



Psychrometric Analysis

Professional Edition User Manual

VERSION 6.0

Released Jan-2007



Authored and Produced By:



The Psychrometric Source™



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MENU & TOOLBARS

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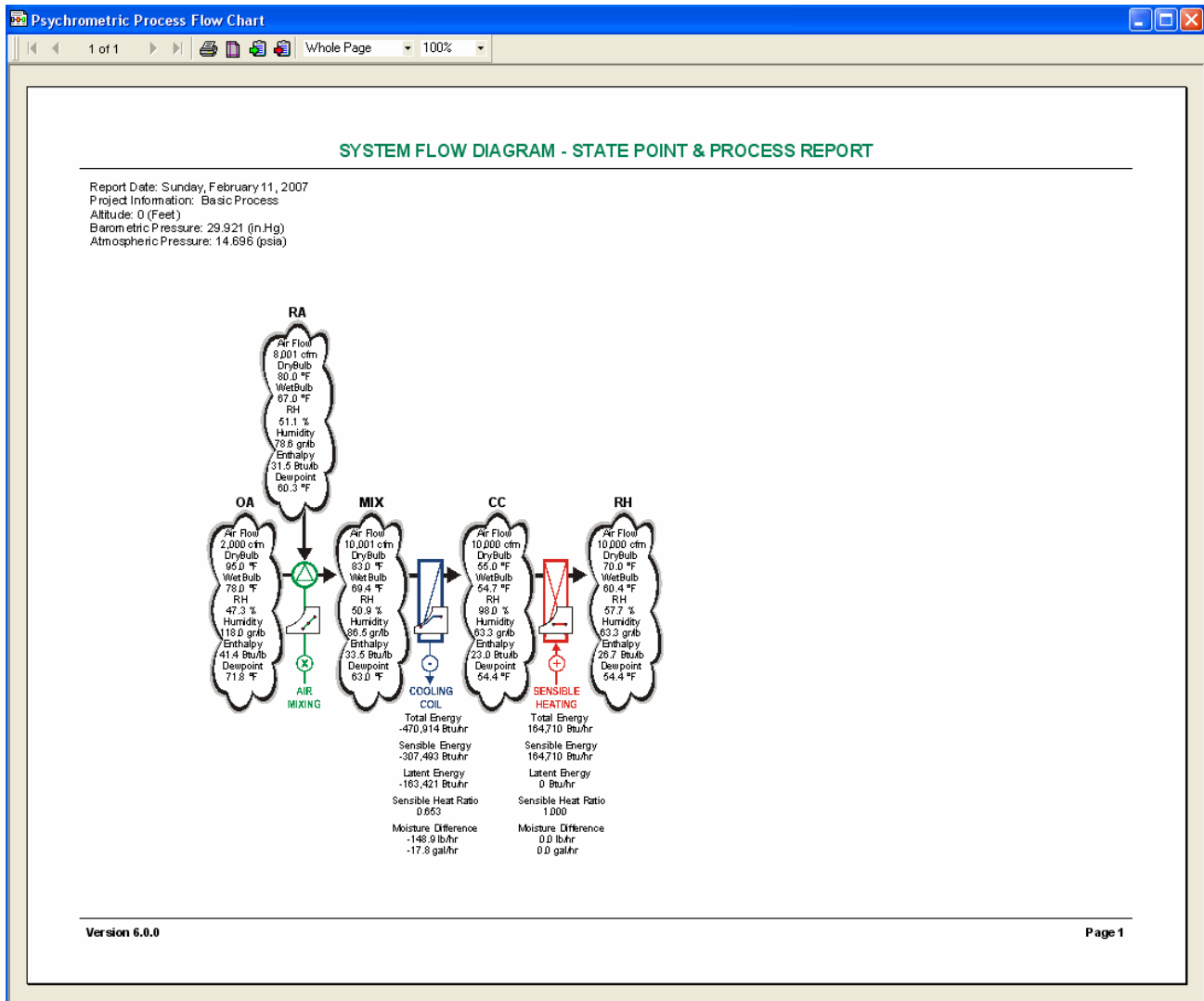


PROGRAM FEATURES

NEW VERSION 6 FEATURES!

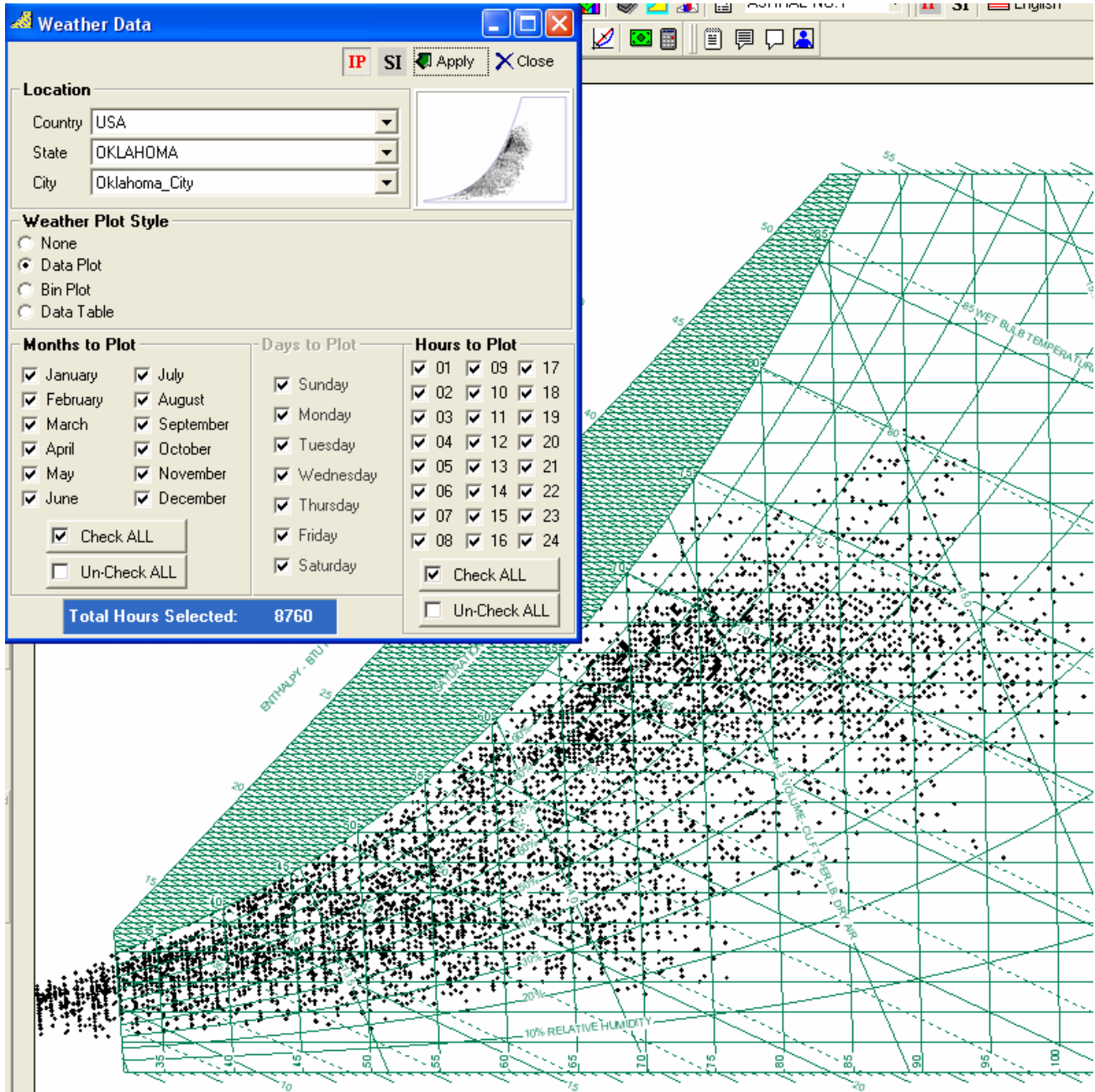
NEW Auto Flow Chart Diagram!

Now you can get a Complete Flow Diagram Schematic with all Process and Thermo-Physical properties with One-Button-Click! Flow diagram and/or data can be copied with One-Button-Click to the clipboard for pasting into your reports and presentations!



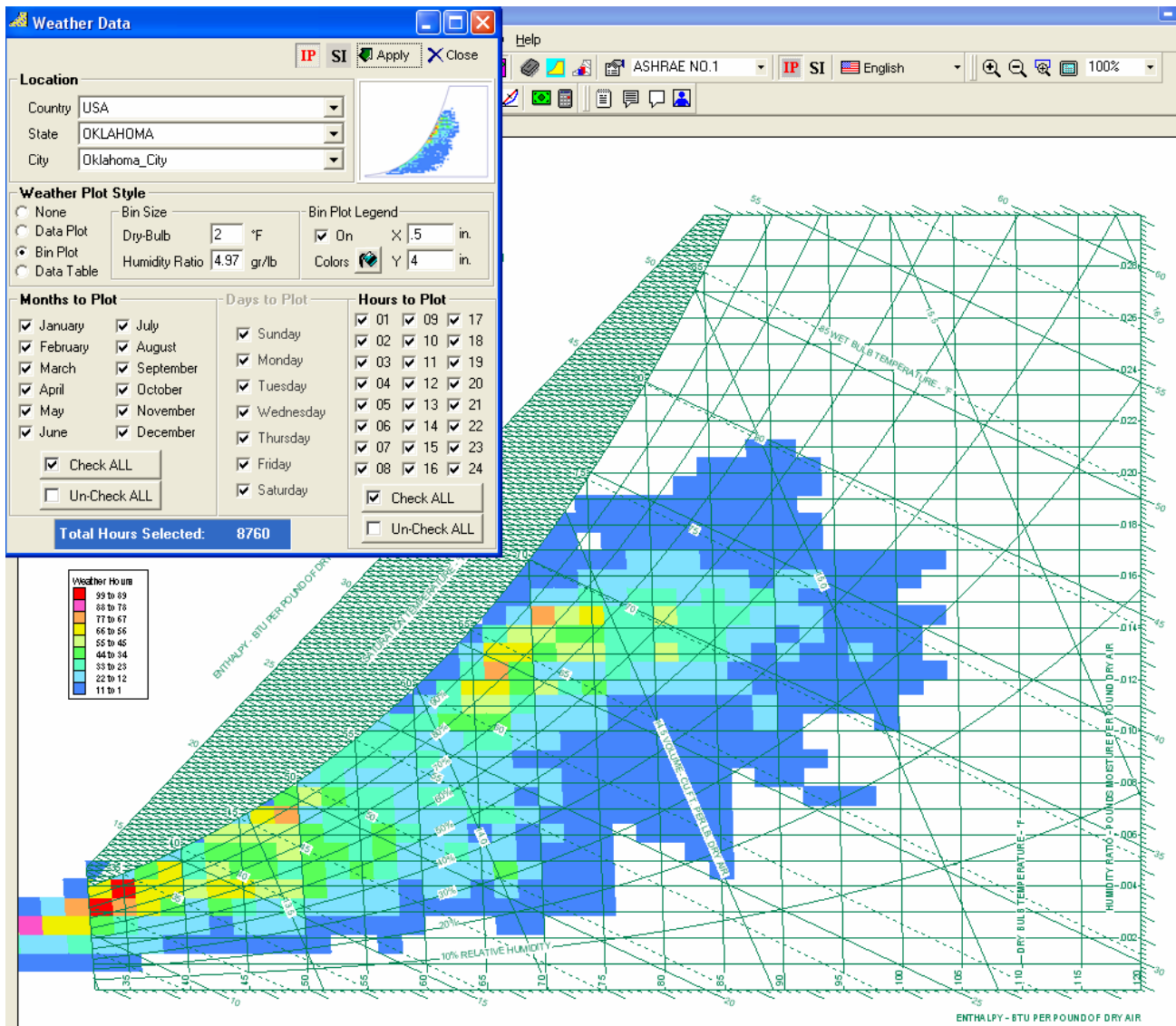
NEW Weather Data Plotting with Complete Global Weather Files!!

Now you can see the weather data plotted right on the chart with one click!!



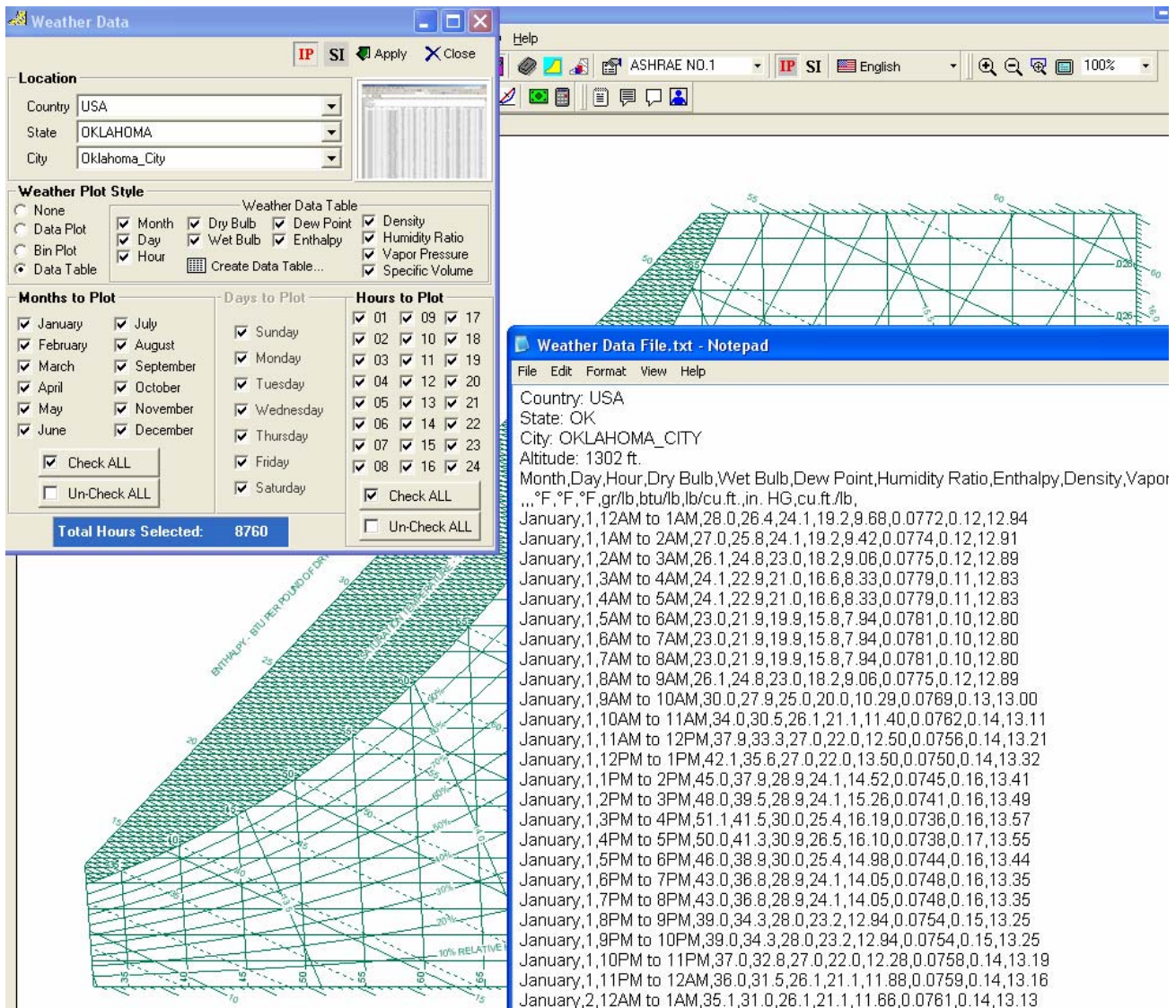
NEW Weather Bin Shade Plotting with Complete Control!!

Now you can display Bin Weather data right on the chart and specify the bin size and colors!!...even displays a bin legend that you can locate where you want!!



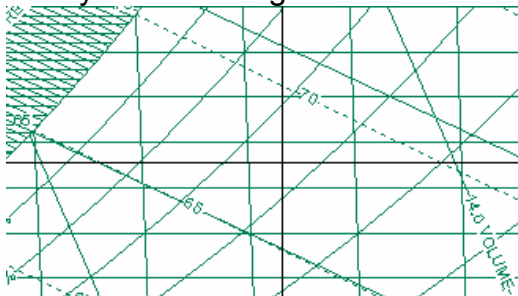
NEW Global Weather Data Table Access!!...CREATE YOUR OWN BIN TABLES!!

Now you have access to world-wide weather data at your fingertips!!...create a complete weather data file that you can modify, import to Excel, etc. with One-Click!!

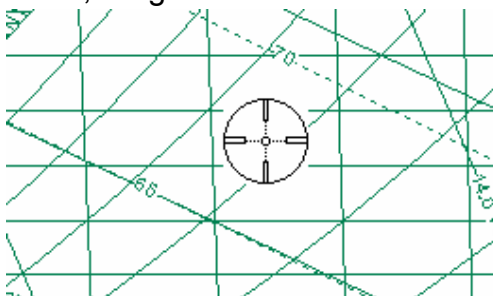


NEW Mouse Icon Control!!

Now you can change the mouse icon to Arrow, Target or Cross-Hair!!



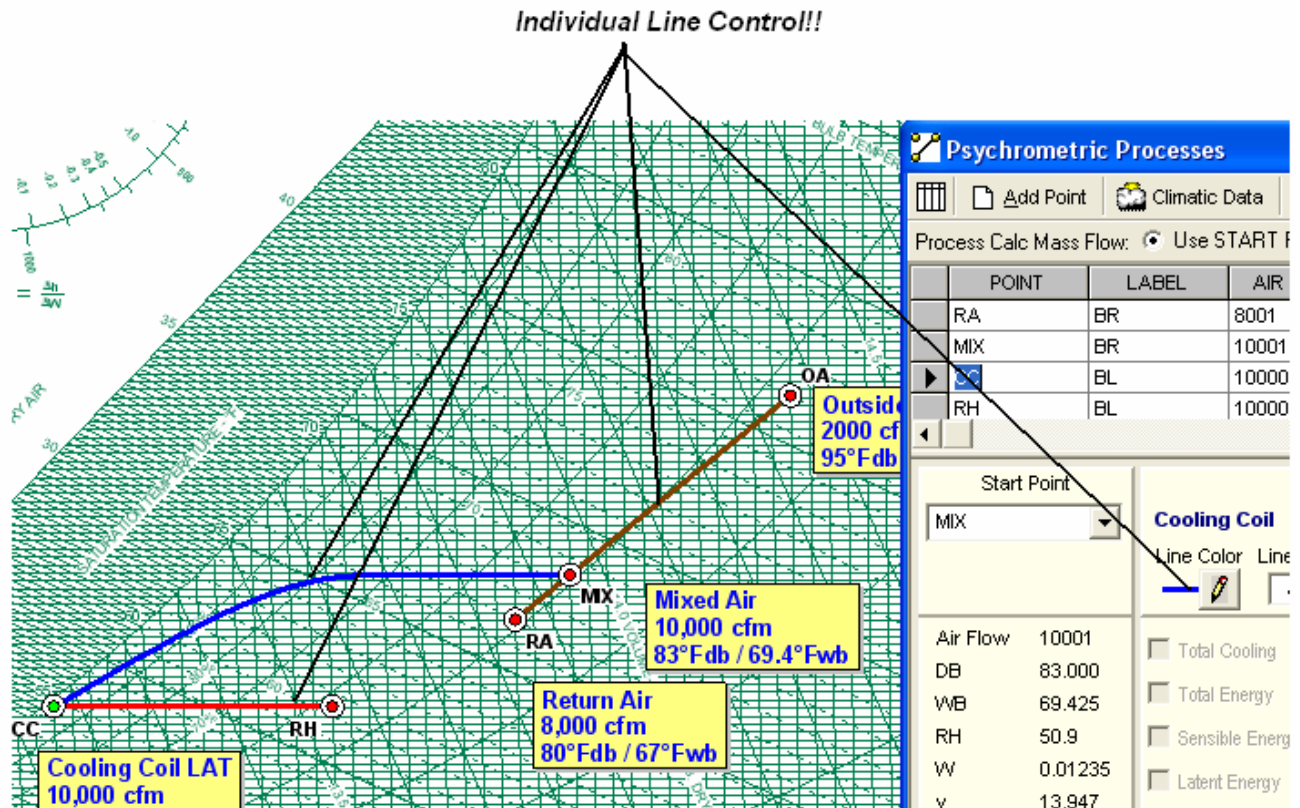
Cross-Hair Mouse (just like CAD!!)



Or Target Style!!

NEW Individual Process Line Color Control!

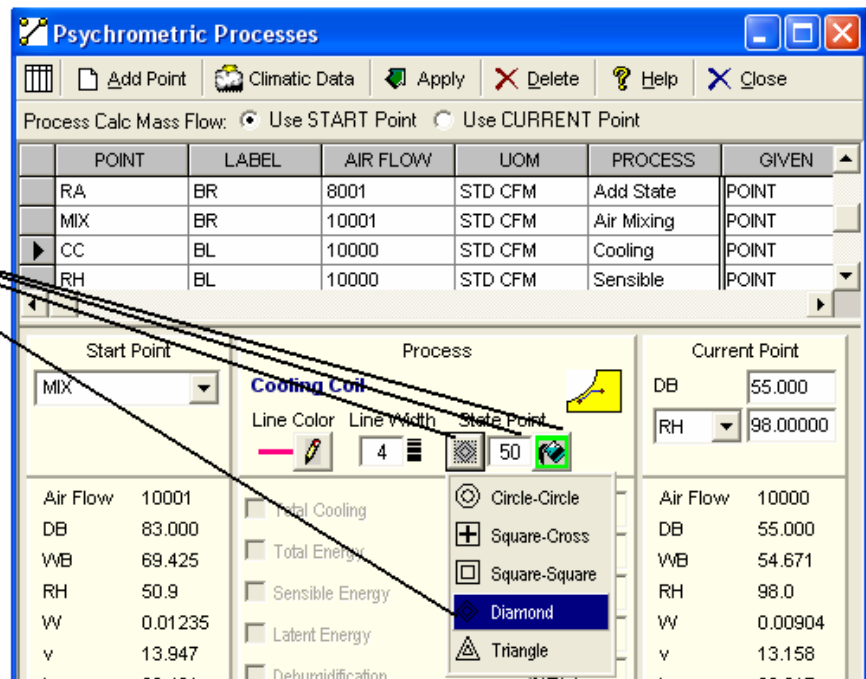
Now you can control the color and thickness of EACH Individual Process Line!!



NEW Individual Point Color, Shape and Size Control!

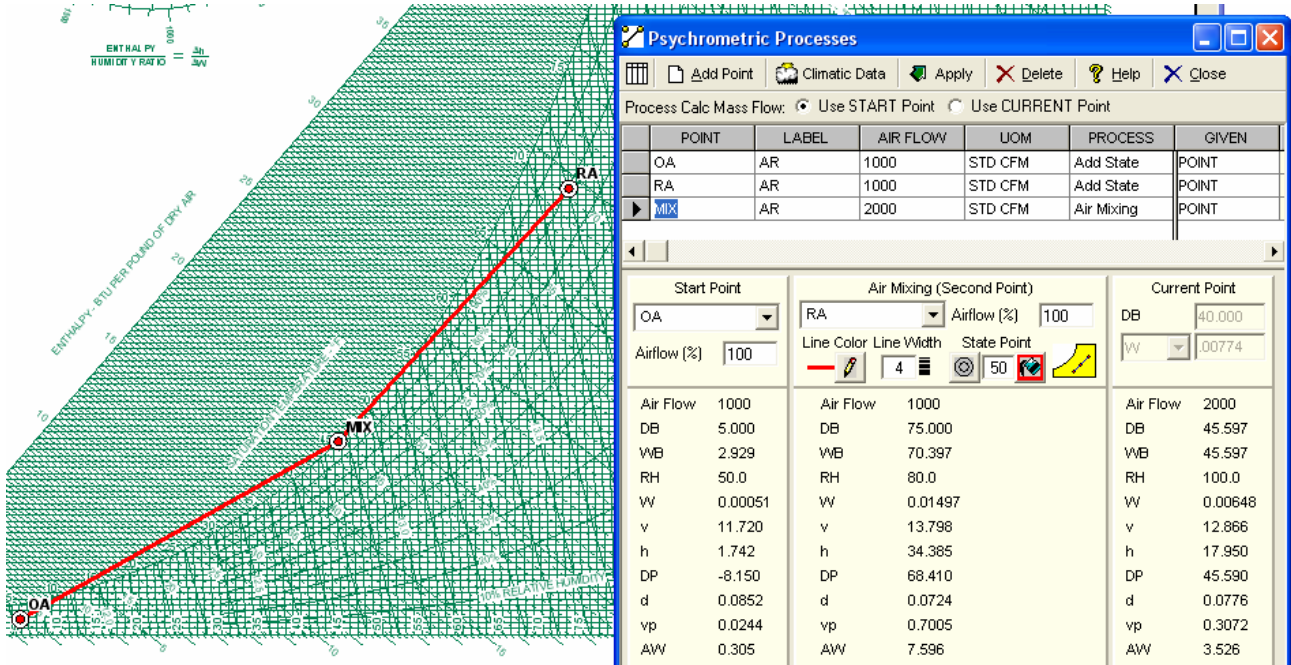
Now you can control the icon, color and size of EACH Individual State Point!!

Individual Point Icon, Color and Size Control!!



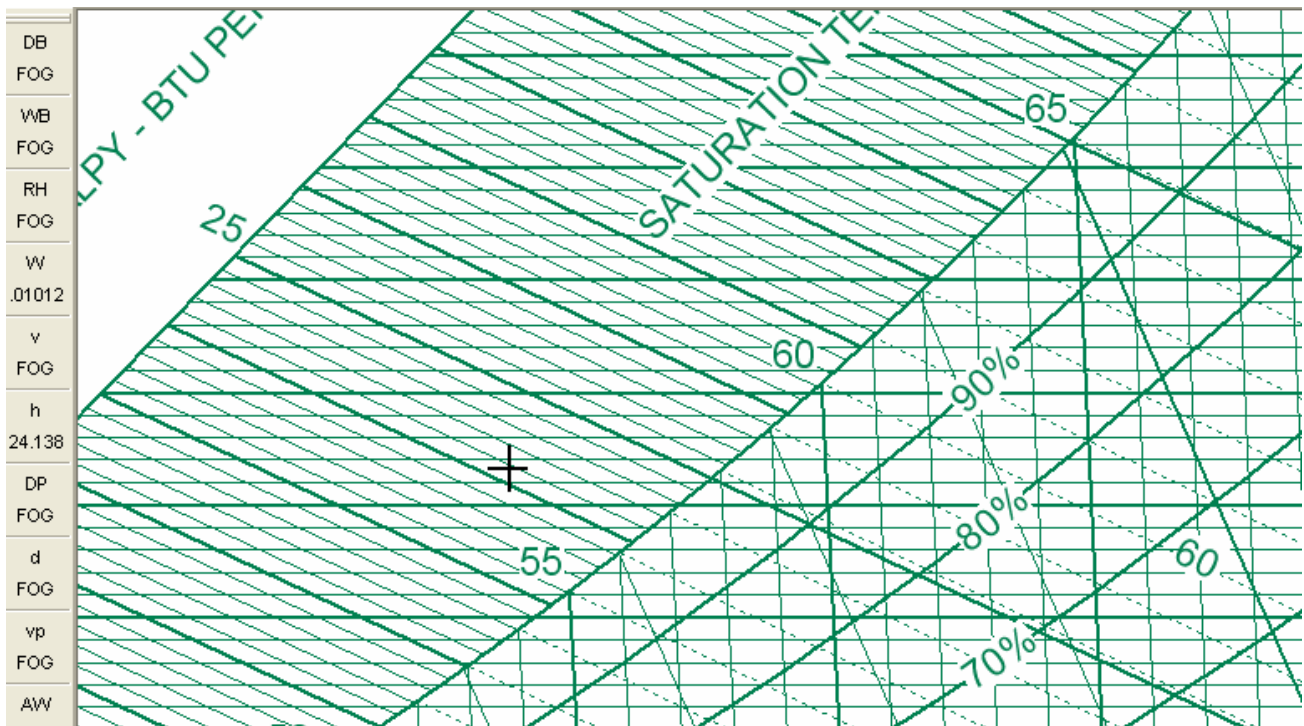
NEW Winter "V" Air Mixing Capability!

Now you can plot mixing processes that cross the saturation line!!



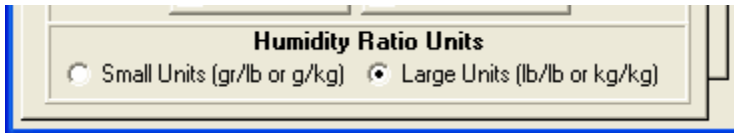
NEW Fog Region Property Display!!

Now you can read fog region properties!!



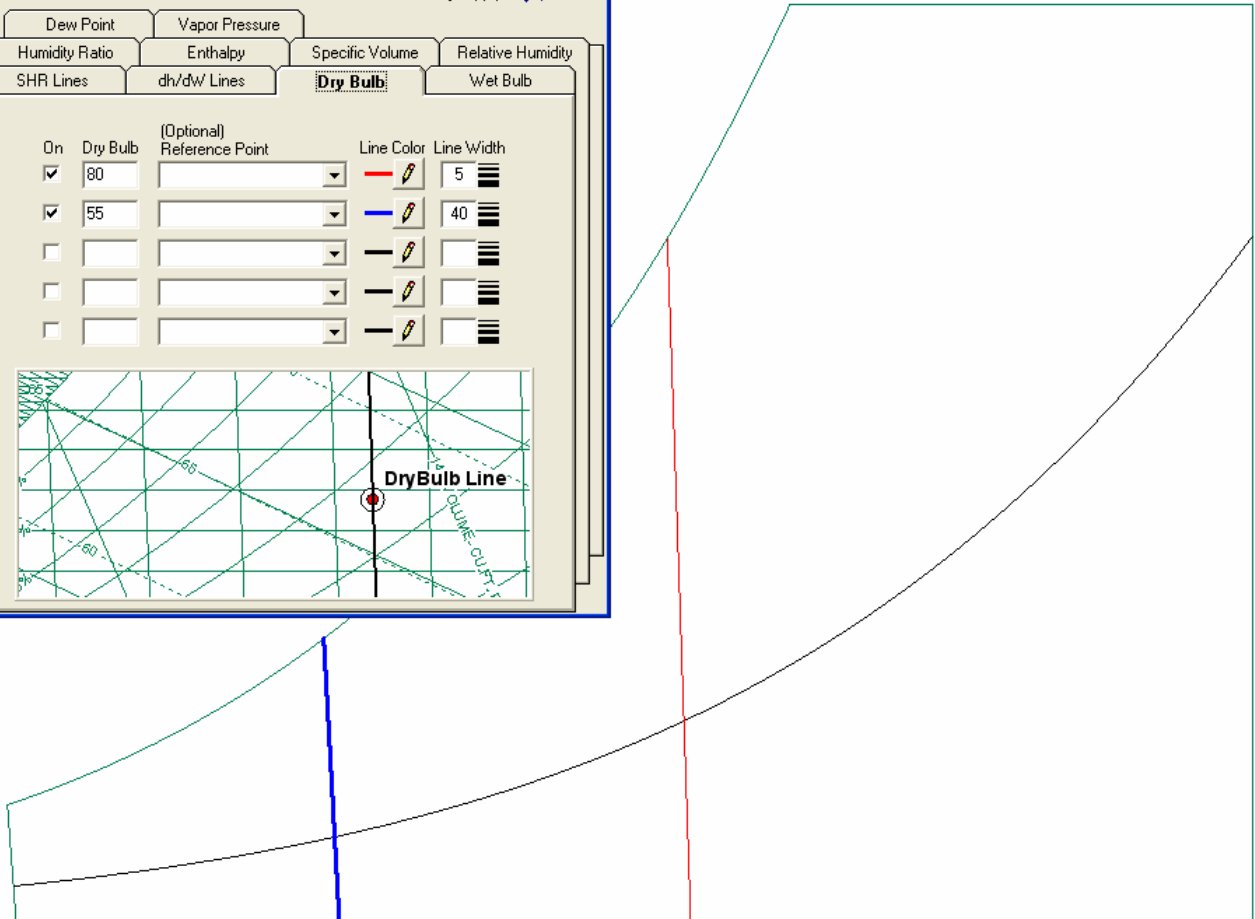
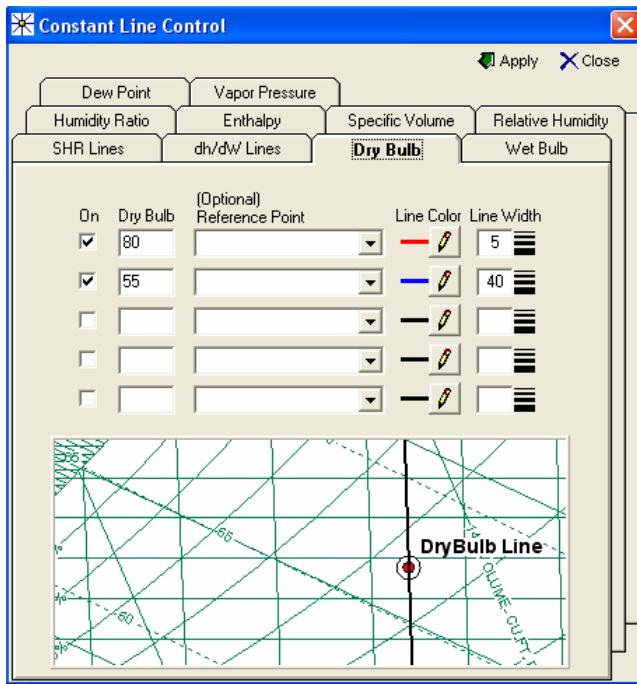
NEW Humidity Ratio Unit of Measure Control!!

Now you can select the Humidity Ratio units displayed on the chart and used in Psychrometric Analysis with one button click!!



NEW Constant h, WB, HR, DB, VP, DP, SHR & dW/dh Line Control!!

Now you can specify exact individual property lines to be displayed!!



NEW Complete Thermal Comfort Calculator!!

Now you can perform thermal comfort modeling calculations on the fly!!

