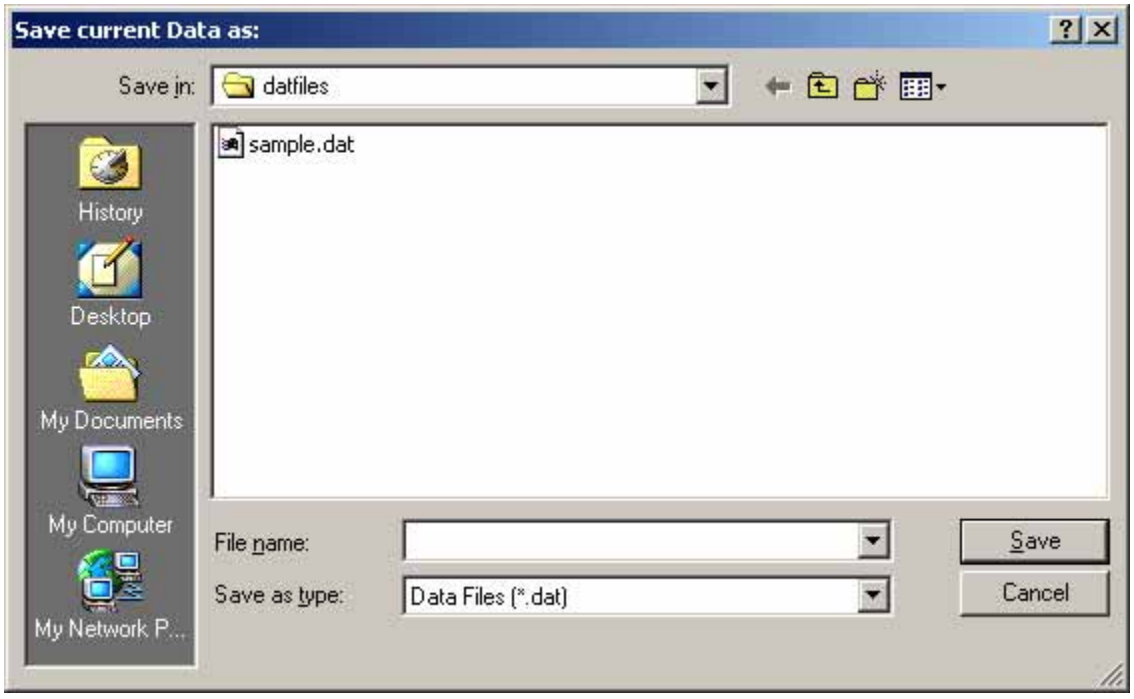
b. Enter the new time interval in minutes and select **OK**.

Saving the System Data

A copy of the current system data file may be saved at any time into a tab separated ASCII data file which is compatible with most spreadsheet programs. To save a copy of the current data file:

a. Select **Save Data as...** from the **File** menu.

b. Using the dialog box that appears, select or enter an appropriate path and filename, then click **OK**.



Although files may be stored with any extension (or non at all), a *.dat* extension is recommended for data files. By default, the files will be stored in the *\datfiles* directory.

The file is always written in a tab separated data format with a carriage return as the line terminator. If using a spreadsheet program to view this data file, be sure to set the column delimiter to *tab* and the line delimiter to *carriage return* in the file opening specifications.

When used with the 9800 Data Acquisition System, automatic file saving and naming is available at shutdown (when properly configured in the \sysfiles\daux.ini file). When saved and named automatically, the files are named 'syyyymmddhhmmss.dat' where yyyymmddhhmmss is the date/time stamp indicating the time of the run.

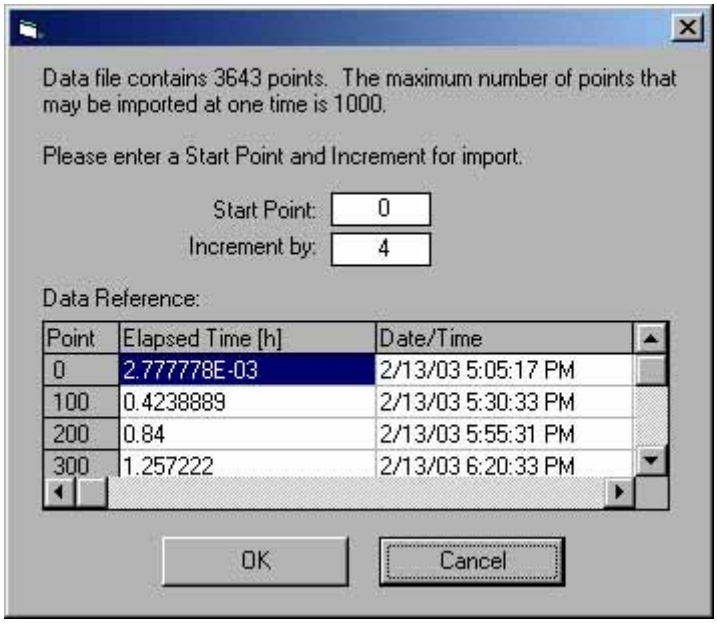
Retrieving Data from Previous Runs

Data that has been saved from a previous run may be imported back into ControLog for subsequent graphing functions. A very large data file may also be imported and broken down into smaller, more manageable chunks. Files of no more than 1000 lines each are both usable by ControLog and fit nicely on floppy disks. Larger files may be imported 1000 lines at a time then saved to different file names.

a. Select **Import Data...** from the **File** menu.

b. From the dialog box that appears, choose the file you wish to import. When Automatic file saving is used, the appropriate files start with 'S' and have a date/time stamp for their names. Date/time stamped files without the 'S' are not the same and are used for a different purpose (see *Data Acquisition*).

If the selected data file contains 1000 lines or less, then this data will replace the current data in the Tabular Data window. If the selected data file contains more than 1000 lines, a dialog box will appear allowing you to select the method for reducing the data to a more manageable size of 1000 lines or less.



By selecting and dragging a range on the Data Reference table, the Starting Point and Increment values will be automatically computed. Or, it may be used just as a reference for you to select an appropriate starting line, reading in each and every point up to the maximum allowed.

Values may be entered directly into the Starting Point and Increment fields if desired. For instance, if the data file contains 1631 points, using a Starting Point of 200 with an Increment of 2 results in every other value being read in (200, 202, 204, ... , 1628, 1632) for a total of 716 points. Using a Starting Point of 500 with an Increment of 1 results in 1000 values being read in from 500 to 1499.

This data, of 1000 points or less, may be saved to a new data file by following the procedures in *Saving the System Data* as previously discussed.

By conscious use of the Import and Save procedures in turn, a very large data file may be broken down into a series of smaller, more manageable files of 1000 lines or less. To retain all significant data into a series of smaller files, first use an Increment of 1 with a Starting Point of 0. This will retrieve lines 0 to 999. Save the data using the procedures previously discussed. Then import with a Starting Point of 1000, saving this data to another file. Next, import with a Starting Point of 2000, and so on.

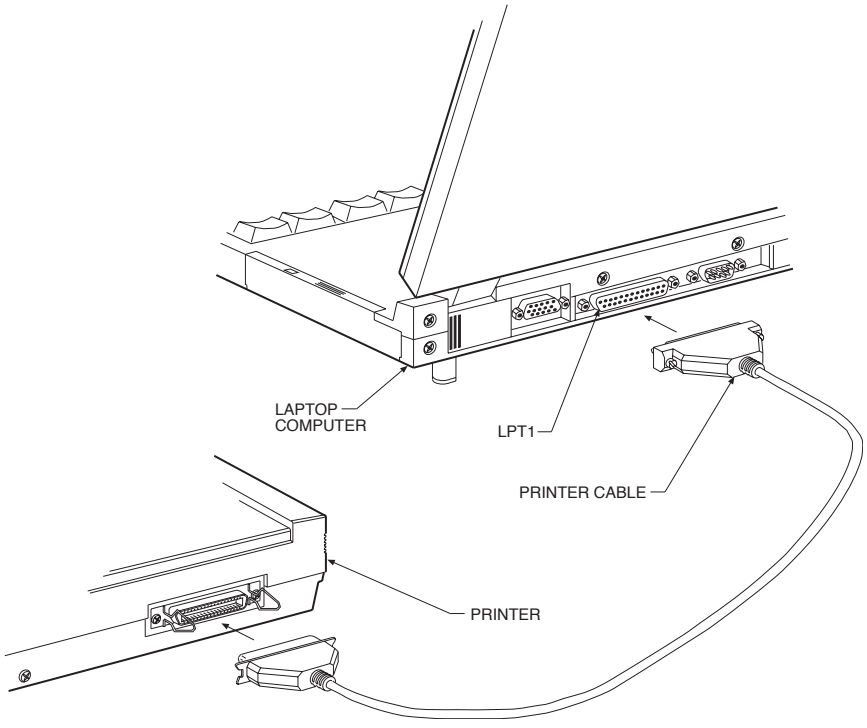
5

Printing

A printer may be connected to the parallel printer connection (LPT Port) of your computer. The printer is used for hardcopy output of system data and other parameters. While the 2500 generator is operating, the printer output is initiated on a timed interval basis when enabled through ControLog. Prior to enabling the printer, ensure that it is properly connected and that a Page Setup is performed.

Connecting a Printer

Connect a parallel printer to the printer port (LPT1, LPT2, or LPT3) of the computer using a standard printer cable.

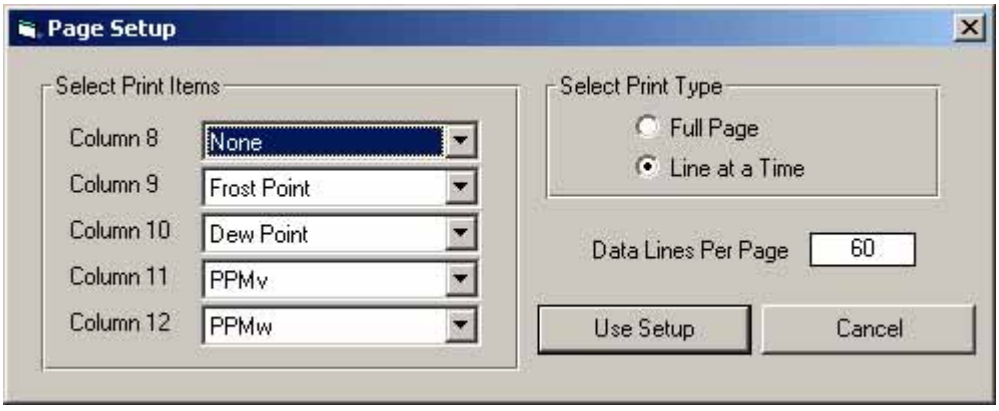


The printer may be either a page printer or a line printer. A page printer, such as a laser printer, requires a complete page of data before printing. A line printer however, is capable of printing each line of data immediately as it is received. Most dot matrix and some ink jet printers are line printers. Using the default printing parameters of ControLog, it could take up to an hour to fill one page with data.

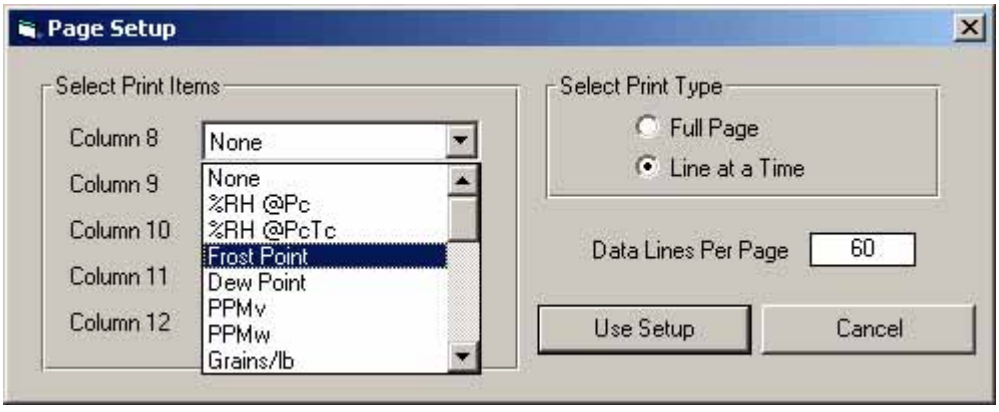
Page Setup

Printer operation and the data sent to it can be customized with Page Setup.

a. Select **Page Setup...** from the **File** menu. The following dialog box appears.



b. In the **Select Print Items** area, select the parameter to print for each of the columns.



Lines of data are printed in a column format. The first several columns are fixed by the system and include such things as Time, Date, Saturation Pressure, etc. The remaining columns of data on each page are user selectable and are shown on the Page Setup form. To select which data items will be sent to the printer in these later columns, choose the item from the drop down menu which corresponds to the column in which the data should be printed.

c. In the **Select Print Type** area, choose either the **Full Page** or **Line at a Time** printing mode.

In full page mode, the system will buffer an entire page of data prior to sending it to the printer. When sending it to the printer, the standard Windows printer driver for the selected printer type is used, and all printing is handled by the Windows Print Manager. Therefore, virtually any printer for which there is a suitable driver will work. Due to the pictorial nature of Windows, the graph must be sent to the printer

using full page mode to insure proper formatting. This is also the case when printing any entire screen using **Print Screen** from the **File** menu.

In line at a time mode, the system bypasses the Windows Print Manager, and communicates directly with the printer. In this mode, each line of data is printed immediately when available, and no data buffering is performed. For proper operation in this mode, the printer must be either Epson or IBM code compatible. This includes most older dot matrix printers, and many newer printers manufactured by Epson and Canon. Line at a time mode is *not* compatible with laser printers, some ink jet printers, and with Hewlett Packard printers operating under Hewlett Packard Graphics Language (HPGL). Line at a time mode requires that the printer and LPT1 printer port be dedicated solely to ControLog. If Windows attempts to use the same printer port when in line at a time mode, printer conflicts will result. Line-at-a-time mode does not function well with Windows NT due to its multi-thread buffering of printer port data.

d. Enter the number of **Data Lines Per Page**. An entry of 60 allows for one hour of printed data per page if the data storage interval is set to one minute.

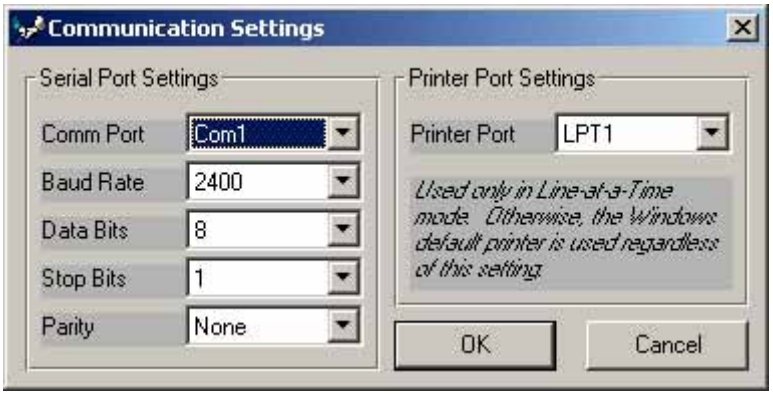
e. After all changes have been made to the Page Setup click the **OK** button, or click **Cancel** to abort any changes.

Changing only the number of points per page will not force a new page and header to occur, however any other changes to the Page Setup will result in a new header if printing is currently enabled.

Selecting the Printer Port

When printing in line at a time mode, data bypasses the Windows Print Manager and is sent directly to the LPT port. While most computers have a parallel printer connection at LPT1, to accommodate various computer/printer configurations ControLog can send the print data to either LPT1, LPT2, or LPT3. Any change made to the default setting is remembered by the system, and therefore only needs to set once.

a. Select **Communication Settings** from the **!** menu (left of the File menu). The following window appears.



b. In the Printer Port Settings area, select the Printer Port which is currently connected to the line-at-a-time printer. This setting will not affect any full page printing.

c. Click **OK**. The window will close, and any line at a time printing will be directed to the selected port.

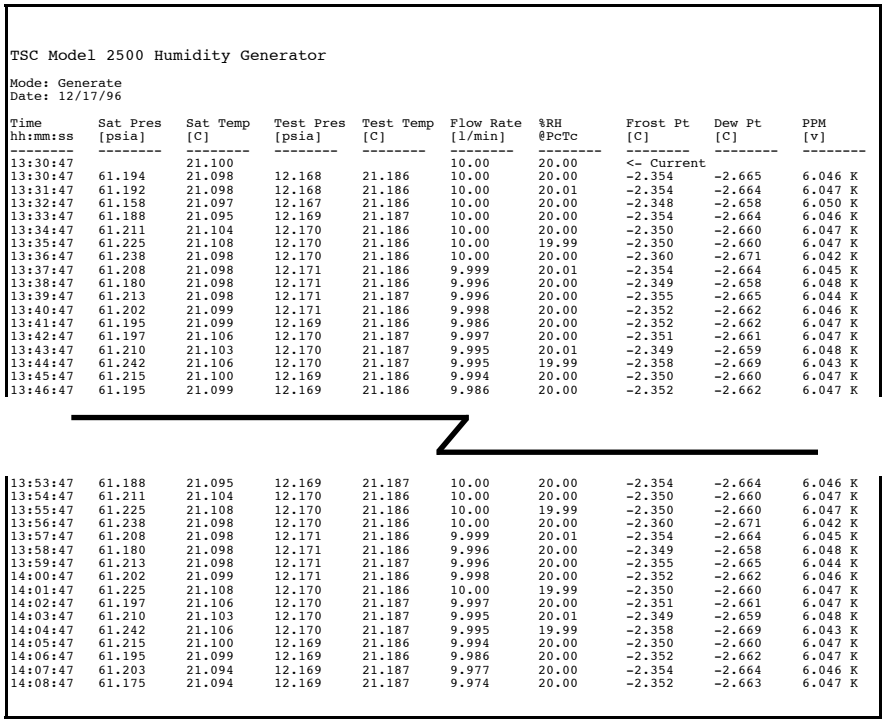
Enabling/Disabling the Printer

Enabling and disabling of the printer is done by selecting **Enable Printer** from the **File** menu. When enabled, a √ appears in front of the menu item and data will be sent to the printer on a timed interval basis (see *Data Storage Interval*).