Thermal Comfort Calculator

IP SI Print Close

Environmental Conditions

Air Temperature: 78.8 °F

MRT ☒ Link with Air: 78.8 °F

Air Velocity: 39 ft/min

Relative Humidity: 50 %

☒ Summer ☐ Winter

Activity

User Defined

Metabolic Rate: 1.0 met

Clothing

User Defined

Clothing level: 0.5 clo

Other Details

External Work: 0.0 met

Turbulence Intensity: 70 %

Mean Mo. Outdoor Temp: 15.0 °C

Exposure Time: 60 min

Barometric Pressure: 760 torr

Weight: 70 kg

Surface Area: 1.2 sq.m

Results

ET*: 78.8 °F

SET*: 75.9 °F

TSENS: 0.2

DISC: 0.2

PMV: -0.32

PPD: 7 %


PD: 26 %

PS: 53 %

TS: 0.3 Neutral

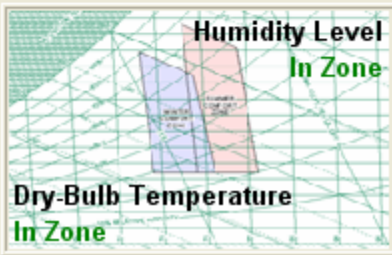
Tneutral: 71.5 °F (Humphreys)

Tneutral: 74.8 °F (Auliciems)

Comfortable 

Comfort Zone Calculation

Summer Comfort

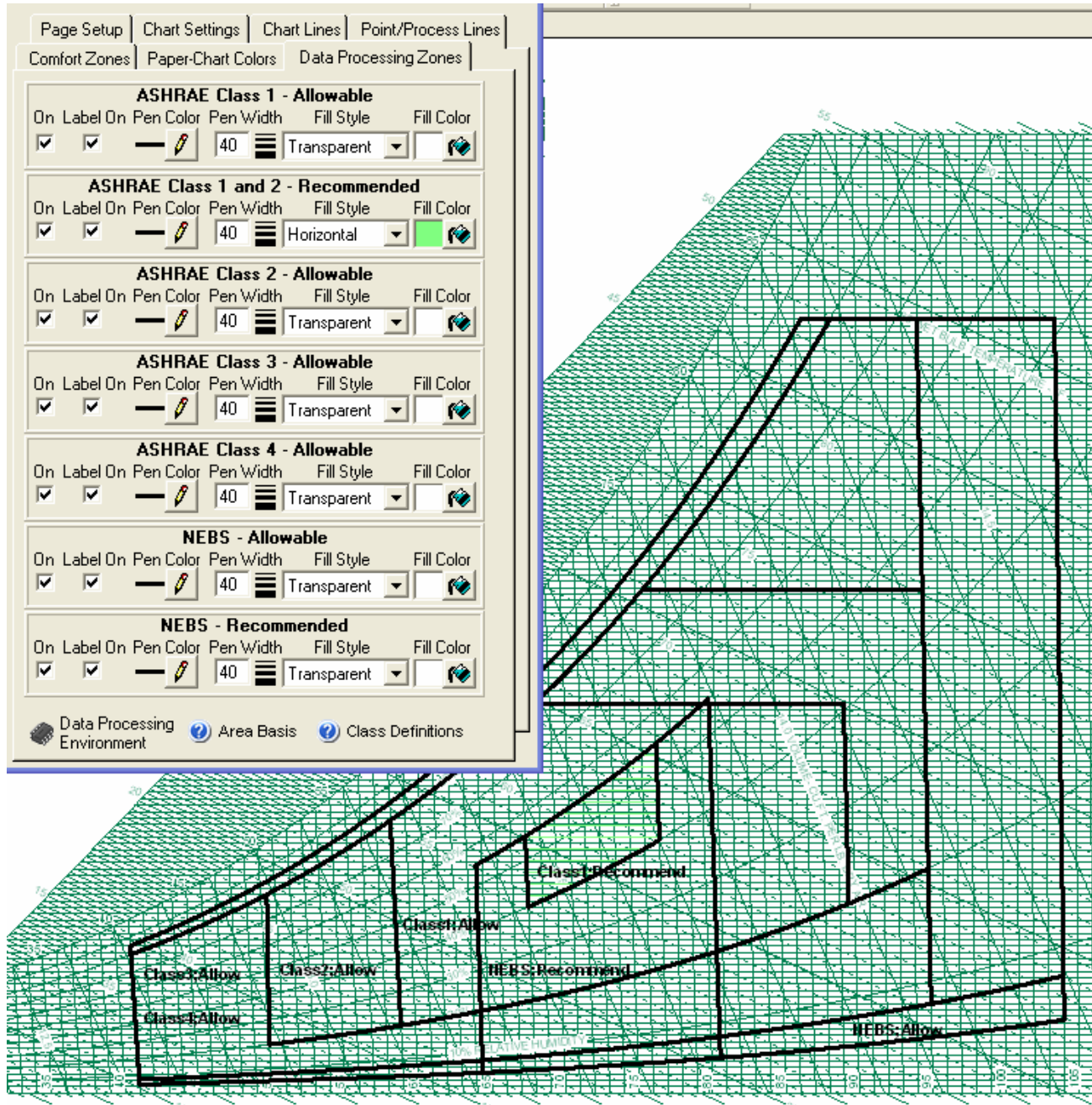


Dry-Bulb Temperature In Zone

Humidity Level In Zone

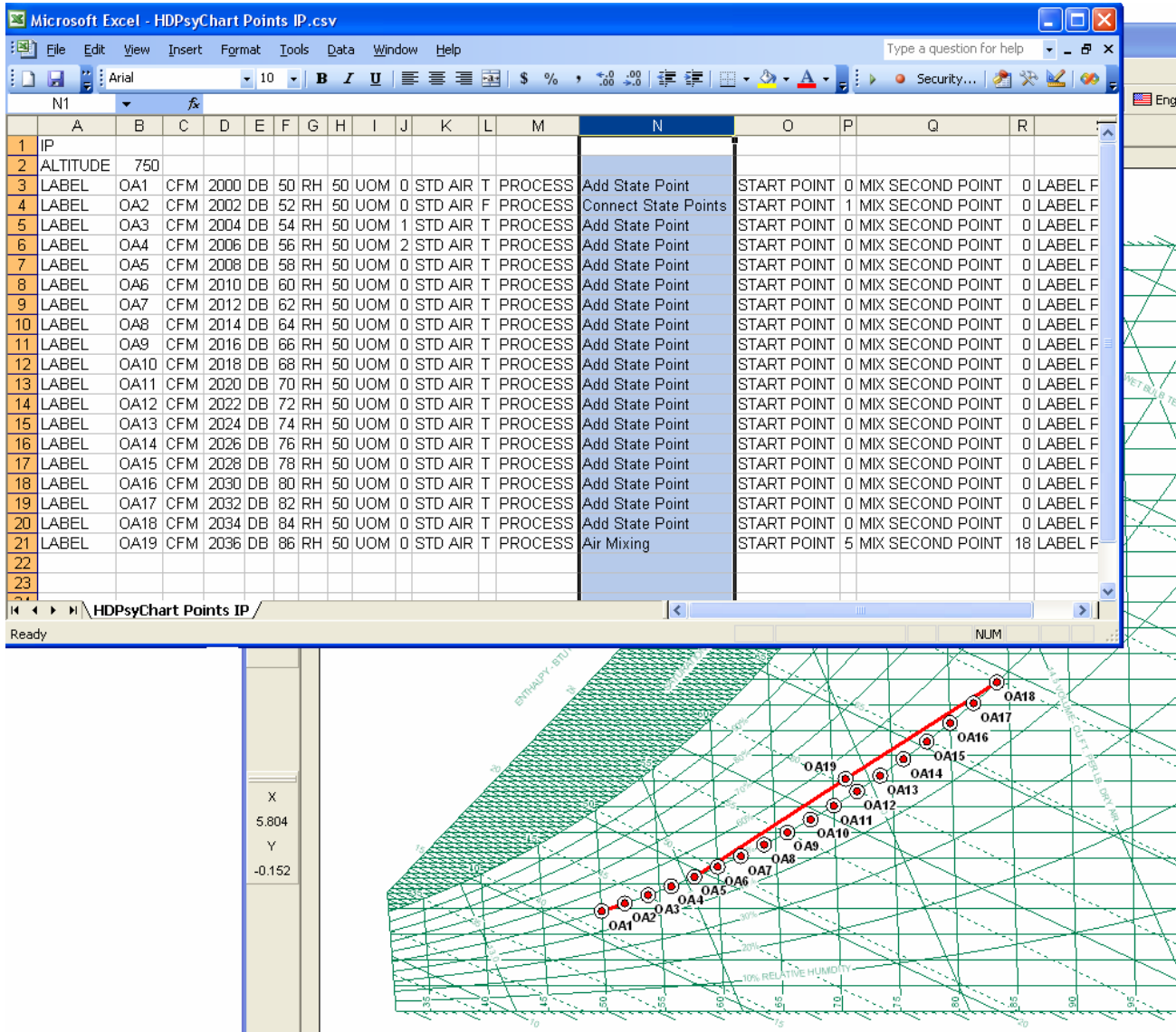
NEW ASHRAE Class 1 through 4 Datacenter Zones (allowed & recommended) and NEBS Datacenter Zones (allowed & recommended)!!

Now you can display the Data Processing Environment regions right on the psychrometric chart!!!!the regions are calculated and are displayed dynamically with elevation!!!



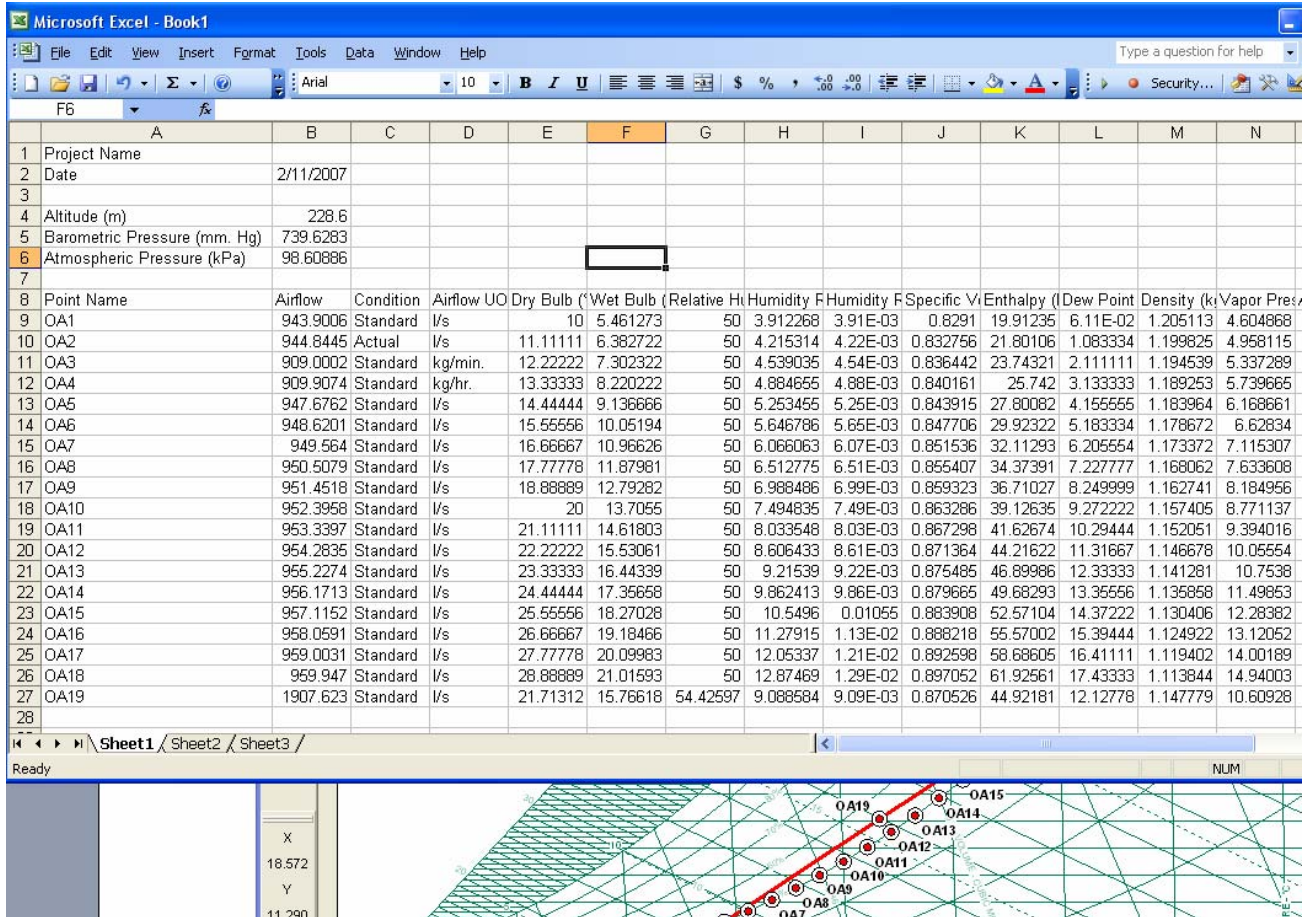
NEW Process Control added to Data Import Function!!

Now when you're importing data text or Excel spreadsheet data, you can specify processes with the data!!



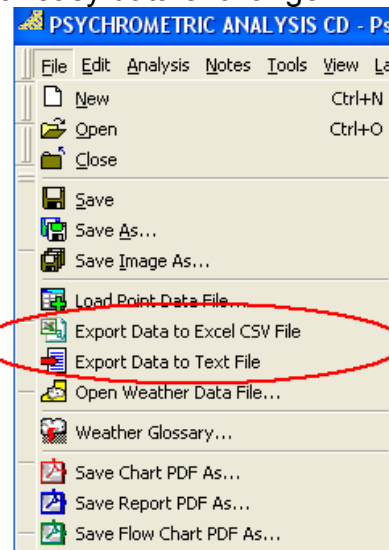
NEW SI units added to text file & Excel Data Exchange!!

Now when you're exporting data text or Excel spreadsheet data, you can export out in SI units of measure!!

**NEW export Data in EITHER *.txt format or *.csv format!!**

Now you can export your psychrometric analysis data in either text file (*.txt) format or an Excel friendly comma delimited format (*.csv) for easy data exchange!!

Export Data as TXT or CSV file!!



NEW Outdoor Air Estimator UPDATED to Standard 62-2004!!

Now you can quickly and easily obtain updated values from Table-16 from ASHRAE Standard 62-2004 with associated Notes and Air Classifications!!

Outside Air Estimator - RE: ASHRAE Standard 62-2004

Application Group: **Educational Facilities**

Specific Application: **Media center**

cfm per Person: **10** cfm per sq.ft.: **0.12**

No. of People: **22** Area (sq.ft.): **7500**

People OA Rate: **220** Area OA Rate: **900**

TOTAL Suggested Fresh Airflow (cfm): 1120

AIR CLASS
Air Class = 1
[Class Definition](#)

NOTES
For high school and college libraries, use values shown for Public Spaces - Library.

GENERAL NOTES

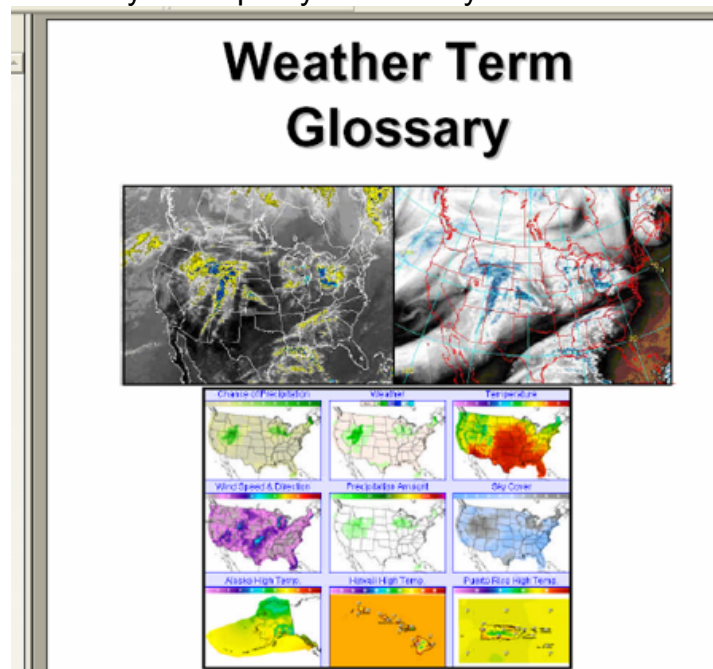
(1.) Related Requirements: The rates in this program are based on all other applicable requirements of ASHRAE Standard 62-2004 being met.

(2.) Smoking: This program applies to no-smoking areas. Rates for smoking-permitted spaces must be determined using other methods. See ASHRAE Standard 62-2004, Section 6.2.9 for ventilation requirements in smoking areas.

(3.) Air Density: Volumetric airflow rates are based on an air density of 0.075 lbda/ft³ (1.2 kgda/m³), which corresponds to dry air at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C). Rates may be adjusted for actual density but such adjustment is not required for compliance with

NEW Weather Term Glossary!!

Now you can quickly and easily look up any almost any weather term or phrase in seconds!!



NEW Wind Chill Factor Calculator!!

Now you wind chill and frost bite times are at your fingertips and can be calculated in seconds!!

Wind Chill Calculator

Calculate Chart FAQ IP SI Print

Temperature and Wind Condition

Temperature: -10 °F

Wind: 45 mph

Wind Chill and Frostbite Time

Wind Chill: -44 °F

Frostbite Time: 10 minutes

NEW Climatic Data PRINTING Capability Added!!

Instead of just viewing design data or adding it to your psychrometric system, now you can print all the design data for your location as well!!

Print Close

☒ COOLING USA 1,302 Elevation, feet ☒ English (IP)

☒ HEATING Oklahoma 35.40 North Latitude ☐ Metric (SI)

☒ WIND Oklahoma City, Will Rogers Airport 97.60 West Longitude

SUMMER COOLING				Evaporation			Dehumidification		
	DB °F	MWB °F	°F db	WB °F	MDB °F	°F db	DP °F	MDB °F	°F db
0.4%	99	74	99.14	77	91	91.04	73	83	83.12
1%	96	74	96.26	76	90	90.32	72	82	82.04
2%	94	73	93.56	75	89	89.24	71	81	81.32

Extr. Annual Max. DB °F 103 Std. Dev. °F 3 Mean Daily Range DB °F 21

WINTER HEATING				Coldest Month		Extreme Annual Daily	
	DB °F	RH %	°F db	WS mph	MCDB °F	DB °F	Std. Dev. °F
99.6%	9	50	9.32	0.4%	29	33	4
99%	15	50	14.72	1%	26	37	5

WIND

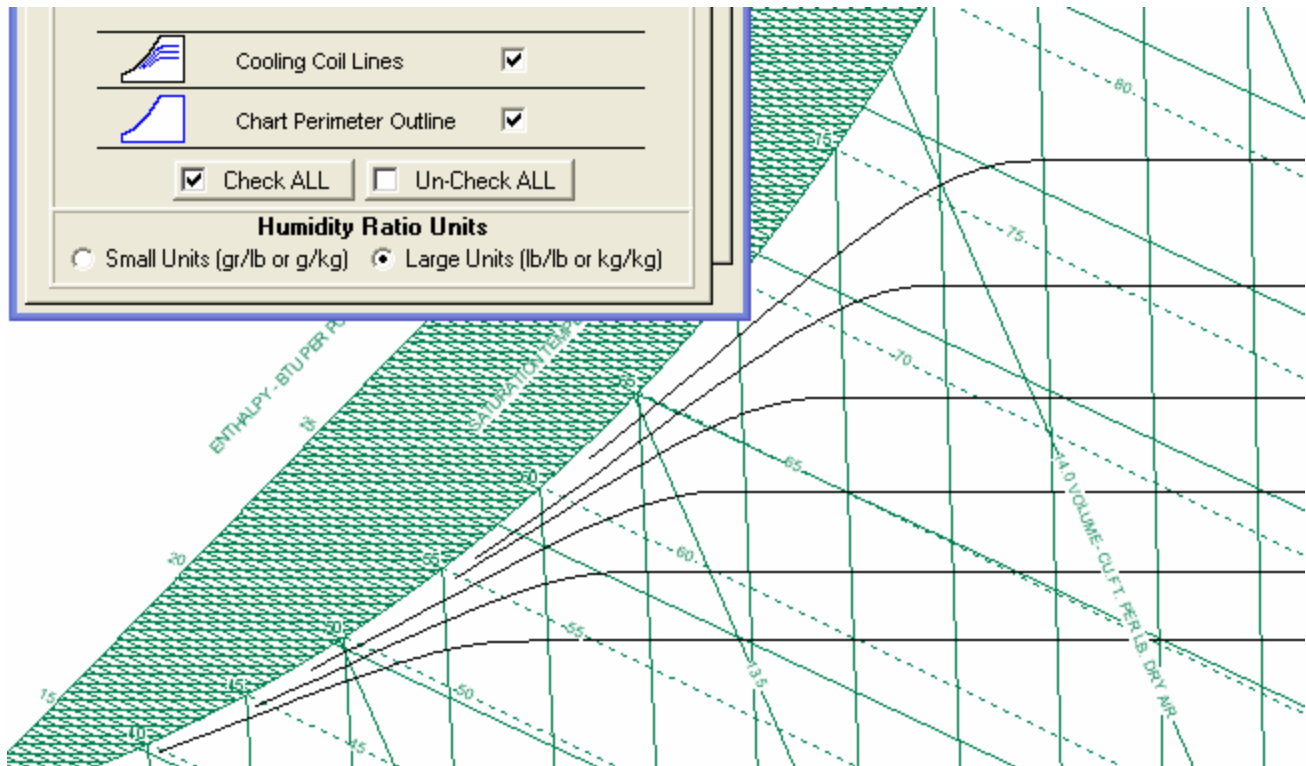
Coincident with 0.4% DB (cooling) MCWS 13 mph PWD 180 deg.

Coincident with 99.6% DB (heating) MCWS 15 mph PWD 360 deg.

Extreme Wind Speed 1% 29 mph 2.5% 25 mph 5% 23 mph

NEW Cooling Coil Performance Line Control!!

Now you can display cooling coil modeled curves right on the psychrometric chart!!



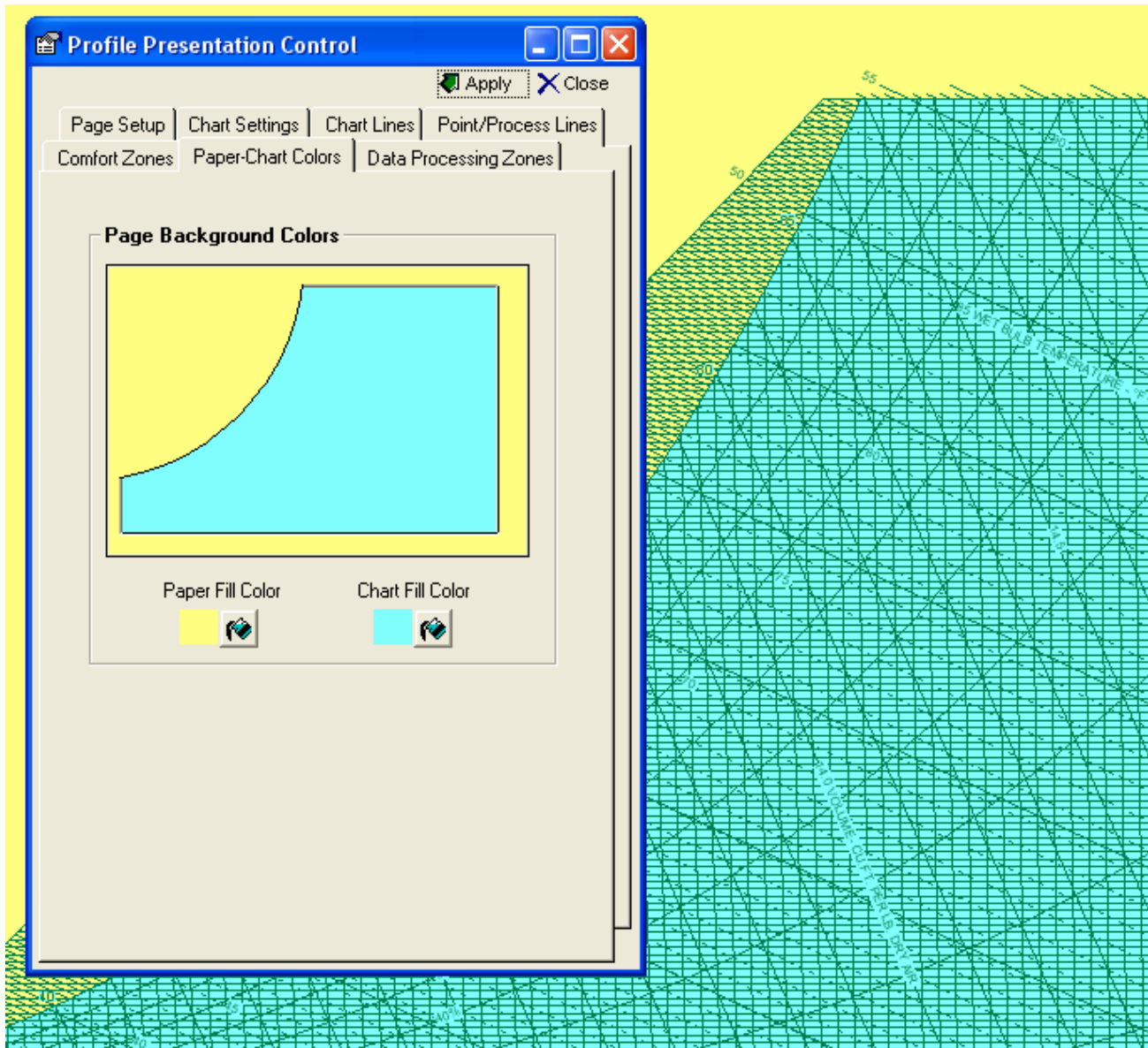
NEW Greek, Japanese and Dutch Languages Added!!

Now Psychrometric Analysis supports (13) Languages!!



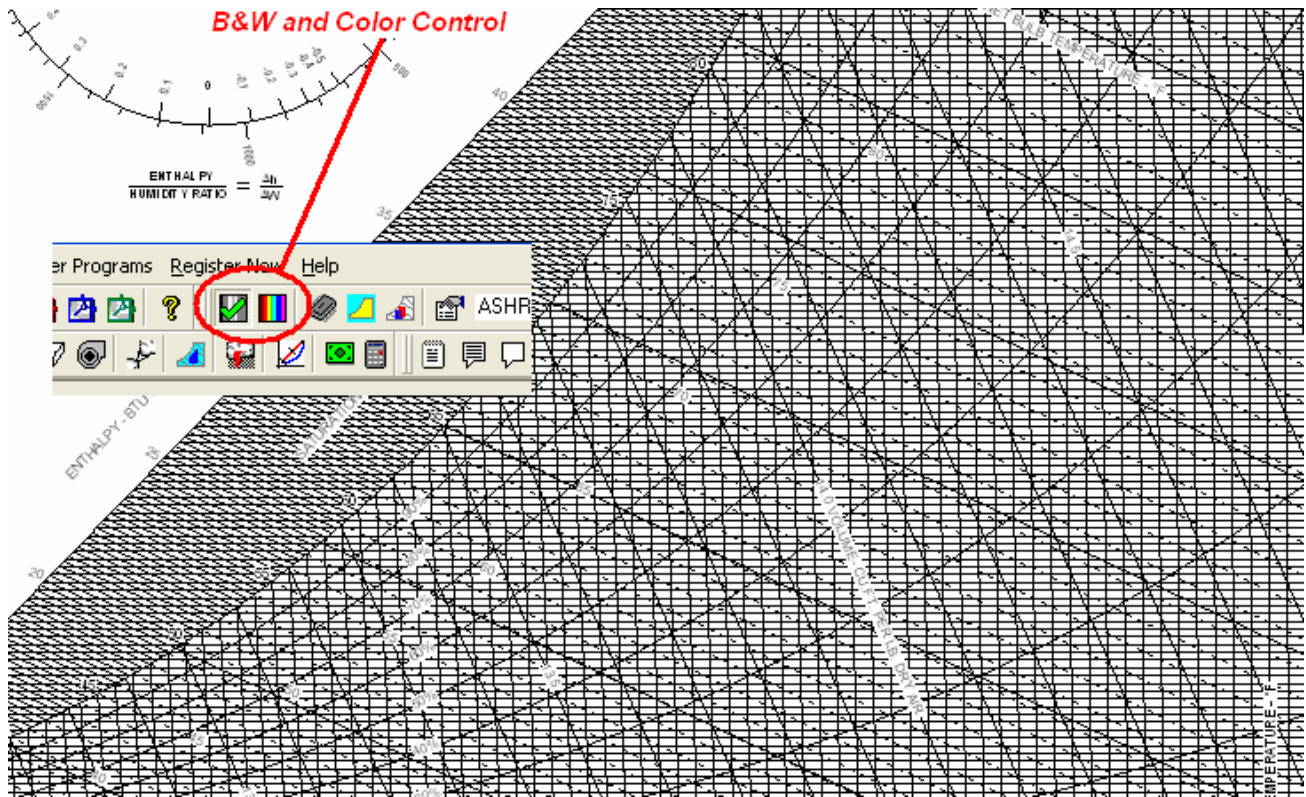
NEW Page and Chart Area Color Control!!

Now you can customize the appearance of the psychrometric chart and select virtually any color for the page and chart area!!



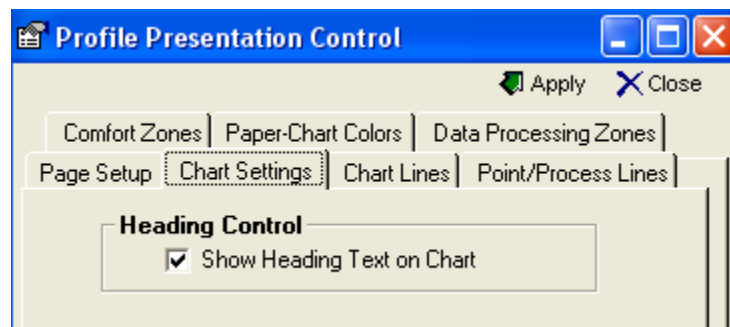
NEW Black & White <=> Color Display & Print Control!!

Now you can select Black and White only or Color display!!



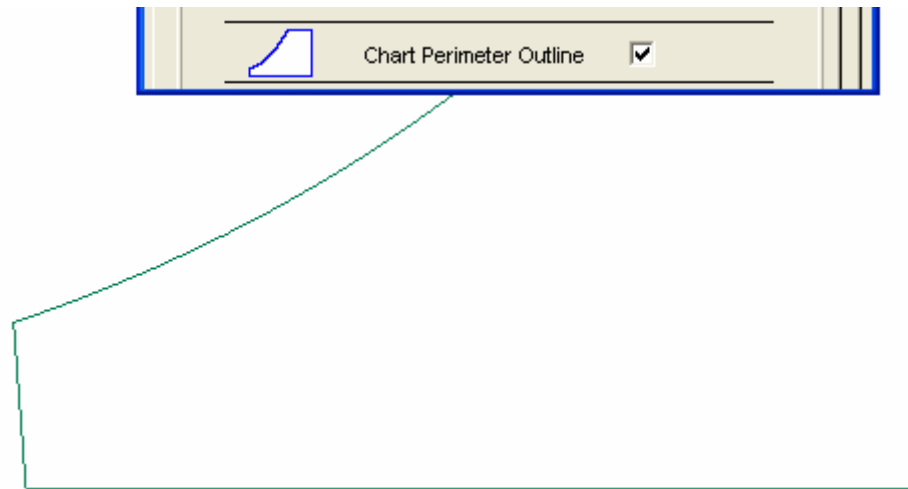
NEW Heading On/Off Control!!!

Now you can turn Headings On or Off!!



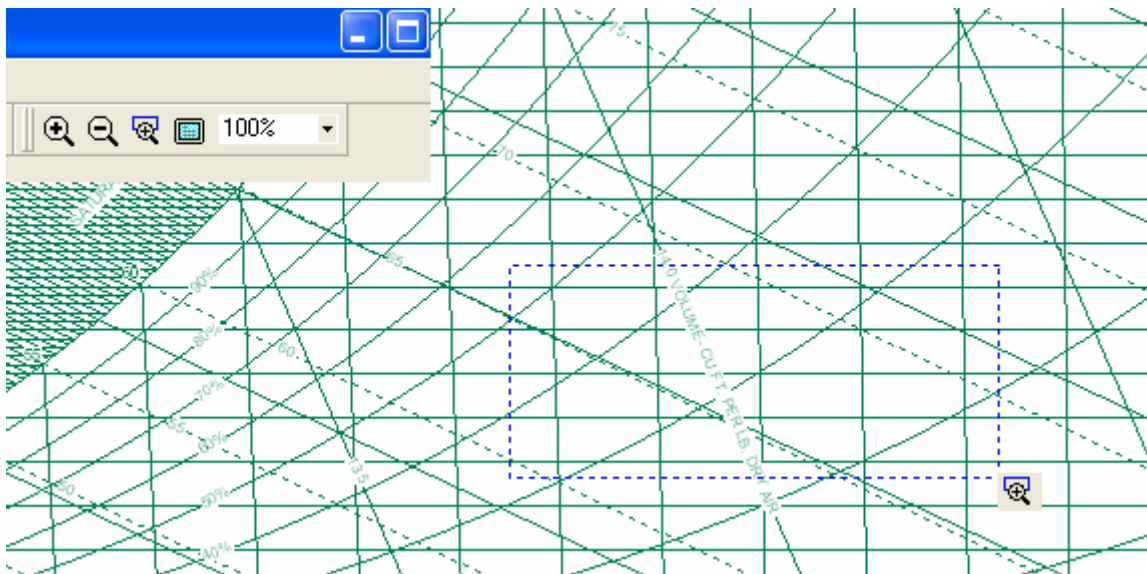
NEW Psychrometric Chart Outline Control!!

Now you can turn the Chart Outline On or Off!!



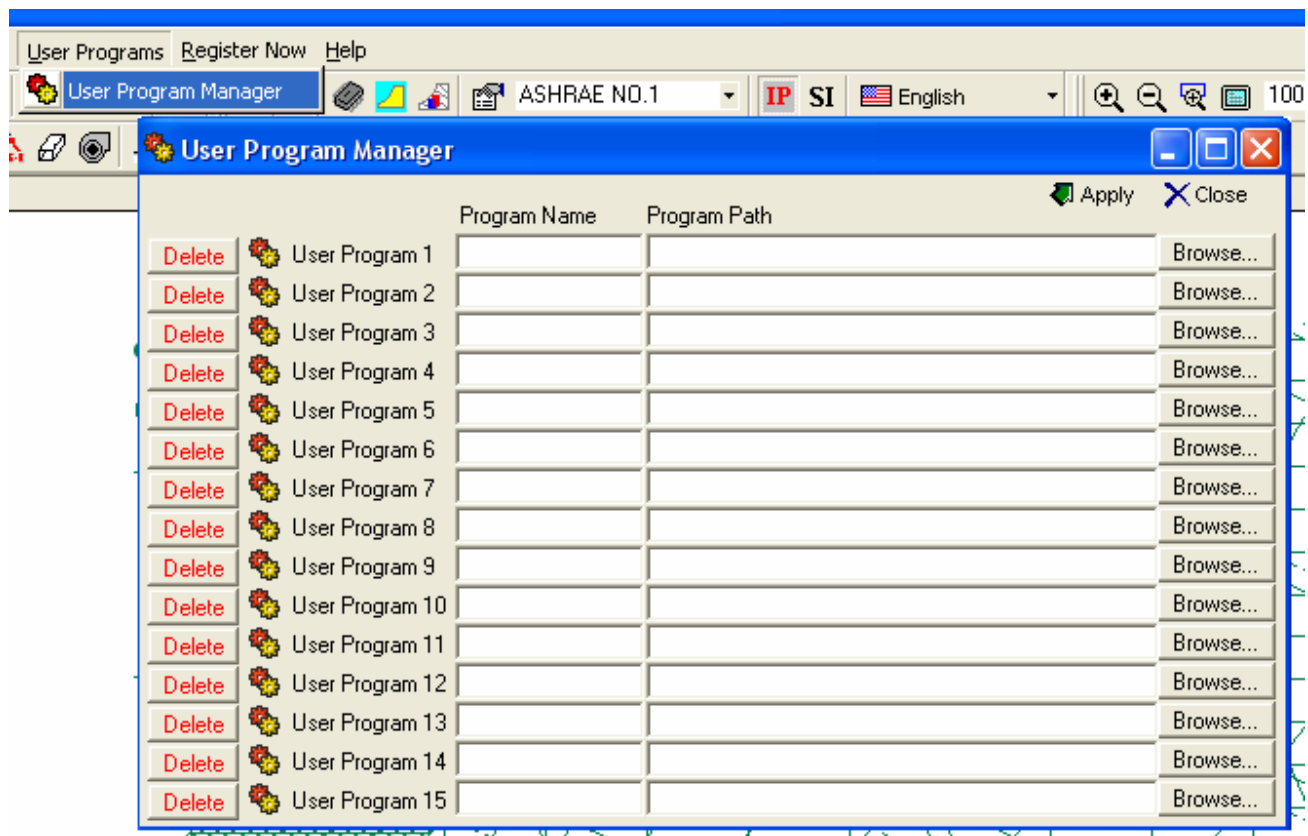
NEW Zoom Window Control!!