When disabling the printer, an end of page command will be sent which causes the page to eject from the printer.

What Happens When the Printer is Enabled

The printer, when properly set up and enabled, prints lines of data at user selectable time intervals. A header is printed at the top of each page to indicate each columns selected parameter along with the parameter's units. If changes are made to the Page Setup or to the Units while the printer is enabled, the current page will eject from the printer and a new page will be started in order to reflect the changes. The following is a sample of the print format.



TSC Model 2500 Humidity Generator

Mode: Generate
Date: 12/17/96

Time hh:mm:ss	Sat Pres [psia]	Sat Temp [C]	Test Pres [psia]	Test Temp [C]	Flow Rate [l/min]	%RH @PcTc	Frost Pt [C]	Dew Pt [C]	PPM [v]
13:30:47		21.100			10.00	20.00	<- Current		
13:30:47	61.194	21.098	12.168	21.186	10.00	20.00	-2.354	-2.665	6.046 K
13:31:47	61.192	21.098	12.168	21.186	10.00	20.01	-2.354	-2.664	6.047 K
13:32:47	61.158	21.097	12.167	21.186	10.00	20.00	-2.348	-2.658	6.050 K
13:33:47	61.188	21.095	12.169	21.187	10.00	20.00	-2.354	-2.664	6.046 K
13:34:47	61.211	21.104	12.170	21.186	10.00	20.00	-2.350	-2.660	6.047 K
13:35:47	61.225	21.108	12.170	21.186	10.00	19.99	-2.350	-2.660	6.047 K
13:36:47	61.238	21.098	12.170	21.186	10.00	20.00	-2.360	-2.671	6.042 K
13:37:47	61.208	21.098	12.171	21.186	9.999	20.01	-2.354	-2.664	6.045 K
13:38:47	61.180	21.098	12.171	21.186	9.996	20.00	-2.349	-2.658	6.048 K
13:39:47	61.213	21.098	12.171	21.187	9.996	20.00	-2.355	-2.665	6.044 K
13:40:47	61.202	21.099	12.171	21.186	9.998	20.00	-2.352	-2.662	6.046 K
13:41:47	61.195	21.099	12.169	21.186	9.986	20.00	-2.352	-2.662	6.047 K
13:42:47	61.197	21.106	12.170	21.187	9.997	20.00	-2.351	-2.661	6.047 K
13:43:47	61.210	21.103	12.170	21.187	9.995	20.01	-2.349	-2.659	6.048 K
13:44:47	61.242	21.106	12.170	21.187	9.995	19.99	-2.358	-2.669	6.043 K
13:45:47	61.215	21.100	12.169	21.186	9.994	20.00	-2.350	-2.660	6.047 K
13:46:47	61.195	21.099	12.169	21.186	9.986	20.00	-2.352	-2.662	6.047 K
13:53:47	61.188	21.095	12.169	21.187	10.00	20.00	-2.354	-2.664	6.046 K
13:54:47	61.211	21.104	12.170	21.186	10.00	20.00	-2.350	-2.660	6.047 K
13:55:47	61.225	21.108	12.170	21.186	10.00	19.99	-2.350	-2.660	6.047 K
13:56:47	61.238	21.098	12.170	21.186	10.00	20.00	-2.360	-2.671	6.042 K
13:57:47	61.208	21.098	12.171	21.186	9.999	20.01	-2.354	-2.664	6.045 K
13:58:47	61.180	21.098	12.171	21.186	9.996	20.00	-2.349	-2.658	6.048 K
13:59:47	61.213	21.098	12.171	21.187	9.996	20.00	-2.355	-2.665	6.044 K
14:00:47	61.202	21.099	12.171	21.186	9.998	20.00	-2.352	-2.662	6.046 K
14:01:47	61.225	21.108	12.170	21.186	10.00	19.99	-2.350	-2.660	6.047 K
14:02:47	61.197	21.106	12.170	21.187	9.997	20.00	-2.351	-2.661	6.047 K
14:03:47	61.210	21.103	12.170	21.187	9.995	20.01	-2.349	-2.659	6.048 K
14:04:47	61.242	21.106	12.170	21.187	9.995	19.99	-2.358	-2.669	6.043 K
14:05:47	61.215	21.100	12.169	21.186	9.994	20.00	-2.350	-2.660	6.047 K
14:06:47	61.195	21.099	12.169	21.186	9.986	20.00	-2.352	-2.662	6.047 K
14:07:47	61.203	21.094	12.169	21.187	9.977	20.00	-2.354	-2.664	6.046 K
14:08:47	61.175	21.094	12.169	21.187	9.974	20.00	-2.352	-2.663	6.047 K

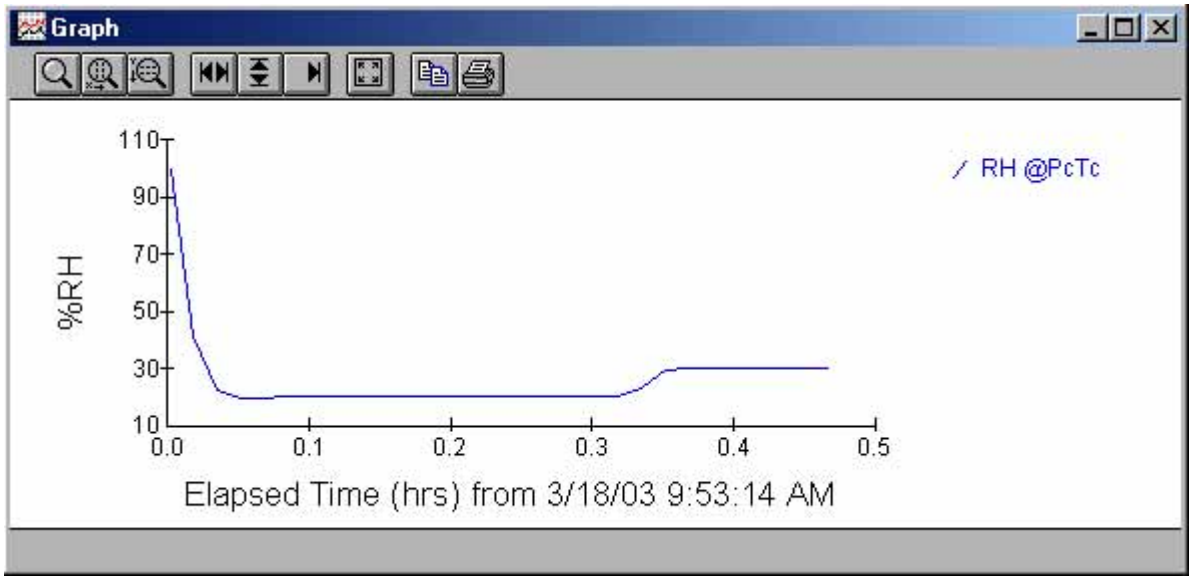
Printing Immediate Data

Selecting **Print Now** from the **File** menu causes the system to immediately send one line of current data to the printer. When in line at a time mode, the line of data should print immediately. When in page at a time, the data is sent immediately to the print buffer, but nothing will be seen until enough data has been collected to print the entire page.

6

Graphing

The Graph window is a powerful tool used to view previously generated data or to monitor the generated data in real time using the strip chart feature.



The Tool Bar

Zoom in

Turns the pointer into a cross hair zoom tool. Move the cross hair to the graph, then click and drag the cursor to create a box around the portion to zoom in on. The portion of the graph within the drag box will expand to fill the entire graph. The time and Y-axis limits update accordingly.

Zoom X

Turns the pointer into a cross hair zoom tool. Click on the graph and drag the cursor so that the portion of the X-axis (time axis) of interest is contained within the two vertical dashed zoom lines. The portion contained within this region will expand to fill the entire X-axis. The Y-axis remains unchanged.

Zoom Y

Turns the pointer into a cross hair zoom tool. Click on the graph and drag the cursor so that the portion of the Y-axis of interest is contained within the two horizontal dashed zoom lines. The portion contained within this region will expand to fill the entire Y-axis. The X-axis remains unchanged.

Fit X

Adjusts the left and right limits of the time axis to match the beginning and ending points of the stored data. This allows the parameters being graphed to fit within the left and right limits of the graph window. The X limits update accordingly.

Fit Y

Rescales the Y-axis in order to make the graphed data fit within the graph window. The Y limits update accordingly. The X-axis remains unchanged.

Current X

Shifts the graph so that right edge of the graph to the ending data point. The time span remains fixed.

Shrink to Fit

Adjusts the left, right, top and bottom limits on the graph axes so that entire data set of each selected items is contained with in the boundaries of the graph.

Copy Graph

Copies the current graph picture to the clipboard in a metafile format. This picture may then be pasted into another program.

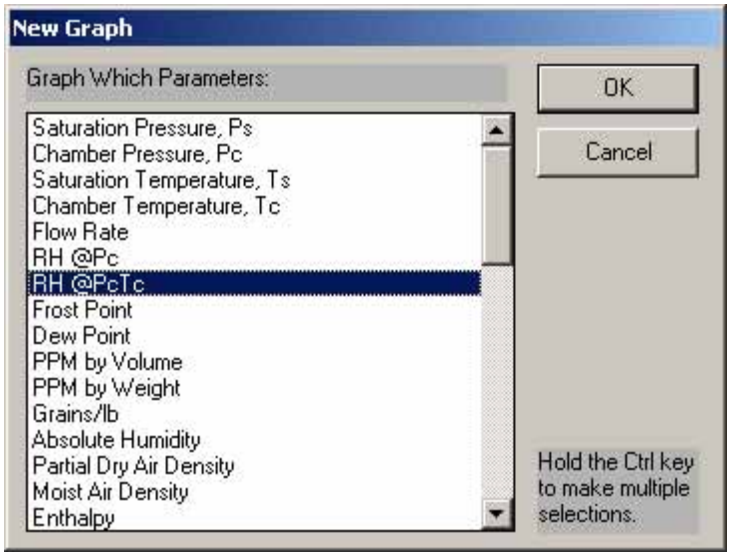
Print Graph

Causes the graph to maximize and a page size picture of the current graph to be sent to the printer. Once the graph has been sent to the printer the graph window returns to its previous size. This item is only available when using the full page print mode.

The Graph Menu

New Graph

Select **New Graph...** from the **Graph** menu. A dialog box with a scrolling list of all available data will appear. The currently selected graph items will be highlighted.



Select the items to be graphed, then click on the **OK** button. The graph will update to reflect the changes. The source of the graph data is the tabular data window. Selecting the **Cancel** button will terminate the new graph operation and no changes will occur.

Time Span

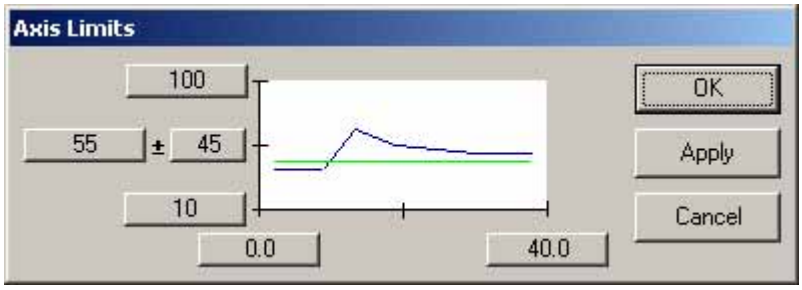
Select **Time Span...** from the **Graph** menu. A dialog box appears asking you to enter a new X-axis time span. The X-axis is updated by maintaining the right time limit and adjusting the left time limit to reflect the specified time span.

Shrink to Fit

Selecting **Shrink to fit** from the **Graph** menu adjusts the left, right, top and bottom limits on the graph axes so that entire data set of each selected items is contained within the boundaries of the graph.

Edit Axis Limits

Selecting **Edit Axis Limits...** from the **Graph** menu, or double clicking directly on the graph itself, causes the following input box to appear.



Both the minimum and maximum limits for the X and Y axes may be changed. Another feature of the Edit Axis input box is the ability to set a mid point and span value for the Y axis.

Enable Strip Chart

When the strip chart is enabled, the rightmost time limit reflects the time of the last stored data point, while the leftmost time limit adjusts accordingly to keep a constant time span. Each time data is stored, the strip chart is updated

Selecting **Enable Strip Chart** from the **Graph** menu enables and disables the strip chart feature of ControLog. When enabled, a √ appears in front of the menu item and the graph begins updating at regular time intervals (see *Data Storage Interval*).

Graph Title

Select **Graph Title...** from the **Graph** menu to add or change a graph title. Enter the desired graph title into the dialog box that appears. Click **OK**.

Y-axis Title

Select **Y-Axis Title...** from the **Graph** menu to change the y-axis title. Enter the new title in the dialog box that appears. Click **OK**.

Show Legend

Selecting **Show Legend** from the **Graph** menu causes a legend to appear on the graph window. A √ appears in front of the menu item.

To hide the graph legend, select √ **Show Legend** from the **Graph** menu.

Edit Legend

Select **Edit Legend...** from the **Graph** menu. A dialog box appears, asking you to rename legend item 1. The current default name is already entered and highlighted.

If you want to change the name, simply type in the new one. Select **OK** to update the change and/or go to the next legend item. You will be asked to accept or change each graph legend item. Select **Cancel** to exit the edit routine without making any changes.

Show Grid

Selecting **Show Grid** form the **Graph** menu places a grid on the currently graphed data to help clarify data values. A √ appears in front of the menu item.

To remove the grid, select √ **Show Grid** from the **Graph** menu.

Show Markers

Select **Show Markers** from the **Graph** menu to place marker symbols at each of the individual data points plotted. A √ appears in front of the menu item.

Select √ **Show Markers** from the **Graph** menu to remove the markers.

Print Graph

The **Print Graph** menu item responds exactly like the Print Graph button on the Graph window's toolbar. The printer must be in the full page mode in order for the graph to print properly. During this operation the Graph window will maximize, redraw, print, then return to normal size.

Graph Data

The graph works hand in hand with the tabular data window. While the generator is in operation, the tabular data window stores the most recent one thousand data points. If the data exceeds the maximum number of data points allowable, the data is still stored to the same temporary data file *(\sysfiles\sys.dat)* but only the most recent data is available to the graph. Additional information about the graph data is provided in *Data Storage & Retrieval.*

7

Reports

ControLog can create custom reports containing generator and user supplied data for individual instruments. Data may be collected for as few or as many points as desired. Data collected is placed into a set of temporary files for later use by the Report Editor. Data is written into these temporary files in the following format.

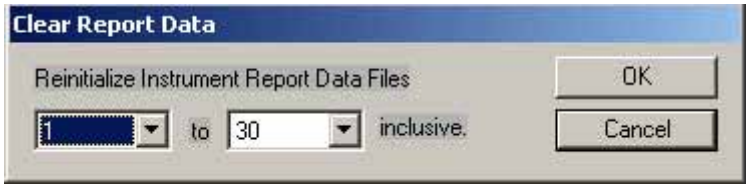
Date/Time	Gen Mode	Temp Unit	----2500 Data---- Hum	Temp	---Instr Data---- Hum	Temp	----Correction--- Hum	Temp
06Feb96 12:48	%RH	C	90.01	21.005	90.27	21.062	-.27	-.062
06Feb96 13:25	%RH	C	84.99	21.010	85.35	21.050	-.35	-.050
06Feb96 13:52	%RH	C	70.00	21.009	70.24	21.045	-.24	-.045

Each data entry into a temporary file is time and date stamped, and includes the generated humidity mode and temperature units. The corresponding instantaneous values of the generated humidity and temperature are included along with the humidity and temperature that you enter for the instrument under test. Also included are calculated correction values which are computed as the difference between the generated values and those entered for the test instrument. There is a separate temporary file created for each of the eight test instruments in the *c:\tsc2500\sysfiles* directory.

Clearing Report Data (when used *without* the 9800 Data Acquisition System)

To start collecting data to a new temporary report data storage file, it is necessary to clear the current temporary data storage file or restart ControLog. If the data files are not cleared, the new data will simply append to the existing data in the file. (Clearing is automatic when ControLog is used with the 9800 Data Acquisition System.)

a. Select **Clear Report Data...** from the **Reports** menu. The following dialog box will appear.

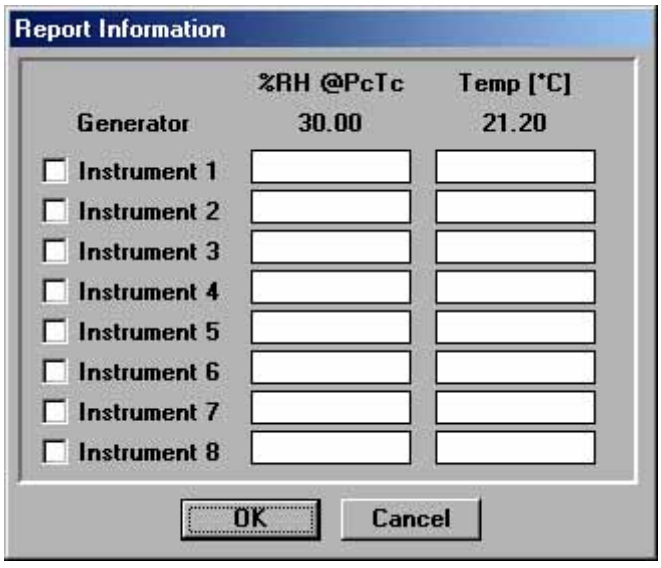


b. Select the desired range for the data files to clear and click **OK**.