Now you can Zoom using a Window to specify where you want to Zoom!!



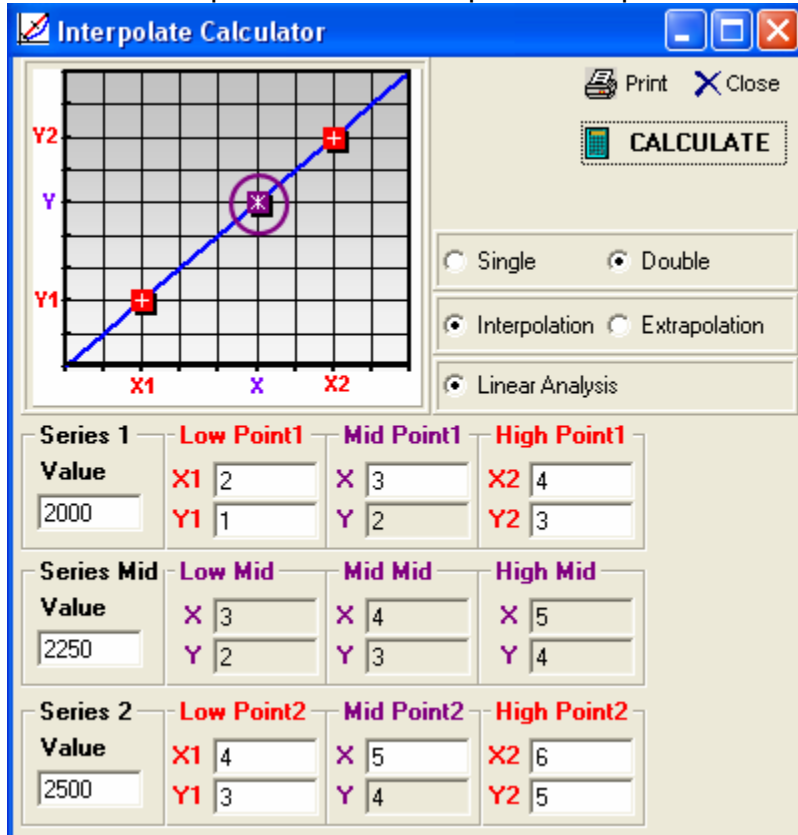
NEW Ability to add user defined "ToolBox" Programs under menu item tools!!

Now you can ADD your other Engineering Tools to the Psychrometric Analysis menu so you can access them easily and quickly!!



NEW Single & Double Interpolation and Extrapolation Calculator!!

Now single and even double Interpolation and Extrapolation is performed easily and quickly!!



Interpolate Calculator

Print Close

CALCULATE

☐ Single
 ☒ Double

☒ Interpolation
 ☐ Extrapolation

☒ Linear Analysis

Series 1

	Low Point1	Mid Point1	High Point1
Value	X1 2	X 3	X2 4
	Y1 1	Y 2	Y2 3

Series Mid

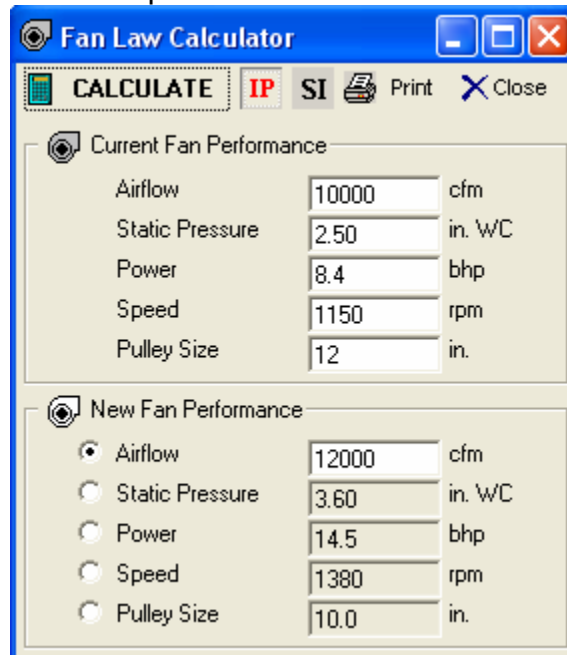
	Low Mid	Mid Mid	High Mid
Value	X 3	X 4	X 5
	Y 2	Y 3	Y 4

Series 2

	Low Point2	Mid Point2	High Point2
Value	X1 4	X 5	X2 6
	Y1 3	Y 4	Y2 5

NEW Fan Law Calculator!!

Now when you're estimating fan motor heat for an unknown condition, you can quickly calculate the new power and heat required!!



Fan Law Calculator

CALCULATE IP SI Print Close

☒ Current Fan Performance

Airflow	10000	cfm
Static Pressure	2.50	in. WC
Power	8.4	bhp
Speed	1150	rpm
Pulley Size	12	in.

☒ New Fan Performance

<input checked="" type="radio"/> Airflow	12000	cfm
<input type="radio"/> Static Pressure	3.60	in. WC
<input type="radio"/> Power	14.5	bhp
<input type="radio"/> Speed	1380	rpm
<input type="radio"/> Pulley Size	10.0	in.

NEW Duct Sizing Calculator!!

Now when you need to estimate duct design static pressures for fan performance, required motor power and motor heat, you can use this tool to quickly determine duct pressure drops!!

Duct Designer

CALCULATE **IP** **SI** **Print** **Close**

Air Condition

Airflow cfm

☒ STD Air ☐ ACTUAL Air

Density lb/cu.ft.

Duct Material

Roughness Factor ft

Rectangular Duct

Side 1 in. Side 2 in. Duct Length ft

Equal Diameter in. Area sq.ft. Velocity ft/min

Pressure Drop in.WC/100ft Total Pressure Drop in.WC

Round Duct

Diameter in. Duct Length ft

Area sq.ft. Velocity ft/min

Pressure Drop in.WC/100ft Total Pressure Drop in.WC

Oval Duct

Side 1 in. Side 2 in. Duct Length ft

Equal Diameter in. Area sq.ft. Velocity ft/min

Pressure Drop in.WC/100ft Total Pressure Drop in.WC

NEW Financial Loan / Payment Calculator!!

Great for when you need to quickly estimate a payment or generate an amortization table!

LoanCalc

Loan Amount

160000

Percent Down

10

%

Maximum Years

30

Minimum Years

30

Max Interest Rate

8.0

%

Min Interest Rate

4.0

%

Show Payments

Copy

Show Amortization Table

Print

Payment	Principal Paid	Interest Paid
\$1,174.02		
1	\$107.35	\$1,066.67
2	\$108.07	\$1,065.95
3	\$108.79	\$1,065.23
4	\$109.51	\$1,064.51
5	\$110.24	\$1,063.78
6	\$110.98	\$1,063.04
7	\$111.72	\$1,062.30
8	\$112.46	\$1,061.56
9	\$113.21	\$1,060.81
10	\$113.97	\$1,060.05



PROGRAM FEATURES

OTHER PROFESSIONAL EDITION FEATURES!

Complete state point and process report with the ability to copy EITHER the report IMAGE or the DATA to the clipboard so you can paste it right into your proposals, presentations or the data into spreadsheets!!

STATE POINT & PROCESS REPORT

Report Date: Saturday, June 12, 2004
 Project Information:
 Altitude: 0 (Feet)
 Barometric Pressure: 29.921 (in.Hg)
 Atmospheric Pressure: 14.696 (psia)

Prepared By: Robert Hanna
 Company: Hands Down Software
 Phone: (405) 844-6314
 Fax: (405) 844-6314
 email: sales@handsdownsoftware.com

1. RA

STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	75.000	63.940	55.0	0.01022	13.696	29.181	57.7592	0.0729	0.4817	5.222

2. DH

STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	90.000	63.940	22.8	0.00676	14.003	29.057	45.7887	0.0713	0.3216	3.390

Process: Desiccant Dehumidification

Start Point Name	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Dehumid- fication (lb/hr)	Sensible Heat Ratio	Enthalpy/ Humidity Ratio (Btu/lb / lb/lb)	Sensible Energy Per Dehumidification (Btu/lb)
RA	-514	16,403	-16,917	-15.5	-31.912	33	-1.0511

3. SC

STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	85.000	60.449	77.4	0.01022	13.439	28.735	57.7592	0.0743	0.4517	5.322

Process: Sensible Cooling

Start Point Name	Total Cooling (tons)	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Moisture Difference (lb/hr)	Sensible Heat Ratio	Enthalpy/ Humidity Ratio (Btu/lb / lb/lb)
RA	-0.9	-11,905	-11,905	0	0.0	1.000	N/A

4. SH

STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	90.000	66.746	33.8	0.01022	14.019	32.649	57.7592	0.0710	0.4817	5.080

Process: Sensible Heating

Start Point Name	Total Heating (tons)	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Moisture Difference (lb/hr)	Sensible Heat Ratio	Enthalpy/ Humidity Ratio (Btu/lb / lb/lb)
RA	1.4	16,506	16,506	0	0.0	1.000	N/A

5. CC

STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	55.000	54.800	98.8	0.00912	13.160	23.097	54.6642	0.0759	0.4306	4.850

Process: Cooling Coil

Start Point Name	Total Cooling (tons)	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Dehumidification (lb/hr)	Sensible Heat Ratio	Enthalpy/ Humidity Ratio (Btu/lb / lb/lb)
RA	-2.3	-27,379	-21,065	-6,414	-4.9	0.802	5.533

6. EC

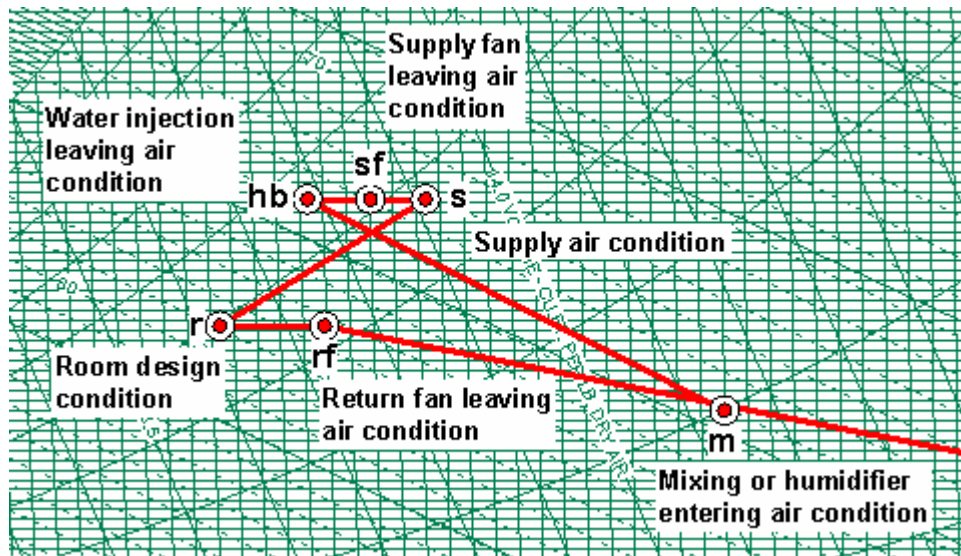
STATE POINT DATA

Air Flow (Standard) (cfm)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in.Hg)	Absolute Humidity (grains/ft.)
1.000	85.000	63.940	94.5	0.01023	13.488	29.256	63.9862	0.0741	0.5885	6.503

Process: Evaporative Cooling

Version 5.0.0
Page 1

Complete project information and note capabilities!! Notes are individually controlled allowing for font, color, border, background, etc to all be specific to each note. Complete Drag-n-drop functionality as well as new-edit-delete note management!!



User information and auto note display capability!! User information is added only once and is automatically available for displaying on both the chart and/or the state point and process report!!

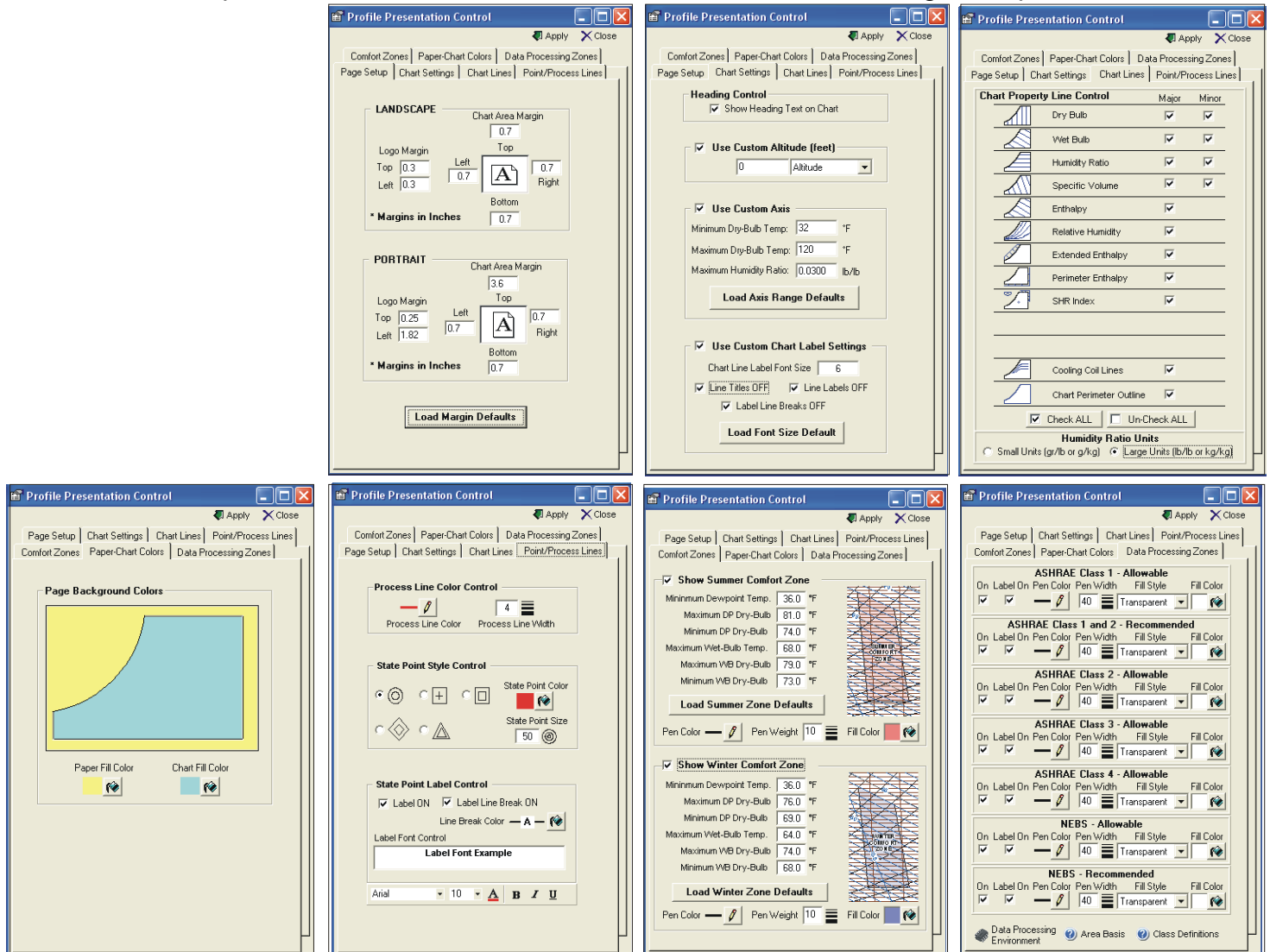
User Information

☐ Always ADD to Projects on Open
 ☒ Show on report

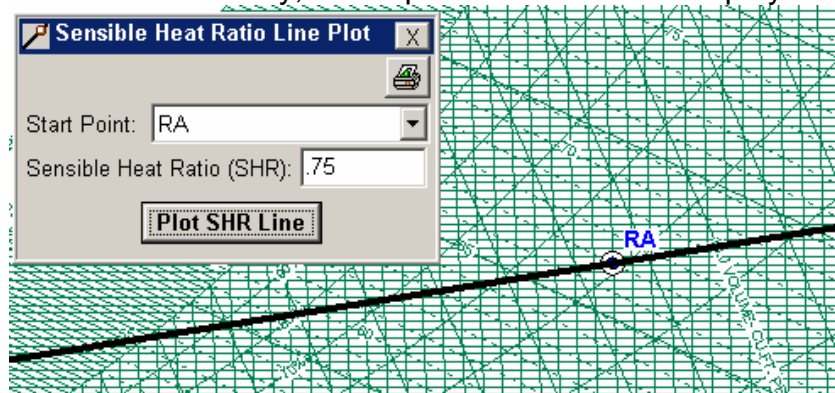
User Name : Robert Hanna
 Company Name : Hands Down Software
 Telephone No. : (405) 844-6314
 Fax No. : (405) 844-6314
 email address : sales@handsdownsoftware.com

Prepared By:
 Name: Robert Hanna
 Company: Hands Down Software
 Tel: (405) 844-6314
 Fax: (405) 844-6314
 email: sales@handsdownsoftware.com
 Date: 6/12/2004

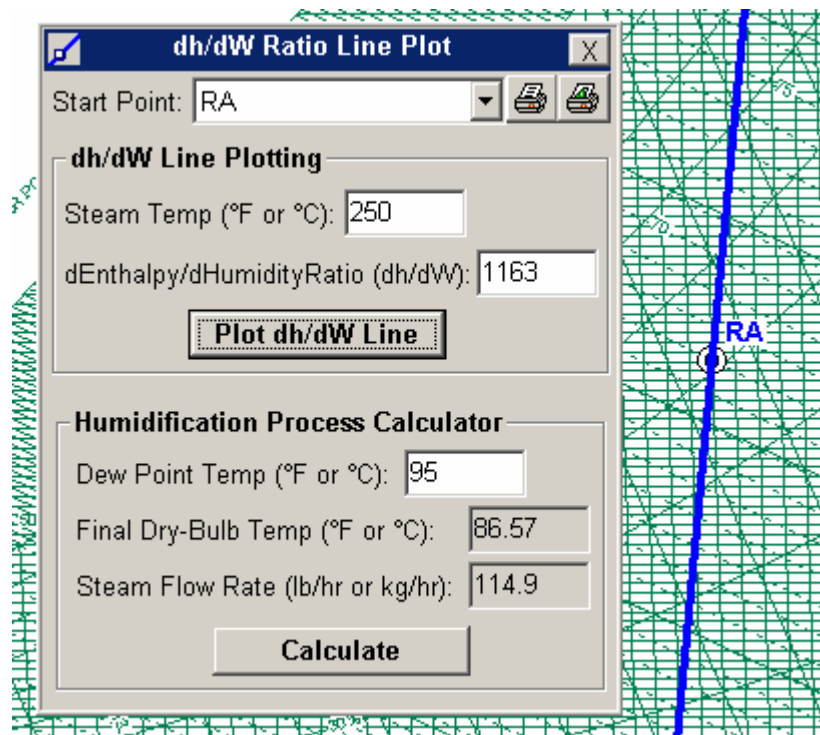
Complete Chart control including virtually any Altitude or Pressure, Dry-Bulb and Humidity Ratio Axis Limit Control, turning Lines ON & OFF, Process line color and width, state point icon and size, state point label font control, Comfort & Data Center Zones, Page Setup and more!!



Sensible Heat Ratio Line Plotting is available with one simple button click!! Type the desired SHR and click the button and instantly, the requested SHR line is displayed on the chart!!



Humidification Delta-Enthalpy / Delta-Humidity Ratio Line Plotting is available with one simple button click!! Steam Flow rate is automatically calculated based on desired Final Dew Point Temperature!!



Complete State-Point and System Process Analysis capable. Process modeling includes AIR MIXING, COOLING COIL, EVAPORATIVE COOLING, DESICCANT DEHUMIDIFICATION, HUMIDIFICATION and SENSIBLE HEATING & COOLING!! All processes can either have END POINT specified, CALCULATING PROCESS DATA or PROCESS DATA specified, CALCULATING END POINT result!

Psychrometric Processes

Apply Add Point Climatic Data... Delete Print Help

	POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
	RA	AR	1000	STD	Add State Point	POINT
	DH	AR	1000	STD	Desiccant Dehumidify	POINT
	SC	AR	1000	STD	Sensible Cooling	POINT
	SH	AR	1000	STD	Sensible Heating	ENERGY
	CC	AR	1000	STD	Cooling Coil	POINT
	EC	AR	1000	STD	Evaporative Cooling	POINT
	HH	AR	1000	STD	Humidification and Heating	POINT
	CS	AR	1000	STD	Connect State Points	POINT
	MIX	AR	2000	STD	Air Mixing	POINT

Start Point		Process		Current Point	
RA		Sensible Heating		DB 89.999	
				WV 0.010217	
Air Flow	1000	<input type="checkbox"/> Total Heating	1.4	Air Flow	1000
DB	75.000	<input type="checkbox"/> Total Energy	16,506	DB	89.999
WB	63.940	<input checked="" type="checkbox"/> Sensible Energy	16,506	WB	68.746
RH	55.0	<input type="checkbox"/> Latent Energy	0	RH	33.8
W	0.01022	<input type="checkbox"/> Moisture Difference	0.0	W	0.01022
v	13.695	<input type="checkbox"/> Sensible Heat Ratio	1.000	v	14.079
h	29.181	<input type="checkbox"/> Enthalpy/Humidity Ratio	N/A	h	32.849
DP	57.759			DP	57.759
d	0.0738			d	0.0718
vp	0.4817			vp	0.4817
AW	5.222			AW	5.080

All Charts, state-points and process data are converted automatically between **IP and/or SI** with the click of a button!!

PSYCHROMETRIC CHART

Normal Temperature

I-P Units

SEA LEVEL

BAROMETRIC PRESSURE: 29.921 in. HG



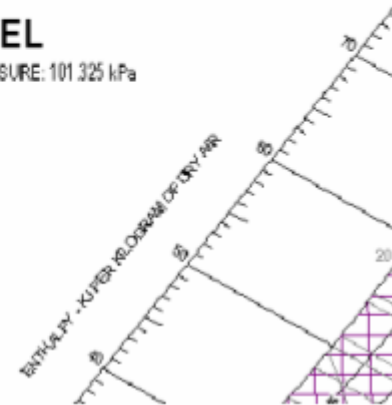
PSYCHROMETRIC CHART

Normal Temperature

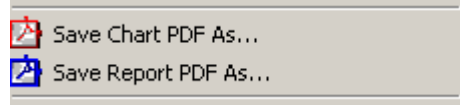
SI Units

SEA LEVEL

BAROMETRIC PRESSURE: 101.325 kPa



Ability to export chart and reports out in PDF format automatically!!



Automatically convert between **(10) different Languages** just by Clicking a button!!



PSYCHROMETRIC DIAGRAMME

La Température Normale
SI Unités

NIVEAU DE LA MER

PRESSION BAROMÉTRIQUE: 101.325 kPa



PSYCHROMETRIC CARTA

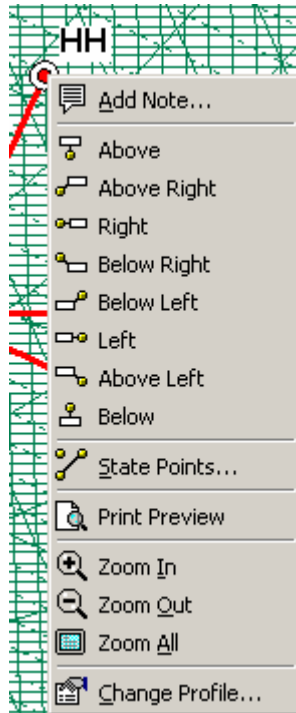
Temperatura Normal
SI Unidades

NIVEL DEL MAR

PRESIÓN BAROMÉTRICA: 101.325 kPa



Right-Click Pop-Up menus allow for easy control of the chart whether it's moving state-point labels or managing chart notes!! Left Double-Click automatically ZOOMS-IN and Right Double-Click automatically ZOOMS-OUT. Hold the left button down and Drag allows you FULL PANNING of the chart!!



Complete Psychrometric Calculator with File-Open-Save capabilities and outputs in either IP or SI units!!

Psychrometric Calculator - New Project

Altitude: 0
 Barometric Pressure: 29.921
 Atmospheric Pressure: 14.696

Dry Bulb Temp: 55
 Wet Bulb Temp: 54.8
 Relative Humidity: 98.784
 Humidity Ratio: 0.00912
 Specific Volume: 13.1600
 Enthalpy: 23.0967
 Dew Point Temp: 54.664
 Density: 0.076687
 Vapor Pressure: 0.43061
 Abs. Humidity: 0.00069
 Parts Per Million by Weight: 9,117
 Parts Per Million by Volume: 14,658

Description	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (gr/lb)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu.ft.)	Vapor Pressure (in. Hg)	Abs. Humidity (gr)
OA	95.000	78.000	47.294	0.01688	0.00000	14.3564	41.3955	71.800	0.070850	0.78631	
RA	80.000	67.000	51.140	0.01123	0.00000	13.8453	31.5098	60.347	0.073047	0.52840	
CC	55.000	54.800	98.784	0.00912	0.00000	13.1600	23.0967	54.664	0.076687	0.43061	

Complete Climatic Outside Air Design Data for over 1,000 cities throughout the WORLD for **either IP or SI units!!**

Climatic Data - ASHRAE 1997 Fundamentals

☒ **COOLING** USA 676 Elevation, Feet ☒ English (IP)
☒ **HEATING** Oklahoma 36.2 North Latitude ☐ Metric (SI)
☒ **WIND** Tulsa 95.9 West Longitude

SUMMER	DB	MWB	°F wb	WB	MDB	°F db	DP	MDB	°F db
COOLING	°F	°F		°F	°F		°F	°F	
0.4%	100	76	76.00	79	92	92.00	76	87	87.00
1%	97	76	76.00	78	92	92.00	74	85	85.00
2%	94	75	75.00	77	90	90.00	73	84	84.00

Average Annual Max. DB °F 103 Std. Dev. °F 4 Mean Daily Range DB °F 19

WINTER	DB	RH	°F wb	Coldest	WS	MCDB	Average
HEATING	°F	%		Month	mph	°F	Annual
99.6%	9	50	6.72	0.4%	24	46	Min.
99%	14	50	11.23	1%	22	40	DB Std. Dev.
							°F °F
							2 6

WIND Coincident with 0.4% DB (cooling) MCWS 12 mph PWD 180 deg.
Coincident with 99.6% DB (heating) MCWS 11 mph PWD 360 deg.
Annual Design Values 1% 25 mph 2% 23 mph 5% 21 mph

Complete Cooling Coil Leaving air condition calculator!!! Automatically calculate the Leaving air temperature or the airflow for cooling coils!!

Coil Leaving Air Condition Calculator			
<input type="button" value="Calculate"/> <input type="button" value="Apply"/> <input type="button" value="Print"/> <input type="button" value="Close"/>			
Room (Zone) RA		Load Data (select any two)	
Airflow	10,000 SCFM	<input checked="" type="checkbox"/> Total Heat	375000 Btu/hr
Dry-Bulb Temp	80.00 °F	<input type="checkbox"/> Sensible Heat	270000 Btu/hr
Humidity Ratio	0.01123 lb/lb	<input type="checkbox"/> Latent Heat	105000 Btu/hr
Enthalpy	31.51 Btu/lb	<input checked="" type="checkbox"/> SHR	.72 Qs/Qt
Leaving Coil CC		Leaving Coil Condition <input type="button" value="Apply"/>	
<input checked="" type="radio"/> Airflow (use)	10,000 SCFM	Airflow	10,000 SCFM
<input type="radio"/> Dry-Bulb (use)	55.00 °F	Dry-Bulb Temp	55.414 °F
Humidity Ratio	0.00904 lb/lb	Humidity Ratio	0.00910 lb/lb
Enthalpy	23.02 Btu/lb	Enthalpy	23.18 Btu/lb

Coil Leaving Air Condition Calculator			
<input type="button" value="Calculate"/> <input type="button" value="Apply"/> <input type="button" value="Print"/> <input type="button" value="Close"/>			
Room (Zone) RA		Load Data (select any two)	
Airflow	10,000 SCFM	<input checked="" type="checkbox"/> Total Heat	375000 Btu/hr
Dry-Bulb Temp	80.00 °F	<input type="checkbox"/> Sensible Heat	270000 Btu/hr
Humidity Ratio	0.01123 lb/lb	<input type="checkbox"/> Latent Heat	105000 Btu/hr
Enthalpy	31.51 Btu/lb	<input checked="" type="checkbox"/> SHR	.72 Qs/Qt
Leaving Coil CC		Leaving Coil Condition <input type="button" value="Apply"/>	
<input type="radio"/> Airflow (use)	10,000 SCFM	Airflow	9.812 SCFM
<input checked="" type="radio"/> Dry-Bulb (use)	55.00 °F	Dry-Bulb Temp	55.00 °F
Humidity Ratio	0.00904 lb/lb	Humidity Ratio	0.00904 lb/lb
Enthalpy	23.02 Btu/lb	Enthalpy	23.02 Btu/lb

Integral Air Collection Calculator!! Simply click on the combo box drop downs and select the state points desired for collection, and with one “Calculate =>” button click, your system collection point is automatically displayed, available to be added to your system, chart and report!!

Air Collection Calculator [Print] [Close]

Selected Point 1	RA
Airflow	1,000 SCFM
Dry-Bulb Temp	75.00 °F
Humidity Ratio	0.01022 lb/lb
Enthalpy	29.18 Btu/lb

Selected Point 2	DH
Airflow	1,000 SCFM
Dry-Bulb Temp	90.00 °F
Humidity Ratio	0.00678 lb/lb
Enthalpy	29.07 Btu/lb

Selected Point 3	CC
Airflow	1,000 SCFM
Dry-Bulb Temp	55.00 °F
Humidity Ratio	0.00912 lb/lb
Enthalpy	23.10 Btu/lb

Selected Point 4	EC
Airflow	1,000 SCFM
Dry-Bulb Temp	65.00 °F
Humidity Ratio	0.01253 lb/lb
Enthalpy	29.26 Btu/lb

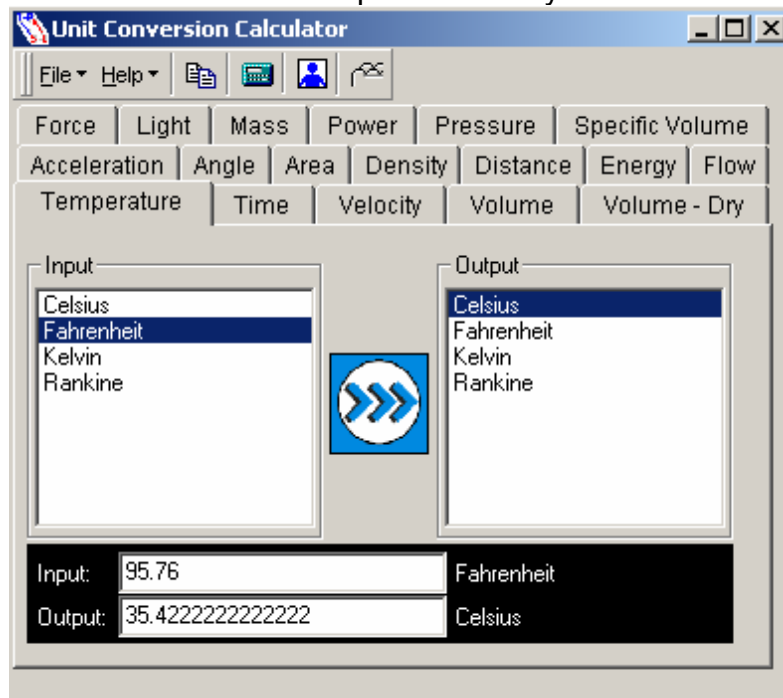
Selected Point 5	CS
Airflow	1,000 SCFM
Dry-Bulb Temp	70.00 °F
Humidity Ratio	0.00200 lb/lb
Enthalpy	18.98 Btu/lb

[Calculate =>]

[Apply Point to Chart]

Collection Point	Point Label Here
Airflow	5,000 SCFM
Dry-Bulb Temp	71.00 °F
Humidity Ratio	0.00813 lb/lb
Enthalpy	25.92 Btu/lb

Complete unit of conversion calculator for quick and easy IP<>SI unit conversions!!

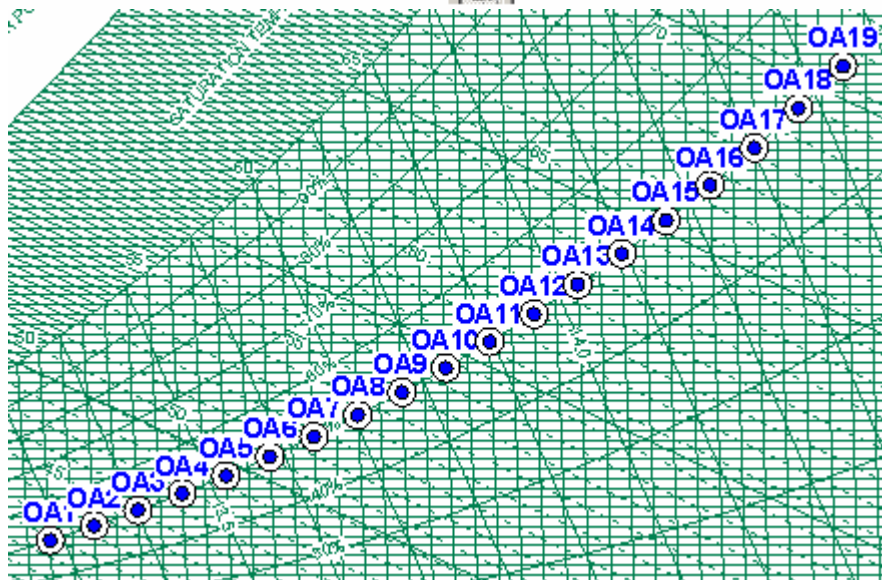


Complete Data Exchange Capabilities!! You can export data, charts and reports either by Edit-Copy copying to the clip board, or by automatically exporting out to a PDF file!! Importing of Data is accomplished with comma delimited “.csv” files which can easily be generated with any text editor or spreadsheet program such as Microsoft Excel!!!

The screenshot displays the Microsoft Excel interface with the file 'HDPsyChart Points.csv' open. The spreadsheet contains the following data:

	A	B	C	D	E	F	G	H
1	ALTITUDE	750						
2	LABEL	OA1	CFM	2000	DB	50	RH	50
3	LABEL	OA2	CFM	2002	DB	52	RH	50
4	LABEL	OA3	CFM	2004	DB	54	RH	50
5	LABEL	OA4	CFM	2006	DB	56	RH	50
6	LABEL	OA5	CFM	2008	DB	58	RH	50
7	LABEL	OA6	CFM	2010	DB	60	RH	50

Below the spreadsheet, a preview of the psychrometric chart is shown, displaying the data points OA1 through OA19 plotted on a green grid. The chart includes labels for ALTITUDE, 750, and various psychrometric properties like DB, RH, and CFM.



Motor heat calculation is one button click away!! Simply type in the motor size (power) and the efficiency and instantly get the resulting sensible heat generated by the motor along with the corresponding temperature rise!!

Given Data		
Airflow	15000	cfm
Motor Size	10	hp
Efficiency	91.4	%

Sensible Air Heating		
Sensible Heat	27835	Btu/hr
Approx Temp Rise	1.71	*F

Complete Steam Property Calculator in both IP and SI units of measure!!!

Temperature	325	*F
Absolute Pressure	96.3000	psi
Absolute Pressure	196.0688	in.Hg

Specific Volume - vf	0.01771	cu.ft./lb
Specific Volume - vfg	4.598	cu.ft./lb
Specific Volume - vg	4.616	cu.ft./lb

Specific Enthalpy - hf	295.64	Btu/lb
Specific Enthalpy - hfg	891.47	Btu/lb
Specific Enthalpy - hg	1187.10	Btu/lb

Specific Entropy - sf	0.4706	Btu/lb *F
Specific Entropy - sfg	1.1361	Btu/lb *F
Specific Entropy - sg	1.6067	Btu/lb *F



VERSION AND RELEASE HISTORY

VERSION 6 – NEW FEATURES (Release Jan-2007)

NEW PROCESS ANALYSIS CAPABILITIES

- New Auto Flow Chart Diagram
- New Individual Process Line Color Control
- New Individual Point Color, Shape and Size Control
- New Winter "V" Air Mixing Capability with Condensation
- New Fog Region Property Display
- Constant h, WB, HR, DB Line Control

NEW TOOLS

- New Complete Thermal Comfort Calculator
- New Weather Data Plotting with Complete Global Weather Files
- New Weather Bin Shade Plotting with Complete Control
- New Global Weather Data Table Access
- New Weather Term Glossary
- New Wind Chill Factor Calculator
- New Climatic Data Printing Capability Added
- New Outside Air Estimator UPDATED to ASHRAE Standard 62-2004

NEW PRESENTATION CONTROL

- New Humidity Ratio Unit of Measure Control
- New Mouse Cross-Hair (Like CAD!!) or Target Control
- New Cooling Coil Performance Line Control
- New Page Color Control
- New Chart Area Color Control
- New ASHRAE Class 1 through 4 Datacenter Zones (allowed & recommended)
- New NEBS Datacenter Zones (allowed & recommended)
- New Black & White \Leftrightarrow Color Display & Print Control
- New Heading On/Off Control
- New Outline On/Off Control
- New Zoom Window Control

NEW TOOLBOX ANALYSIS

- New Ability to add user defined "ToolBox" Programs under menu item tools
- New Single & Double Interpolation Calculator
- New Fan Law Calculator
- New Duct Sizing Calculator
- New Loan Calculator

NEW ADDITIONAL CAPABILITIES

- New High Pressure Capability up to 100 PSI
- New Auto-Altitude Change with Climatic Location Selection
- New Fog Region Thermo-Physical Property Display

NEW LANGUAGES

- Now with (13) Different Languages on Charts and Reports with one button click
- New Greek Language

- *New Japanese Language*
- *New Dutch Language*
- *Improved Italian Language Updated*

NEW DATA EXCHANGE

- *New REAL-TIME Data Monitoring Capability*
- *New Process Control added to Data Import Function*
- *New Complete Weather Data Export to Excel or Text File*
- *SI units added to text file & Excel Data Exchange*
- *New Export-As Excel *.csv File*
- *New Export-As Notepad *.txt File*

NEW NOTES

- *Improved Note Control Update*

VERSION 5 – FEATURES (Release Jan-2005)

NEW PRESENTATION CONTROL

- *New Custom Axis Range Control*
- *New Chart Altitude or Pressure Control*
- *New Lines ON/OFF Control*
- *New Process Line Color & Width Control*
- *New State Point Icon, Size Control, Color & Label Control*
- *New Comfort Zone Area Plotting*
- *New User information Saved/Displayed on Charts & Reports*
- *New Page Setup Control*

NEW PROCESS ANALYSIS CAPABILITIES

- *New Sensible Heat Ratio Line Plotting*
- *New Humidification Delta-Enthalpy / Delta-Humidity Ratio Line Plotting*
- *New Partial Mixing of Airstreams Allows for Component Mixing Bypass*
- *New Cooling Coil Leaving Air Calculator / Auto-Plotting*
- *New Organized Toolbar Menu Setup*

NEW TOOLS

- *New Air Collection Calculator with Auto-Plotting*
- *New Integral IP<=>SI Unit of Measure Calculator*
- *New Fresh Air Estimator Updated to 62-2001*
- *New Motor Heat Calculator*
- *New Steam Property Calculator*

NEW ADDITIONAL CAPABILITIES

- *New Easy Auto-Create / Export PDF Files of Charts & Reports*

NEW LANGUAGES

- *Now (10) Languages including CHINESE*

NEW DATA EXCHANGE

- *New Complete Data Exchange Capabilities*

NEW NOTES

- *New Add/Edit/Delete Note Control with Drag-Drop Positioning*
- *New Project Information Control Displayed on Chart & Report*

VERSION 4 – FEATURES (Release Jan-2003)

NEW PRESENTATION CONTROL

- *New State Point and Process Report*
- *New Universal IP \Leftrightarrow SI Unit Control*

NEW PROCESS ANALYSIS CAPABILITIES

- *New Air Mixing Process*
- *New Cooling Coil Process (with REAL Cooling Coil Curves!)*
- *New Desiccant Dehumidification Process*
- *New Sensible Heating Process*
- *New Heating & Humidification Process*
- *New Evaporative Cooling Process*
- *New Sensible Only Cooling Process*

NEW TOOLS

- *New Stand Alone Psychrometric Calculator*
- *New Stand Alone World-Wide Climatic Data*
- *New Stand Alone Outside Air Calculator based on ASHRAE Standard 62-89*

NEW ADDITIONAL CAPABILITIES

- *New State Point Label Positioning Control*
- *New Zoom & Pan Control*
- *New Mouse-Move Thermo-Physical Property Display*

NEW LANGUAGES

- *New (7) Different Languages on Charts & Reports with one-button click*

NEW DATA EXCHANGE

- *New Ability to Copy Chart to Clipboard*
- *New Ability to Copy Report to Clipboard*



PROGRAM SUPPORT

Technical Support

Technical support is **free of charge** and available by fax, mail, email and through our World Wide Web site.

It is our policy to respond to all inquires within 48 hours from receipt.

Please include Version number found in the "About" box under the Help menu with your inquiry.

Email: support@handsdownsoftware.com

Phone: 405.844.6314

Fax: 405.844.6314

Write: Hands Down Software
1108 Olde Bridge Road
Edmond, OK 73034
USA

Web: <http://www.handsdownsoftware.com>

Contact Us

HANDS DOWN SOFTWARE

1108 Olde Bridge Road
Edmond, OK 73034
USA

Off: 405.844.6314

Fax: 405.844.6314

Email: info@handsdownsoftware.com

OFFICE HOURS

8:00 am - 5:00 pm Central Standard Time
Monday through Friday

HOLIDAYS

New Year's Day
Memorial Day
July 4th
Labor Day
Thanksgiving
Christmas

V6 Registration

Version 6 requires a registration code for EACH Seat, (1) Seat is licensed per CD, unless you have purchased a site license.

Psychrometric Analysis
Release 6.0.0

Registration is REQUIRED for Version 6

** Note: HDPsyChart Psychrometric Analysis will only run for a few days without registration and will stop functioning without notice. Registration is required for this version.*

User Registration

When you register as a User of this program, your contact information will be included in email notification broadcasts of:

- => Corrective patches when issued
- => New Features update links as they become available
- => New Versions as they become available
- => Periodic Tips and Use Examples

Enter Registration Code Below

[Click Here to Validate and Save Registration Code](#)

[Register Later](#) [End without Registering](#)

REGISTRATION CODE REQUEST

Print E-Mail Close

email or fax to 405.844.6314

Installation Code: 13633.21

Version: BENNOR HDPsyChart

Version Type: Professional Edition

Release: 6.0.0

Your Name: _____

Company: _____

Address 1: _____

Address 2: _____

City: _____ State/Prov. _____

Postal Code: _____ Country: _____

Phone: _____ Fax: _____

* E-Mail: _____

** Note: This is where your registration code will be sent. (1) code is provided per CD. Please contact us for additional seat purchases if necessary.*

General Registration

When you register as a User of this program, your contact information is included in email notification broadcasts of Corrective Patches, New Features, New Versions, Tips, etc., everything you need to stay current.

Menu Path

PSYCHROMETRIC ANALYSIS CD - PsyChart1

File Edit Analysis Notes Tools View Language Settings Register Now Help

User Registration Form

Psychrometric Analysis

Close

E-Mail

Print

email or fax to 405.844.6314

Your Name: _____

Company: _____

Version: _____

Address 1: _____

Address 2: _____

City: _____ State/Prov. _____

Postal Code: _____ Country: _____

Phone: _____ Fax: _____

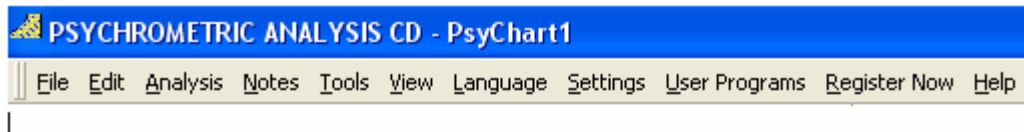
E-Mail: _____



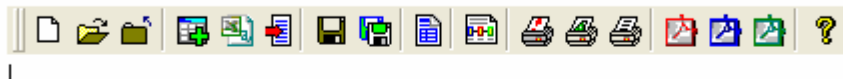
MENUS AND TOOLBARS

Menus and Toolbars

You can access the Psychrometric Analysis services via a standard Windows menu and toolbar system. Each component of the system can be dragged and docked to the top, bottom, left or right sides of the Psychrometric Chart Window, or can become floating menus positioned anywhere within the Psychrometric Window.



Top Level Toolbar Menu



Print and File Actions



Chart Presentation (Profile) and User Preferences Control



Psychrometric Analysis



Zoom Control



Psychrometric and Engineering Tools



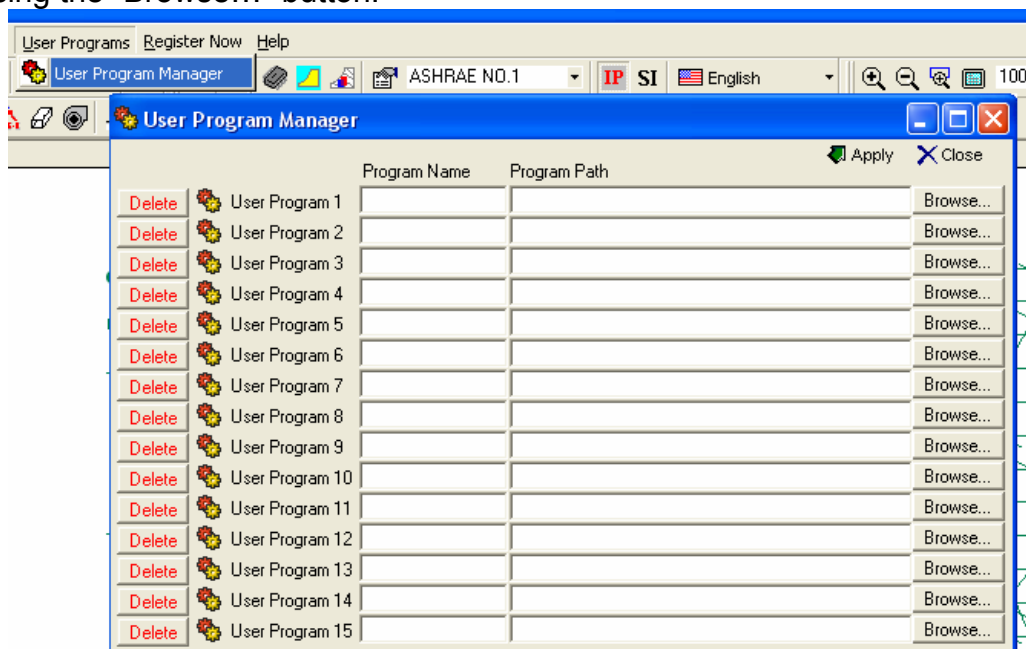
Note Control

DB
96.6
WB
69.1
RH
24.2
W
.0090
v
14.23
h
33.06
DP
54.2
d
0.0703
vp
0.423
AW
4.405
X
7.692
Y
5.660

In addition to accessing these services, a constant display of the mouse position in psychrometric property terms is available at all times. The values are displayed in a button bar that can be docked or floating just as the Psychrometric Analysis's other button bars. See the graphic to the left. Let the mouse pointer hover over a value for just a couple of seconds and the engineering units for that value are displayed. The values can be configured for your own needs via the button bar customize option as described above.

Custom User-Defined Menu Toolbars

To add your favorite engineering tools to the Psychrometric Analysis Menu Toolbars, simple click User Programs => User Program Manager and provide a Program Name and locate the program using the "Browse..." button.





PRESENTATION SETTINGS

IP OR SI UNIT CONTROL

You can switch from IP to SI and back with one button click. All State Points and Processes are dynamically recalculated on the fly!!

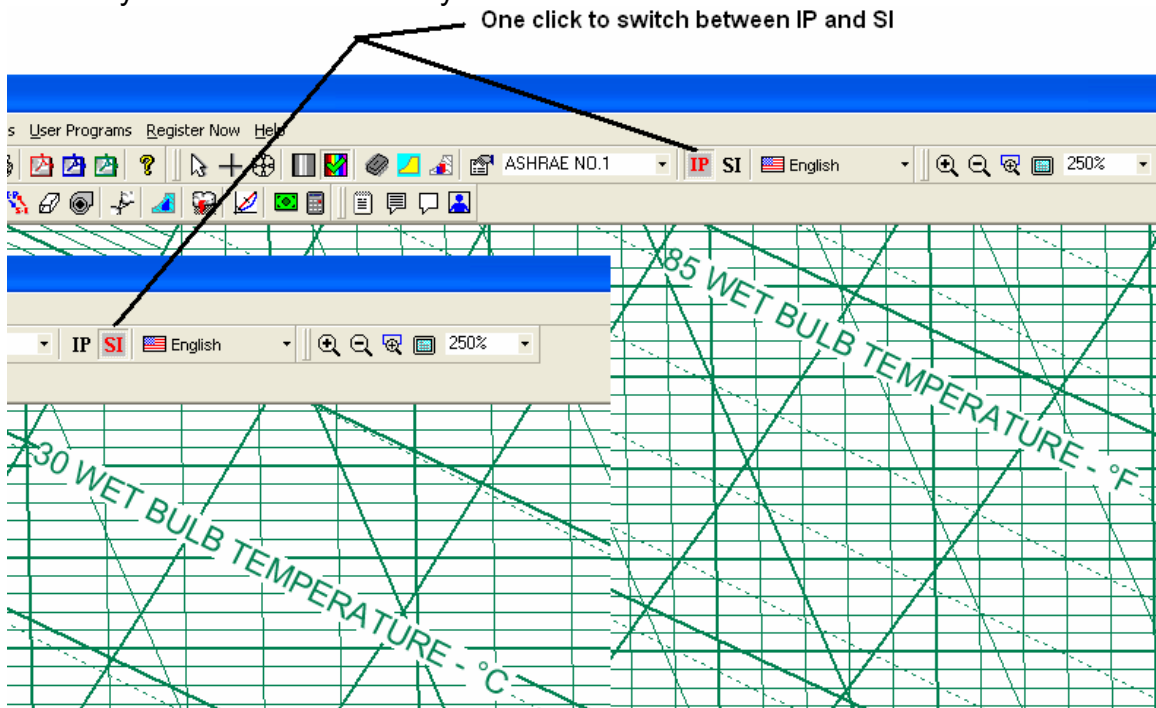
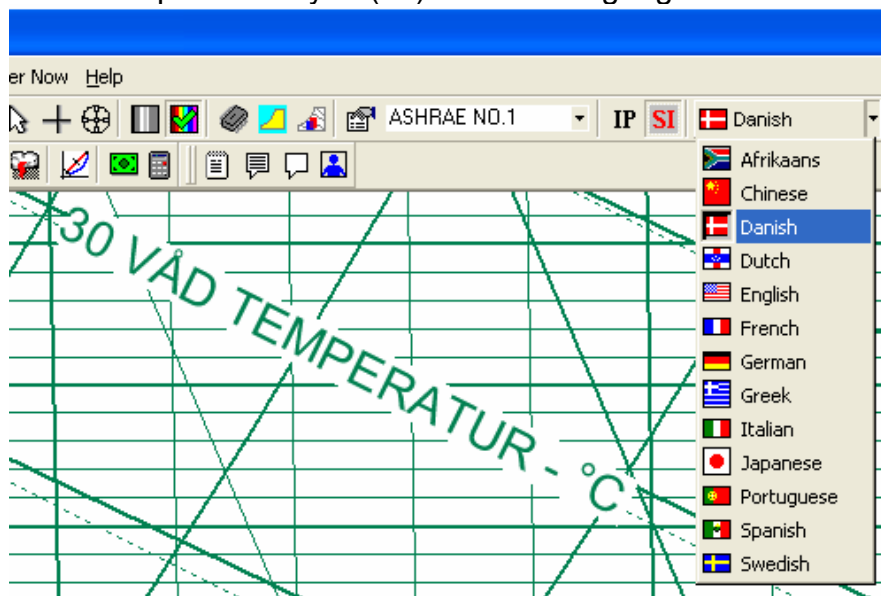


CHART & REPORT LANGUAGE CONTROL

Change your charts and reports to any of (13) different languages with one button click!!



PAGE SETUP CONTROL

Complete page setup control supporting both IP and SI units of measure!

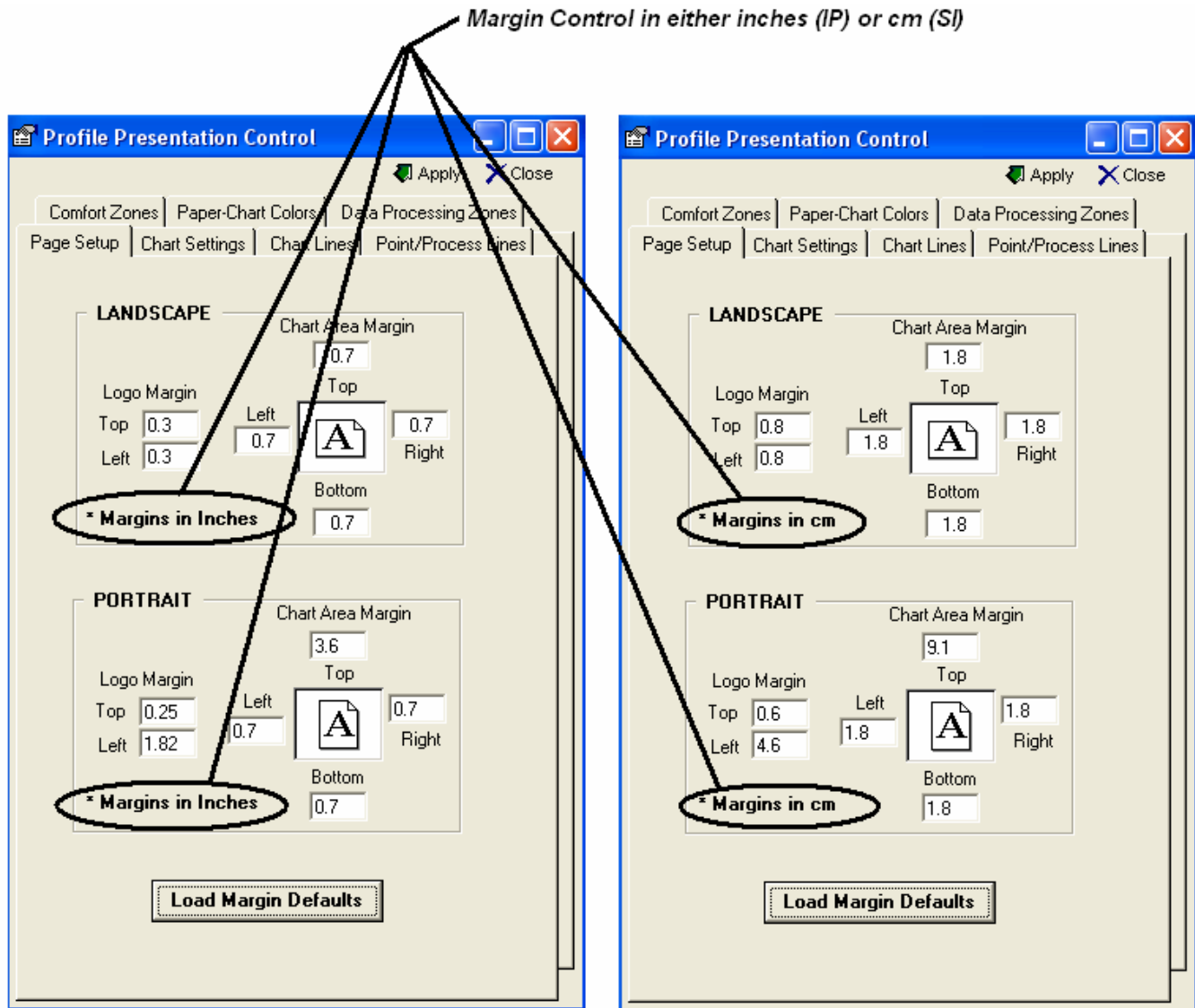


CHART AXIS RANGE CONTROL

Complete Dry-Bulb and Humidity Ratio Range Control!!

☒ **Use Custom Axis**

Minimum Dry-Bulb Temp: °F

Maximum Dry-Bulb Temp: °F

Maximum Humidity Ratio: lb/lb

Load Axis Range Defaults

☒ **Use Custom Axis**

Minimum Dry-Bulb Temp: °C

Maximum Dry-Bulb Temp: °C

Maximum Humidity Ratio: kg/kg

Load Axis Range Defaults

ALTITUDE & PRESSURE CONTROL

Generate Charts and Perform Analysis at virtually any Altitude or Pressure!!

☒ **Use Custom Altitude (in. HG)**














Barometric
 Altitude
 Barometric
 Atmospheric

☒ **Use Custom Altitude (kPA)**

Barometric
 Altitude
 Barometric
 Atmospheric

CHART LINE ON/OFF CONTROL

Improved and Enhanced Line Property and Feature On/Off Control!!

Chart Property Line Control		Major	Minor
	Dry Bulb	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Wet Bulb	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Humidity Ratio	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Specific Volume	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Enthalpy	<input checked="" type="checkbox"/>	
	Relative Humidity	<input checked="" type="checkbox"/>	
	Extended Enthalpy	<input checked="" type="checkbox"/>	
	Perimeter Enthalpy	<input checked="" type="checkbox"/>	
	SHR Index	<input checked="" type="checkbox"/>	
	Dew Point	<input checked="" type="checkbox"/>	
	Vapor Pressure	<input checked="" type="checkbox"/>	
	Cooling Coil Lines	<input checked="" type="checkbox"/>	
	Chart Perimeter Outline	<input checked="" type="checkbox"/>	

☒ Check ALL
 ☐ Un-Check ALL

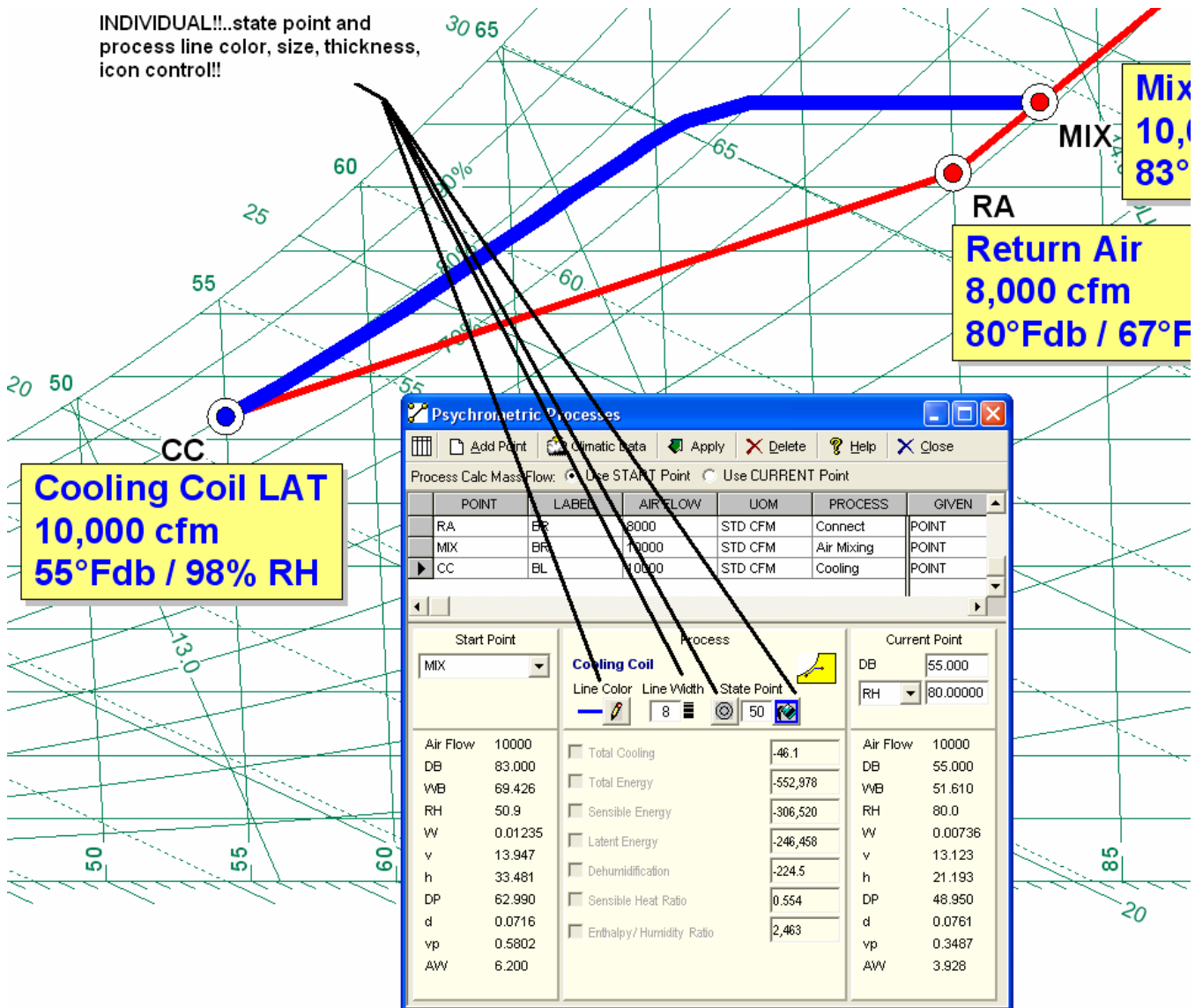
HUMIDITY RATIO UNIT CONTROL

Complete Humidity Ratio Unit of Measure Control!!

Humidity Ratio Units
☐ Small Units (gr/lb or g/kg)
 ☒ Large Units (lb/lb or kg/kg)

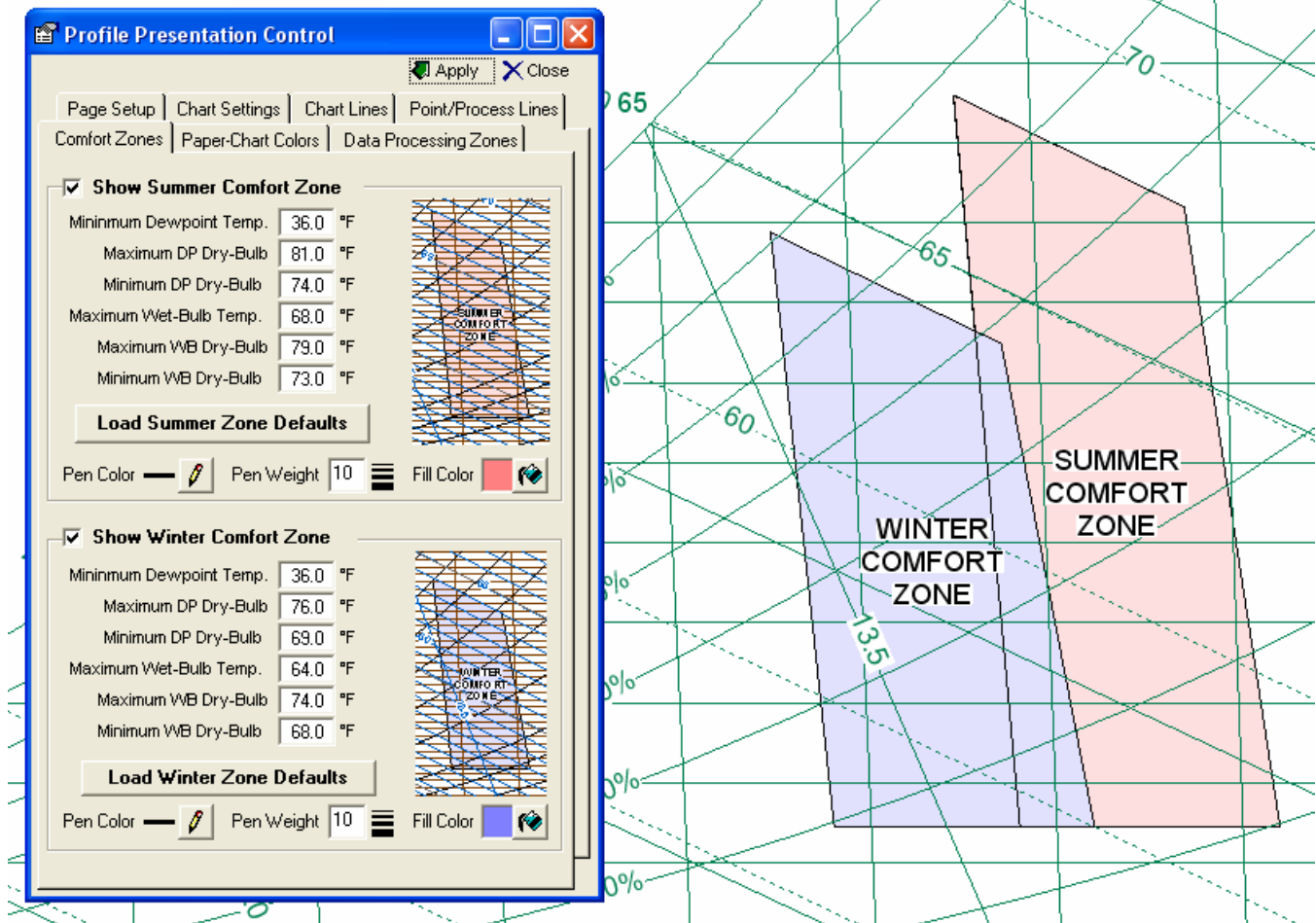
PROCESS LINE & STATE POINT COLOR & SIZE CONTROL

Now you can specify the colors, size, thickness and icons for each individual state point and process!!



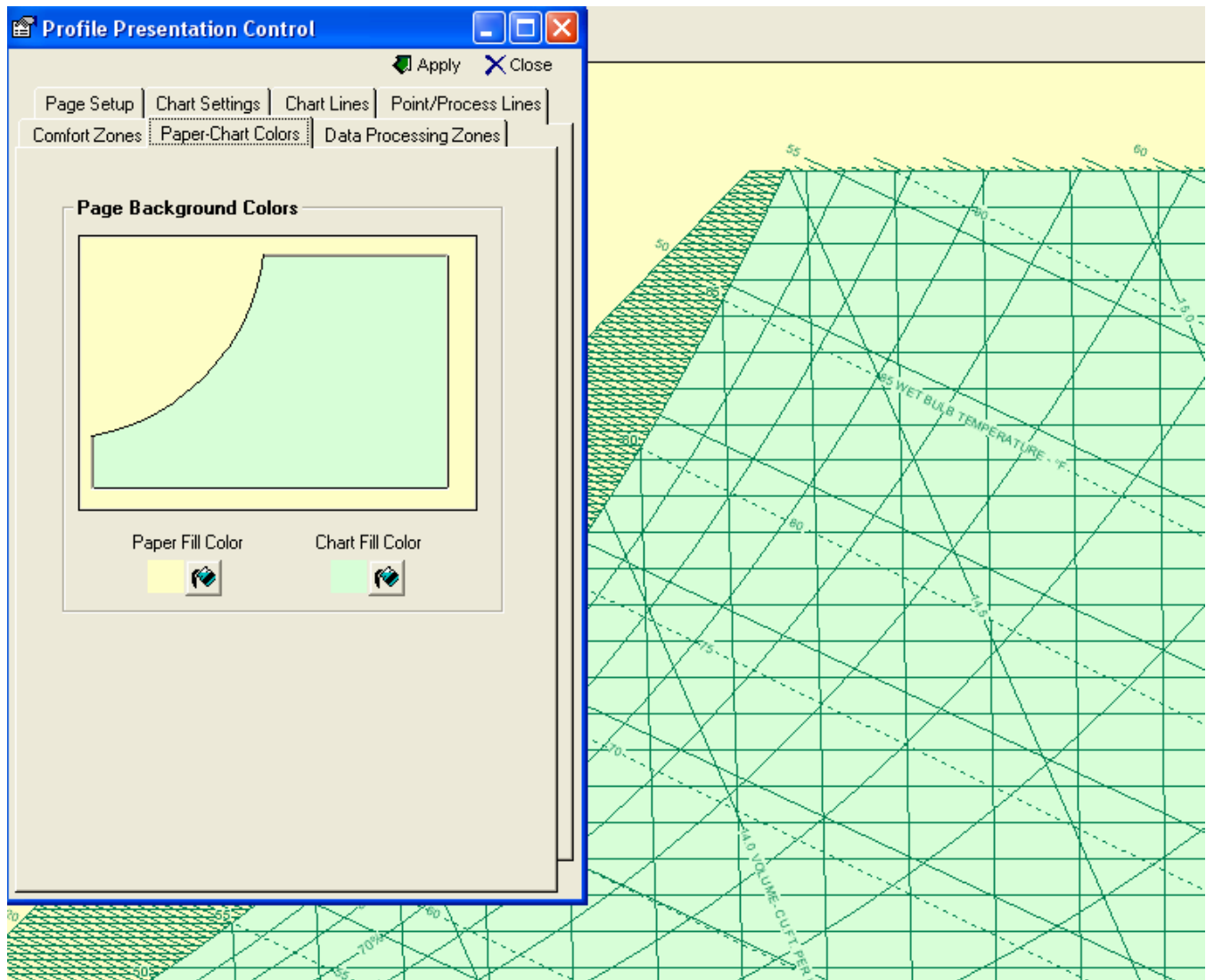
SUMMER & WINTER COMFORT ZONE CONTROL

Seeing the Summer and Winter Comfort Zones is just a button click away, and you can format the line color, weight and area fill color too!!