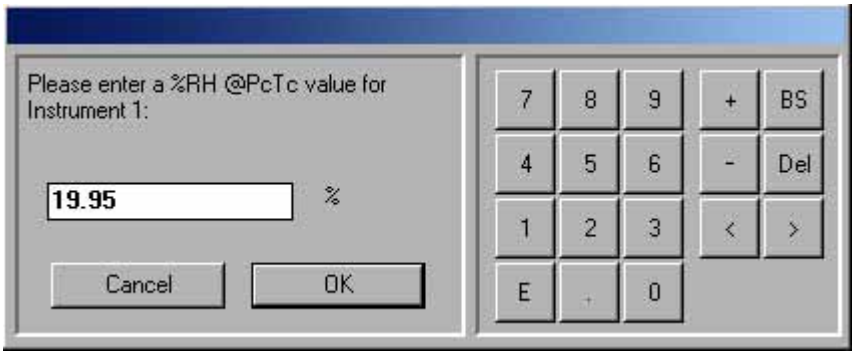
Collecting Report Data (when used *without* the 9800 Data Acquisition System)

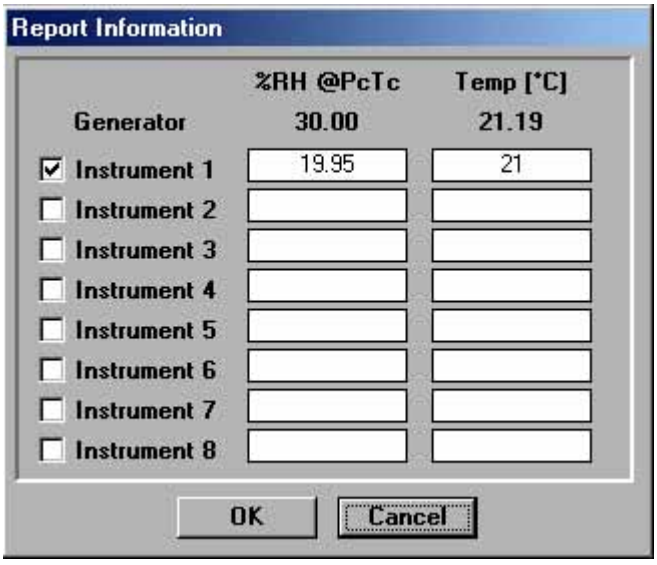
a. Assure both the generator and test instruments are stable at the desired point.

b. Select **Save Data Point Now...** from the **Reports** menu. In the dialog box that appears, the current generated humidity and temperature have already been supplied.



c. Click on the data entry field which corresponds to the instrument data you wish to supply. Enter the data, taking note of both the humidity mode and units.





d. Once you have entered all of your data for each of the instruments, Click **OK**. Data will be appended to a temporary data file for each of the selected instruments.

e. Repeat steps **c** and **d** at each humidity/temperature point that requires instrument data to be entered.

f. When the run is complete and all of the test instrument data has been collected, use the Report Editor to edit, print, and save the instrument reports (see *The Report Editor*).

Collecting Report Data (when used *with* the 9800 Data Acquisition System)

When used with the 9800 Data Acquisition System, Report Data is automatically collected prior to each setpoint change. To save data in addition to that which is automatically collected, select **Save Data Point Now...** from the **Reports** menu. The current data for each channel is stored to files for each of the active channels. For a discussion of Data Acquisition functions, including channel activation, see *Data Acquisition*.

The Report Editor

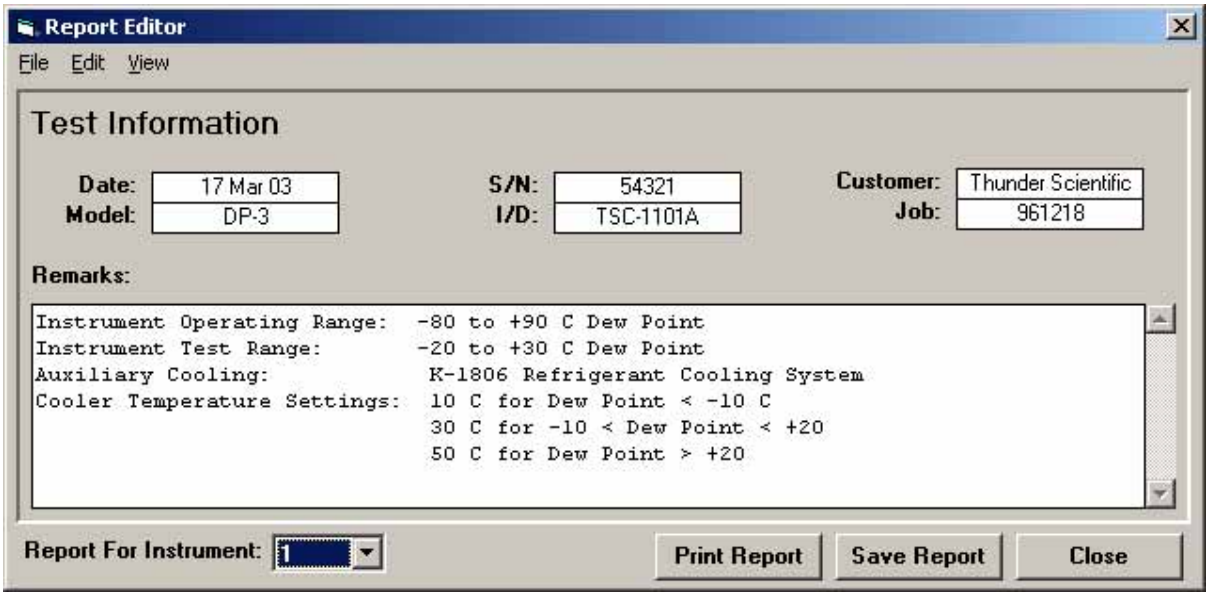
The Report Editor allows for customized report generation showing test instrument performance data. Once the data has been collected (see *Collecting Report Data*), the Report Editor is used to preview, edit, print, and save completed reports for each test instrument.

Creating, Printing, and Saving a Report

Each report consists of a Header, Test Information, Data, and a Footer section. Each of these elements are editable prior to printing and/or saving the report. The Header, Test Information, and Footer sections are completely customizable and may be saved in their customized forms for later recall and inclusion in future reports.

a. Since this procedure involves sharing the use of the printer with other portions of ControLog, ensure that the *Page at a Time* printing mode is selected (see *Page Setup*).

b. Select **Report Editor...** from the **Reports** menu. The Report Editor appears.



c. Select **Header** from the **View** menu. Load, edit, or save the header information as needed (see *Editing the Header*).

d. Select **Footer** from the **View** menu. Load, edit, or save the footer information as needed (see *Editing the Footer*).

e. Select **Test Information** from the **View** menu. Load, edit, or save the test information as needed (see *Editing the Test Information*).

f. Select **Data** from the **View** menu to bring up the data screen.

g. From the **Report for Instrument:** box at the bottom of the screen, select an instrument number. The previously collected data for the selected instrument appears on the screen.

h. Edit the data if needed (see *Editing the Data*).

i. Click **Print Report** to print a report for the instrument selected using all of the information (header, footer, data, etc.) as currently edited.

j. Click **Save Report** to save the report to a text file. A dialog box appears asking for the destination path and filename. By default, the reports will be stored in the *\rptfiles* directory. The recommended file extension is *.rpt.*

k. Enter a valid filename and click **OK**, or click **Cancel** to abort the file save process. Saved reports are stored as standard text files and may be imported into a word processor or text editor program for viewing or further editing at a later date.

l. Repeat steps **c** through **k** as needed for each of the instruments requiring reports.

Editing the Header

The report header is printed at the top of each report and should contain fixed information such as Company Name, Address, etc. Several report headers may be created and saved for use with different types of report styles. For example, a different header would most likely be used when printing a report on letterhead rather than on plain paper. The header information on the screen at the time of printing or saving a report is the information that is used for that report.

a. If not already in the Report Editor, select **Report Editor...** from the **Reports** menu.

b. If the Header window is not visible, select **Header** from the Report Editor's **View** menu.

c. Using normal text editing procedures, edit the header text as needed. Add blank lines (using the *Return* key) at the top of the header to shift the entire report downward as needed. The header can be centered visually using spaces to the left of each line.

Saving a Report Header

a. Once edited, save the header for later recall by selecting **Header...** from the **Save** sub menu of the Report Editor's **File** menu.

b. From the dialog box that appears, enter an appropriate header filename. Use a *.hdr* suffix when naming header files. This makes it easier to distinguish them from other types of files when recalling them later.

Recalling a Previously Stored Report Header

a. Select **Header...** from the **Open** sub menu of the Report Editor's **File** menu. A list of any previously created header files is displayed (files with a *.hdr* suffix).

b. Select a header file from the list, or enter a valid filename in the dialog box that appears. Click **OK** to load the header selected, or click **Cancel** to abort the load process and retain the current header information.

Saving a Default Report Header

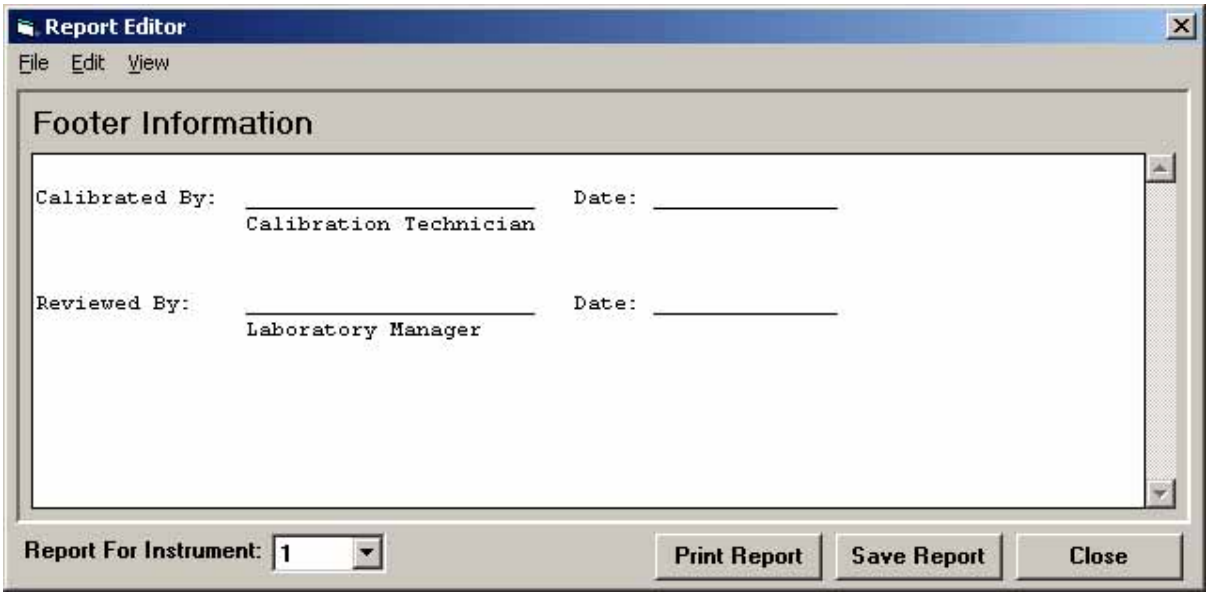
To make a header the default, create the report header and save it as *\sysfiles\header.hdr*.

Editing the Footer

The report footer is printed at the bottom of each report and should contain fixed information such as technician name, signature and date lines, etc. Several report footers may be created and saved for use by different technicians. The footer information on the screen at the time of printing or saving a report is the information that is used for that report.

a. If not already in the Report Editor, select **Report Editor...** from the **Reports** menu.

b. If the Footer window is not visible, select **Footer** from the Report Editor's **View** menu.



c. Using normal text editing procedures, edit the footer text as needed.

Saving a Report Footer

a. Once edited, save the footer for later recall by selecting **Footer...** from the **Save** sub menu of the Report Editor's **File** menu.

b. From the dialog box that appears, enter an appropriate footer filename. Use a *.ftr* suffix when naming footer files. This makes it easier to distinguish them from other types of files when recalling them later.

Recalling a Previously Stored Report Footer

a. Select **Footer...** from the **Open** sub menu of the Report Editor's **File** menu. A list of any previously created footer files is displayed (files with a *.ftr* suffix).

b. Select a footer file from the list, or enter a valid filename in the dialog box that appears. Click **OK** to load the footer selected, or click **Cancel** to abort the load process and retain the current footer information.

Saving a Default Report Footer

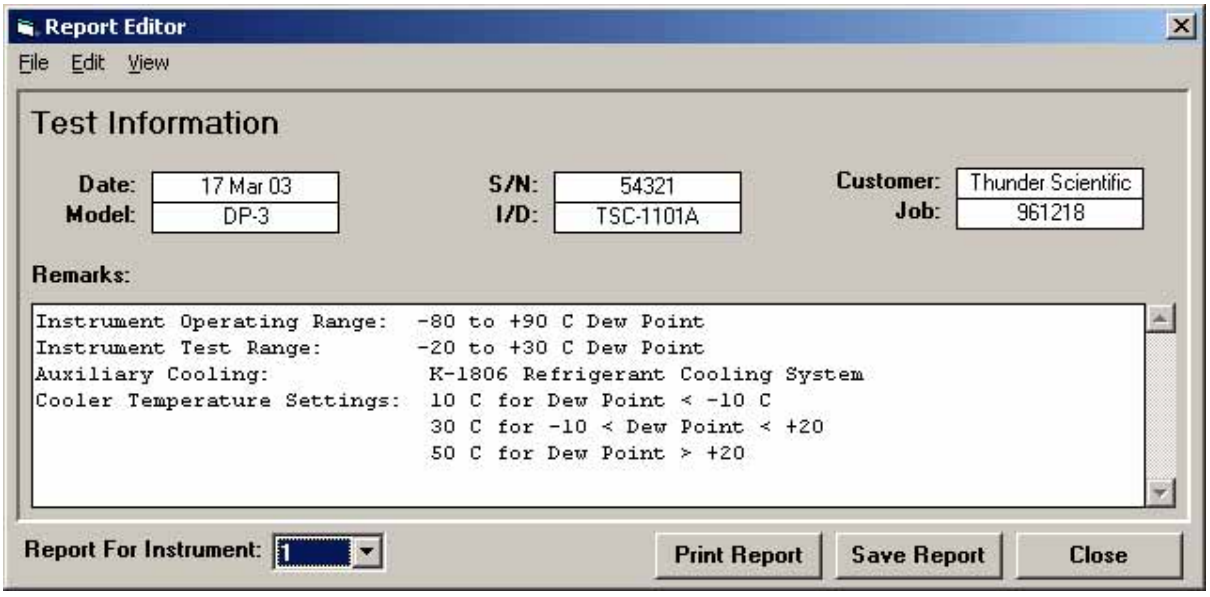
To make a footer the default, create the report footer and save it as *\sysfiles\footer.ftr*.

Editing the Test Information

The test information is printed immediately after the header of each report and should contain fixed information such as serial number, model number, etc. specific to the instrument under test. Since test information is device specific, several test information files may be created and stored for later recall. The test information on the screen at the time of printing or saving is the information that is used for that report.

a. If not already in the Report Editor, select **Report Editor...** from the **Reports** menu.

b. If the Test Information window is not visible, select **Test Information** from the Report Editor's **View** menu. The Test Information window appears.



c. Using normal text editing procedures, edit the remarks area of the test information section as needed.

d. Using normal data entry procedures, edit any or all fixed data items such as Serial Number, Model Number, etc. If an entry is left blank, then neither the title or the entry will appear on the report.

e. To change the titles of the fixed data items, hold the *Ctrl* key and click directly on the title itself. You will be prompted for a new title for that item.

Saving the Test Information

a. Once edited, save the test information for later recall by selecting **Test Information...** from the **Save** sub menu of the Report Editor's **File** menu..

c. From the dialog box that appears, enter an appropriate Test Information filename. Use a *.msc* suffix when naming test information files. This makes it easier to distinguish them from other types of files when recalling them later.

Recalling Previously Stored Test Information

a. Select **Test Information...** from the **Open** sub menu of the Report Editor's **File** menu. A list of any previously created test information files is displayed (files with a *.msc* suffix).

b. Select a test information file from the list, or enter a valid filename in the dialog box that appears. Click **OK** to load the test information selected, or click **Cancel** to abort the load process and retain the current test information.