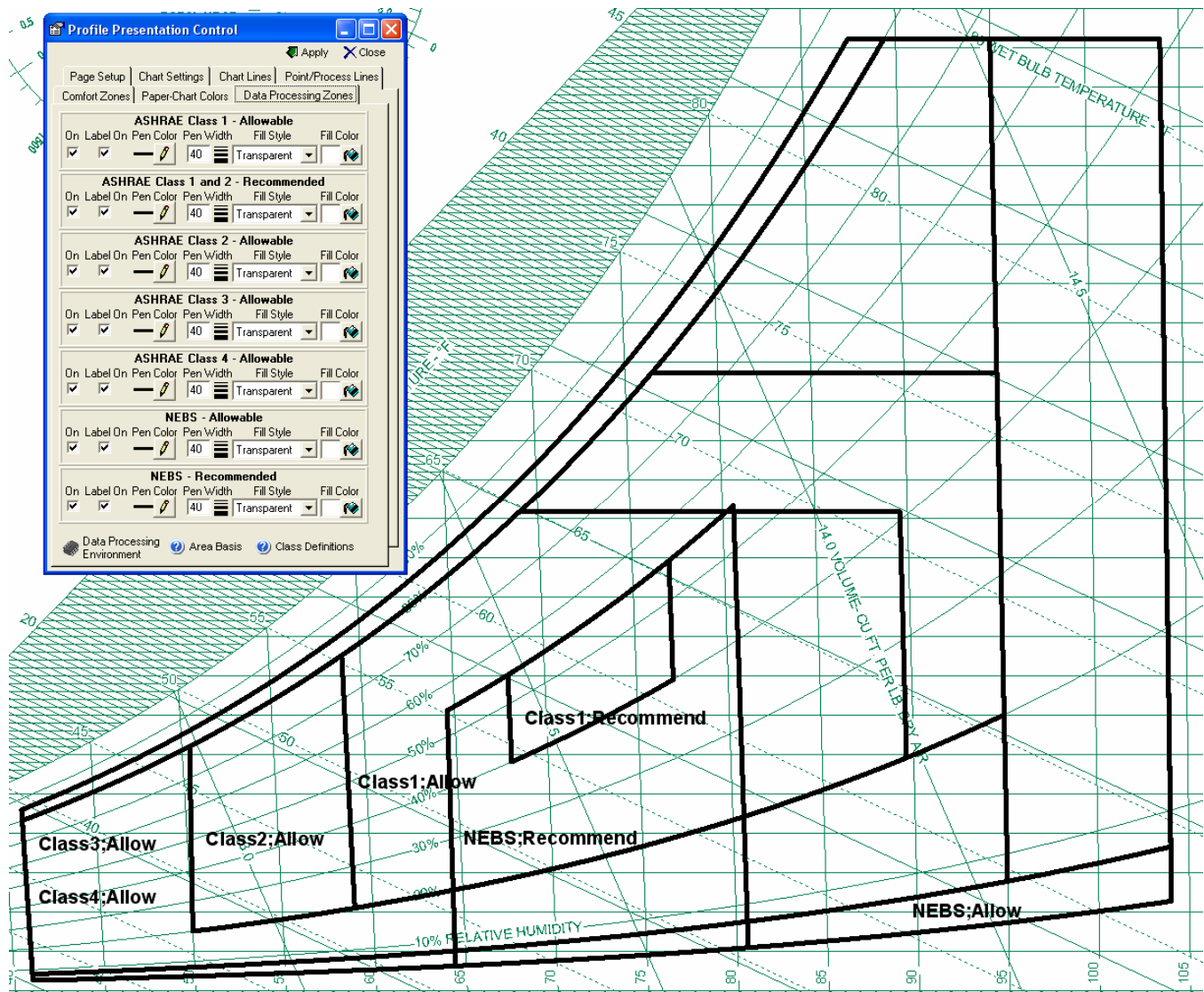
PAPER & CHART AREA COLOR CONTROL

Specifying the chart area and paper area colors is a snap!!



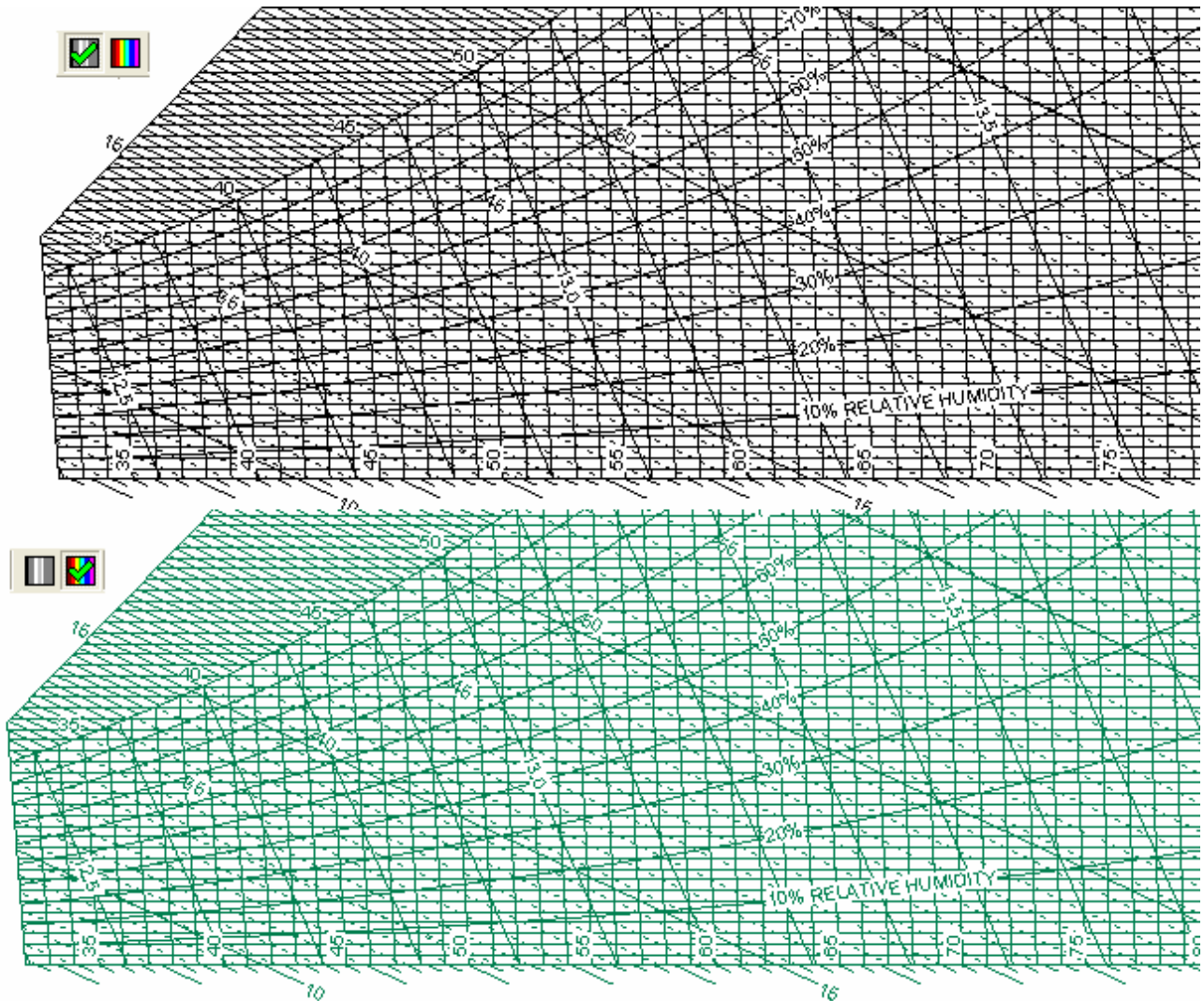
DATA PROCESSING ENVIRONMENT AREA DISPLAY CONTROL

Take the mystery out of the ASHRAE Data Processing Environment Class Areas with one button click!!!...Dynamically adjusts the areas based on altitude or pressure too!!



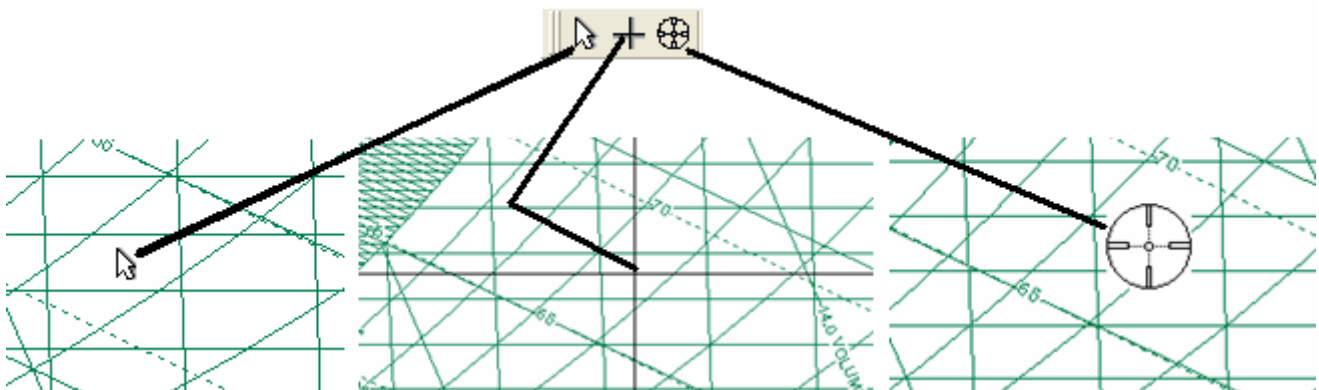
COLOR OR B&W CHART CONTROL

Switch from Color to Black & White and back with just one button click!!!



MOUSE POINTER CONTROL

Simply click the icon on the toolbar to select the mouse tracking icon preference!!!

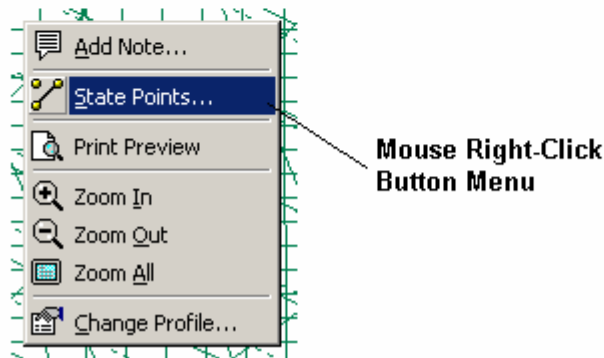
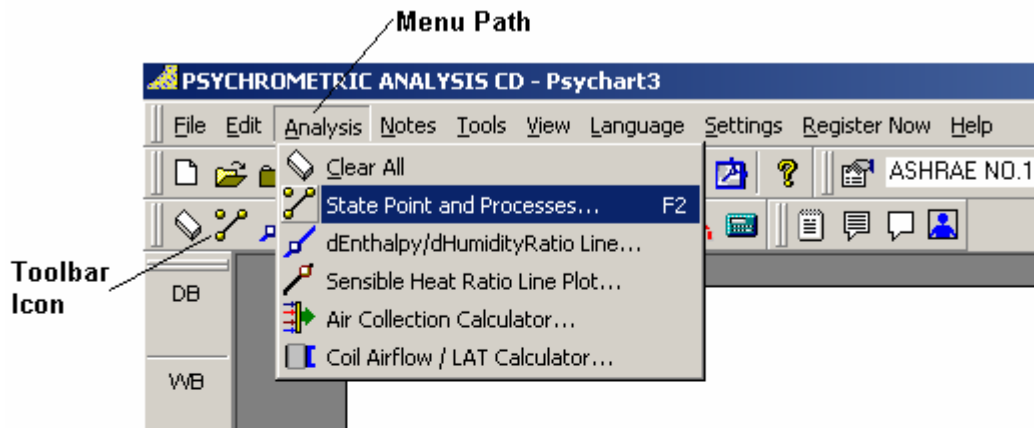




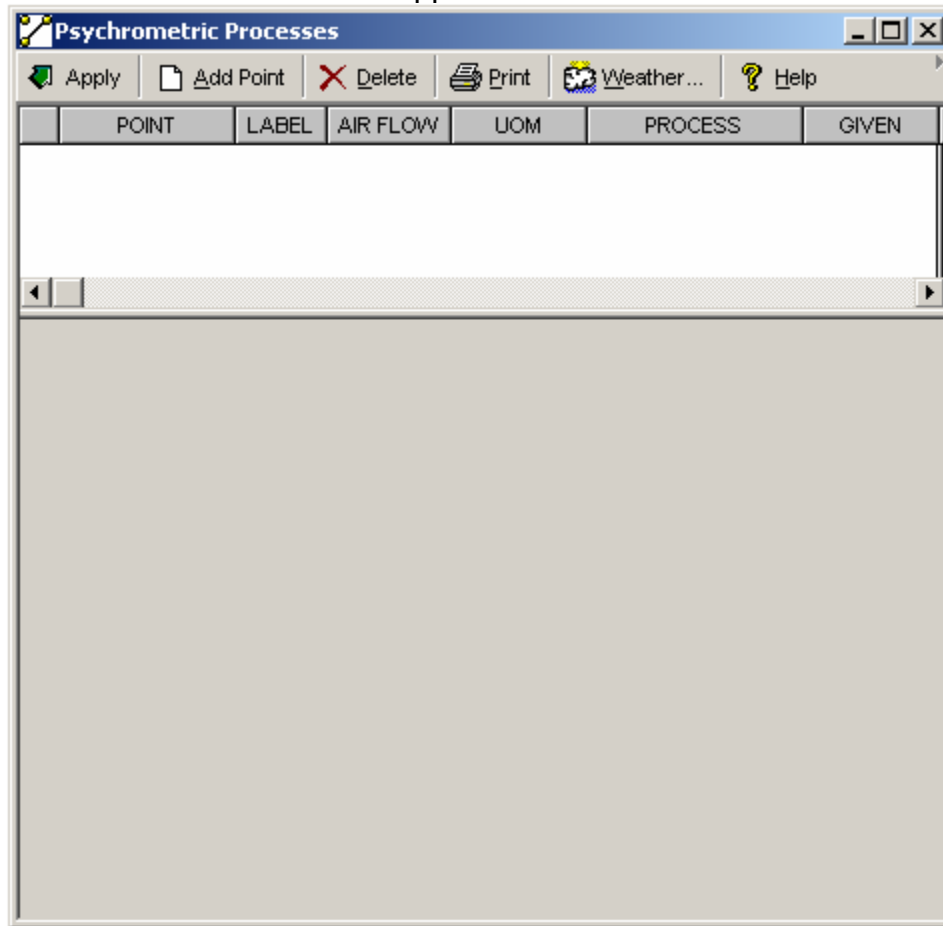
PSYCHROMETRIC ANALYSIS

STATE POINT & PROCESS ANALYSIS

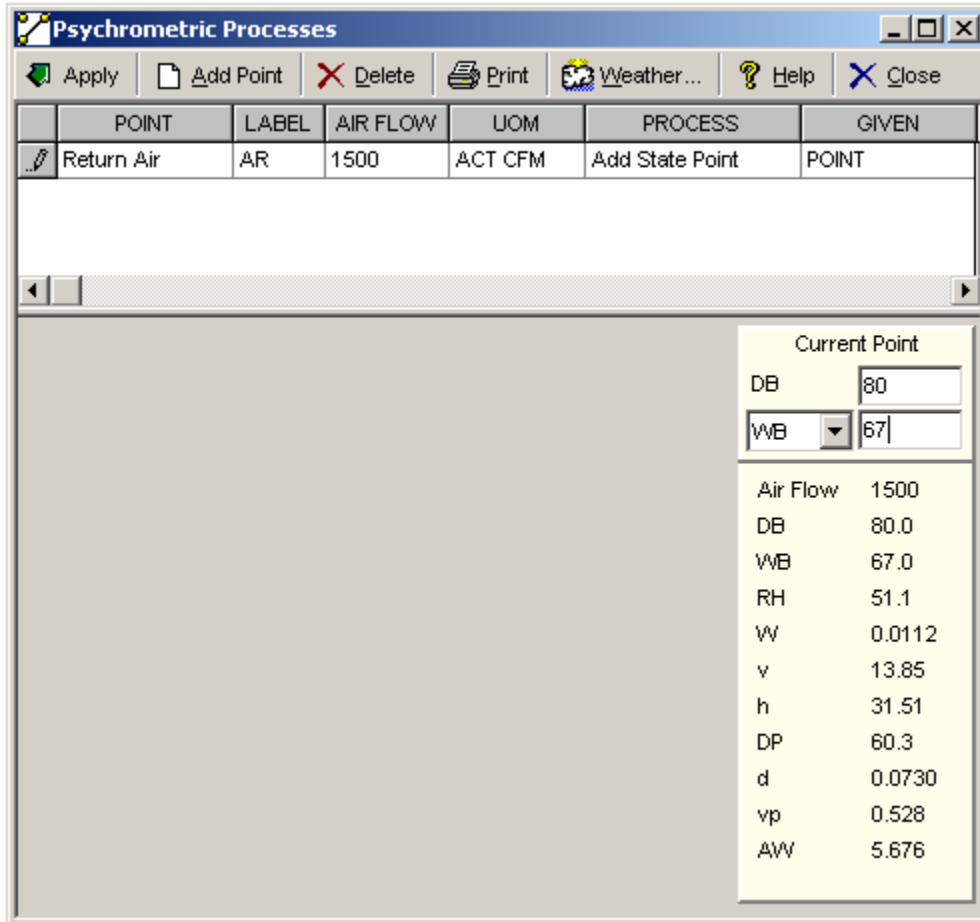
1. Activate "State Point and Processes" by any of the three methods shown below:



2. The Psychrometric Processes window appears with blank data fields.



3. To enter a new point, click the Add Point button. Fill in the grid information as needed (point name, point label location, enter the airflow, select air flow units, select process and select given option). If this is the first point, the only process offered is "Add State Point" since there are no other points to create a process with. Click on the "Current Point" panel and enter dry bulb temperature, enter moisture value and select moisture property from the drop-down box.



POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
Return Air	AR	1500	ACT CFM	Add State Point	POINT

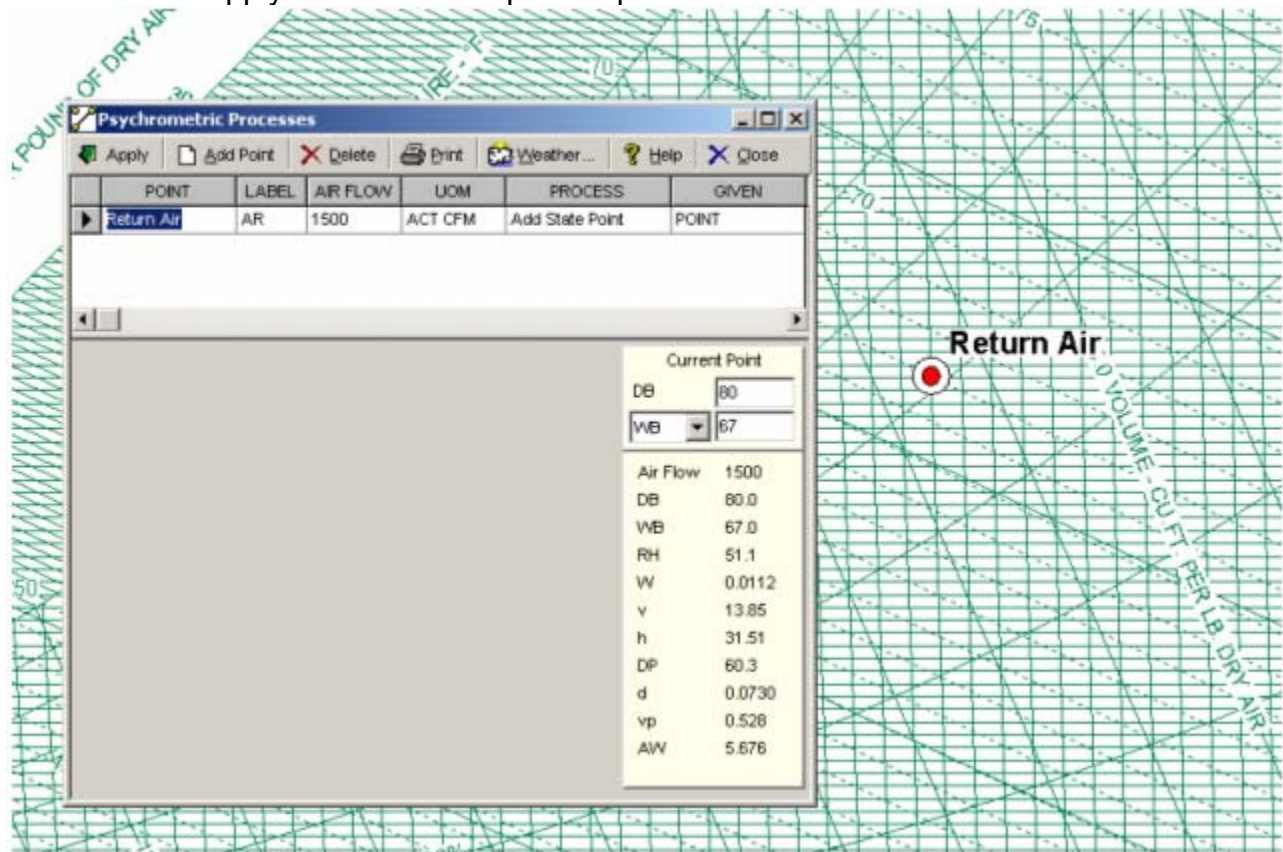
Current Point

DB

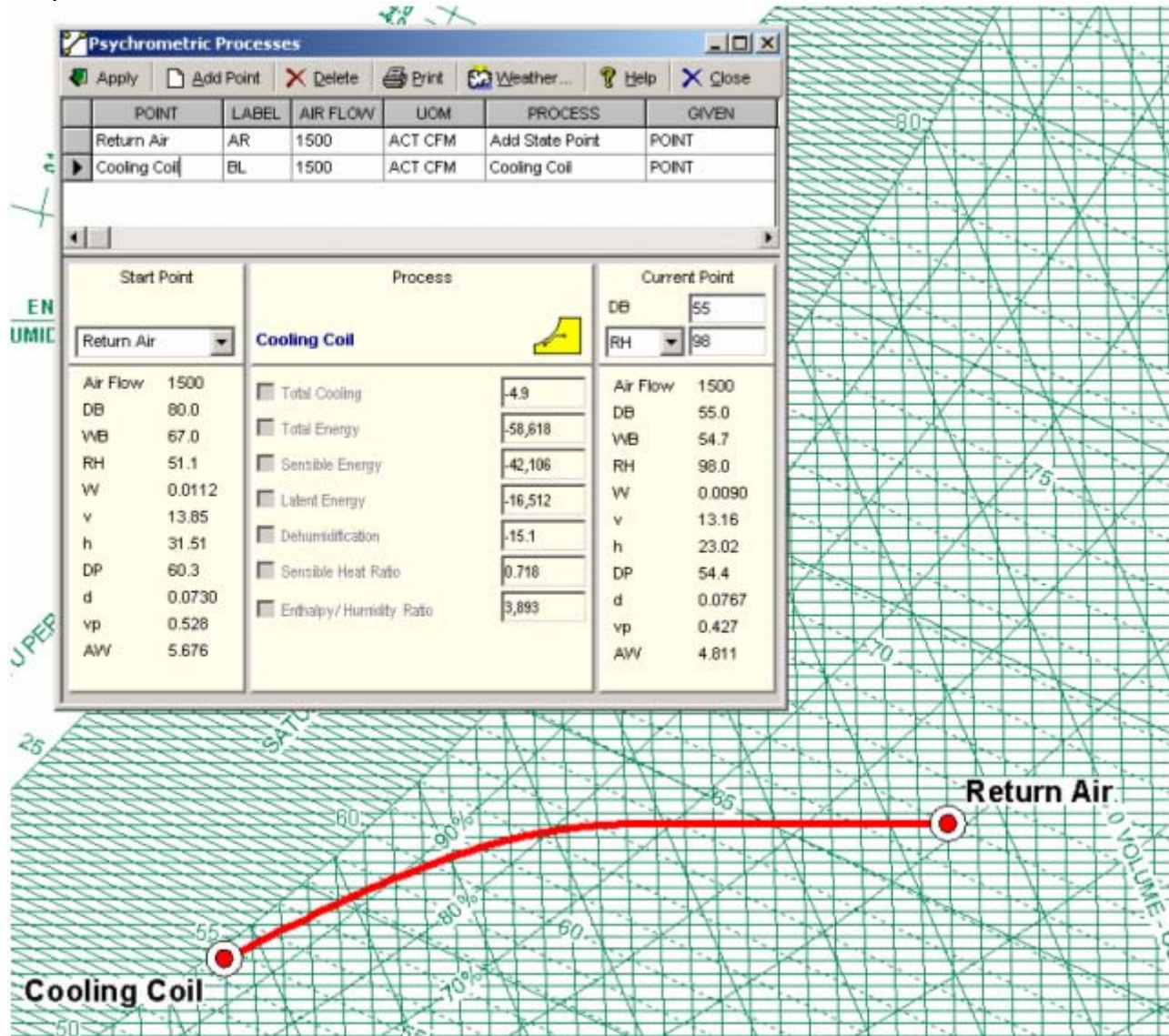
WB ▼

Air Flow	1500
DB	80.0
WB	67.0
RH	51.1
W	0.0112
v	13.85
h	31.51
DP	60.3
d	0.0730
vp	0.528
AW	5.676

4. Click on the Apply button and the point is plotted to the chart.

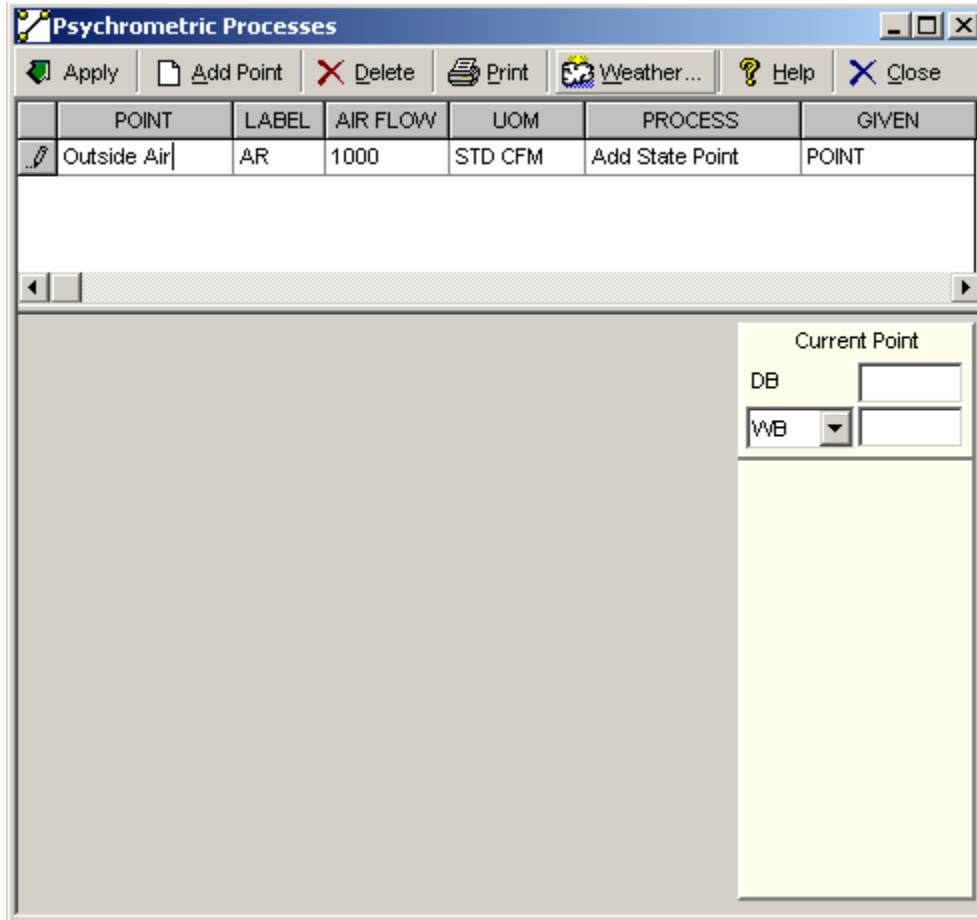


5. Click the Add Point button again to continue adding new points. Adding more than one point enables additional PROCESSES to be selected in the grid. The GIVEN column will also be enabled, after the first point is entered, to allow entering either the end point (POINT), calculating the process energy or entering the process energy (ENERGY) and calculating the end point. After each successive point, click the Apply button to plot the point and process to the chart.




Additional processes can be added to complete any system. If you need to make changes you may do so to any point by just clicking on the proper grid row, make any desired changes and simply click "Apply" and the point and connecting processes are automatically updated.

6. To apply a Climatic Data weather point to the chart, simply click on the Weather icon to access the Climatic Data Window.

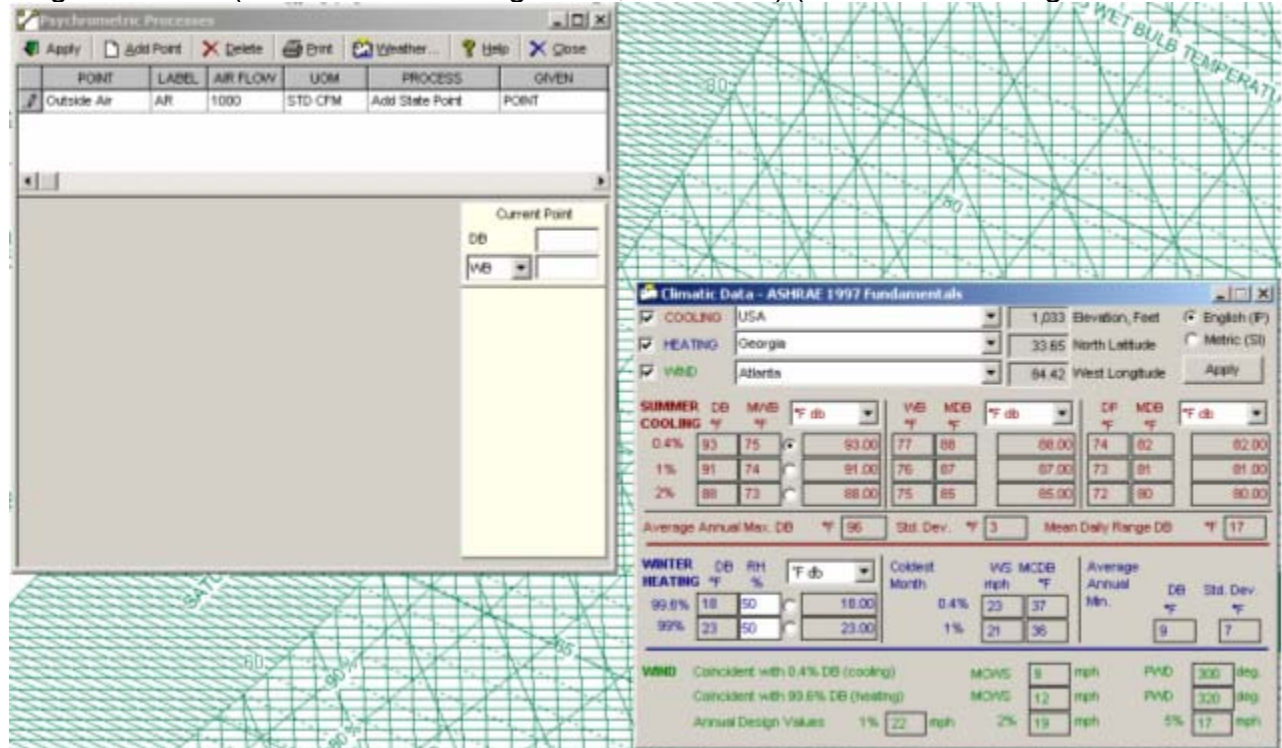


The screenshot shows the 'Psychrometric Processes' window. It features a menu bar with 'Apply', 'Add Point', 'Delete', 'Print', 'Weather...', 'Help', and 'Close'. Below the menu is a table with the following data:

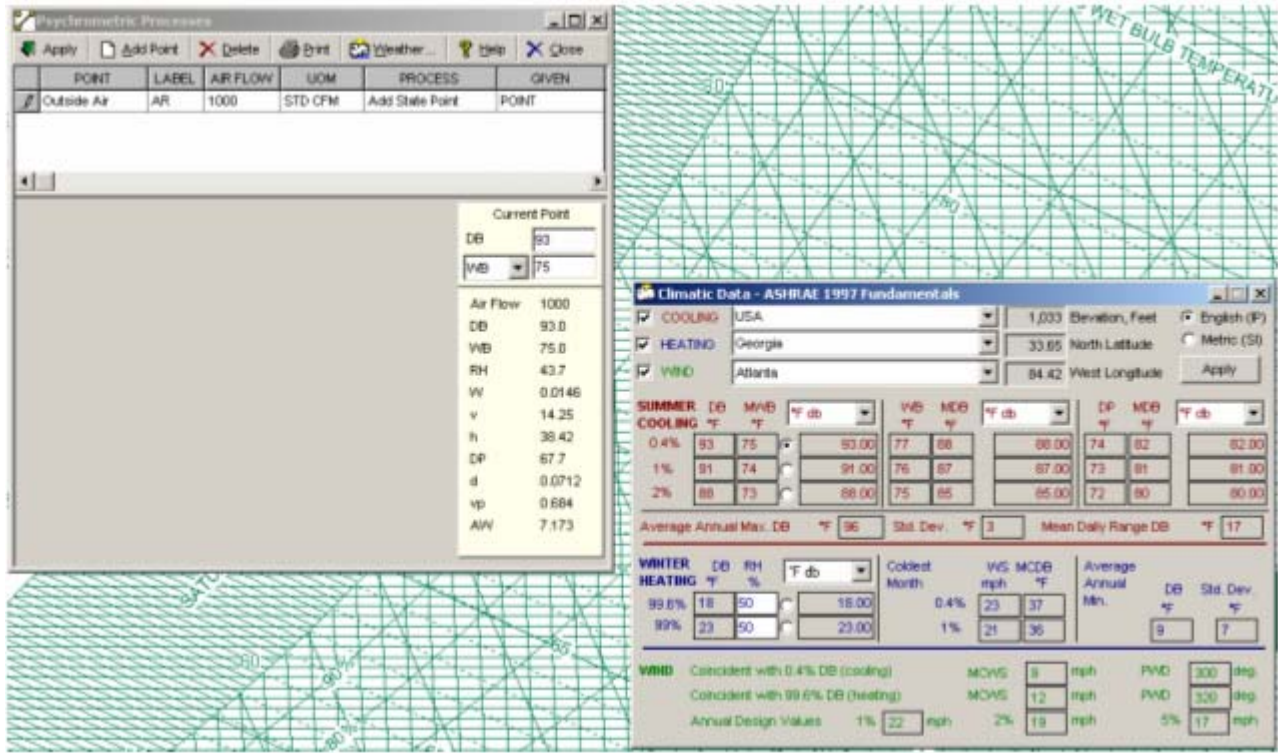
	POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
	Outside Air	AR	1000	STD CFM	Add State Point	POINT

Below the table is a large empty area for the psychrometric chart. On the right side, there is a 'Current Point' section with input fields for 'DB' and 'WB' (Wet Bulb), and a dropdown menu for 'WB'.

7. Select the geographic location by country, state and city. Select the desired outside design condition (for Summer Cooling: 0.4%, 1% or 2%) (for Winter Heating: 99.6% or 99%).



8. To apply this design condition as a State Point, simply click the Apply button in the upper left hand of the Window and then close the Climatic Data Window to return to State Points & Processes.



CONSTANT LINE CONTROL

Click the Constant Line Icon on the toolbar, select the line type and specifics, and click “Apply” to see the specified line displayed on the chart!!



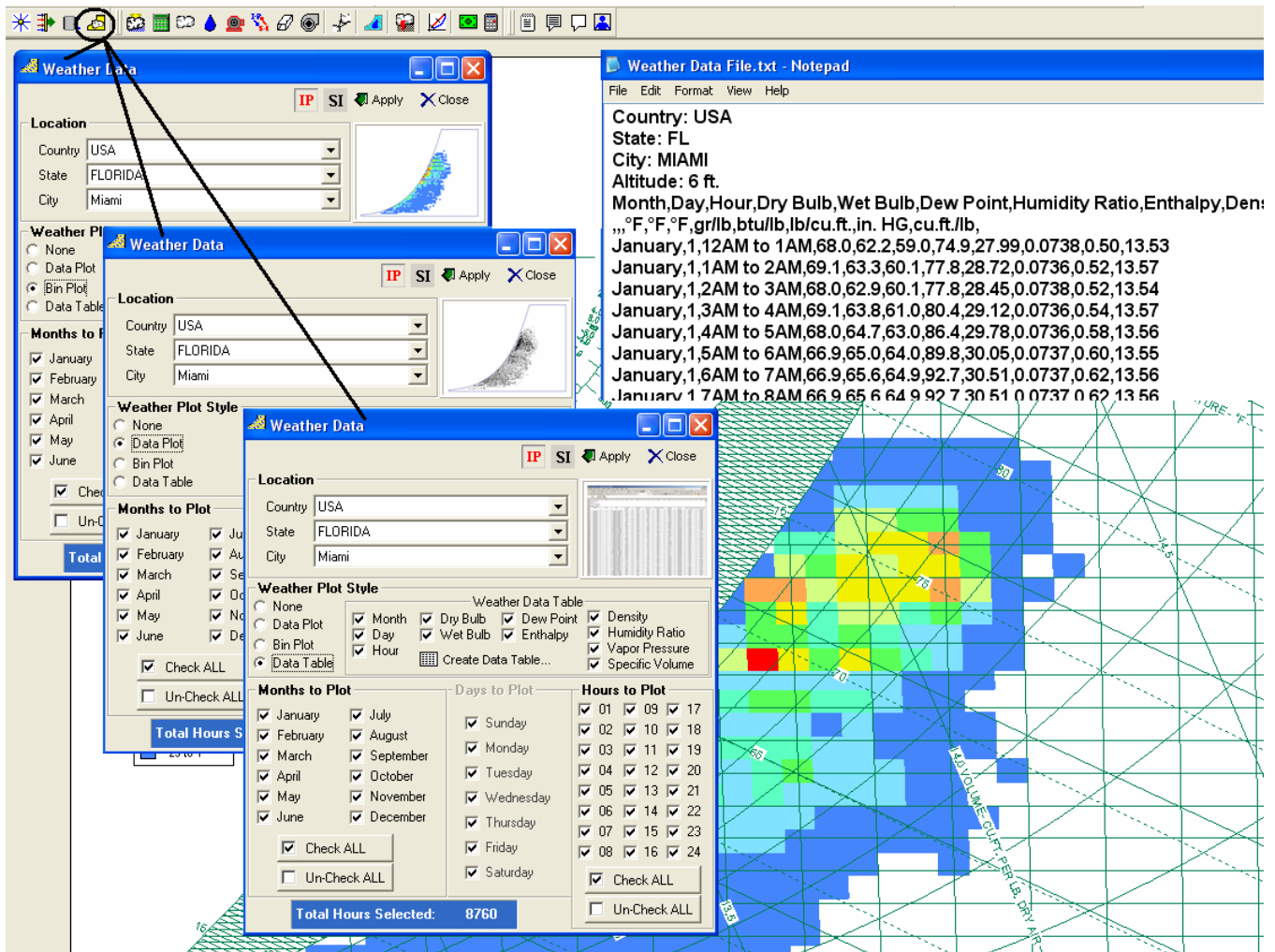
Constant Line Control [Apply] [Close]

Dew Point Vapor Pressure
Humidity Ratio Enthalpy Specific Volume Relative Humidity
SHR Lines dh/dw Lines **Dry Bulb** Wet Bulb

On	Dry Bulb	(Optional) Reference Point	Line Color	Line Width
<input checked="" type="checkbox"/>	80		Red	5
<input checked="" type="checkbox"/>	55		Blue	40
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				

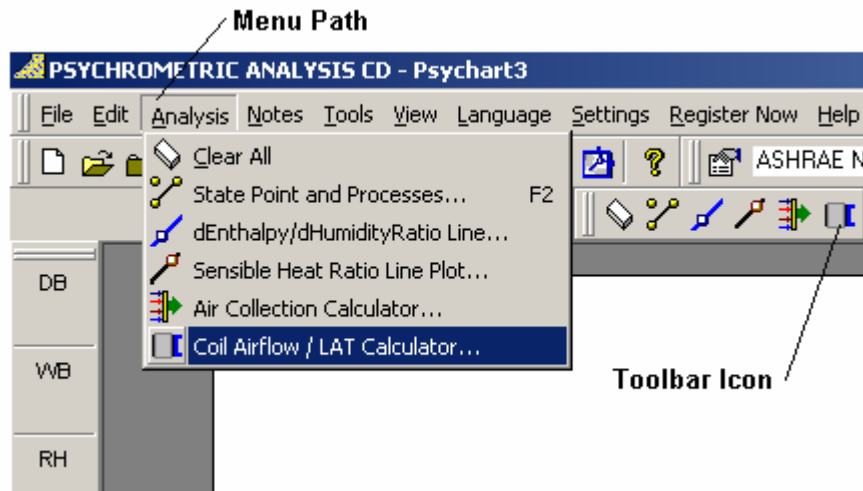
WEATHER DATA PRESENTATION CONTROL

Simply click the Weather Icon on the toolbar and select the location, style and bins desired and with one button click, you can SEE the weather data on the chart as data dots, colored bins or even CREATE your OWN Bin Weather Table!!!

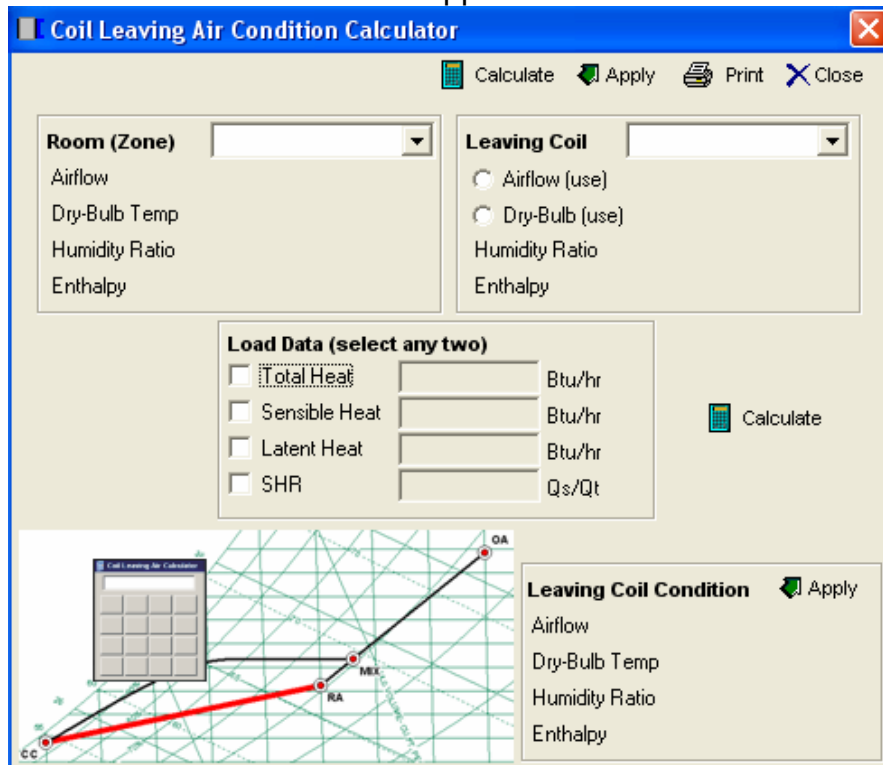


COIL LEAVING AIR CALCULATOR

1. **NOTE:** You need to have the Room Zone state point and Coil state point created for reference by the Coil Airflow/LAT Calculator **BEFORE continuing**.
2. Activate "Coil Airflow / LAT Calculator" by either of the two methods shown below:



3. The Coil Airflow / LAT Calculator window appears with blank data fields.



- Click the Room (Zone) and Coil combo box drop-downs and select the desired points that you've already created with the State Point and Process dialog.

Coil Leaving Air Condition Calculator

Calculate Apply Print Close

Room (Zone)			Leaving Coil		
Airflow	8,000	SCFM	<input type="radio"/> Airflow (use)	10,000	SCFM
Dry-Bulb Temp	80.00	°F	<input type="radio"/> Dry-Bulb (use)	55.00	°F
Humidity Ratio	0.01123	lb/lb	Humidity Ratio	0.00736	lb/lb
Enthalpy	31.51	Btu/lb	Enthalpy	21.19	Btu/lb

Load Data (select any two)

☐ Total Heat Btu/hr

☐ Sensible Heat Btu/hr

☐ Latent Heat Btu/hr

☐ SHR Qs/Qt

Calculate

Leaving Coil Condition Apply

Airflow SCFM

Dry-Bulb Temp °F

Humidity Ratio lb/lb

Enthalpy Btu/lb

- To calculate coil leaving airflow, click the “Dry-Bulb (use)” option.

Coil Leaving Air Condition Calculator

Calculate Apply Print Close

Room (Zone)			Leaving Coil		
Airflow	8,000	SCFM	<input type="radio"/> Airflow (use)	10,000	SCFM
Dry-Bulb Temp	80.00	°F	<input checked="" type="radio"/> Dry-Bulb (use)	55.00	°F
Humidity Ratio	0.01123	lb/lb	Humidity Ratio	0.00736	lb/lb
Enthalpy	31.51	Btu/lb	Enthalpy	21.19	Btu/lb

Load Data (select any two)

☐ Total Heat Btu/hr

☐ Sensible Heat Btu/hr

☐ Latent Heat Btu/hr

☐ SHR Qs/Qt

Calculate

Leaving Coil Condition Apply

Airflow SCFM

Dry-Bulb Temp 55.00 °F

Humidity Ratio 0.00736 lb/lb

Enthalpy 21.19 Btu/lb

6. To calculate coil leaving dry-bulb, click the “Airflow (use)” option.

Coil Leaving Air Condition Calculator

Calculate Apply Print Close

Room (Zone)			Leaving Coil		
Airflow	8,000	SCFM	<input checked="" type="radio"/> Airflow (use)	10,000	SCFM
Dry-Bulb Temp	80.00	°F	<input type="radio"/> Dry-Bulb (use)	55.00	°F
Humidity Ratio	0.01123	lb/lb	Humidity Ratio	0.00736	lb/lb
Enthalpy	31.51	Btu/lb	Enthalpy	21.19	Btu/lb

Load Data (select any two)

☐ Total Heat Btu/hr

☐ Sensible Heat Btu/hr

☐ Latent Heat Btu/hr

☐ SHR Qs/Qt

Calculate

Leaving Coil Condition Apply

Airflow 10,000 SCFM

Dry-Bulb Temp °F

Humidity Ratio lb/lb

Enthalpy Btu/lb

7. Click any two of the Load Data variables you wish to specify and input the appropriate values.

Coil Leaving Air Condition Calculator

Calculate Apply Print Close

Room (Zone)			Leaving Coil		
Airflow	8,000	SCFM	<input type="radio"/> Airflow (use)	10,000	SCFM
Dry-Bulb Temp	80.00	°F	<input checked="" type="radio"/> Dry-Bulb (use)	55.00	°F
Humidity Ratio	0.01123	lb/lb	Humidity Ratio	0.00736	lb/lb
Enthalpy	31.51	Btu/lb	Enthalpy	21.19	Btu/lb

Load Data (select any two)

☐ Total Heat Btu/hr

☒ Sensible Heat 250000 Btu/hr

☐ Latent Heat Btu/hr

☒ SHR .7 Qs/Qt

Calculate

Leaving Coil Condition Apply

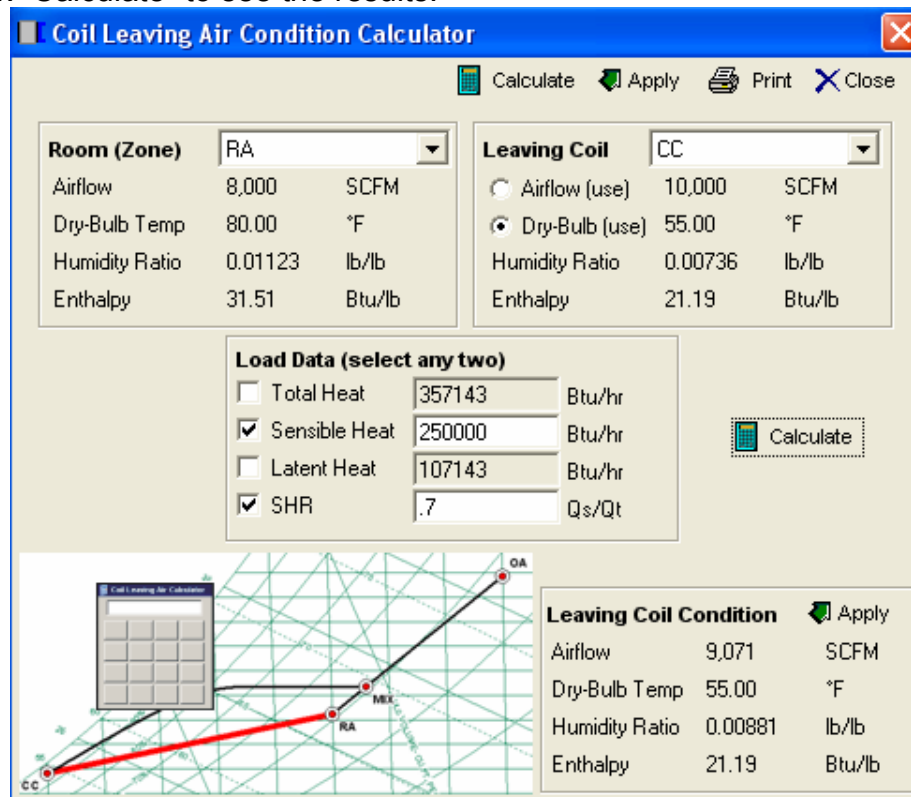
Airflow SCFM

Dry-Bulb Temp 55.00 °F

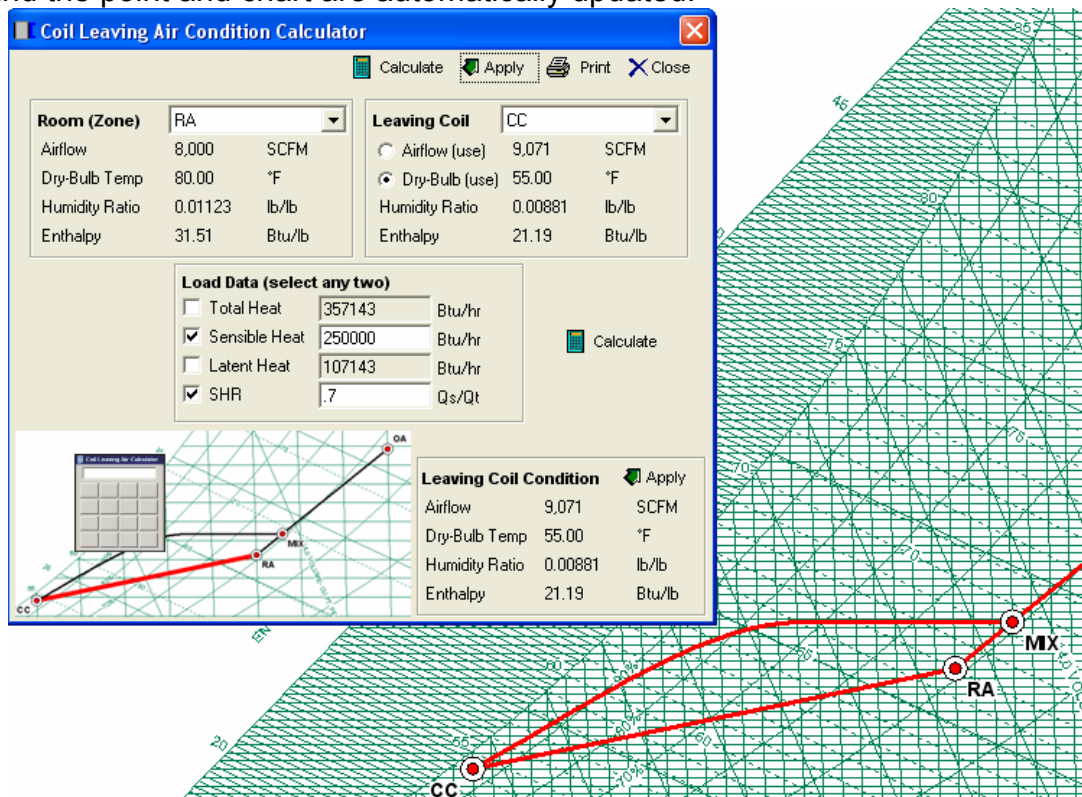
Humidity Ratio 0.00736 lb/lb

Enthalpy 21.19 Btu/lb

8. Lastly, click “Calculate” to see the results.

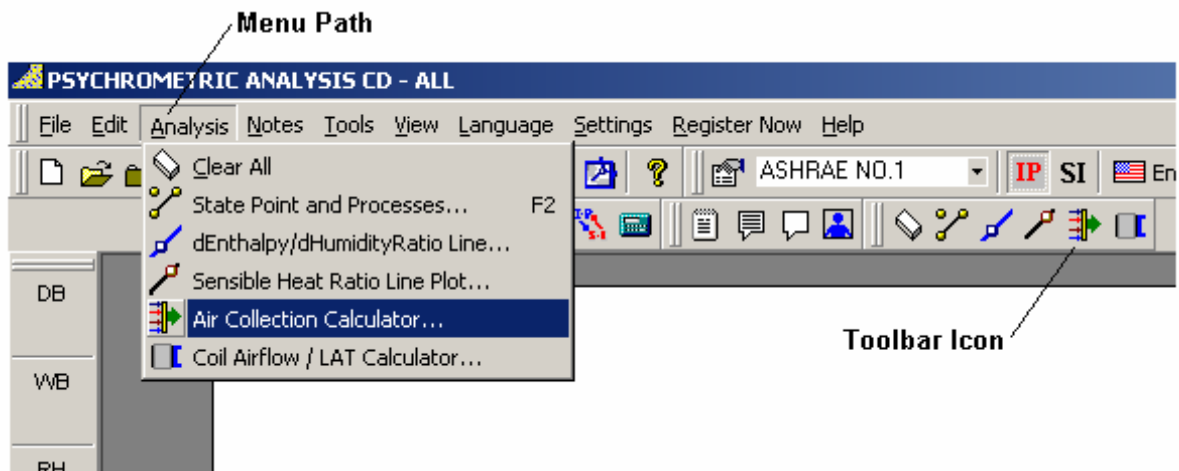


9. To Update the Coil LAT point created with the calculated result, simply click “Apply” on the menu and the point and chart are automatically updated.



AIR COLLECTION CALCULATOR

1. NOTE: You need to have two or more points created BEFORE calculation of a collection point can be performed.
2. Activate "Air Collection Calculator" by either of the two methods shown below:



3. The Air Collection Calculator window appears with blank data fields.

Air Collection Calculator [Print] [Close]

Selected Point 1 [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

Selected Point 2 [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

Selected Point 3 [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

Selected Point 4 [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

Selected Point 5 [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

[Calculate =>]

Collection Point [Dropdown]
Airflow
Dry-Bulb Temp
Humidity Ratio
Enthalpy

[Apply Point to Chart]

4. Click the Selected point combo box drop-downs to specify the points you wish to collect, then click “Calculate =>” to see the Collection Point result.

Air Collection Calculator [Print] [Close]

Selected Point	Point Label	Airflow	Dry-Bulb Temp	Humidity Ratio	Enthalpy
1	RA	1,000 SCFM	75.00 °F	0.01022 lb/lb	29.18 Btu/lb
2	DH	1,000 SCFM	90.00 °F	0.00678 lb/lb	29.07 Btu/lb
3	SC	1,000 SCFM	65.00 °F	0.01022 lb/lb	26.74 Btu/lb
4	SH	1,000 SCFM	90.00 °F	0.01022 lb/lb	32.85 Btu/lb
5	CC	1,000 SCFM	55.00 °F	0.00912 lb/lb	23.10 Btu/lb

Calculate =>

Apply Point to Chart

Collection Point	Point Label Here...	Airflow	Dry-Bulb Temp	Humidity Ratio	Enthalpy
		5,000 SCFM	75.00 °F	0.00931 lb/lb	28.19 Btu/lb

5. Type in the desired Point Label and click “Apply Point to Chart” to add the Collection Point to the chart and report.

Air Collection Calculator [Print] [Close]

Selected Point 1 RA		
Airflow	1,000	SCFM
Dry-Bulb Temp	75.00	°F
Humidity Ratio	0.01022	lb/lb
Enthalpy	29.18	Btu/lb

Selected Point 2 DH		
Airflow	1,000	SCFM
Dry-Bulb Temp	90.00	°F
Humidity Ratio	0.00678	lb/lb
Enthalpy	29.07	Btu/lb

Selected Point 3 SC		
Airflow	1,000	SCFM
Dry-Bulb Temp	65.00	°F
Humidity Ratio	0.01022	lb/lb
Enthalpy	26.71	Btu/lb

Selected Point 4 SH		
Airflow	1,000	SCFM
Dry-Bulb Temp	90.00	°F
Humidity Ratio	0.01022	lb/lb
Enthalpy	32.85	Btu/lb

Selected Point 5 CC		
Airflow	1,000	SCFM
Dry-Bulb Temp	55.00	°F
Humidity Ratio	0.00912	lb/lb
Enthalpy	23.10	Btu/lb

[Calculate =>]

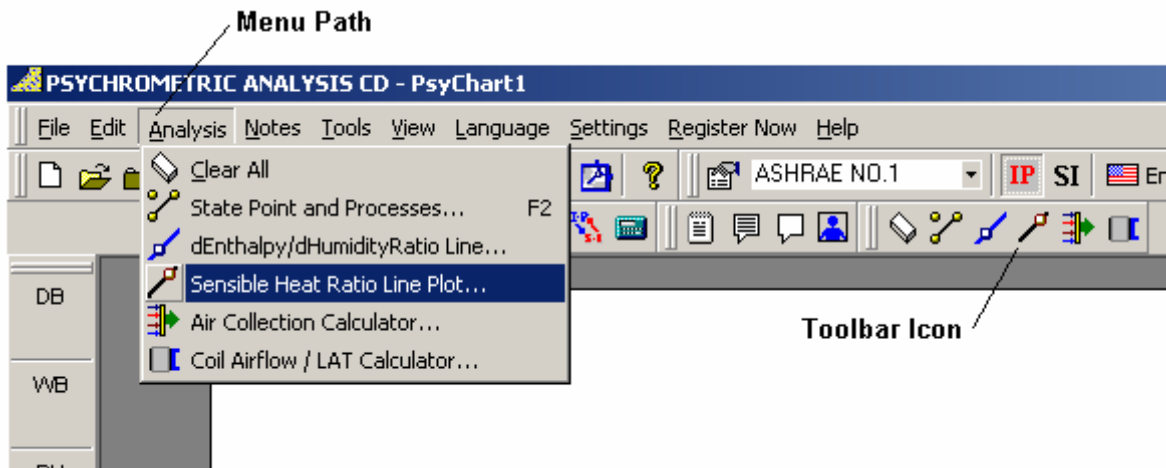
Collection Point Collection		
Airflow	5,000	SCFM
Dry-Bulb Temp	75.00	°F
Humidity Ratio	0.00931	lb/lb
Enthalpy	28.19	Btu/lb

[Apply Point to Chart]

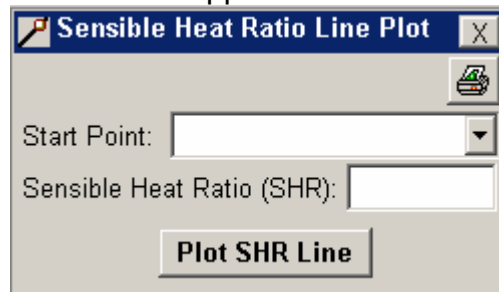
SENSIBLE HEAT RATIO LINE PLOTTING

1. NOTE: You need to have at least ONE point created BEFORE calculation of a constant sensible heat ratio line can be performed.

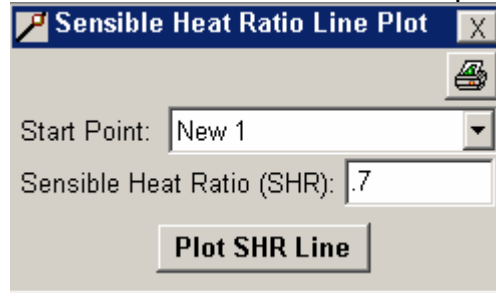
2. Activate "Sensible Heat Ratio Line Plot" by either of the two methods shown below:



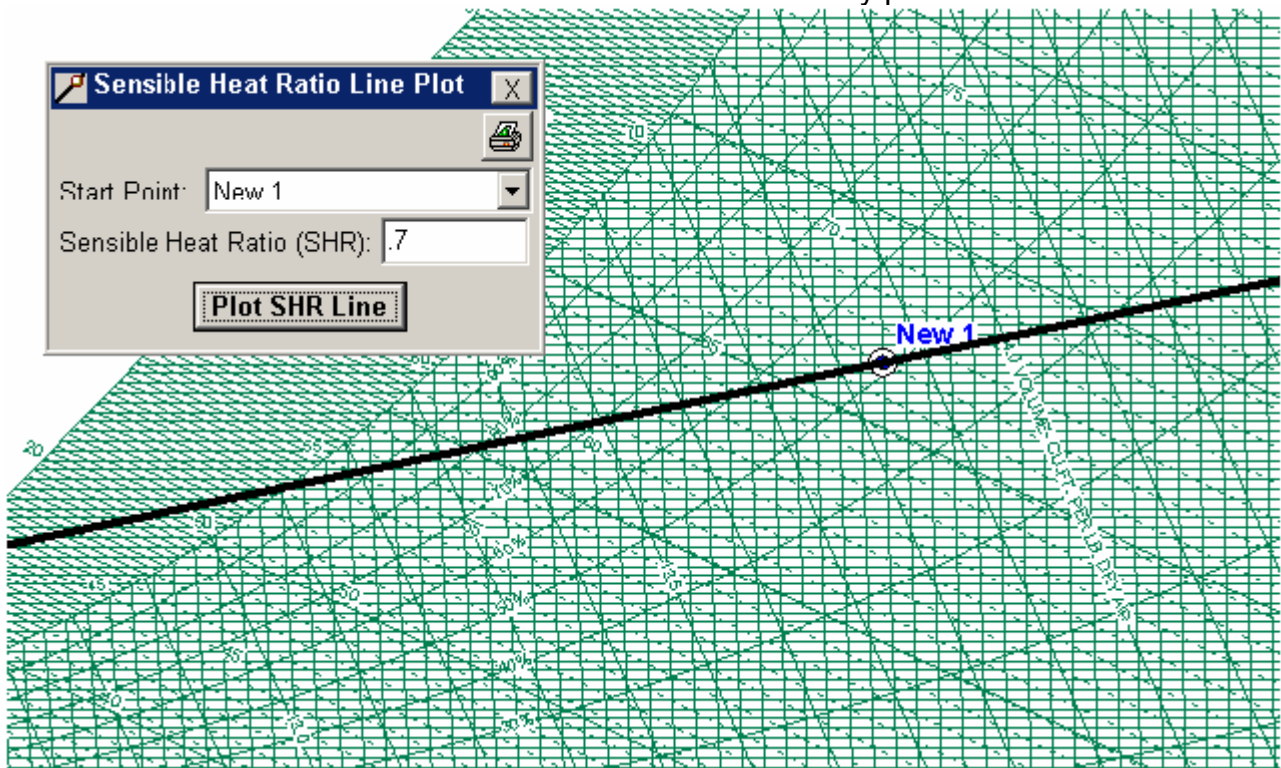
3. The Sensible Heat Ratio Line window appears with blank data fields.



- Click the Start Point combo box drop-down to select a reference state point to plot through. Then type in the desired sensible heat ratio in the space provided.



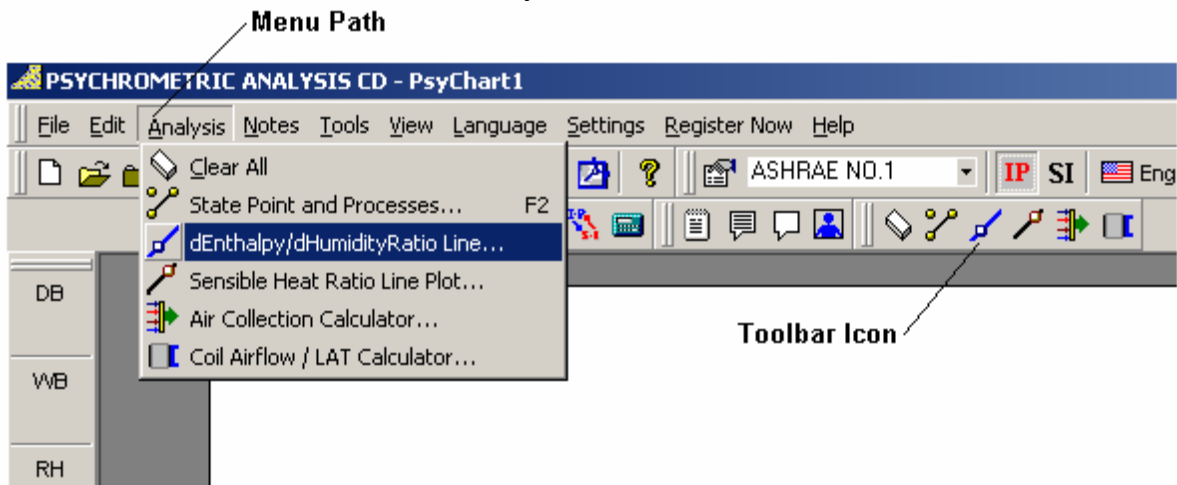
- Click the "Plot SHR Line" and the SHR Line is automatically plotted across the chart.



DELTA-h / DELTA-W LINE PLOTTING

1. NOTE: You need to have at least ONE point created BEFORE calculation of a constant delta-h / delta-W line can be performed.

2. Activate "Delta-h / Delta-W Line Plot" by either of the two methods shown below:



3. The Delta-h / Delta-W Line window appears with blank data fields.

The 'dh/dW Ratio Line Plot' window is shown. It has a 'Start Point' dropdown menu. Below it, the 'dh/dW Line Plotting' section contains input fields for 'Steam Temp (°F or °C):', 'dEnthalpy/dHumidityRatio (dh/dW):', and a 'Plot dh/dW Line' button. The 'Humidification Process Calculator' section contains input fields for 'Dew Point Temp (°F or °C):', 'Final Dry-Bulb Temp (°F or °C):', 'Steam Flow Rate (lb/hr or kg/hr):', and a 'Calculate' button.

4. Click the Start Point combo box drop-down to select the desired reference point and enter the “Steam Temperature” or “dh/dW” values in the space provided. Please note that which ever value isn’t provided, is automatically calculated real-time.

dh/dW Ratio Line Plot

Start Point: New 1

dh/dW Line Plotting

Steam Temp (°F or °C): 250

dEnthalpy/dHumidityRatio (dh/dW): 1163

Plot dh/dW Line

Humidification Process Calculator

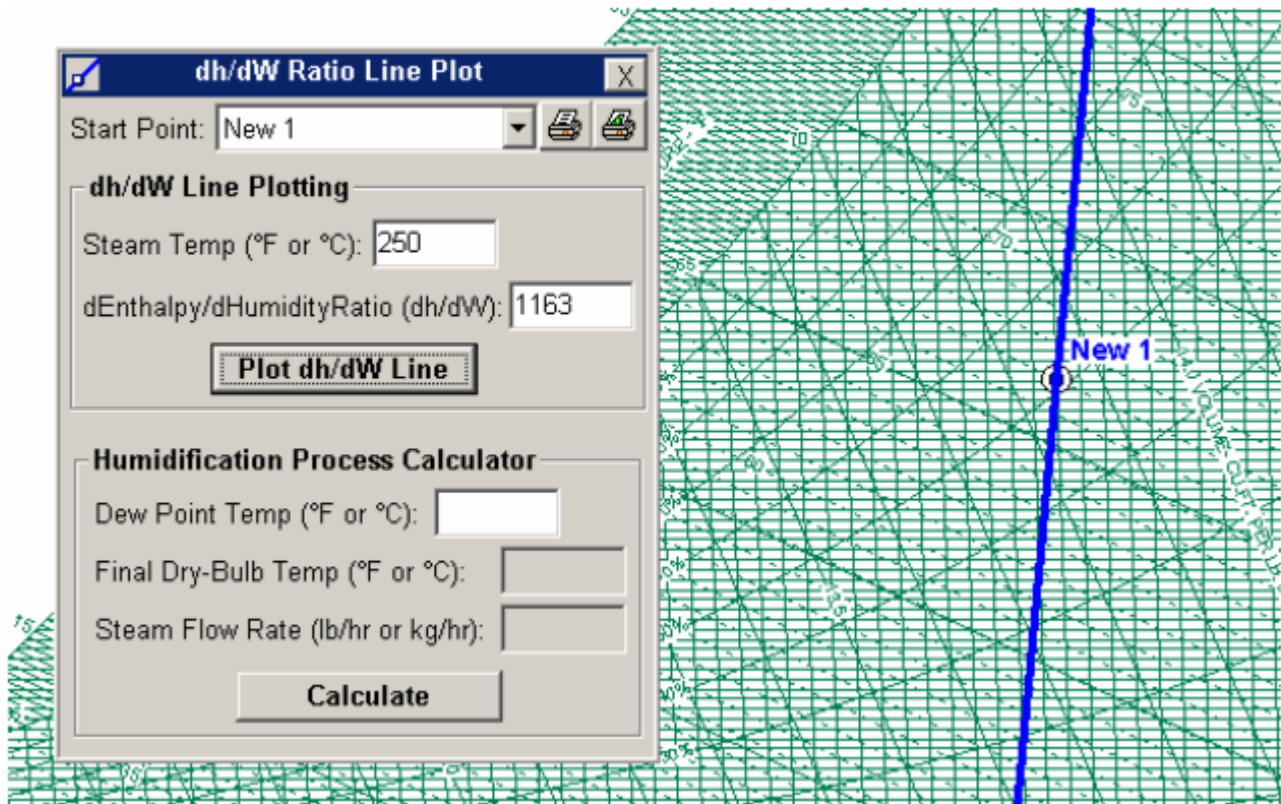
Dew Point Temp (°F or °C):

Final Dry-Bulb Temp (°F or °C):

Steam Flow Rate (lb/hr or kg/hr):

Calculate

5. Click the “Plot dh/dW Line” and the Delta-h/Delta-W Line is automatically plotted across the chart.



6. Type the desired final Dew Point Temperature and click the “Calculate” button to see the resulting Final Dry-Bulb Temperature and Steam Flow Rate.