Saving the Default Test Information

To make the current test information the default, create the report footer and save it as *\sysfiles\misc.msc.*

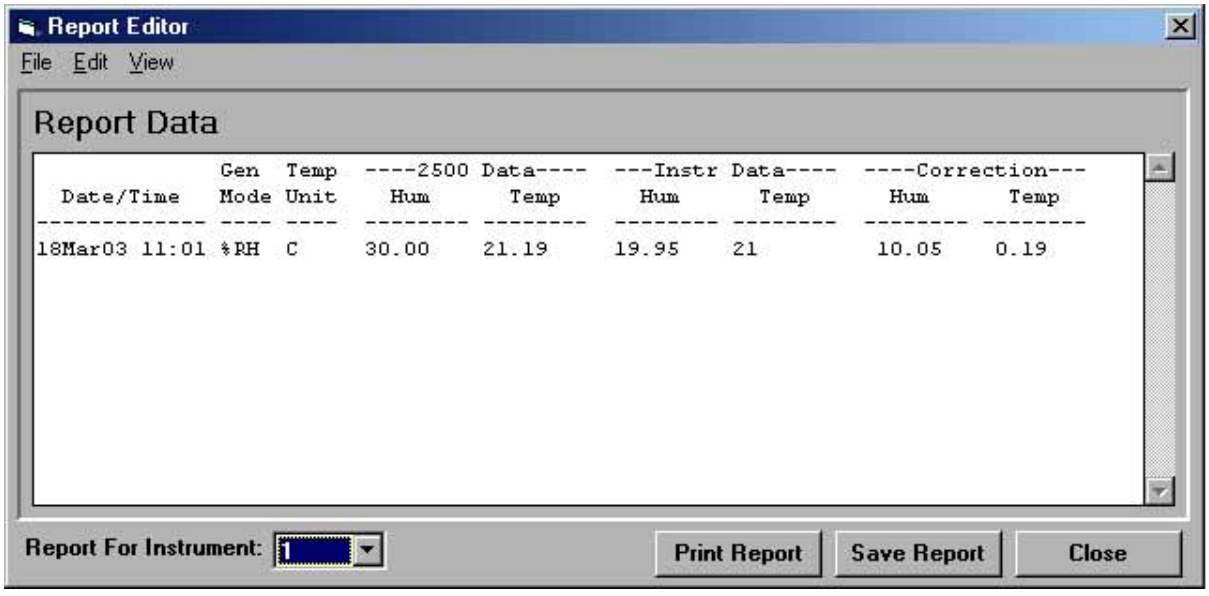
Editing the Data

The report data is printed immediately following the test information and contains previously collected data for the specified instrument. Prior to printing or saving the report, the data may be viewed and edited. The data as it is on the screen at the time of printing or saving a report is the data that is used for that report.

Selecting the Test Instrument Data

a. If not already in the Report Editor, select **Report Editor...** from the **Reports** menu.

b. If the Data window is not visible, select **Data** from the Report Editor's **View** menu. The Data window appears.



c. From the **Report for Instrument:** box at the bottom of the screen, select an instrument number. The previously stored data for the selected instrument appears on the screen.

Prior to printing or saving, the data text may be edited as needed using normal text editing procedures.

Alternate Report Generation

In addition to the report files already discussed, use of the 9800 Data Acquisition automatically provides for an alternate data storage. This file is named with a time/date stamp stored in the /datfiles directory. One file is written for each run, and contains one entry per channel for each setpoint, in addition to the corresponding humidity and temperature generated at each of these points. The data is stored in a consistent format, with descriptive headers, and fixed columns. This file is written at the completion of each run and is named with a 14 character time stamp filename of the form yyyymmddhhmmss containing the year, month, day, hour, minute, and second the file was created. This results in a unique file name for each individual run. This file may be used in your own custom report generation program. Custom Report Generation programs can be written using third party tools such as Excel, Visual Basic, and others.

8

Auto Profiling

The Auto Profiling mode of operation is very similar to the Generate mode with the main exception that profiling relies on a predefined list of referred to as a *profile*. The user configurable profile is used as ControLog's road map during Auto Profile operation. It defines which setpoint values to go to, at what rate to go from one setpoint to another, and how long to stay at a specific setpoint before moving to the next one.

> **Note-** *Before attempting to operate the system in an Auto Profile mode, you should become thoroughly familiar with the Generate mode of operation.*

It is assumed in this section that either the 9800 Data Acquisition System has already been configured (see *Data Acquisition*) or it was OFF while ControLog was started.

Creating a Profile

A profile is a list of humidity, temperature, pressure, flow, and time parameters that are used during automated control of the 2500 generator. The profile essentially programs the computer/controller operations.

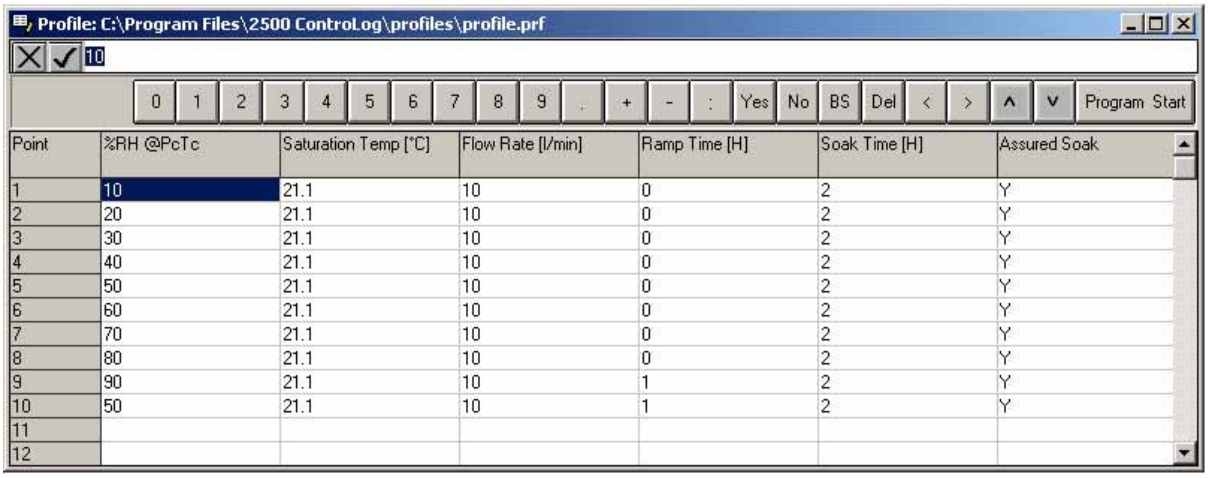
Prior to operating in the Auto Profile mode, a profile must be created, or a previously created profile must be recalled from disk. In either case, a profile must currently be loaded into ControLog and be visible on the Profile window.

Creating a profile consists of several steps:

- Showing the Profile window
- Clearing any existing profile if desired
- Selecting the mode of humidity control
- Selecting units for temperature, pressure, flow, etc.
- Entering the profile data
- Editing assurance conditions
- Enabling/disabling historical information

Show the Profile Window

a. Select **Profile** from the **Window** menu. The Profile window appears.



Point	%RH @PcTc	Saturation Temp [°C]	Flow Rate [l/min]	Ramp Time [H]	Soak Time [H]	Assured Soak
1	10	21.1	10	0	2	Y
2	20	21.1	10	0	2	Y
3	30	21.1	10	0	2	Y
4	40	21.1	10	0	2	Y
5	50	21.1	10	0	2	Y
6	60	21.1	10	0	2	Y
7	70	21.1	10	0	2	Y
8	80	21.1	10	0	2	Y
9	90	21.1	10	1	2	Y
10	50	21.1	10	1	2	Y
11						
12						

The first column, next to the point numbers, contains values of humidity to generate and is titled at the top according to the currently selected profile humidity control mode. In the example shown, the profile humidity control mode is set to %RH @Pc. Whenever the profile humidity control mode is changed, the title on this column changes to reflect the mode selected.

The *Saturation Temp* column contains the saturation temperature setpoint and should be set to the desired test temperature. Temperature values are entered and displayed in the currently selected profile units.

The *Flow Rate* column contains values of system air flow at which the generator will operate. Although not affecting the generated value of humidity, flow rate does affect the air exchange rate within the test chamber and the equilibration time of any instruments under test.

Ramp Time is the desired amount of time that the 2500 should take to transition from one profile test point to another. Setting a ramp time of 0 (zero) instructs the 2500 to make the transition as quickly as possible. 0 (zero) is the setting used for most applications.

Soak Time is the desired amount of time to generate at a particular profile point. The soak time required depends on the application, but should be at least 10 to 15 minutes, depending upon the humidity measurement devices being calibrated.

Assured Soak, if set to *Y*, forces the system to wait until measured values are within a specified tolerance and stability before the computer starts the Soak Phase. If *N* is set, the Soak Phase will start immediately upon completion of the Ramp Phase.

Clear old Profile Data

b. Select **New Profile...** from the **Profile** menu. While this is not a requirement, clearing the old profile data allows you to start with a blank profile window.

Set the Profile Humidity Mode

c. From the **Profile** menu, select **Mode.**

d. From the **Mode** submenu, select the desired profile humidity control mode.

Upon selection, the new mode caption with its units will appear as the title of the profile window's humidity value column. The data in the humidity value column will be cleared if the new mode is not similar to the old profile mode (such as when changing from Frost Point to PPMv).

Set the Profile Units

e. From the **Profile** menu, select **Units**.

f. From the **Units** submenu, select the unit type to change, and finally the actual units desired.

The profile units are for use in entering the profile only and affect nothing else but the profile window (note the units indicators in the profile window's column headings). Setting the profile units will not change the systems units. If you want the systems units to be the same as the profile's, you must change them separately.

Enter the Profile Data

g. Click once on the cell of any value needing change. It is usually best to start at the upper leftmost cell.

h. Edit the value, then press either the *Return* or *Enter* key, or click on the checkmark button at the upper left area of the profile window. (Clicking the X button cancels the entry, leaving the value unchanged.)

i. Enter all required values of humidity, temperature, pressure, flow, ramp time, soak time, and either a "Y" or "N" for assured soak. Pressing *Return*, *Enter*, or clicking the checkmark button after each entered value advances the cursor to the next parameter.

j. Enter all remaining profile lines in the same manner. To make corrections to an existing profile item, simply select and edit the data for that cell.

As the points are entered, the computer will predict the next value based on previous points entered. If these predictions are not correct simply enter the correct value desired.

Each Profile entry is validated at time of entry as you are moving across the profile line. This validation is to assure that each entry is within system tolerances.

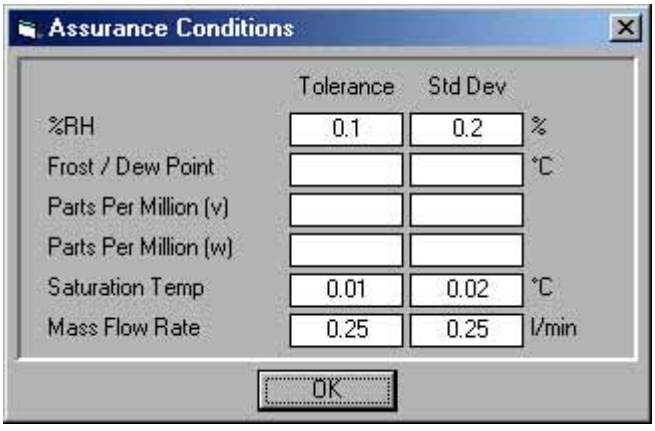
When moving from one line to another, the entire line is validated with respect to all other items contained on that profile line. Any invalid entry will cause a message box to appear and the value that may be causing the problem to be hilighted.

While an item that is left empty is a valid entry choice, all items on the line must be completed in order for the line to used. When the system is operating in Auto Profile mode, the first line encountered with a missing entry is considered the end of the profile, causing the system to shut down when that line is reached.

Set the Assurance Conditions

Assurance conditions are user specified tolerances between setpoint and measured values. If assured soak is to be used (any "Y" in the assured soak column), then these tolerances must be met during the Assurance Phase before the Soak Phase begins.

k. Select **Assurance Conditions...** from the **Profile** menu. The following dialog box appears.



l. Edit the values of Tolerance and Std Dev as required. For quicker Assurance times, increase the Tolerance and/or the Std Dev values. Tighter tolerances or standard deviations (smaller values) result in longer Assurance times. Setting these values too small could prevent assurance conditions from being met, therefore preventing the system from advancing to the next profile point. Although all parameters may be edited, only the humidity parameter of the currently selected control mode and the lower system parameter tolerance values will affect assurance conditions.

A tolerance or standard deviation value left blank will always meet the assurance conditions.

m. Click **OK** to accept the assurance conditions as entered and close the window.

Enable/Disable Historical Data

The historical data feature of the profile allows you to retain a record of the generator's performance for long term comparison or repeatability analysis. When historical data is enabled, each point of a given profile will maintain a separate data file of the soak phase data collected for that point during the profile run. The data files have the same name as the profile itself, but the first point will have the suffix *.001*, the second point will have the suffix *.002*, etc. Each time this same profile is run, the new soak data is appended to the existing data in the appropriate historical files. These files are located in the same place as the original profile which is usually the *profiles* directory.

n. Selecting **Append to Historical Files** from the **Profile** menu enables and disables the historical data feature. When enabled, a √ appears in front of the menu item.

After completing all of the steps in the profile entry process, the profile is ready to be used to control the operation of the 2500. There is no requirement for the profile to be saved to disk in order to be used. However, you will find that a given profile is often times run more than once. It is to your advantage to save it so that you don't have to re-create it each time.

Saving a Profile

Once a profile is properly entered, the assurance conditions set, and the historical data decision made, it may be save to disk for later retrieval. Profiles are normally saved to the *profiles* directory and it is recommended that an extension of *.prf* be used.

a. Save a profile to disk by selecting **Save Profile...** from the **Profile** menu.

b. In the dialog box that appears, supply a valid path and filename, then click **OK**.

Once saved, the Profile window title will indicate the new profile name. The existence of a profile path name on the Profile window title bar is an indication that the profile currently in memory matches the profile of the same name stored on disk.

A profile window that is titled **Profile: Untitled** indicates that either the profile has not yet been saved, or has been altered after loading. This occurs if the profile points are edited after being saved. Profiles are saved with all attributes such as control mode, units, assurance conditions, historical data mode, etc. Changing assurance conditions or historical data mode after loading does not affect the profile window title.

Saving a Profile as the Default

To make a specific profile the default, which loads automatically at power-up, save it as *sysfiles**profile.prf*.

Loading an Existing Profile

a. To retrieve a previously saved profile from disk, select **Open Profile...** from the **Profile** menu.

b. In the dialog box that appears, choose an existing profile filename, then click OK.

When opened, the profile is verified and then loaded into memory. The previous profile is cleared from memory and the new profile is loaded with all the attributes that it was saved with, including units, assurance conditions, and historical data mode.

Printing a Profile

To print a copy of the profile in memory, select **Print Profile** from the **Profile** menu. It is best to save the profile to disk before printing so that the profile name will also be printed.

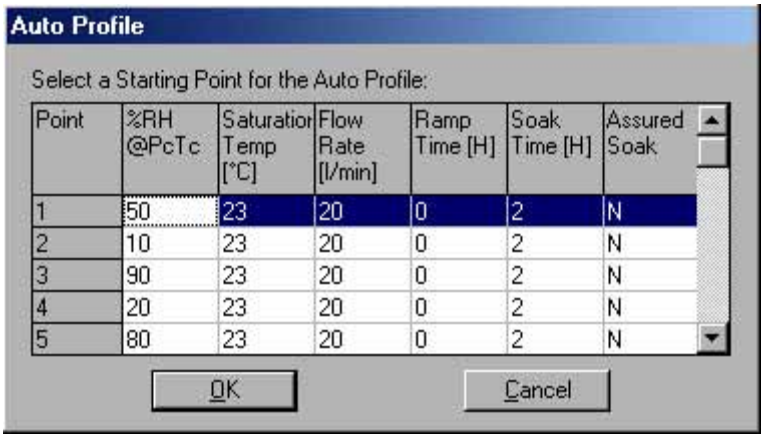
Starting Auto Profile

a. Check the Profile window to assure the profile you want to run exists in the system memory.

b. If profile uses assurance conditions, verify assurance conditions are correctly specified.

c. Select **Auto Profile** from the **Run** menu.

d. Select the starting point from those listed in the dialog box, then click **OK**.



The selected starting point will be entered into the appropriate setpoint fields of the Control Parameters window and the generator will start-up in the same fashion as a normal Generate mode. While operating the system in the Auto Profile mode, setpoint changes in the Control Parameters window are not allowed. Also, if changes are made with the 2500 keypad directly, they will quickly be overridden by ControLog.

You may, however, make changes to the profile itself while it is executing. Changes made to any points beyond the currently executing one will be effective. But changes made to the current point or any prior ones are ignored.

To see which point and phase is being executed, use the System Timing window.

Stopping Auto Profile

A Shutdown may be performed at any time during a profile but will automatically occur when the last soak phase has been completed.

Another way to exit the Auto Profile is to switch from Auto Profile to Generate. The current setpoints for Saturation Pressure, Saturation Temperature and Flow are used to continue control of the system in Generate mode.

Understanding *Phase* and *Point*

Each profile *point* consists of three distinct *phases*; Ramp, Assurance and Soak. Each phase accomplishes a specified task.

The Ramp phase is used to linearly transition from one *point'* to the next *point'* in a given amount of time.

The Assurance phase forces the system to wait until measured parameters and setpoint values are within a specified tolerance and stability before the computer starts the Soak Phase.

The Soak phase is the desired amount of time to generate the particular profile point before proceeding to the next point.

Examples of Ramp/Soak/Assured Soak Phase combinations:

	Ramp Time	Soak Time	Assured Soak
Example 1:	0	1	N

Example 1 causes the Soak phase to begin immediately at the start of the profile point, even though the 2500 may still be adjusting to the point. The next point will start after the 1 hour soak phase.