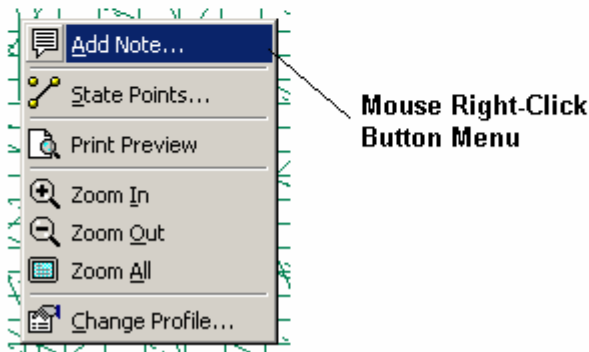
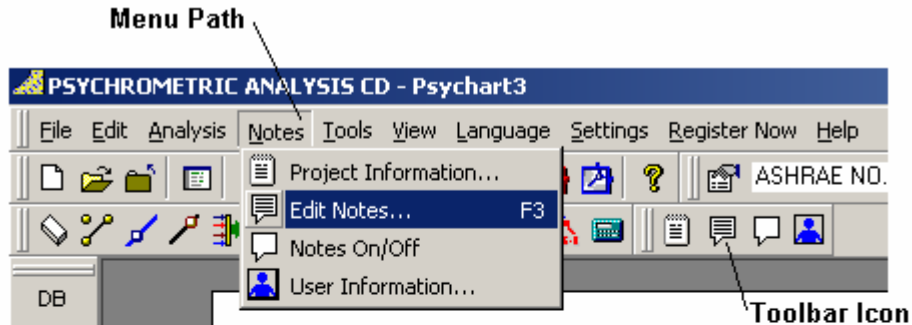
The screenshot shows the 'dh/dW Ratio Line Plot' dialog box with the following fields and buttons:

- Start Point:** New 1
- dh/dW Line Plotting:**
 - Steam Temp (°F or °C): 250
 - dEnthalpy/dHumidityRatio (dh/dW): 1163
 - Plot dh/dW Line** button
- Humidification Process Calculator:**
 - Dew Point Temp (°F or °C): 75
 - Final Dry-Bulb Temp (°F or °C): 82.02
 - Steam Flow Rate (lb/hr or kg/hr): 34.2
 - Calculate** button

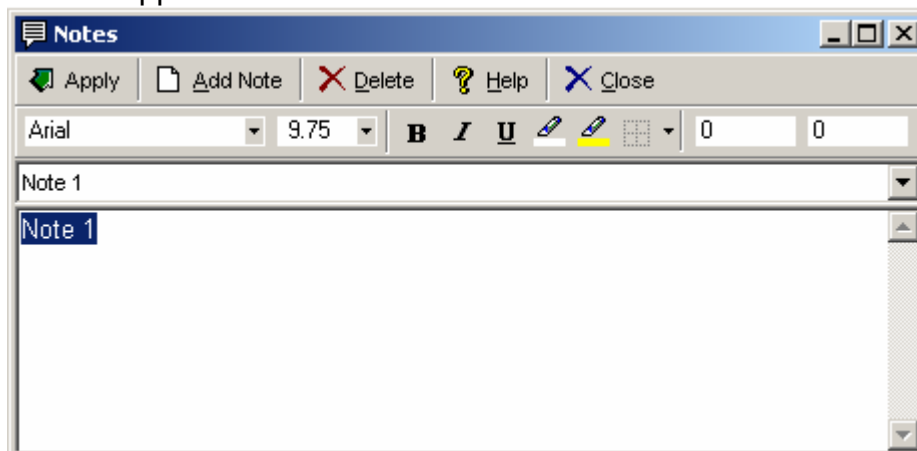
NOTE CONTROLS

CHART NOTES

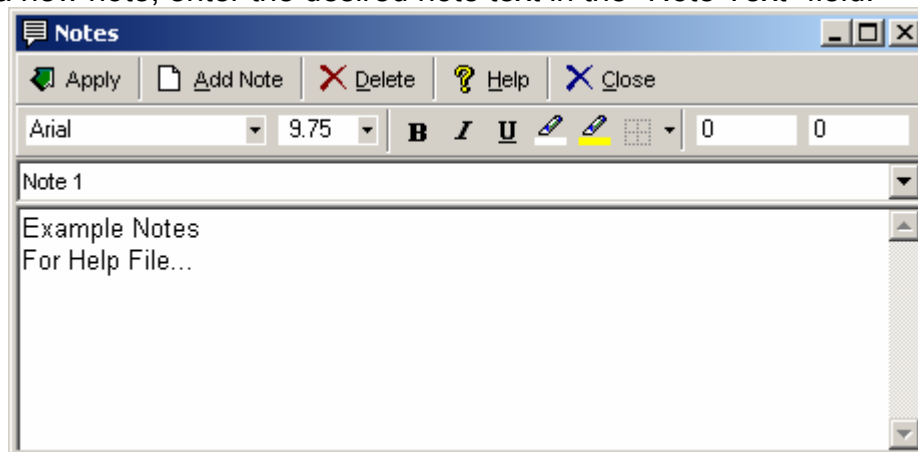
1. Activate "Notes" by any of the three methods shown below or press 'F3':



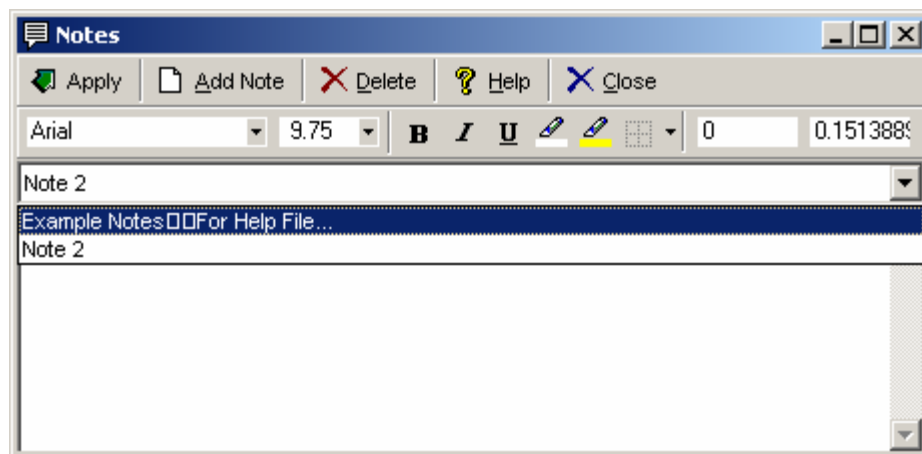
2. The Notes window appears with New Note #1 as the current note.



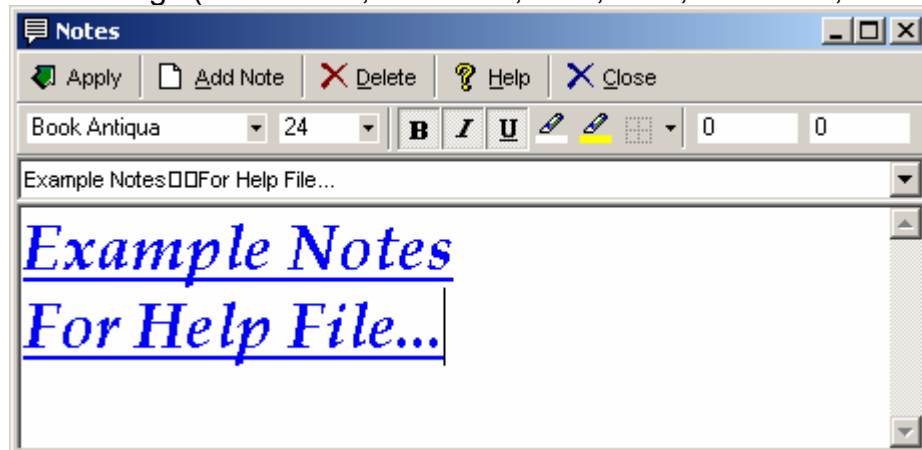
3. To create a new note, enter the desired note text in the "Note Text" field.



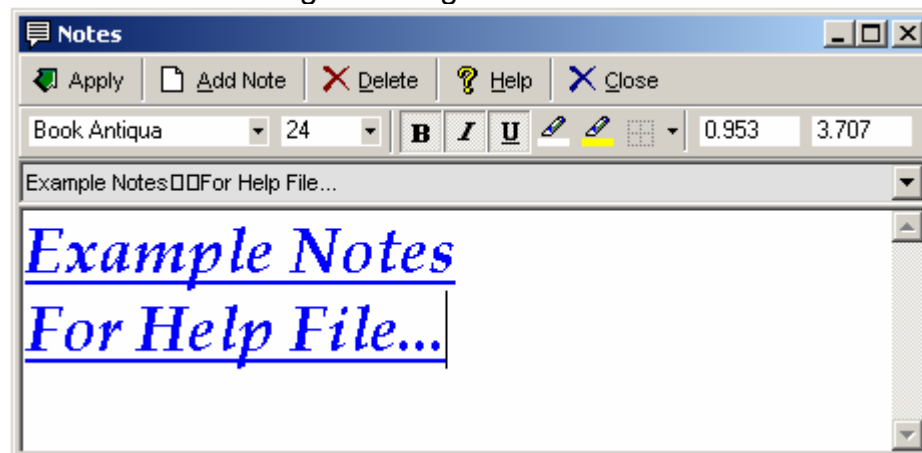
4. To edit an existing note, click the "Selected Note Name" drop-down and select the desired existing Note to be edited from the list. Enter the "Note Text" field to make any text revisions.



5. Adjust the font settings (Font Name, Font Size, Bold, Italic, Underline, Color) as desired.

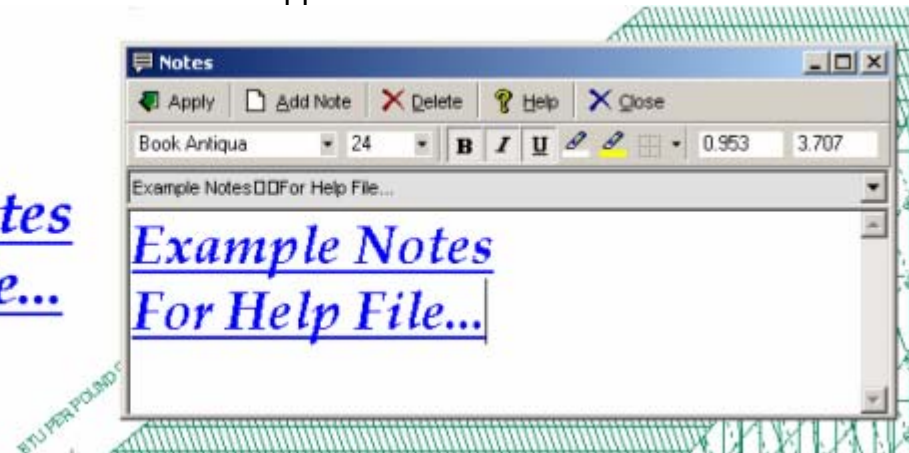


6. Enter the Note X & Y location by either typing the X & Y coordinates in to the appropriate fields or use the left mouse button and click once on the chart, move the mouse to see the coordinates track the mouse location and when the mouse is at the desired location, perform a left mouse button single click again to set the coordinates. See Above graphic.

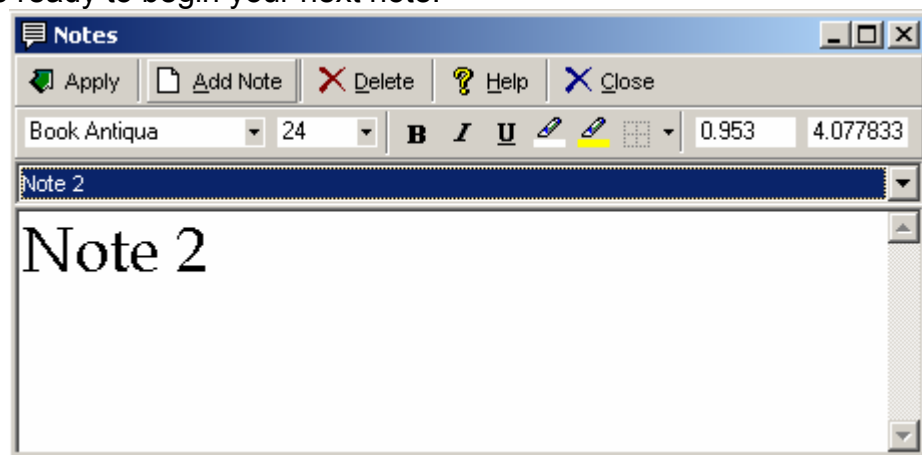


7. Click the "Apply" button and the note will appear on the chart:

Example Notes
For Help File...



8. The Note window remains open. To add additional notes, simply click the "New" button and you're ready to begin your next note.



9. Psychrometric Analysis allows an unlimited amount of notes to be entered. Each note can have its own properties. All information is saved to the project file. The Notes window accepts the information you want to place on the chart, allows font changes and provides a means to position the information.

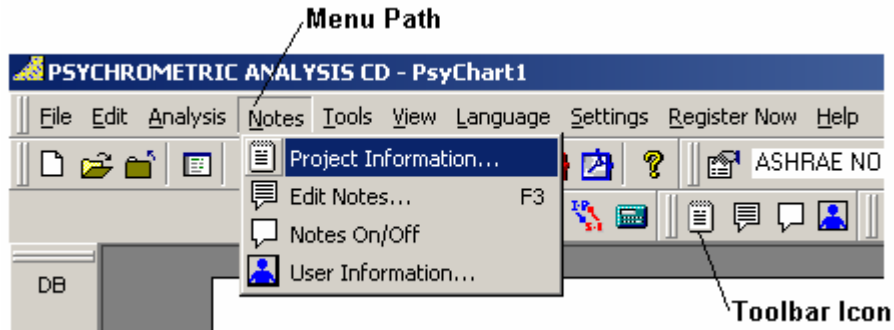
10. Enter your notes in the text box. Use any of the font buttons to adjust the settings. Set the position by clicking on the chart or using the X and Y position settings provided in text box. Now click "Apply" to add the project information to the chart.

11. You may want to change the position of the information on the chart after you see it. While the Notes window is open you may do so by making a single click on the information and then another single click at the new location. To edit the information, make the changes in the Notes window and click "Apply".

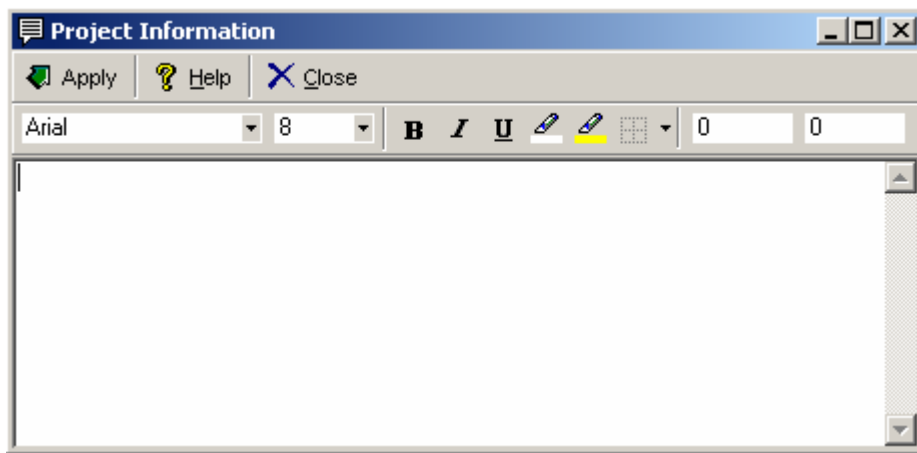
12. You may edit this information, change its font or position at any time. Simply open the Notes window and make the changes.

PROJECT INFORMATION NOTE

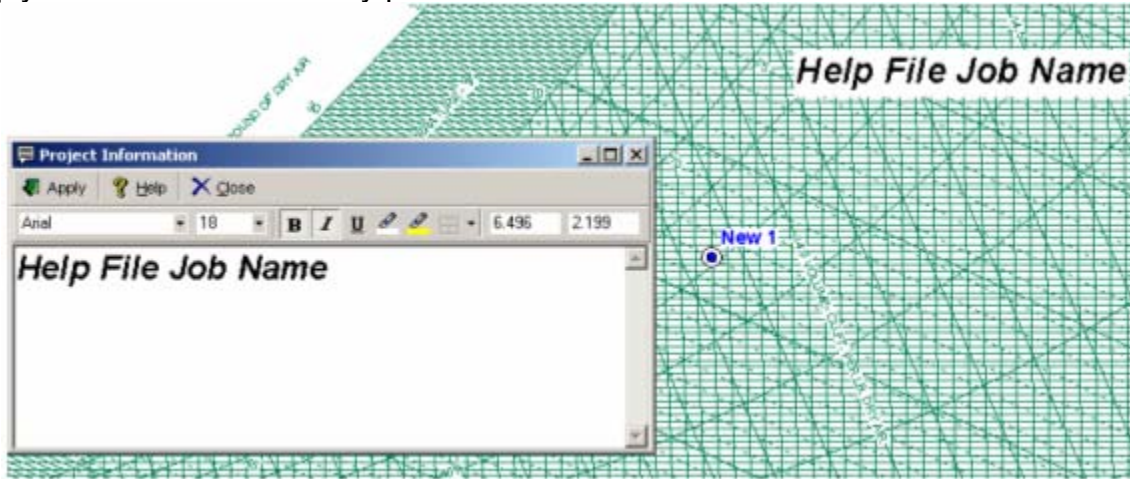
1. Activate "Project Information" by any of the two methods shown below.



2. The Project Information window appears ready to receive the Project Name as the current note. Please note that this note will appear on the state point reports as the Project Name.

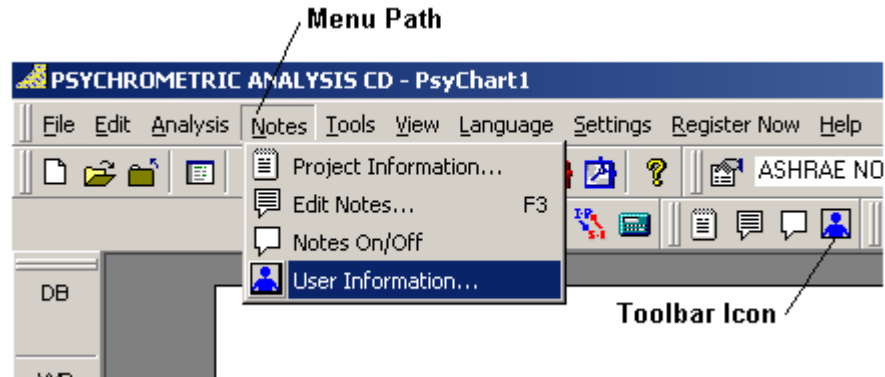


3. Type in the project name you wish, adjust fonts, location, etc. When finished, click the “Apply” button to automatically place on the chart.



USER INFORMATION NOTE

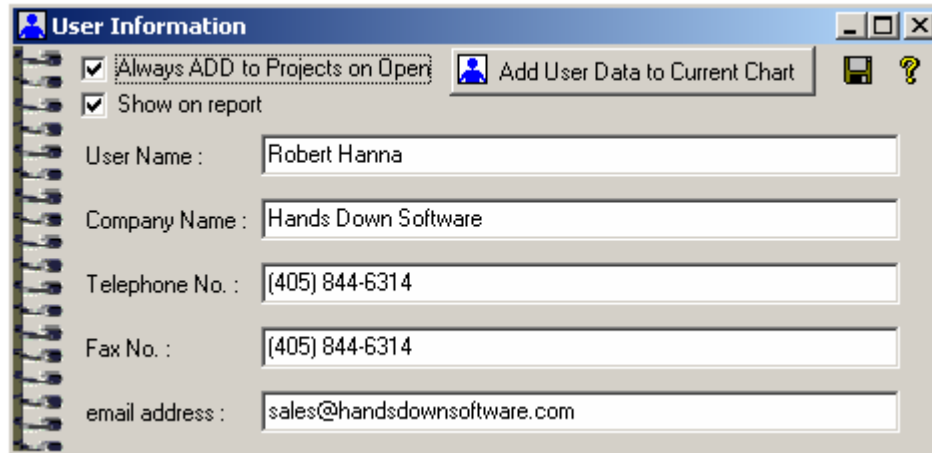
1. Activate "User Information" by either of the two methods shown below.



2. The User Information window appears as shown below:

The 'User Information' dialog box is shown. It has a title bar with a user icon and the text 'User Information'. Below the title bar, there are two checkboxes: 'Always ADD to Projects on Open' and 'Show on report'. To the right of these checkboxes is a button labeled 'Add User Data to Current Chart' with a user icon. Below these are five text input fields labeled: 'User Name :', 'Company Name :', 'Telephone No. :', 'Fax No. :', and 'email address :'. On the left side of the dialog, there is a vertical list of icons representing different project files.

3. Type in your information in the space providing. Check the display options you wish to choose for your default.



User Information

☒ Always ADD to Projects on Open ☐ Add User Data to Current Chart

☒ Show on report

User Name : Robert Hanna

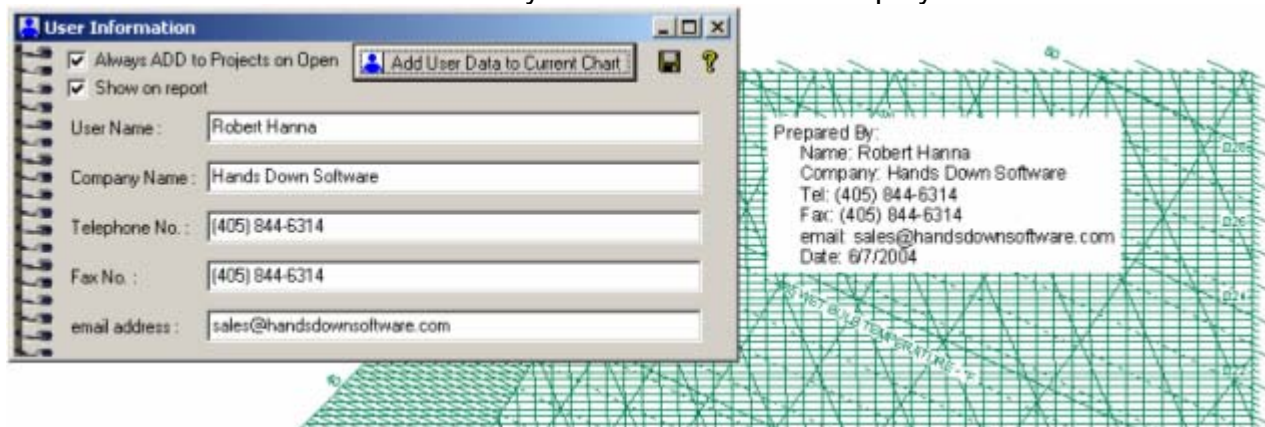
Company Name : Hands Down Software

Telephone No. : (405) 844-6314

Fax No. : (405) 844-6314

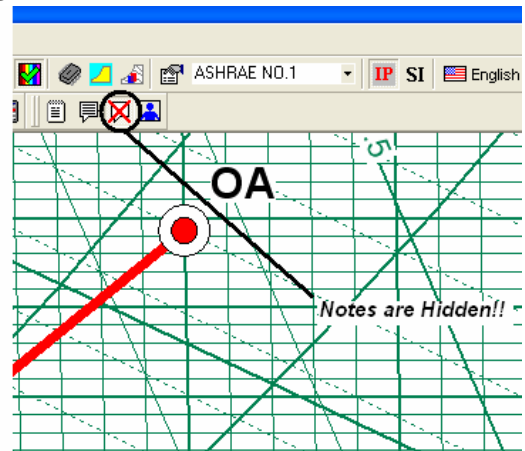
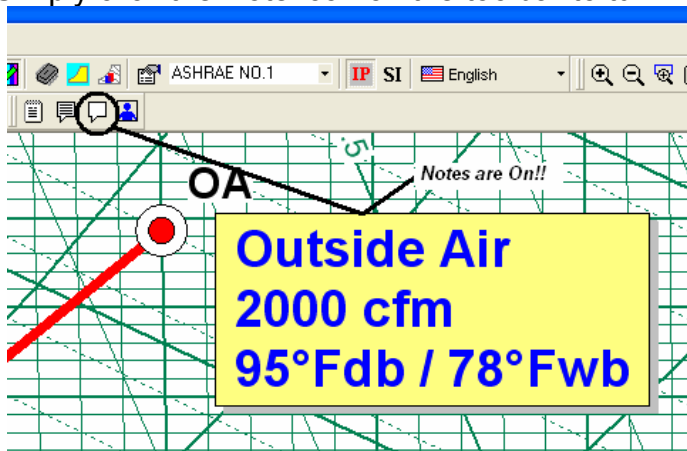
email address : sales@handsdownsoftware.com

4. Click the “Save” button in the upper right hand corner. You may also click the “Add User Data to Current Chart” button to have your user information displayed on the current chart.



NOTE ON/OFF CONTROL

Simply click the Note icon on the toolbar to turn Notes On/Off.





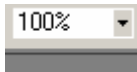
VIEW CONTROLS

ZOOMING AND PANNING

Zoom IN

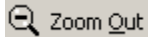


1. Click View on the menu bar, then click the Zoom In icon.
2. Click the Zoom In icon on the toolbar.
3. Enter the Zoom Percent into the zoom factor dropdown on the toolbar.

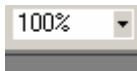


4. Move your mouse so the cursor is on the chart and [Double-Click the LEFT mouse button.](#)

Zoom OUT



1. Click View on the menu bar, then click the Zoom Out icon.
2. Click the Zoom Out icon on the toolbar.
3. Enter the Zoom Percent into the zoom factor dropdown on the toolbar.

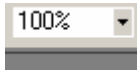


4. Move your mouse so the cursor is on the chart and [Double-Click the RIGHT mouse button.](#)

Zoom ALL

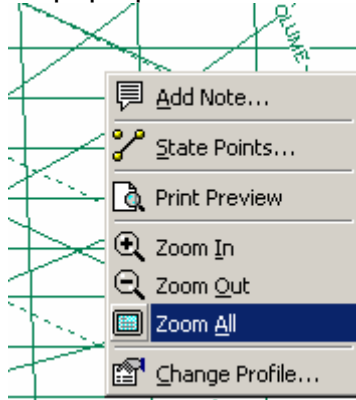


1. Click View on the menu bar, then click the Zoom All icon.
2. Click the Zoom All icon on the toolbar.
3. Enter 100 into the zoom factor dropdown on the toolbar.



Zoom MENU

1. Move your mouse so the cursor is on the chart and **Single-Click** the **RIGHT** mouse button and click the Zoom action icon on the pop-up menu.

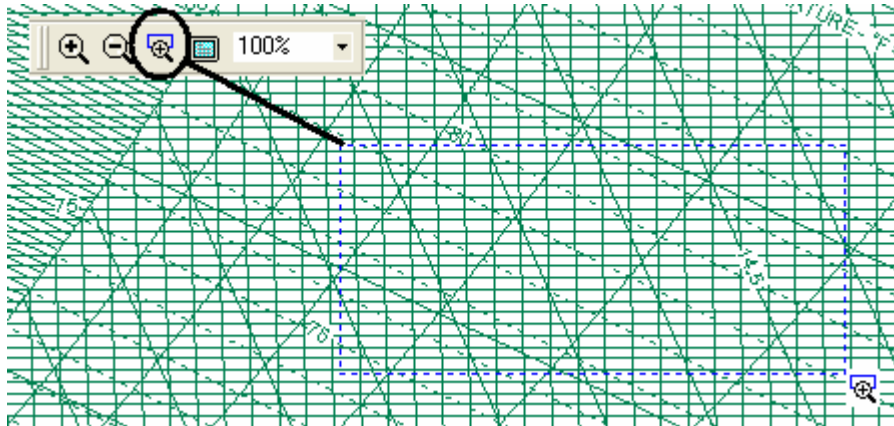


Panning

If you are **ZOOMED IN** on the chart, simply position your mouse on the chart and hold the LEFT mouse button down and move your mouse. When you have panned to the desired position, release the left mouse button.

Zoom WINDOW

Simply click the Zoom Window icon on the tool bar, then click the first corner of the window on the chart, move the mouse and click the other window corner.

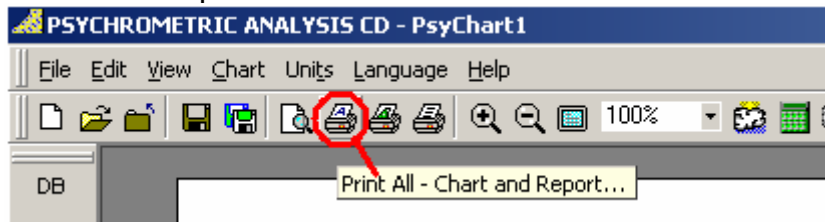


REPORTS

PRINT ALL

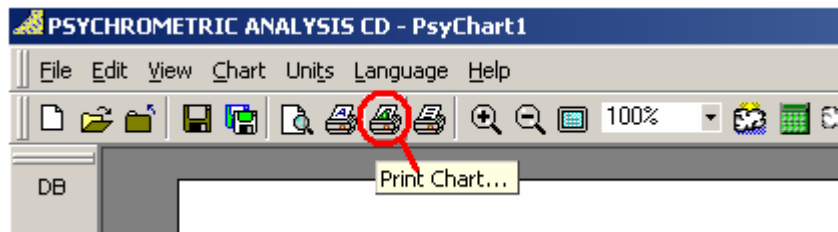
There are four different choices when printing:

1. Print BOTH the Chart and Report. Click on the Print All icon on the toolbar.



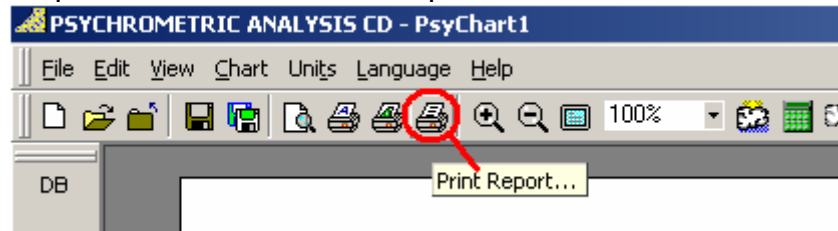
PRINT CHART

2. Print ONLY the Chart. Click on the Print Chart icon on the toolbar.

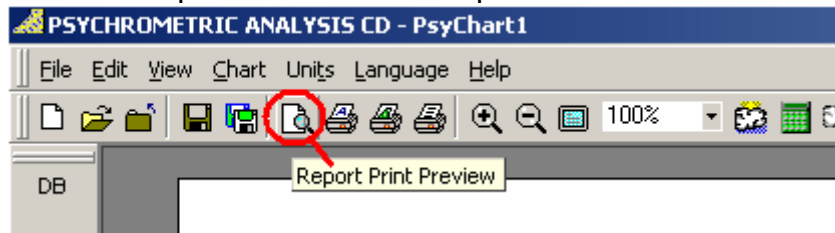


PRINT REPORT

3. Print ONLY the Report. Click on the Print Report icon on the toolbar.

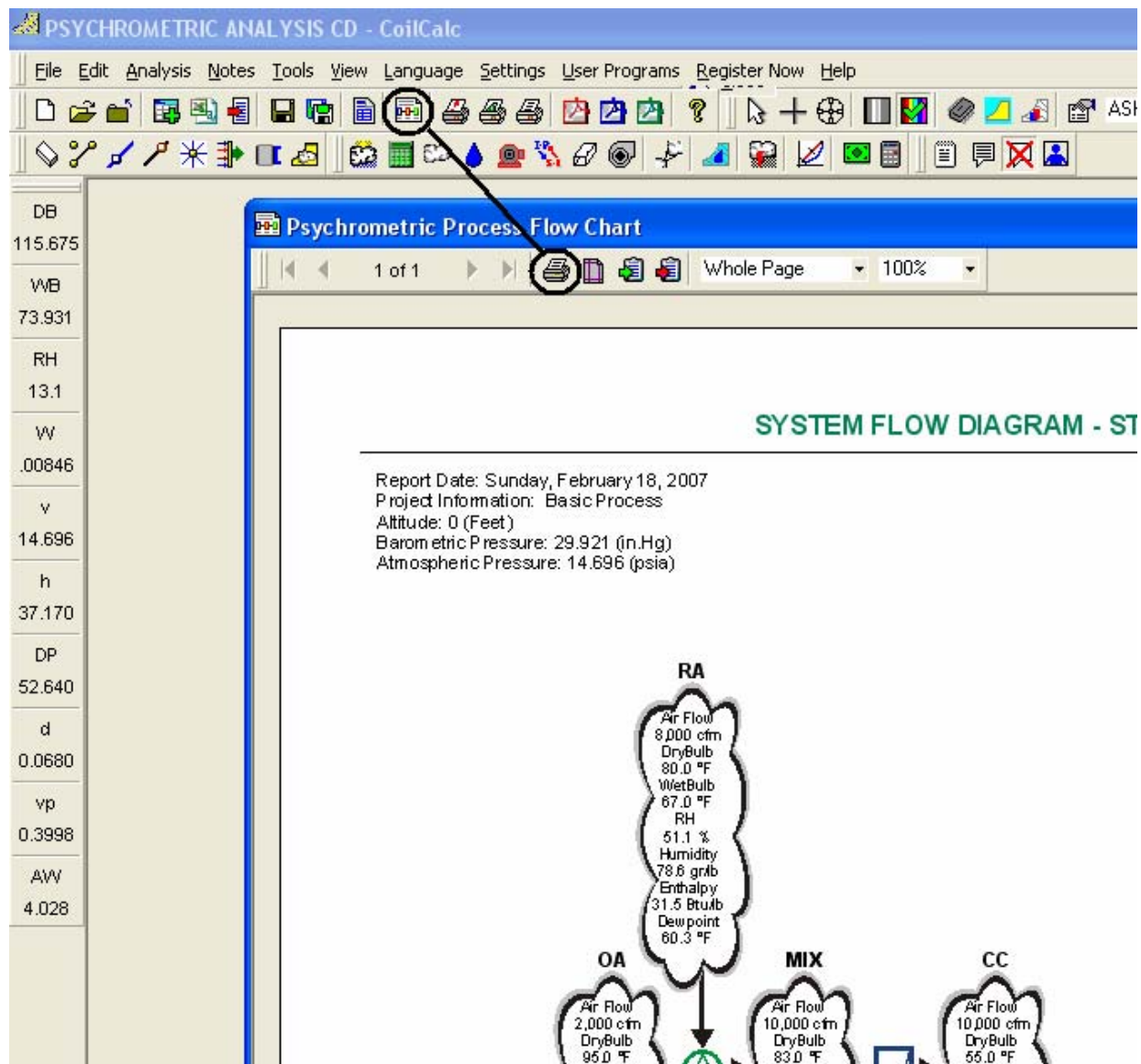


4. Print Preview ONLY the Report. Click on the Report Print Preview icon on the toolbar.



PRINT FLOWCHART

Click the FlowChart icon on the toolbar, and then click the print icon on the flowchart window to print the flowchart.

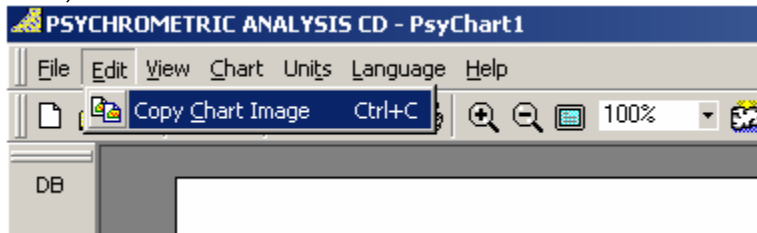




DATA EXCHANGE

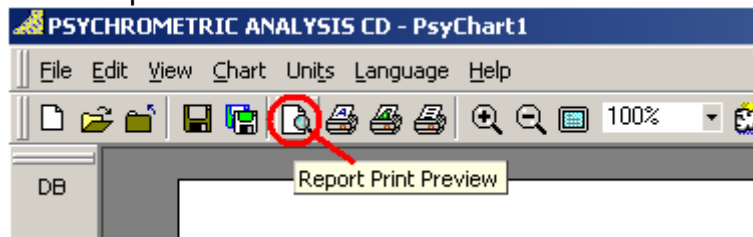
EXPORT/COPY CHART

From the menu, click on Edit, and then click Copy Chart Image. The psychrometric chart image is automatically placed on your clipboard for you to paste into your reports, presentations, proposals, etc.