	Ramp Time	Soak Time	Assured Soak
Example 2:	0	1	Y

Example 2 causes the Assurance phase to begin immediately at the start of the profile point. The measured values are continually compared with the setpoint values until they agree to within a set tolerance and the measured values are stable to within the specified degree. Once assured (tolerances met) the Soak phase begins. Total time required for this point is variable and depends upon the amount of time that is required for assurance (dictated by tolerances). Total time for example 2 is elapsed assurance time plus 1 hour.

	Ramp Time	Soak Time	Assured Soak
Example 3:	.5	1	Y

The Ramp phase (Ramp Timer) begins at the start of the point. The system adjusts slowly toward the setpoint, taking 30 minutes. Once the Ramp Time has elapsed, Assurance starts and waits for tolerances to be met. When tolerances are met, the Soak phase begins and last 1 hour. Total time for example 3 is 30 minutes, plus elapsed Assurance time, plus 1 hour. Assurance time is a variable and depends on tolerances.

Manual Override of Profile

Although the system is operating automatically, some manual control is allowed using the **Hold Point**, **Next Phase** and **Next Point** menu items on the **Run** menu.

Holding the Profile

Selecting **Hold Point** from the **Run** menu stops the current "Remaining Time" timers, allowing the system to remain indefinitely at the current point. While in a hold mode, the system is prevented from completing the ramp, assurance, or soak phases or a point. When holding, a √ appears in front of the menu item and hold indicator appears in the System Timing window.

To resume the profile point select the menu item again. This re-enables the timing functions and allows the profile to resume normal operation.

Advancing to the Next Phase

Selecting **Next Phase** from the **Run** menu manually duplicates the action which automatically occurs when a Remaining Ramp or Soak Time counter reaches 0 (zero), or when the assurance conditions are met. In other words, it causes Ramp Phase to proceed to the Assurance or Soak Phase, Assurance to proceed to Soak, or Soak to proceed to Ramp of the next profile point. This allows for early manual termination of any phase within a profile point.

Advancing to the Next Point

Selecting Next Point from the Run menu manually duplicates the action which automatically occurs when the Point time counter reaches 0 (zero).

Auto Profiling with Data Acquisition

If ControLog recognizes that the 9800 Data Acquisition System is connected and powered on, the Auto Profile mode cannot be enabled until after the Data Acquisition System has been configured. See *Data Acquisition*.

When used with the 9800 Data Acquisition System, data is automatically sampled and stored for each active channel to the time/date stamped file in the *\datfiles* directory. One line entry is made to the file for each setpoint executed. Data is stored at the end of each point just prior to the start of the next point (or completion of the profile if on the last point).

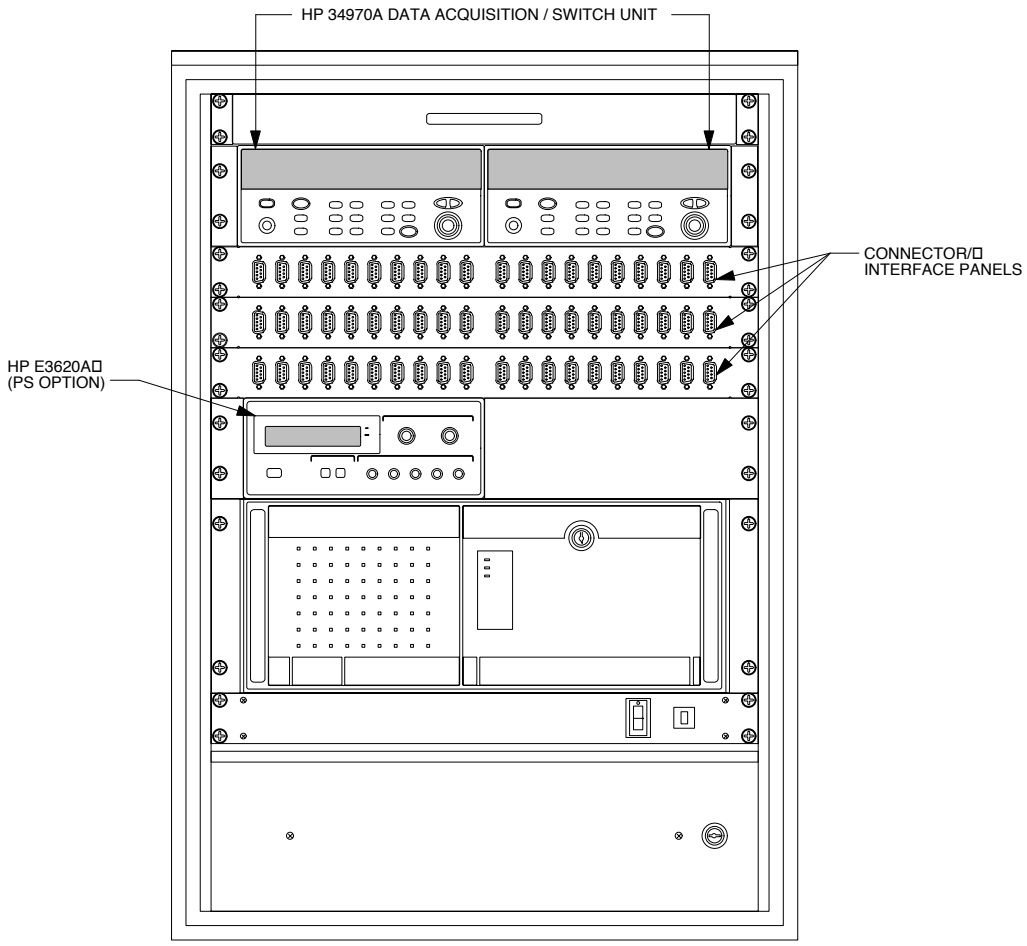
9

Data Acquisition

When used with the 9800 Data Acquisition System, ControLog has the ability to measure and record data for up to 30 channel-pairs of humidity and temperature. The raw signals can be voltage, current, or resistance (either 2 or 4 wire). It can scale the raw measured data to humidity and temperature units, and can then use this data to compute an alternate humidity expression. For example, if a channel is configured to measure the dewpoint from a chilled mirror hygrometer, this dewpoint can then be used to automatically compute %RH.

In addition to the 30 channel-pairs of temperature and humidity, there are also 30 channels of auxiliary temperature measurement which are coupled with the humidity/temperature channels. These auxiliary temperatures, when their probes are placed in close physical proximity to the humidity measurement device of their corresponding humidity/temperature channel, can be used to automatically correct the measured humidity for temperature differences between them and the 2500's chamber temperature sensor. This is most useful when working with Relative Humidity. RH is dependent upon temperature, meaning that a temperature gradient in the chamber of the 2500 will result in a corresponding RH gradient as well. By using the auxiliary temperature probes, one mounted in close physical proximity to each of the humidity measurement probes, the temperature gradients, and thus the RH gradients, can automatically be accounted for.

9800 Data Acquisition System



Setting up for Data Acquisition

When the ControLog program is launched, it looks for the presence of the 9800 as one of its initialization sequences. It queries the HP34970A meters within the 9800 looking for an expected response. If it finds that both meters are connected and responding properly, it loads the remainder of the code required to utilize them. If for some reason the HP34970A meters do not respond properly (power off, improper communication settings, etc.) then the Data Acquisition section of ControLog is completely removed, and operation reverts to that of standard ControLog. So what this means is that prior to launching ControLog, ensure that the HP34970A meters are turned on and that their communication interfaces are properly configured.

HP34970A Communication Interface

The HP34970A meters are connected to ControLog via RS-232 communication. As shipped from the factory, communication parameter defaults for ControLog are set to COM3 for the left HP34970A, and COM4 for the right one. Both communicate with the following parameters:

Baud Rate: 9600
Data Bits: 8
Parity: N
Stop Bits: 1
Handshaking: RTS/CTS

The HP34970A meters will have been set up prior to shipment from the factory. If for some reason you need to view or change these parameters, please refer to the applicable HP instruction manual. However, here is an abbreviated set of instructions:

Press ***Shift*** then ***Interface*** on the HP front panel. The display should show either *HPIB* or *RS-232*.
Using the dial knob, select *RS-232*.

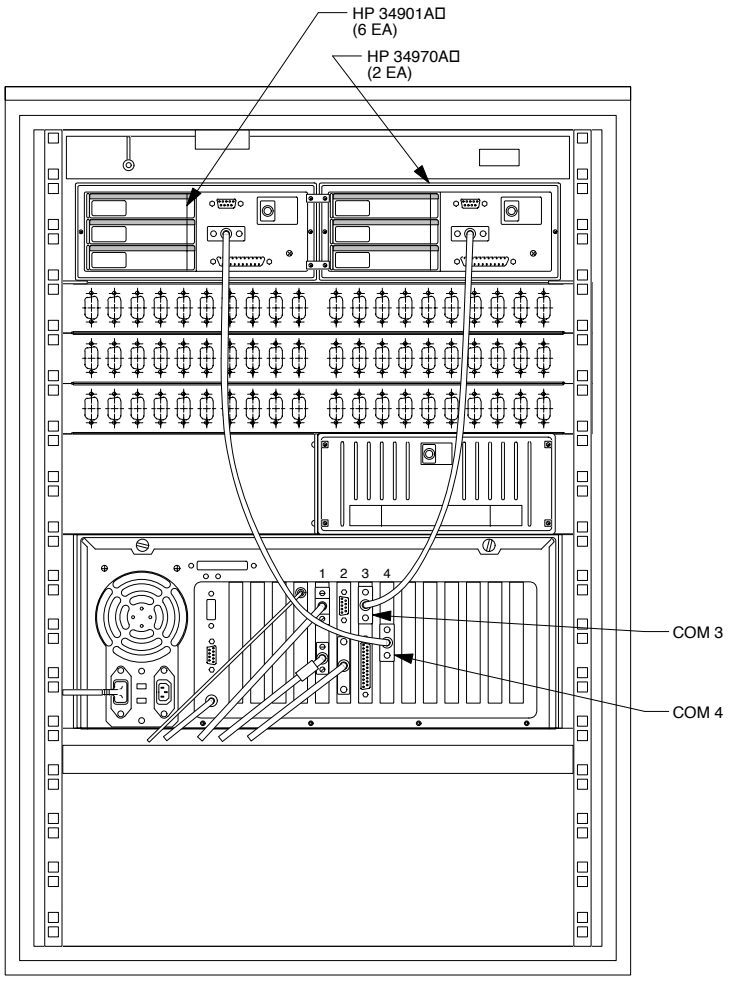
Press ***Interface*** again. The baud rate should appear.
Using the dial knob, select *9600 BAUD*.

Press ***Interface*** again. The data bits, parity, and stop bits should appear.
Use the dial knob to set these parameters to *NONE, 8 BITS*.

Press ***Interface*** again. The handshaking parameters appear.
Use the dial knob to set the handshaking to *FLOW RTS/CTS*.

Press ***Interface*** again to finish setting up the communications, causing the HP to accept the changes.

Ensure that the RS-232 cables are properly connected. The left HP (as viewed from the front) must connect to the computers COM3 port. The right HP (as viewed from the front) connects to the computers COM4 port.



REAR VIEW

Ensuring the 9800 Detection

If the Data Acquisition System was detected properly while ControLog was launching, then two new items, *Channel Monitor* and *Data Acquisition*, appear at the bottom of the *Window* menu. When these two items are there, ControLog has successfully identified the HP34970A meters, both serial ports are properly connected, and the communication parameters are most likely correct.

If *Channel Monitor* and *Data Acquisition* do not appear at the bottom of the *Window* menu, then one or both of the HP34970A meters was not properly detected. In this case, ControLog reverts to its standard mode of operation and makes no further attempt to communicate with the data acquisition system until it is exited and re-launched. In this way, ControLog will still launch and run normally on non-9800 systems.

The following things can cause ControLog to fail in its attempt to detect the 9800:

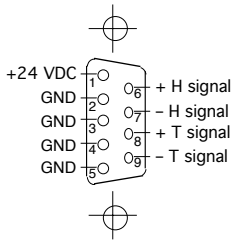
- One or both of the HP34970A meters not powered on,
- One or more of the three plug in cards (HP34901A 20-channel multiplexer) in each HP34970A incorrect or missing,

- RS-232 cables not connected,
- RS-232 cables connected to the wrong COM ports,
- RS-232 parameter mismatch between the computer and either HP34970A.

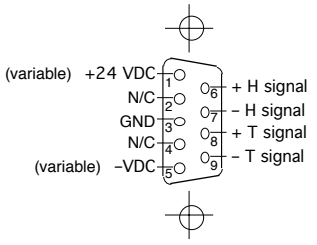
If this problem is encountered, see *The HP34970A Communication Interface*.

Hardware Connection of Instruments

The 9800 can connect to a variety of instrument types with a variety of output options including voltage, current, resistance, and temperature detectors. The HP34970A meters that make the actual measurements are connected to the front panel of the 9800 in channel-pairs of 2 wires each. This means that there are 4 wires per channel pair. For the left side of the connector/interface panel, there are two wires for humidity measurement, and 2 wires for temperature measurement. On the right side of the connector/interface panel, there are 4 wires for resistance (or temperature) measurement of an auxiliary temperature probe. All measurement channels of the HP34970A have fully floating, differential inputs. Both panels also have a power and ground signal for powering transducers directly if desired. Depending upon the specific 9800 system, the power will either be 24 VDC single ended, or a bipolar (plus and minus) variable power supply connection along with a ground connection. On this later system, there are 3 wires used for power. These connections are brought to the pins of the DB-9 connectors with the following pinout:



The latter system discussed has a slightly different pinout for the power connections:



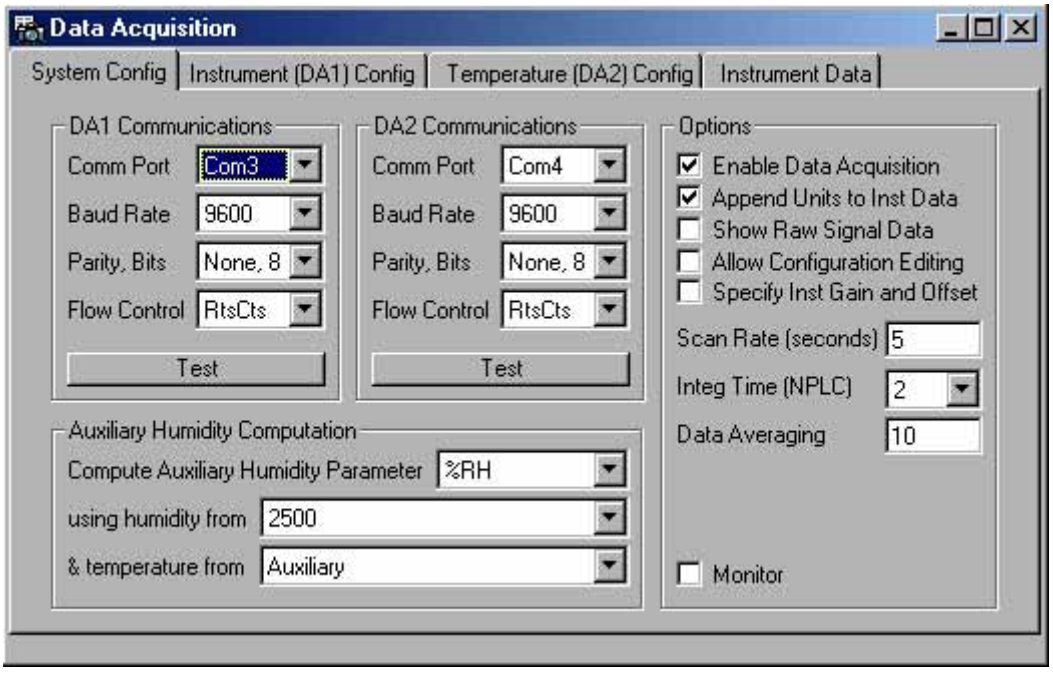
Specific personality modules are then used to make the appropriate connections between the instruments under test (or the auxiliary temperature probes) and the data panel. The transition is also made in the personality modules for grounding of the appropriate signal lines in the case of single ended instrument outputs, since the HP34970A has differential inputs. It is also in the personality modules that the power supply connections to the instrument are properly routed. When needed, a module with a current dropping resistor is used to properly convert a loop current to a voltage in order to be measured. The value of

this dropping resistor is stored in the sysfiles\daux.ini file and is used to mathematically determine the value of the current that produced the voltage measured (*see The Daux.ini file*).

There are several different personality modules, each terminating for user connection into an RJ-45 or RJ-11 connector for quick connection/disconnection and easy replacement. For details of the specific modules available, or for a determination of the exact modules needed for your application, please consult the factory.

System Configuration

Prior to collecting data, and prior to generating, the Data Acquisition System must first be configured. This is done through the Data Acquisition window. To bring up the Data Acquisition window, select *Data Acquisition* from the *Window* menu. The following window appears.



The *System Config* tab in the Data Acquisition window shows parameters and options which affect the way ControLog and the Data Acquisition system communicate, the method used to compute auxiliary humidity parameters, and some options regarding measuring, averaging, and viewing of data.

DA1 and DA2 Communications

The DA1 and DA2 Communications sections are used to set the communications parameters of the computer so it will match those of the left and right HP34970A meters respectively. These selection boxes are generally locked out so that changes can not be made. When unlocked (see *Allow Configuration Editing*), changes can be made to the various parameters that can then be tested with the Test button. The Test button sends a message request to the HP34970A for its ID name. The response from the HP34970A, if any, is displayed in a small window.

Regardless of the selected parameters, ControLog always reverts back to a set of default parameters each time it is launched. These default parameters are stored within an *ini* file. The only way to permanently change the defaults that ControLog launches with is to change the parameters in this *ini* file. For further discussion of the ini file parameters, see *The Daux.ini File*.

Auxiliary Humidity Computations

In addition to measuring humidity and temperature from connected devices, ControLog can compute an alternate humidity parameter (Relative Humidity, Dew Point, or Frost Point) to display alongside the measured humidity value. For instance, if your device measures Relative Humidity, but you want to also compute the Dew Point, you can do automatically by properly setting the Auxiliary Humidity Computations. Or, if your device measures Relative Humidity, and you want it to be compensated for temperature gradients, this is possible also. Any one of the following parameters may be selected in any possible combination:

Compute Auxiliary	using	and
Relative Humidity	2500 Humidity	2500 Chamber Temperature
Dew Point	Instrument Humidity	Instrument Temperature
Frost Point		Auxiliary Temperature

The only requirement is that there be a defined Compute parameter, and that the sources of humidity and temperature data be defined. ControLog takes care of the various units conversions that may be required to accomplish the selected computation. The auxiliary humidity that is computed, along with the measured instrument and auxiliary temperature data, will appear in columns in the *Instrument Data* tab.

The Auxiliary Humidity Computation area is normally locked out, and must be unlocked in order to make changes. See Allow Configuration Editing to unlock the Auxiliary Humidity Configuration area. Any changes you make will only be temporary. Regardless of the selected parameters, ControLog always reverts back to a set of default parameters each time it is launched. These default parameters are stored within an *ini* file. The only way to permanently change the defaults that ControLog launches with is to change the parameters in this *ini* file. For further discussion of the *ini* file parameters, see *The Daux.ini File*.

Options

There are a few options which allow you to modify the way that ControLog shows configuration and instrument data, how often it scans the data, and how it averages. Any changes you make to these options will only be temporary. Regardless of the selected options, ControLog always reverts back to a set of default options each time it is launched. These default options are stored within an *ini* file. The only way to permanently change the options that ControLog launches with is to change the parameters in this *ini* file. For further discussion of the *ini* file parameters, see *The Daux.ini File*.

Enable Data Acquisition

This option allows you to turn off the data acquisition system so you can run ControLog without requiring measurements to be taken from instruments. This option is normally left ON and is generally used only when troubleshooting a problem between ControLog and the Data Acquisition System.

Append Units to Inst Data

This option, when selected, appends units to the measured data which is shown in the *Instrument Data* tab. If copying and pasting the data from the *Instrument Data* tab and using it in other programs, like spreadsheets for example, you may want to de-select this unit's option. Some other programs require numeric value only and cannot properly deal with the appended units. ControLog handles the data properly either way. If the data is not being copied and pasted into any other application, then the choice about appending units to the data is one based solely on personal preference of the current user.

Show Raw Signal Data

When selected, the Instrument Data tab now only shows the scaled instrument humidity and temperature data, it also shows the raw voltage, current, or resistance data it measured for the particular channel. Selection of this option is based solely on the personal preferences of the current user.

Allow Configuration Editing

When de-selected (default), no configuration changes can be made within the System Configuration (except these options), within the Instrument Configuration tab (except to enable/disable a channel), or within the Temperature Configuration tab. This prevents things from inadvertently being changed.

When attempting to select this option, a password is required. Without the proper password, this option may not be selected. There are two levels of password protection.

The lowest password level allows for user configuration within the *Instrument Config* and *Temperature Config* tabs in order to define measurement type, scaling factors, units, etc.

The highest level password allows the same possibilities as the lowest level, but additionally allows for editing of the parameters within the *System Config* tab.

Specify Instrument Gain and Offset

Scaling of the raw instrument data into usable humidity and/or temperature values may be done in either of two ways. Assume that the signal output from a particular sensor is 4 to 20 mA, and that represents 0 to 100% RH. One way to configure the channel for this data scaling is to specify (enter in) the low and high raw values (4, 20) and the low and high scaled values (0,100). ControLog then internally computes the gain and offset needed (in this case 6.25 and ñ25 respectively) to perform the required scaling.

The other way to configure the system for the scaling requirement is to specify the gain and offset values directly. As with the example above, the values to enter would be 6.25 and ñ25. What this means is that the raw signal is to be multiplied by 6.25, then ñ25 is to added to it. For example, 4 mA, when multiplied by 6.25 and added to ñ25, results in a value of 0. And 20 mA, when multiplied by 6.25 and added to ñ25, results in a value of 100.

The column heading within the Instrument Config tab change to reflect the method selected for specifying the scaling parameters.

Scan Rate

The scan rate is the number of seconds to wait between scans of the data acquisition system. Allowable values are from 1 to 60 seconds. The scan rate will depend upon your particular requirements, and requires some consideration of the amount of integration time and averaging used. Fast scan rates do not mix with high integration times. A 5 to 20 second scan rate is typical.

Integ Time (NPLC)

Integration time is the amount of time that the HP34970 will sample the data on each channel, and is specified as the number of power line cycles (NPLC). An integration time, or NPLC, of 1 means that the channel will be sampled for 1/60th of a second to determine its measured value. So in theory, with an integration time of 1, a full system of 60 channels of data (30 humidities and 30 temperatures) could be sampled in a matter of just 1-second. However, this does not include the time required for channel switching, switch settling, auto-ranging, or RS-232 communication. In practice, a scan of a fully loaded system of 30 humidity and 30 temperature channels, along with 30 auxiliary temperature channels, takes several seconds to make a complete scan of all channels with an NPLC of 1. In the case of an integration time of 2 or below, it is the switching time and other factors that dominate the minimum scan time required.

With an NPLC of 10 and higher, the scan time becomes increasingly slower with these higher integration times. For example, an NPLC of 20, with a full system of 30 humidity, 30 temperatures, and 30 auxiliary temperatures, may take more than a minute to perform a complete scan. During the scan, all ControLog functions are temporarily locked out, including using the mouse to change windows or select menu items. Smaller integration values may result in somewhat noisier data, but allow for increased system response to user events and allow for better time management for ControLog so it can do other things, such as communicate with the 2500. Integration times of 2 or smaller are generally recommended.

Data Averaging

Noisy signals, whether from noisy sensors or from fast integration times (low NPLC numbers), may be averaged in order to improve the smoothness. The averaging scheme employed within the data acquisition system is that of a running average or low pass filter. Consider both the sampling rate and the integration time when selecting a data averaging value. Long integration rates and/or less frequent scans can adversely affect the data results if the averaging is also set high.

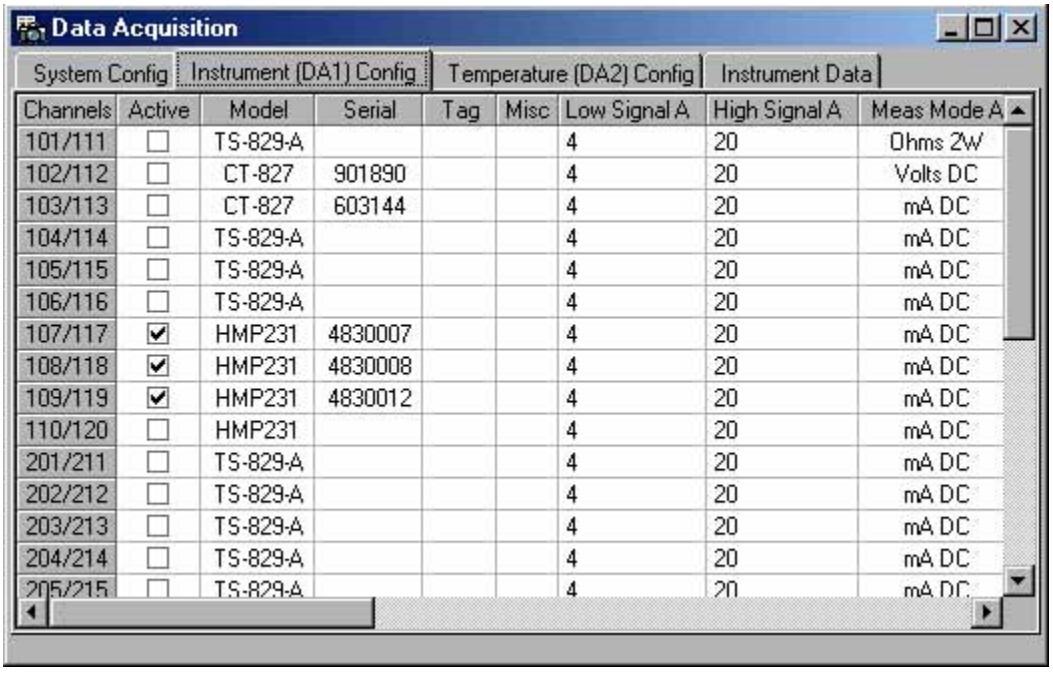
Data Averaging values up to 5 or 10 are typical. A value of 0 is used to disable averaging. Large values, near 100 for instance, are considered excessive and may result in a failure of the indicated data to reach the actual mean of the data being measured.

Monitor

The monitor option, when selected, causes the data acquisition system to begin scanning even though ControLog may not be in a generate mode. This is useful for testing channel configuration and that the channels are returning reasonable expected data. The data measured is visible within the *Instrument Data* tab. When ControLog is in a *Generate* or *Auto-Profile* mode, the *Monitor* option is disabled.

Instrument Configuration

The Instrument Configuration tab is used to configure the channels for the particular measurements to be performed. In this area, each instrument/channel combination is configured for measurement type, scaling, units, and associated sensor information such as model number and serial number.



Channels	Active	Model	Serial	Tag	Misc	Low Signal A	High Signal A	Meas Mode A
101/111	☐	TS-829-A				4	20	Ohms 2W
102/112	☐	CT-827	901890			4	20	Volts DC
103/113	☐	CT-827	603144			4	20	mA DC
104/114	☐	TS-829-A				4	20	mA DC
105/115	☐	TS-829-A				4	20	mA DC
106/116	☐	TS-829-A				4	20	mA DC
107/117	☑	HMP231	4830007			4	20	mA DC
108/118	☑	HMP231	4830008			4	20	mA DC
109/119	☑	HMP231	4830012			4	20	mA DC
110/120	☐	HMP231				4	20	mA DC
201/211	☐	TS-829-A				4	20	mA DC
202/212	☐	TS-829-A				4	20	mA DC
203/213	☐	TS-829-A				4	20	mA DC
204/214	☐	TS-829-A				4	20	mA DC
205/215	☐	TS-829-A				4	20	mA DC

Measurement and scaling parameters in this section apply to the left HP34970A only. All instruments are connected to this left HP34970A, while the right one is for auxiliary temperature measurements only.

> **Note 1)** No information within this tab can be edited unless the *Allow Configuration Editing* option is selected on the *System Config* tab.
>
> **Note 2)** All edited configurations, with the exception of the "active" column, will be saved upon power down.

Channels

There are thirty rows of paired channel numbers, with labels such as 101/111. This indicates that the first channel, for humidity, is identified as 101 on the HP34970A, and that the second channel in that pair is identified as 111 on the HP34970A, and is used for temperature.

Active

The Active column is used to select which channel-pairs to use. Any channel-pair, or combination of channel-pairs, may be selected. If a channel-pair is not selected as active, it will not be measured by ControLog, but it may still be configured to the parameters specified in the remainder of the row.

Channel-pair activation must be done prior to enabling the Generate or Auto-Profile mode, as updates to this area are locked out while running.

Channels may be individually selected/de-selected by either using the mouse, or tabbing to them then toggling on/off with the [Enter] key or space bar. To globally change all or a group of them at once, use the mouse to select and drag across the entire group. With them all highlighted, press the space bar to toggle the group on/off. To change all 30 of them at once, click directly on the column header *Active* then use the space bar to toggle them all on/off together.

Model

Use this field to enter a model number for the particular instrument under test that is currently connected to that channel. If there are several instruments with the same model number, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Serial

Use this field to enter a serial number for the particular instrument under test that is currently connected to that channel. Since serial numbers are unique (or at least should be), there is no global editing feature associated with the serial number cells. Serial numbers must be entered one at a time.

Tag

Use this field to enter a tag number (if applicable) for the particular instrument under test that is currently connected to that channel. If there are several instruments with the same tag number, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Misc

Use this field to enter any miscellaneous information desired for the particular instrument under test that is currently connected to that channel. If there are several instruments requiring the same miscellaneous information, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Low Signal A

Use this field to enter the instrument's lowest humidity output signal. For instance, if the instrument has a 4 to 20 mA humidity output, enter **4** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

High Signal A

Use this field to enter the instrument's highest humidity output signal. For instance, if the instrument has a 4 to 20 mA humidity output, enter **20** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Meas Mode A

Use this field to select the instrument's humidity output signal. For instance, if the instrument has a 4 to 20 mA output, select **mA DC** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Press the space bar or enter key to display allowed selections, select the desired value, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Low Value A

Use this field to enter the instrument's lowest humidity represented by the output signal. For instance, if the instrument's output is to represent 0 to 100% RH, enter **0** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

High Value A

Use this field to enter the instrument's highest humidity represented by the output signal. For instance, if the instrument's output is to represent 0 to 100% RH, enter **100** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Gain A (only visible if *Specify Inst Gain and Offset* option is selected within the *System Config* tab)

Use this field to enter the instrument's gain or scaling factor required to convert the raw output signal into the desired humidity value. For instance, if the instrument's output is 4 to 20 mA for 0 to 100% RH, compute the gain as

HumidityRange/SignalRange = [HighHumidity-LowHumidity] / [HighSignal/LowSignal]
= [100-0] / [20-4]
= 6.25

and enter **6.25** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Offset A (only visible if *Specify Inst Gain and Offset* option is selected within the *System Config* tab)

Use this field to enter the instrument's offset factor required to convert the raw output signal into the desired humidity value. For instance, if the instrument's output is 4 to 20 mA for 0 to 100% RH, compute the offset as

GainA * [LowHumidity -LowSignal] = 6.25* [0-4]
= -25

and enter **-25** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Units A

Use this field to select the humidity units to represent. For instance, if the instrument has a 4 to 20 mA output, for 0 to 100% RH, you would select **%RH**. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Press [Space Bar] or [Enter]to display allowed selections, select the desired value, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

When set to either Dew Point or Frost Point, this field reflects the units to use (˚C, ˚F, or K) during the measurement and scaling process only. The resulting Dew or Frost Point will then be displayed in the current ControLog temperature units.

Low Signal B

Use this field to enter the instrument's lowest temperature output signal. For instance, if the instrument has a 0 to 5 VDC temperature output, enter 0 here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

High Signal B

Use this field to enter the instrument's highest temperature output signal. For instance, if the instrument has a 0 to 5 VDC temperature output, enter 5 here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Meas Mode B

Use this field to select the instrument's type of temperature output signal. For instance, if the instrument has a 0 to 5 VDC output, select **Volts DC** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Press the space bar or enter key to display allowed selections, select the desired value, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

This channel is capable of measuring temperature directly from an RTD, PRT, or Thermistor, but is only capable of doing so in 2-wire mode. 4-wire measurement mode is not available on these channels. When using RTDs, PRTs, or Thermistors, it is best to set the GainB and OffsetB values to 1 and 0 respectively unless you have knowledge of other values specific to the probe from a previous calibration.

Low Value B

Use this field to enter the instrument's lowest temperature represented by the output signal. For instance, if the instrument's output is to represent 0 to 100˚F, enter **0** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

High Value B

Use this field to enter the instrument's highest temperature represented by the output signal. For instance, if the instrument's output is to represent 0 to 100˚F, enter **100** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Gain B (only visible if *Specify Inst Gain and Offset* option is selected within the *System Config* tab)

Use this field to enter the instrument's gain or scaling factor required to convert the raw output signal into the desired temperature value. For instance, if the instrument's output is 0 to 5 VDC for 0 to 100˚F, compute the gain as

TemperatureRange/SignalRange = [HighTemp-LowTemp]/[HighSignal-LowSignal]
= [100-0] / [5-0]
= 20

and enter **20** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

Offset B (only visible if *Specify Inst Gain and Offset* option is selected within the *System Config* tab)

Use this field to enter the instrument's offset factor required to convert the raw output signal into the desired temperature value. For instance, if the instrument's output is 0 to 5 VDC for 0 to 100˚F, compute the offset as

GainA * [LowTemperature-LowSignal] = 20* [0-0]
= 0

and enter **0** here. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Type in the number, then press [Enter] or [Tab]. The entered value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

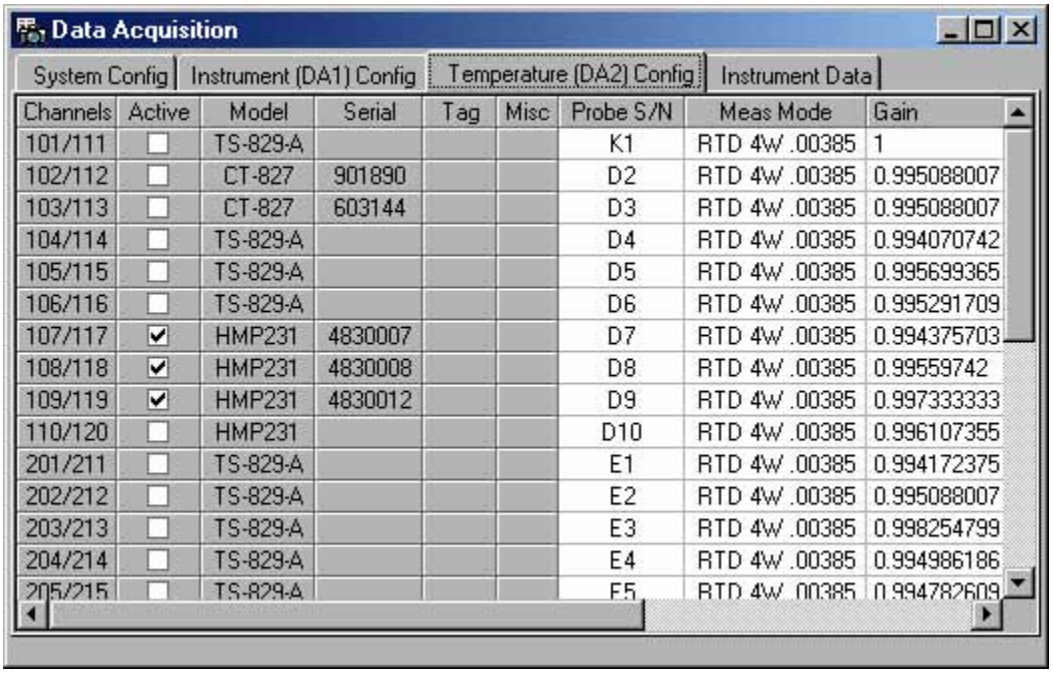
Units B

Use this field to select the temperature units to represent. For instance, if the instrument has 0 to 5 VDC output, for 0 to 100˚F, select **˚F**. If there are several instruments requiring the same entry, you can globally change an entire group of cells at the same time. Starting with the first cell in the group, click and drag down to the last cell in the group to highlight them. Press [Space Bar] or [Enter] to display allowed selections, select the desired value, then press [Enter] or [Tab]. The selected value will automatically be pasted into all the highlighted cells. An entire column (all 30 cells) may be selected for global editing by clicking directly on the column header.

This field reflects the temperature units to use (˚C, ˚F, or K) during the measurement and scaling process only. The resulting temperature will then be displayed in the current ControLog temperature units.

Temperature Configuration

The Temperature Configuration tab is used to configure Auxiliary Temperature probes (if used). In this area, each probe is configured for type, gain, offset, and temperature units.



Channels	Active	Model	Serial	Tag	Misc	Probe S/N	Meas Mode	Gain
101/111	☐	TS-829-A				K1	RTD 4W .00385	1
102/112	☐	CT-827	901890			D2	RTD 4W .00385	0.995088007
103/113	☐	CT-827	603144			D3	RTD 4W .00385	0.995088007
104/114	☐	TS-829-A				D4	RTD 4W .00385	0.994070742
105/115	☐	TS-829-A				D5	RTD 4W .00385	0.995699365
106/116	☐	TS-829-A				D6	RTD 4W .00385	0.995291709
107/117	☑	HMP231	4830007			D7	RTD 4W .00385	0.994375703
108/118	☑	HMP231	4830008			D8	RTD 4W .00385	0.99559742
109/119	☑	HMP231	4830012			D9	RTD 4W .00385	0.997333333
110/120	☐	HMP231				D10	RTD 4W .00385	0.996107355
201/211	☐	TS-829-A				E1	RTD 4W .00385	0.994172375
202/212	☐	TS-829-A				E2	RTD 4W .00385	0.995088007
203/213	☐	TS-829-A				E3	RTD 4W .00385	0.998254799
204/214	☐	TS-829-A				E4	RTD 4W .00385	0.994986186
205/215	☐	TS-829-A				E5	RTD 4W .00385	0.994782609

When auxiliary temperature probes are used, there are typically groups of ten temperature probes each labeled A1 through A10, B1 through B10, etc., or groups of ten prefixed with any letter up to Z. Before use, these probes should be calibrated in the system to gain and offset values. These values are stored (manually) in sysfiles\AuxTemp.ini for later retrieval by ControLog. As originally shipped without auxiliary temperature probes, the AuxTemp.ini file is pre-loaded with gains and offsets of 1 and 0 respectively for all probe combination from A1 through Z10. If calibrating your own temperature probes for use as auxiliary temperature measurements, you must manually edit the AuxTemp.ini file with the appropriate gain and offset values for each probe. See *Auxiliary Temperature Probe Calibration*.

Measurement and scaling parameters in this section apply to the right HP34970A only. All auxiliary temperature probes are connected to this (right) HP34970A, while the left one is for instrument connections of humidity/temperature. It is important to understand the distinction between instrument temperatures measured with the left HP34970A, and auxiliary temperatures measured with the right one.

Note that no information within this tab can be edited unless the *Allow Configuration Editing* option is selected on the *System Config* tab.

Channels

There are thirty paired channels with number labels such as 101/111. These are paired channels to allow for either 2-wire or 4-wire resistance (temperature) measurements. The first listed channel number in a pair, 101 for example, is the channel we read the measured value from. The channel-pair combination, such as 101/111 indicates the current-source, voltage-sense pair for 4 wire measurements. Regardless of the 2 or 4-wire mode, the lower channel is always the one measured. Also note that these channel numbers correspond exactly with those of the Instrument Configuration tab. These auxiliary temperature measurements are coupled with the corresponding instrument humidity/temperature channel-pairs. For instance, an auxiliary temperature measurement on channel 204/214 is the one used to perform auxiliary humidity computations (if applicable) on the instrument humidity/temperature connected to its channel 204/214 combination. It is important to note then which auxiliary probes are used with which humidity/temperature instruments.

Active

The Active column mimics that of the *Instrument Config* tab. An active instrument channel results in an active auxiliary temperature channel. Activity changes can only be performed within the *Instrument Config* tab.

Model

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Serial

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Tag

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Misc

This field is a copy of the information entered from within the Instrument Config tab and can not be edited from here.

Probe ID

This field is used to enter a probe ID which is then used to look up probe specific calibration data from the auxiliary temperature probe calibration file sysfiles\AuxTemp.ini. From this file, the Meas Mode, Gain, Offset, and Units fields will automatically fill in with the appropriate information specific to that probe. It is recommended that probes be connected in groups of ten, in alpha-numeric order. Rather than entering individual probe IDs, they can be entered globally. Global entries in the Probe ID column auto increment A1 through A10, then to B1 through B10, etc. If, for instance, your probe ID groups are J, K, and L, you could globally enter all 30 probes by clicking once on the column header to highlight the entire group, then J and press [Enter]. The probe IDs will automatically fill in with J1 through J10, K1 through K10, and L1 through L10. All of the appropriate Meas Mode, Gain, Offset, and Units data stored within the *sysfile/AuxTemp.ini* calibration file for each of the probes will then appear in the respective cells.

Meas Mode

This field may be used to change the measurement mode for the auxiliary temperature probe. The probe may be either a 2-wire or 4-wire configuration, and may be any of a wide variety of types. Note that changes made to this field are volatile and will be overwritten by a change made to the Probe ID field. Changes here do not cause a change to the calibration data file *sysfiles\AuxTemp.ini*. Any permanent changes required must be manually entered into the *sysfiles\AuxTemp.ini* file directly using a text editor or spreadsheet program capable of creating delimited text files.

Gain

This field may be used to change the calibration gain for the auxiliary temperature probe Note that changes made to this field are volatile and will be overwritten by a change made to the Probe ID field. Changes here do not cause a change to the calibration data file *sysfiles\AuxTemp.ini*. Any permanent changes required must be manually entered into the *sysfiles\AuxTemp.ini* file directly using a text editor or spreadsheet program capable of creating delimited text files.

Offset

This field may be used to change the calibration offset for the auxiliary temperature probe Note that changes made to this field are volatile and will be overwritten by a change made to the Probe ID field. Changes here do not cause a change to the calibration data file *sysfiles\AuxTemp.ini*. Any permanent changes required must be manually entered into the *sysfiles\AuxTemp.ini* file directly using a text editor or spreadsheet program capable of creating delimited text files.

Units

This field may be used to change the calibration units for the auxiliary temperature probe Note that changes made to this field are volatile and will be overwritten by a change made to the Probe ID field. Changes here do not cause a change to the calibration data file *sysfiles\AuxTemp.ini*. Any permanent changes required must be manually entered into the

sysfiles\AuxTemp.ini file directly using a text editor or spreadsheet program capable of creating delimited text files.

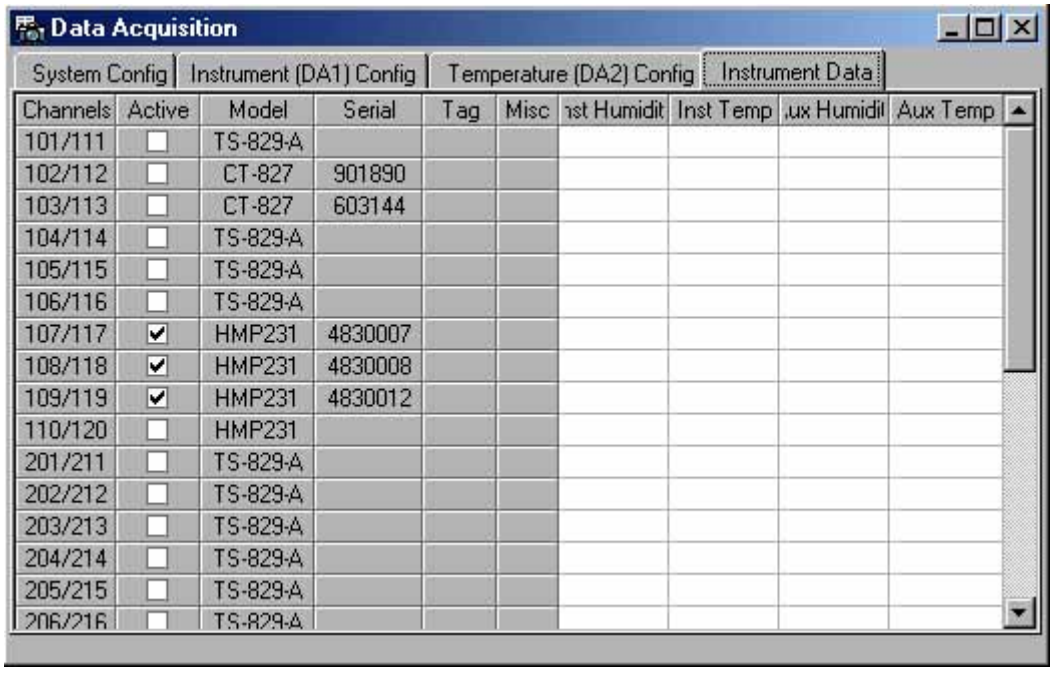
This field reflects the temperature units used during the calibration of the probe only and is subsequently used during the measurement and scaling process only. The resulting auxiliary temperature will be displayed in the current ControLog temperature units.

Instrument Data

The Instrument Data tab is used to view the instrument and auxiliary data. This is a view only informational screen, with no cells or fields to edit.

However, the first time it is viewed, or the first time it is re-viewed following a configuration change to either the *Instrument Config* or *Temperature Config* tabs, it forces an update to configuration information held within the HP34970A systems. In other words, this tab must be opened, at least once and again after configuration changes, in order to properly configure the HP34970A systems. As the configuration information is sent to each HP34970A, a small progress bar moves along the bottom of the Data Acquisition window. This operation can take nearly half a minute to complete. The progress bar moves across the screen twice, once for the left HP34970A configuration, then again for the right HP34970A.

Once the meters are configured, and the progress bar again disappears, neither this tab, nor the Data Acquisition window, needs to remain open. Like the rest of ControLog, even if the window is closed, data is still collected and stored normally. In addition, the instrument and auxiliary data is available for graphing along with the normal ControLog data. The only benefit of having this window open is that you can numerically see the data.



Channels	Active	Model	Serial	Tag	Misc	nst Humidit	Inst Temp	ux Humidit	Aux Temp
101/111	☐	TS-829-A							
102/112	☐	CT-827	901890						
103/113	☐	CT-827	603144						
104/114	☐	TS-829-A							
105/115	☐	TS-829-A							
106/116	☐	TS-829-A							
107/117	☑	HMP231	4830007						
108/118	☑	HMP231	4830008						
109/119	☑	HMP231	4830012						
110/120	☐	HMP231							
201/211	☐	TS-829-A							
202/212	☐	TS-829-A							
203/213	☐	TS-829-A							
204/214	☐	TS-829-A							
205/215	☐	TS-829-A							
206/216	☐	TS-829-A							

Channels

The channel numbers correspond with those of the *Instrument Config* and *Temperature Config* tabs.

Active

The Active column mimics that of the *Instrument Config* tab. An active instrument channel results in visible measurements in this *Instrument Data* tab. Activity changes can only be performed within the *Instrument Config* tab, and can not be edited from here.

Model

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Serial

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Tag

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Misc

This field is a copy of the information entered from within the *Instrument Config* tab and can not be edited from here.

Hum Signal

The Humidity Signal column is only visible if the *Show Raw Signal Data* option from the *System Config* tab is selected. When visible, this field displays the instrument's humidity output signal prior to scaling into the desired humidity units.

Temp Signal

The Temperature Signal column is only visible if the *Show Raw Signal Data* option from the *System Config* tab is selected. When visible, this field displays the instrument's temperature output signal prior to scaling into the desired temperature units.

Inst Humidity

This field displays the instrument's scaled humidity measurement data. If the *Append Units to Inst Data* option is selected from the *System Config* tab, the corresponding units will be appended within this same field immediately following the data. If the displayed humidity is a Dew or Frost Point temperature, then the temperature units will be those currently selected for the ControLog system.

Inst Temp

This field displays the instrument's scaled temperature measurement data. If the *Append Units to Inst Data* option is selected from the *System Config* tab, the corresponding units will be appended within this same field immediately following the data. Since the displayed value is a temperature, the temperature units will be those currently selected for the ControLog system.

Aux Humidity

This field displays the auxiliary humidity computed as specified in the *Auxiliary Humidity Computation* section of the *System Config* tab. If the *Append Units to Inst Data* option is selected from the *System Config* tab, the corresponding units will be appended within this same field immediately following the data. If the displayed humidity is a Dew or Frost Point temperature, then the temperature units will be those currently selected for the ControLog system.

Aux Temp

This field displays the auxiliary temperature measurement data (if applicable). If the *Append Units to Inst Data* option is selected from the *System Config* tab, the corresponding units will be appended within this same field immediately following the data. Since the displayed value is a temperature, the temperature units will be those currently selected for the ControLog system.

The Daux.ini File

The *System Config* tab in the *Data Acquisition* window is preset to specific default values when ControLog is launched. The data used to set these values is retrieved from the Daux.ini file within the sysfiles folder. ControLog treats this as a read only file and never writes to or updates it in any way. If changes are to be made to this file, in order to alter the System Configuration settings of the Data Acquisition, then those changes must be done manually using a standard text editor such a NotePad or WordPad. The file should be saved in plain text format only.
The following is a list of the Daux.ini file, followed by a brief explanation of each parameter.

```
IDN,"HEWLETT-PACKARD,34970A"
CType,"34901A"
Authorization,496
Authorization2,1022
CommPortA,3
BaudRateA,9600
DataBitsA,8
ParityA,None
FlowA,RtsCts
CommPortB,4
BaudRateB,9600
DataBitsB,8
ParityB,None
FlowB,RtsCts
Compute,"%RH"
FromA,"2500"
FromB,"Auxiliary"
DA2Temps,2
ShowUnits,1
ScanRate,5
ScanRateMin,1
LoadResistor,500
NPLC,2
Averaging,10
SaveConfigOnQuit,0
AutoSaveDataFiles,2
LongFileNames,2
DataAcqEnabled,1
SpecifySignalGainAndOffset,0
AutoClearRPTFiles,-1
Locked,-1
lockWhileRunning,-1
```

IDN

"HEWLETT-PACKARD,34970A" is the exact expected response string from the HP34970A meters during the detection phase while launching ControLog. If the response, or lack of response, does not exactly match this IDN data, then ControLog reverts to normal operation without data acquisition.

CType

"34901A" is the exact expected response string to a card type query executed from the HP34970A meters during the detection phase while launching ControLog. If the response, or lack of response, does not exactly match this IDN data, then ControLog reverts to normal operation without data acquisition.

Authorization

This is an encoded lower level password. When you click on the *Allow Configuration Editing* option, you are prompted for a password. If the password entered, after going through a numeric algorithm, produces the same value as is stored here, it is authorized. When authorized, configuration of the Instrument Config and Temperature Config information is allowed. System Config parameters are still not allowed though. If not authorized, then the *Allow Configuration Editing* option remains de-selected and editing of the system, instrument, and temperature configuration is not allowed.
The password algorithm is:

*Authorization = [length(password)] + [1*asc(char(1))] + [2*asc(char(2))] + … +[n*asc(char(n))]*

For instance, the password 2500 should result in

*Authorization = [length("2500")] + [1*asc("2")] + [2*asc("5")] + [3*asc("0")] + [4*asc("0")]*
*= [4] + [1*50] + [2*53] + [3*48] + [4*48]*
= 496

Authorization2

This is an encoded higher level password. When you click on the *Allow Configuration Editing* option, you are prompted for a password. If the password entered, after going through a numeric algorithm, produces the same value as is stored here, it is authorized. When authorized, configuration of the System Config parameters are allowed, as well as altering of Instrument Config and Temperature Config information as is allowable with the lower level password. If not authorized, then the *Allow Configuration Editing* option remains de-selected and editing of the system, instrument, and temperature configuration is not allowed. The password algorithm is identical to the *Authorization* algorithm above.

CommPortA

(Default = 3)
The value here appears in the *Comm Port* field of the *DA1 Communications* section of the *System Config* tab of the *Data Acquisition* window. This identifies the COMM port to use for communication with the leftmost HP34970A multimeter. The COMM port chosen must physically exist in the computer, and must be uniquely different from any other COMM port used for any other function. The same COMM port can not be used for both HP34970A systems, nor can this same port be used for communication with the 2500.

BaudRateA

(Default = 9600)
The value here appears in the *Baud Rate* field of the *DA1 Communications* section of the *System Config* tab of the *Data Acquisition* window. BaudRateA is the baud rate used for communication with the leftmost HP34970A multimeter. This must match the baud rate selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

DataBitsA

(Default = 8)
The value here appears in the *Parity/Bits* field of the *DA1 Communications* section of the *System Config* tab of the *Data Acquisition* window. DataBitsA is the number of data bits (7 or 8) per frame used for communication with the leftmost HP34970A multimeter. This must match the data bits selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

ParityA

(Default = None)
The value here appears in the *Parity/Bits* field of the *DA1 Communications* section of the *System Config* tab of the *Data Acquisition* window. ParityA is the parity (None, Odd, or Even) used for communication with the leftmost HP34970A multimeter. This must match the parity selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

FlowA

(Default = RtsCts)
The value here appears in the *Flow Control* field of the *DA1 Communications* section of the *System Config* tab of the *Data Acquisition* window. FlowA defines the handshaking (None, XonXoff, or RtsCts) used for communication with the leftmost HP34970A multimeter. This must match the handshaking selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

CommPortB

(Default = 4)
The value here appears in the *Comm Port* field of the *DA2 Communications* section of the *System Config* tab of the *Data Acquisition* window. This identifies the COMM port to use for communication with the rightmost HP34970A multimeter. The COMM port chosen must physically exist in the computer, and must be uniquely different from any other COMM port used for any other function. The same COMM port can not be used for both HP34970A systems, nor can this same port be used for communication with the 2500.

BaudRateB

(Default = 9600)
The value here appears in the *Baud Rate* field of the *DA2 Communications* section of the *System Config* tab of the *Data Acquisition* window. BaudRateB is the baud rate used for communication with the rightmost HP34970A multimeter. This must match the baud rate selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

DataBitsB

(Default = 8)
The value here appears in the *Parity/Bits* field of the *DA2 Communications* section of the *System Config* tab of the *Data Acquisition* window. DataBitsB is the number of data bits (7 or 8) per frame used for communication with the rightmost HP34970A multimeter. This must match the data bits selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

ParityB

(Default = None)
The value here appears in the *Parity/Bits* field of the *DA2 Communications* section of the *System Config* tab of the *Data Acquisition* window. ParityB is the parity (None, Odd, or Even) used for communication with the rightmost HP34970A multimeter. This must match the parity selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

FlowB

(Default = RTS/CTS)
The value here appears in the *Flow Control* field of the *DA2 Communications* section of the *System Config* tab of the *Data Acquisition* window. FlowB defines the handshaking (None, XonXoff, or RtsCts) used for communication with the rightmost HP34970A multimeter. This must match the handshaking selected within the HP34970A. For information regarding the HP34970A communication settings, see the HP documentation or *The HP34970A communication interface*.

Compute

This is the parameter that will be computed as the Auxiliary Humidity value. It appears in the *Compute Auxiliary Humidity Parameter* field of the *Auxiliary Humidity Computation* section of the *System Config* tab of the *Data Acquisition* window.

FromA

This parameter identifies the humidity source that will be used when computing Auxiliary Humidity. It appears in the *using humidity from* field of the *Auxiliary Humidity Computation* section of the *System Config* tab of the *Data Acquisition* window.

FromB

This parameter identifies the temperature that will be used when computing Auxiliary Humidity. It appears in the *& temperature from* field of the *Auxiliary Humidity Computation* section of the *System Config* tab of the *Data Acquisition* window.

DA2Temps

(Default = 2)
This parameter was intended for future expansion, and as such is not yet fully implemented. It identifies the type of data to be measured with the rightmost HP34970A multimeter. The following values, while not yet implemented, are planned:

0 - allow DA2 to be used for any valid measurements
1 - only allow DA2 to be used for auxiliary temperature measurements
2 - same as 1, but lock the option and prevent it from being changed by the operator.

ShowUnits

(Default = 1)
This is the *Append Units to Instrument Data* checkmark of the *Options* section of the *System Config* tab of the *Data Acquisition* window. It has the following options:

0 - unchecked. Do not show units with the Instrument Data
1 - checked. Show units with the Instrument Data
2 - same as 1, but lock the checkmark and prevent it from being changed by the operator.

ScanRate

Appears in the *Scan Rate (seconds)* field of the *Options* section of the *System Config* tab of the *Data Acquisition* window. Valid range is 1 to 60.

ScanRateMin

Use this to set the minimum Scan Rate value selected by the operator. Allowable values are 1 to 60. If set below 1, the minimum scan rate is still 1.

LoadResistor

Use this to set the nominal value of the load resistor used during current measurements. All current measurements are made by measuring the voltage dropped across a load resistor within the personality module plugged into the front of the data acquisition panel. Each personality module set for current measurement contains high precision resistors in series with the current flow. The voltage developed is measured by the HP34970A and is then divided by the resistance specified here to determine the current. This is a single global value and as such requires that all resistors used for current measurements be of the same nominal value. Resistor tolerances of ±0.01% are recommended.

NPLC

NPLC is the Number of Power Line Cycles used in the measurement of each channel. It has a direct affect on the quality of the measurement and the amount of noise that can be rejected. It appears in the *NPLC* field of the Options section of the *System Config* tab of the *Data Acquisition* window.

Averaging

Use this to set the amount of averaging used when measuring instrument data. It appears in the *Averaging* field of the *Options* section of the *System Config* tab of the *Data Acquisition* window. A value of 0 equates to no averaging. Values up to 10 are typical.

SaveConfigOnQuit

This parameter was intended for future expansion, and as such is not yet fully implemented. When implemented, it is intended to allow the operator selected parameters of the System Config tab of the Data Acquisition window to update the Daux.ini file. Presently, this is not the case, and the Daux.ini file must be altered manually using a text editor (such as notepad or wordpad).

AutoSaveDataFiles

This parameter specifies whether or not to automatically save data files at the end of a run. If enabled, the data files are saved using a date/time stamp as the filename. If not, then the user is prompted to save the file, and asked for a valid filename. The following values are acceptable:

0 - prompt user to save file, then ask for filename
non 0 - automatically save the file using a date/time stamp as the filename

LongFileNames

When AutoSaveFileNames is enabled (AutoSaveFileNames = 1 or 2), the date/time stamp used for the filename can either be kept short to maintain DOS compatibility (8 characters) or can be longer as allowed by Windows 95/NT. When short, only the date portion of the filename is used, meaning that a file may have more than one run worth of data in it. With long filenames, each file contains only one run since the filename includes both date & time. Each run therefore has a unique long filename. The following values are acceptable:

0 - use short filenames only (date only) in DOS compatible format
non 0 - use long filenames with both date and time

DataAcqEnabled

This determines the initial status of the *Enable Data Acquisition* checkmark of the *Options* section of the *System Config* tab of the *Data Acquisition* window. The following values are acceptable:

0 - checkmark of Enable Data Acquisition initially OFF
non 0 - checkmark of Enable Data Acquisition is initially ON.

SpecifySignalGainAndOffset

This determines the initial state of the *Specify Inst Gain and Offset* checkmark of the *Options* sections of the *System Config* tab of the *Data Acquisition* window. The following values are acceptable:

0 - checkmark of *Specify Inst Gain and Offset* initially OFF
non 0 - checkmark of *Specify Inst Gain and Offset* initially ON.

AutoClearRPTFiles

This specifies whether or not to automatically clear the report files at the beginning of each new run. If enabled (value is non 0), the report files are cleared at the start of each new run just as if the user had selected Clear Report Files from the Reports menu. If disabled (value is 0), then the report files are not cleared and the data from each new run is appended to the data from the previous runs. In this manner, the report files (stored in the sysfiles folder) grow increasingly larger in size with each new run and require clearing manually.

Locked

This determines the initial state of the items contained on the *System Config* tab of the *Data Acquisition* window. If Locked (value is non 0), then the *DA1* and *DA2 Communication* parameters and the *Auxiliary Humidity Computation* parameters are not editable until the *Allow Configuration Editing* checkmark is turned on and the level 2 password (encrypted in the Authorization2 variable above) is entered. However, if not Locked (value = 0) then the *DA1* and *DA2 Communication* parameters and the *Auxiliary Humidity Computation* parameters are editable initially without checking *Allow Configuration Editing* or entry of a password. Note that once *Allow Configuration Editing* has been checked, the password is subsequently required for access to these parameters. The Locked variable only affects the initially locked status of these parameters.

LockWhileRunning

This determines whether or not to lock out all configuration editing while in Generate or Auto-Profile (i.e., the 2500 is running), including DA1 and DA2 Communication parameters, Auxiliary Humidity Computation parameters, Instrument Configuration, and Temperature Configuration. When locked (value is non 0), all parameters are locked and can not be altered when running. When unlocked (value=0), the user is free to make changes to the configuration while running, provided that *Allow Configuration Editing* is checked and the proper password has been entered. Changing configuration while the system is running can have a negative impact on the data collection files being written, and/or may lock up the system due to communication errors. It is good practice to leave configuration locked while running.

Channel Monitor

The Channel Monitor, located under the *Window* menu, is used to display any of the channels of the left HP34970A used by the 9800 Data Acquisition System. These channels include 101 through 120, 201 through 220, and 301 through 320. Channels 121, 122, 221, 222, 321, and 322 are not configured by the 9800 system and are not usable by the channel monitor. The Channel Monitor displays both the raw measured value (voltage, current, resistance, temperature, etc.) and the scaled value in its selected engineering units (RH, dewpoint, ˚F, ˚C, etc.) In addition, the Channel Monitor either displays the corresponding auxiliary temperature channel from the right HP34970A (if the currently selected instrument signal is a temperature channel) or the computed auxiliary humidity (if the currently selected instrument signal is a humidity channel).

Changing Channels

The Channel Monitor displays only one channel of a channel pair at a time, along with its corresponding auxiliary temperature or humidity value. The displayed channel may be changed in either of two ways:

1. Rotate the channel knob on the front of the leftmost HP34970A to the desired channel number as indicated on the HP front panel, or
2. Click the up/down arrow buttons on the Channel Monitor window. The channel number will increment/decrement accordingly.

Note that regardless of the method chosen, the channel number field updates to reflect the currently selected channel number. When changing channel number using the knob, always do so using the leftmost HP34970A. The knob on the other one has no affect on the Channel Monitor. Also note that while the instrument signal and corresponding humidity or temperature (depending on which of the channel pair is selected) updates rather quickly. The corresponding auxiliary humidity or temperature updates much more slowly along with the normal scan rate as selected on the *System Config* tab of the *Data Acquisition* window.

Channel Pairing vs. Meter Pairing

Remember that the instrument data channels are paired together in the leftmost HP34970A so that channels 101 through 110 (instrument humidities) pair with channels 111 through 120 (instrument temperatures) respectively. So to view the humidity of the 3rd instrument channel, tune to channel 103. Likewise, to see the corresponding temperature as measured from the same instrument, tune to channel 113. This is called channel-pairing.

Instrument-pairing refers to the linking of auxiliary temperature measurements from the right HP34970A to the corresponding humidity/temperature channel pairs of the left HP34970A. As in the previous example, an instrument connected to the 3rd channel gives humidity on channel 103 and temperature on channel 113 of the left HP34970A. The corresponding auxiliary temperature measurement is made on channel 103 of the rightmost HP34970A. This is referred to as meter-pairing.

High Priority and the Wait Indicator

When the Wait flag is visible near the upper right of the Channel Monitor window, it indicates that the system is busy performing a complete group channel scan or other communication chore. During this time, the data on the Channel Monitor window is frozen. Once the group scan is complete, the flag extinguishes, and the channel monitor attempts to once again measure and update the selected channel several times per second. The Wait flag appears periodically, coincident with the scan rate selected.

During times when attempting to make adjustments to instruments, and relying on the data from the Channel Monitor, it is desirable to make these periodic Wait interruptions hold off as much as possible. By checking *High Priority*, the Channel Monitor gains priority over other communication processes. The periodic group scan which causes the Wait flag to appear now holds off for much longer periods. Since the system must still occasionally make these scanned group measurements, it will still gain control approximately once per minute, showing the Wait flag for a few seconds during this time. However, the Wait flag appears much less frequently than before.

When High Priority is selected, the normal data scan rate (and thus the data averaging) is adversely affected. Rather than being able to scan the 2500 and the 9800 instrument data channels frequently enough to provide good averaged data, the data gathering frequency is reduced, resulting in a significantly fewer number of measurements used in the average. Therefore, with High Priority checked, the averaged data may not actually achieve the true mean of the data being sampled. For this reason, it is best to check High Priority only when required, and turn it back off once it is no longer needed. Closing the Channel Monitor window will also disable High Priority and allow the system to return to normal operation.

Auxiliary Temperature Probe Calibration

Calibration of auxiliary temperature probes for use with the rightmost HP34970A is not an automated process and requires the use of an external temperature bath, a temperature reference, Microsoft Excel (or a similar spreadsheet program), a text editor, and some copying/pasting. The following procedures should give you a good outline to follow in calibrating your particular probes. Calibration is used to individually correct the gain and offset values of probes, but is not capable of compensating for probe non-linearity, hysteresis, or non-repeatability.

1. Separate the probes into groups of 10, grouping like type probes together. Give each group a letter designation and number each probe within the group, such as A1 through A10 for the first group, B1 through B10 for the second group, and so on. Any letter of the alphabet is fine, but it is best to keep the groups consecutively lettered. For instance, if there are three groups of ten probes each, give them group letters of A, B, and C perhaps, or J, K, and L. Label the probes with the group and number designations on each end of each cable.
2. Connect the probes to the rightmost channel connections of the 9800 underneath the right HP34970A. Connect them according to their group and channel numbers, lowest letters on top, lowest number to the left. If your probes are labeled A1 - A10, B1 - B10, and C1 - C10, put the A group on top, starting with A1 connected to channel 101/111, A2 to channel 102/112, and so on. Put the B group on the next row down, followed by the C group on the bottom row.

3. Configure the Data Acquisition window's Temperature Config tab with the probe IDs (labels), probe type (thermistor, thermocouple, RTD, etc.) and measurement type (2 or 4 wire).
4. Globally set the Gain and Offset parameters to 1 and 0 respectively so we get unaltered raw temperature data from the HP34970A.
5. Place the probes in a temperature bath, bundled together with a reference thermometer.
6. Shutdown the system if in Generate or Auto-Profile mode.
7. Uncheck the *Append Units to Inst Data* box of the *Options* section of the *System Config* tab of the *Data Acquisition* window.
8. Click to select the Monitor checkbox within this same section. This starts the measurement scan process even though the 2500 is not generating.
9. If desired, use the graph menu to select the auxiliary temperature channels, and enable strip chart mode. The probe data then appears on the graph within a few seconds.
10. Set the bath temperature to the low end of the calibration range of interest.
11. Watch for stable data in the *Aux Temp* column of the *Instrument Data* tab of the *Data Acquisition* window.
12. Once stable, note the reading of the reference thermometer. Select and copy the raw temperature data displayed in *Aux Temp* column.
13. Open the file sysfiles\TempCalForm.xls using Microsoft Excel or a compatible spreadsheet program. Enter the reference thermometer's value into the **Low Standard**(blue) and paste the copied Aux Temp data from the previous step into the **Low** (blue) column.
14. Set the bath temperature to the upper end of the calibration range of interest.
15. Once stable, note the reading of the reference thermometer, and again copy the Aux Temp data from ControLog.
16. Returning to Excel, enter the reference thermometer's value into the **High Standard**(red) cell, and paste the copied Aux Temp data into the **High** (red) column.
17. The new Gain and Offset (yellow) columns now hold the newly computed gain and offset values specific to each probe. Select and Copy this Gain and Offset data as a group.
18. Using Excel, open the file sysfiles\AuxTemp.ini. Choose Delimited, and Comma separated in the data import dialog boxes that appear. Once opened, it should have a listing for all probes from A1 to Z10 for a total of 260 data line entries, plus a header line.
19. Find the appropriate rows corresponding to the labels for the probes just calibrated. Then select the Gain and Offset data for this group. Select Paste Special... from the Edit menu. In the dialog box that appears, select the Values option so that the numbers paste in here rather than the formulas that were used to get those numbers. Click OK.

20. Make sure the probe type is correct for each probe being calibrated. If it is not, then change it to the correct value exactly as it is listed in the Meas Mode column of the Temperature Config tab of the Data Acquisition window of ControLog.

21. Make sure the Units column agrees with the units used during the calibration .

22. Once the data of the AuxTemp.ini file appears correct, select Save As... from the File menu. In the dialog box, select CSV (Comma Delimited) as the file type. If you do not select CSV, the file will be written in a format incompatible with ControLog.

23. Once the file is saved, it may have been renamed by Excel to something like "AuxTemp.ini.csv". Using the Windows Explorer, go rename the file back to AuxTemp.ini so that it can be found by ControLog. You may also want to open it up once with a simple text editor. If it looks readable, and comma separated, then most likely it was saved correctly.

24. Quit ControLog.

25. Re-launch ControLog. This causes it to re-read the AuxTemp.ini file you just changed.

26. Go to the *Temperature Config* tab of the *Data Acquisition* window in ControLog. Change the probe ID column to the probes just calibrated. The *Meas Mode*, *Gain*, *Offset*, and *Units* columns should update to the values just saved in the AuxTemp.ini file.

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