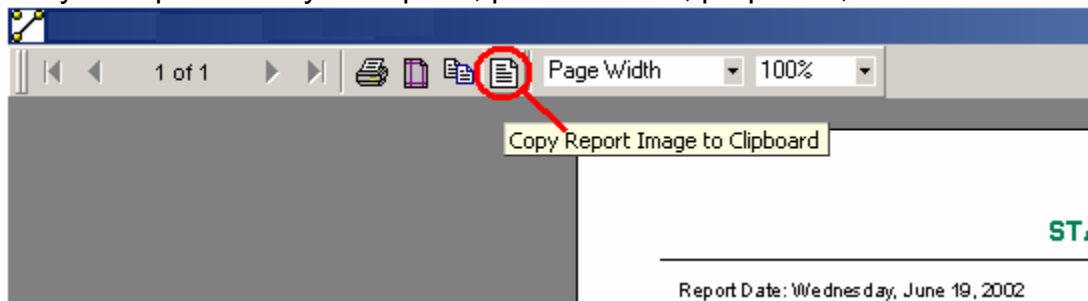


EXPORT/COPY REPORT

From the toolbar, click the Report Print Preview icon.

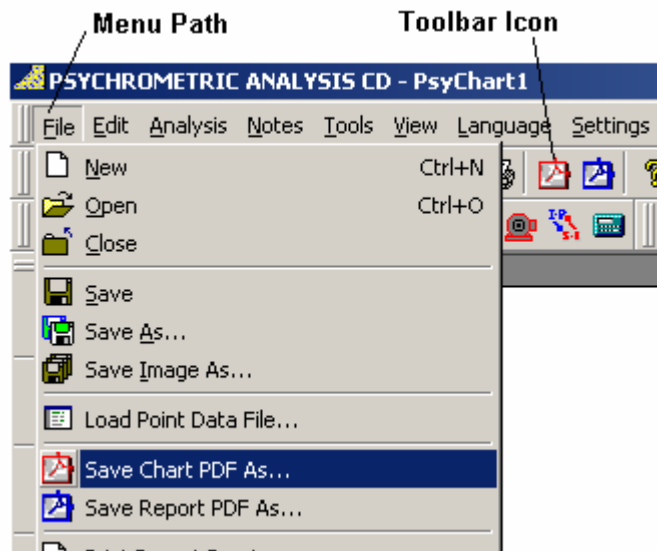


Then from the toolbar on the Report Print Preview, click the Copy Report Data to Clipboard icon. The complete state-point and process report image is automatically placed on your clipboard for you to paste into your reports, presentations, proposals, etc.

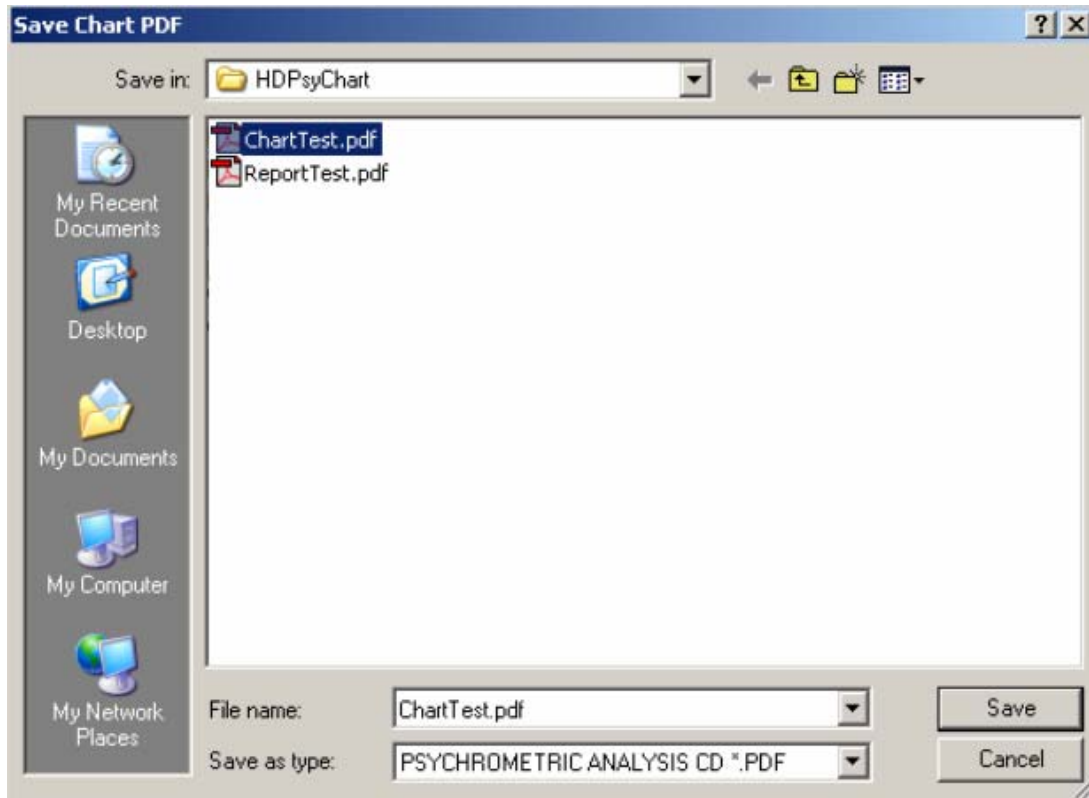


EXPORT/CREATE CHART PDF

1. Activate "Save Chart PDF As..." by either of the two methods shown below:

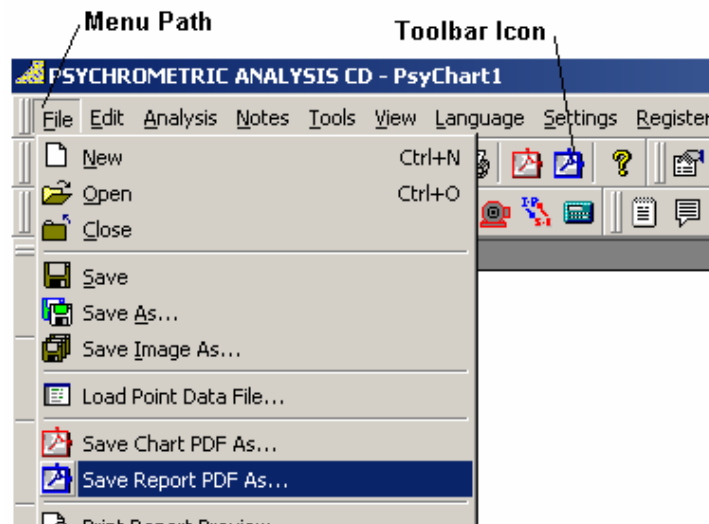


2. Navigate to where you want to save the file, type in the file name and click the "Save" button.

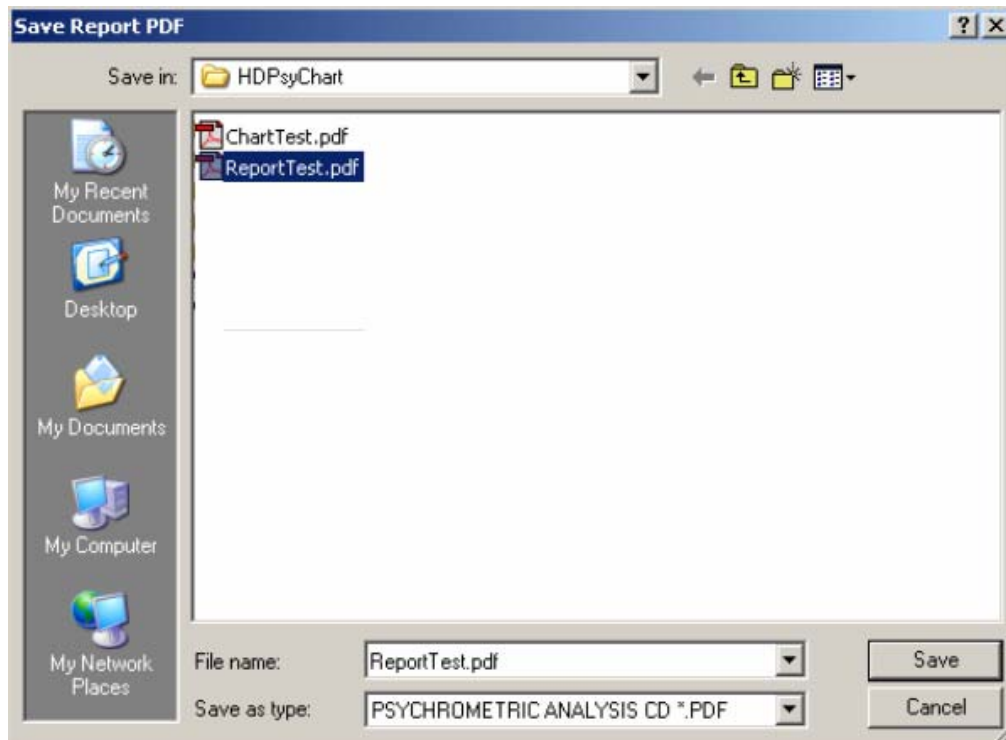


EXPORT/COPY REPORT PDF

1. Activate "Save Report PDF As..." by either of the two methods shown below:

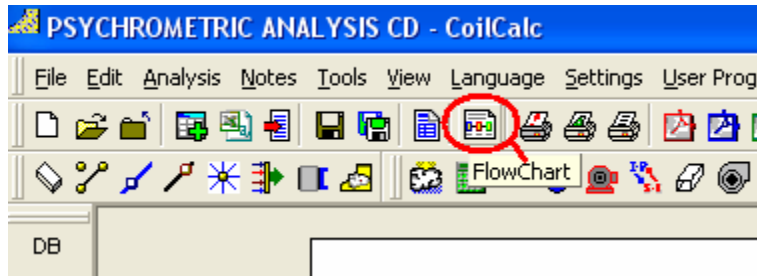


2. Navigate to where you want to save the file, type in the file name and click the "Save" button.

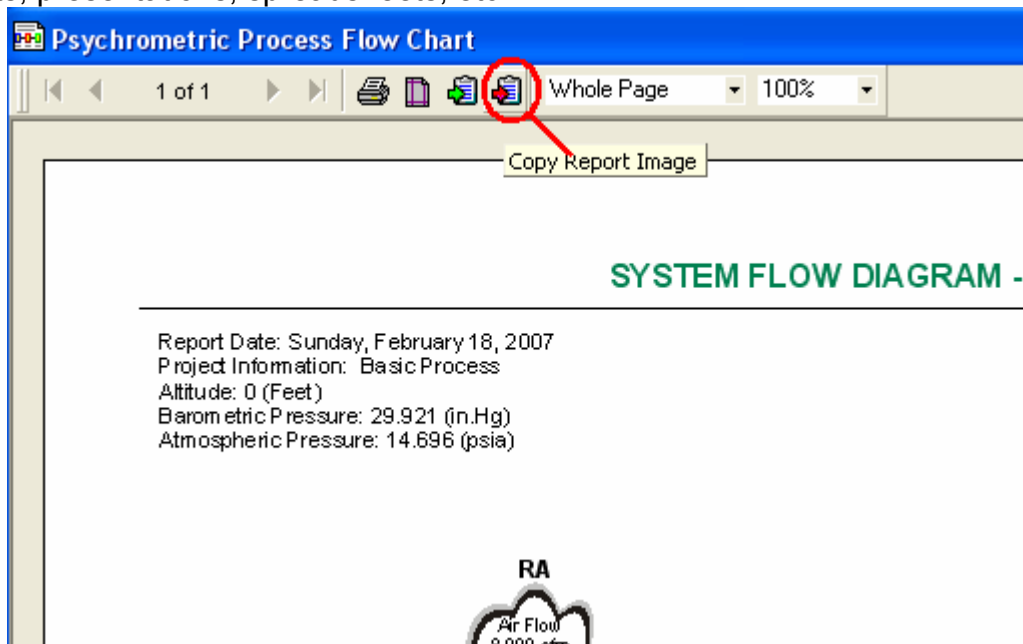


EXPORT/COPY FLOWCHART

From the toolbar, click the Flow Chart icon.

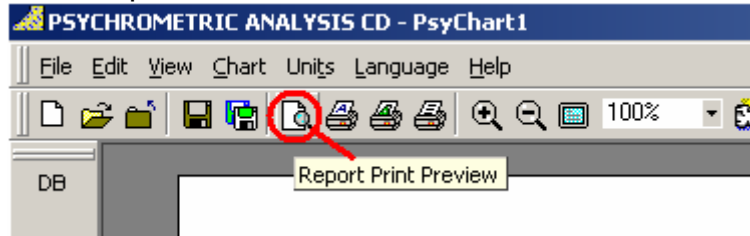


Then from the toolbar on the Flow Chart, click the Copy Report Image to Clipboard icon. The complete flow chart report image is automatically placed on your clipboard for you to paste into your reports, presentations, spreadsheets, etc.

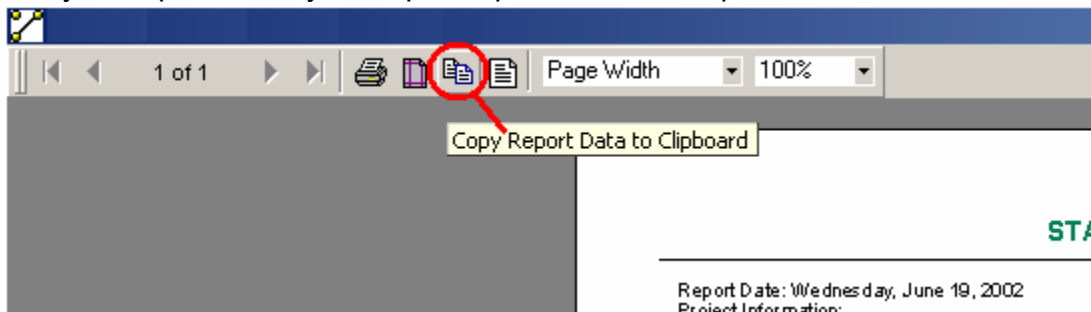


EXPORT/COPY REPORT DATA

From the toolbar, click the Report Print Preview icon.

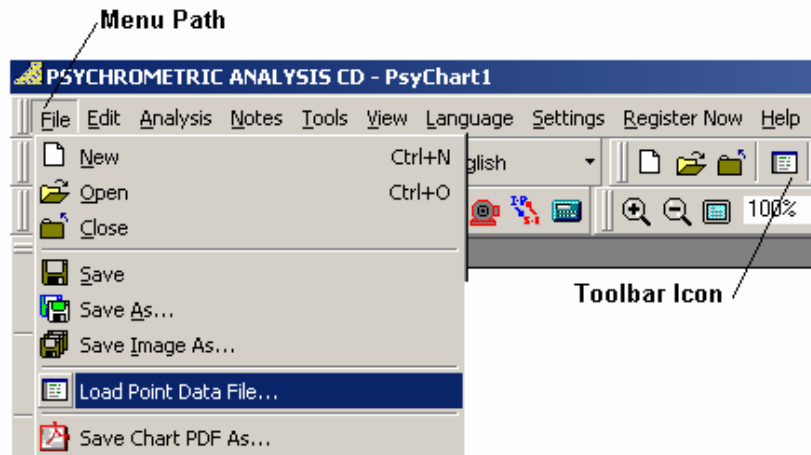


Then from the toolbar on the Report Print Preview, click the Copy Report Data to Clipboard icon. The complete state-point and process report data is automatically placed on your clipboard for you to paste into your reports, presentations, spreadsheets, etc.

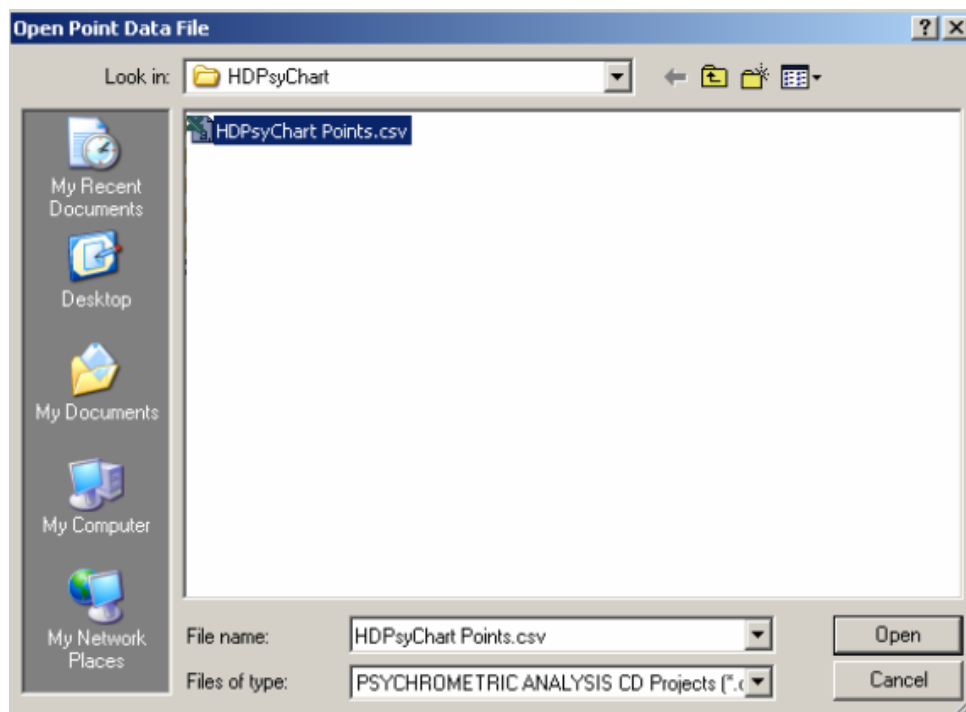


IMPORTING DATA

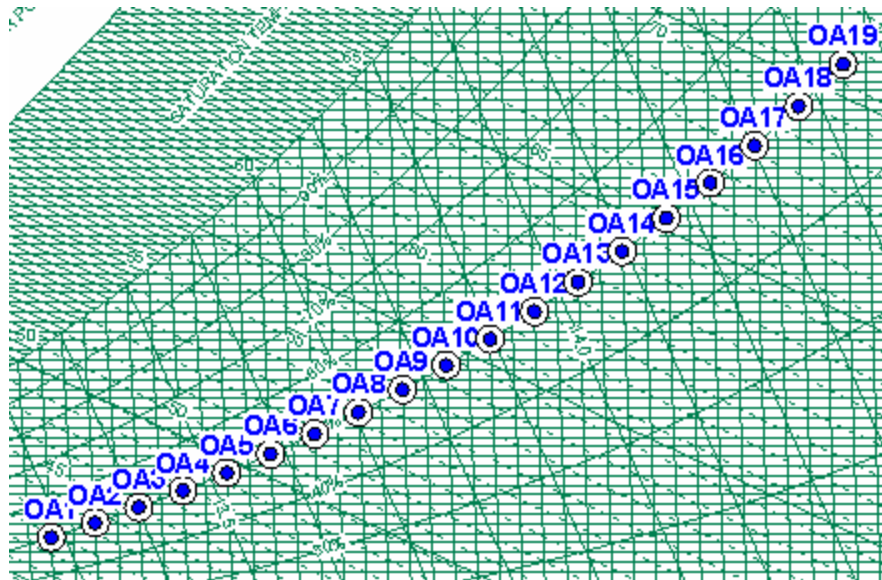
From the toolbar, click the Import Data File icon.



Then navigate to the ".csv" file with the data you wish to import. ".csv" file format is a comma delimited file format, which is an export option for spreadsheet programs such as Microsoft Excel.



Then Click the "Open" button and the data points will be imported and displayed on the chart. Below is an example shipped with this program:

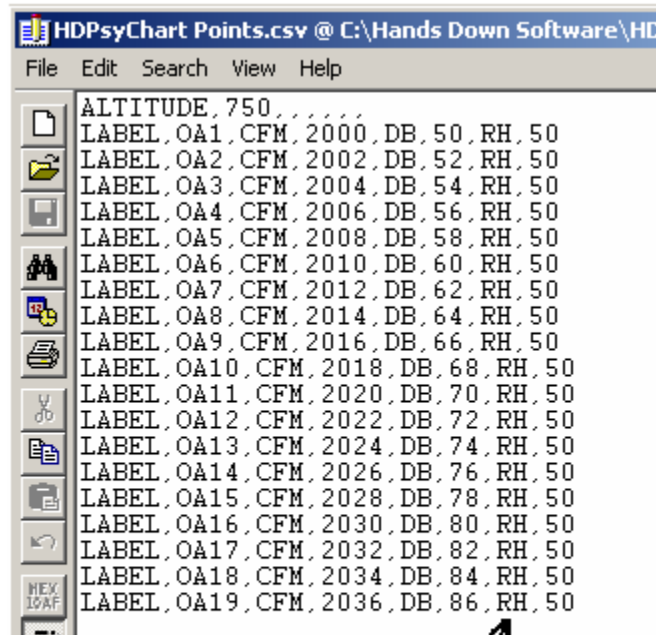


If using a Spreadsheet to create the “.csv” file, data points must be set up with the following structure:

Microsoft Excel - HDPsyChart Points.csv								
File Edit View Insert Format Tools Data Window Help Acrobat								
J25								
	A	B	C	D	E	F	G	H
1	ALTITUDE	750						
2	LABEL	OA1	CFM	2000	DB	50	RH	50
3	LABEL	OA2	CFM	2002	DB	52	RH	50
4	LABEL	OA3	CFM	2004	DB	54	RH	50
5	LABEL	OA4	CFM	2006	DB	56	RH	50
6	LABEL	OA5	CFM	2008	DB	58	RH	50
7	LABEL	OA6	CFM	2010	DB	60	RH	50

This column can be:
RH, WB, W, V, H or DP
and can change from
one point to another

If using a text editor to create the “.csv” file, data points must be set up with the following structure:



**This column can be:
RH, WB, W, V, H or DP
and can change from
one point to another**



TOOLBOX PROGRAMS

CLIMATIC DATA

Climatic Data provides ambient design conditions for over 1,000 locations in either IP or SI units of measure. Ambient data is from ASHRAE 1997 Fundamentals.

Climatic Data - ASHRAE 1997 Fundamentals

☒ **COOLING** USA 676 Elevation, Feet ☒ English (IP)
☒ **HEATING** Oklahoma 36.2 North Latitude ☐ Metric (SI)
☒ **WIND** Tulsa 95.9 West Longitude

SUMMER COOLING

	DB °F	MWB °F	°F wb	WB °F	MDb °F	°F db	DP °F	MDb °F	°F db
0.4%	100	76	76.00	79	92	92.00	76	87	87.00
1%	97	76	76.00	78	92	92.00	74	85	85.00
2%	94	75	75.00	77	90	90.00	73	84	84.00

Average Annual Max. DB °F 103 Std. Dev. °F 4 Mean Daily Range DB °F 19

WINTER HEATING

	DB °F	RH %	°F wb	Coldest Month	WS mph	MCDB °F	Average Annual Min.	DB °F	Std. Dev. °F
99.6%	9	50	6.72	0.4%	24	46			
99%	14	50	11.23	1%	22	40			

Average Annual Min. DB °F 2 Std. Dev. °F 6

WIND

	MCWS	mph	PWD	deg.
Coincident with 0.4% DB (cooling)	12	mph	180	deg.
Coincident with 99.6% DB (heating)	11	mph	360	deg.
Annual Design Values 1%	25	mph	5%	21 mph

PSYCHROMETRIC CALCULATOR

Complete stand-alone psychrometric calculator is one of the tools provided. This psychrometric wonder has full File-Open-Save-SaveAs capabilities.

Description	Altitude (ft)	Barometric Pressure (in. Hg)	Atmospheric Pressure (psia)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (gr/lb)	Humidity Ratio (lb/lb)	Specific Volume (cu.ft./lb)
Outside Air	0	29.921	14.696	95.000	78.000	47.294	0.01686	0.00000	14.3564
Return Air	0	29.921	14.696	80.000	67.000	51.140	0.01123	0.00000	13.8453
Cooling Coil	0	29.921	14.696	55.000	54.800	98.784	0.00912	0.00000	13.1600

The program also has a data report for printing and the ability to copy all data points to the clipboard so you can paste them into your reports or spreadsheets.

	A	B	C	D	E	F	G	H	I
	Description	Altitude (ft)	Barometric Pressure (in. Hg)	Atmospheric Pressure (psia)	Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (gr/lb)	Humid Ratio (lb/lb)
1	OA	0	29.921	14.696	95	78	47.294	117.9941	0.01686
2	RA	0	29.921	14.696	80	67	51.14	78.5834	0.01123
3	CC	0	29.921	14.696	55	54.671	98	63.311	9.04E-05
4									
5									
6									
7									
8									

OUTSIDE AIR ESTIMATOR

Complete stand-alone fresh air estimator is one of the tools provided. This tool has many of the applications listed in ASHRAE Standard 62-2004.

Outside Air Estimator - RE: ASHRAE Standard 62-2004

Application Group: **Educational Facilities** **IP** **SI** **Print** **Close**

Specific Application: **Media center**

cfm per Person: **10** cfm per sq.ft.: **0.12**

No. of People: **22** Area (sq.ft.): **7500**

People OA Rate: **220** Area OA Rate: **900**

TOTAL Suggested Fresh Airflow (cfm): **1120**

AIR CLASS
Air Class = 1
[Class Definition](#)

NOTES
For high school and college libraries, use values shown for Public Spaces - Library.

GENERAL NOTES

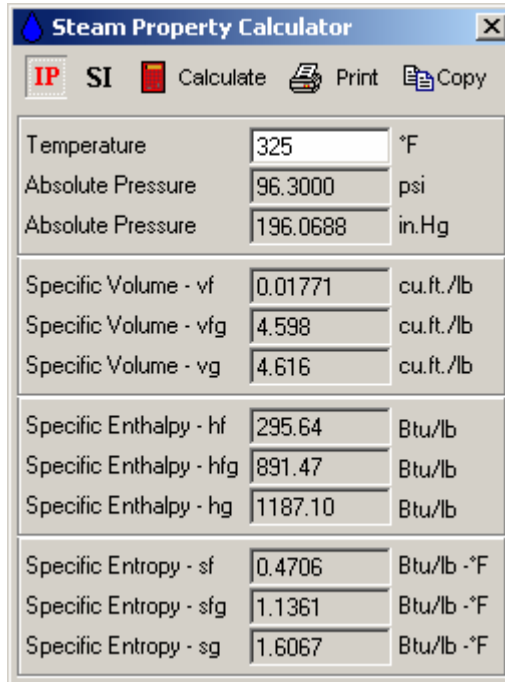
(1.) Related Requirements: The rates in this program are based on all other applicable requirements of ASHRAE Standard 62-2004 being met.

(2.) Smoking: This program applies to no-smoking areas. Rates for smoking-permitted spaces must be determined using other methods. See ASHRAE Standard 62-2004, Section 6.2.9 for ventilation requirements in smoking areas.

(3.) Air Density: Volumetric airflow rates are based on an air density of 0.075 lbda/ft³ (1.2 kgda/m³), which corresponds to dry air at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C). Rates may be adjusted for actual density but such adjustment is not required for compliance with

STEAM PROPERTY CALCULATOR

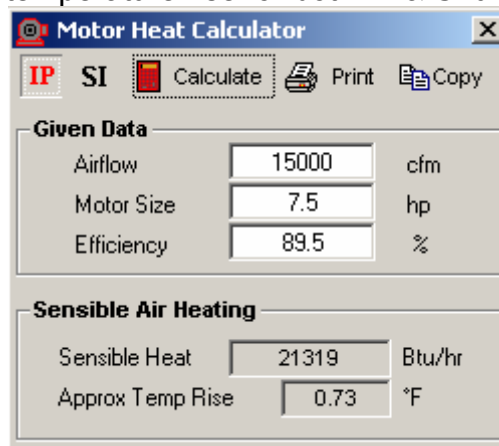
Complete steam property calculator is one of the tools provided. This tool provides complete thermo-physical properties of steam for both IP & SI units of measure.



Property	Value	Unit
Temperature	325	°F
Absolute Pressure	96.3000	psi
Absolute Pressure	196.0688	in.Hg
Specific Volume - vf	0.01771	cu.ft./lb
Specific Volume - vfg	4.598	cu.ft./lb
Specific Volume - vg	4.616	cu.ft./lb
Specific Enthalpy - hf	295.64	Btu/lb
Specific Enthalpy - hfg	891.47	Btu/lb
Specific Enthalpy - hg	1187.10	Btu/lb
Specific Entropy - sf	0.4706	Btu/lb · °F
Specific Entropy - sfg	1.1361	Btu/lb · °F
Specific Entropy - sg	1.6067	Btu/lb · °F

MOTOR HEAT CALCULATOR

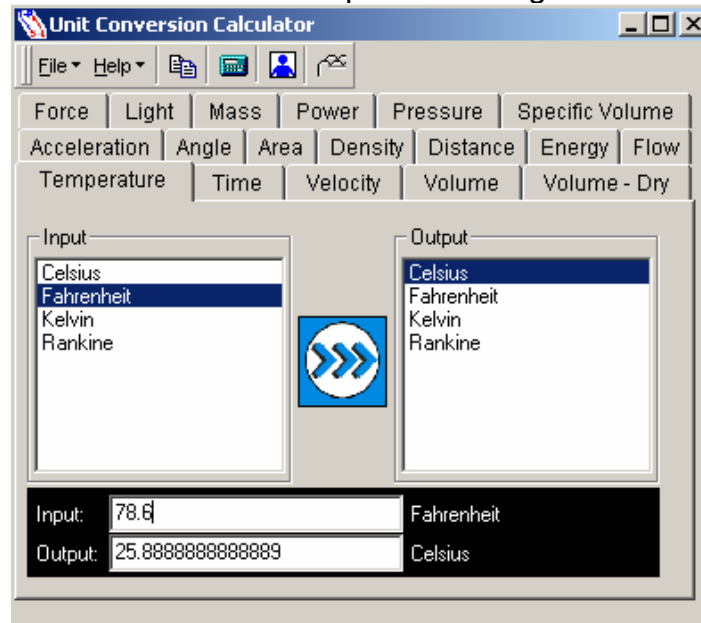
Sensible Heat generated by motors in the air stream can now be easily calculated. This Motor Heat Calculator is one of the tools provided. Simply input three variables and click calculate. Calculates sensible heat and temperature rise for both IP & SI units of measure.



Section	Property	Value	Unit
Given Data	Airflow	15000	cfm
	Motor Size	7.5	hp
	Efficiency	89.5	%
Sensible Air Heating	Sensible Heat	21319	Btu/hr
	Approx Temp Rise	0.73	°F

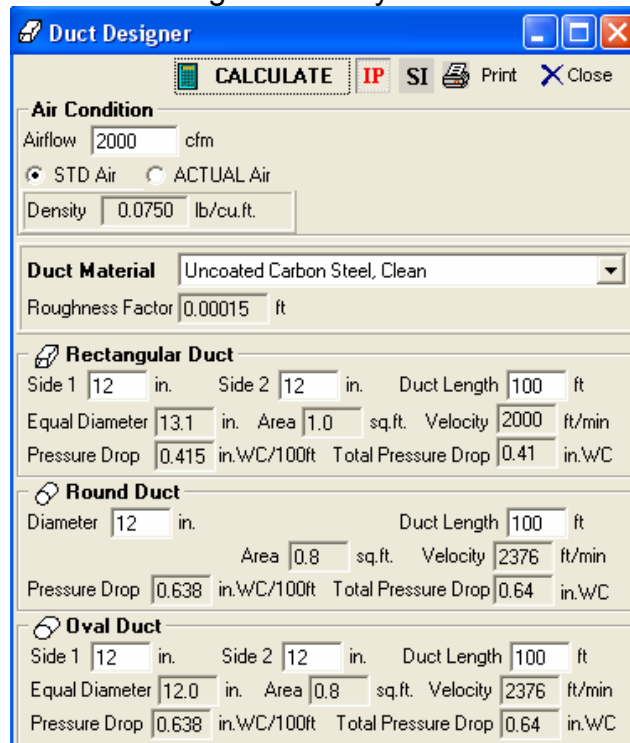
UNIT CONVERSION CALCULATOR

Unit of Measure converter is one of the tools provided. Simply click on the unit category and then click on the source and target units of measure and type in your value, resulting in real time conversion. This tool also allows the user complete Category Tab Management, unit of measurement management and conversion equation management.



DUCT DESIGNER CALCULATOR

This Duct Designer tool aids in the design of duct system and associated pressure drops.



FAN LAW CALCULATOR

The Fan Law Calculator is a very useful tool for modeling “what-if” scenarios.

The Fan Law Calculator window displays two sections for fan performance data. The 'Current Fan Performance' section has five input fields: Airflow (10000 cfm), Static Pressure (2.50 in. WC), Power (8.4 bhp), Speed (1150 rpm), and Pulley Size (12 in.). The 'New Fan Performance' section has five input fields: Airflow (12000 cfm), Static Pressure (3.60 in. WC), Power (14.5 bhp), Speed (1380 rpm), and Pulley Size (10.0 in.). The window includes a 'CALCULATE' button, unit selection buttons for 'IP' and 'SI', and 'Print' and 'Close' buttons.

Parameter	Current Value	Unit	New Value	Unit
Airflow	10000	cfm	12000	cfm
Static Pressure	2.50	in. WC	3.60	in. WC
Power	8.4	bhp	14.5	bhp
Speed	1150	rpm	1380	rpm
Pulley Size	12	in.	10.0	in.

WIND CHILL CALCULATOR


This Wind Chill calculator is a useful tool when considering outdoor thermal comfort conditions.

The Wind Chill Calculator window displays two sections. The 'Temperature and Wind Condition' section has two input fields: Temperature (-10 °F) and Wind (45 mph). The 'Wind Chill and Frostbite Time' section has two output fields: Wind Chill (-44 °F) and Frostbite Time (10 minutes). The window includes a 'Calculate' button, a 'Chart' button, a 'FAQ' button, unit selection buttons for 'IP' and 'SI', and a 'Print' button.

Parameter	Value	Unit
Temperature	-10	°F
Wind	45	mph
Wind Chill	-44	°F
Frostbite Time	10	minutes

THERMAL COMFORT CALCULATOR

This Thermal Comfort Calculator models human comfort based on ASHRAE equations.


Thermal Comfort Calculator

Environmental Conditions

Air Temperature: °F
 MRT: ☒ Link with Air °F
 Air Velocity: ft/min
 Relative Humidity: %
☒ Summer ☐ Winter

Activity

User Defined
 Metabolic Rate: met

Clothing


User Defined
 Clothing level: clo

Other Details

External Work: met
 Turbulence Intensity: %
 Mean Mo. Outdoor Temp: °C
 Exposure Time: min
 Barometric Pressure: torr
 Weight: kg
 Surface Area: sq.m

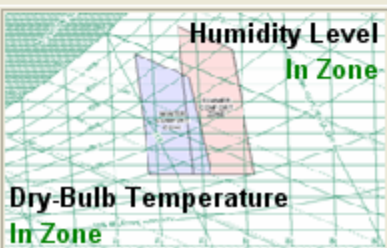
Results

ET*: °F
 SET*: °F
 TSENS:
 DISC:
 PMV:
 PPD: %
 PD: %
 PS: %
 TS: Neutral
 Tnuetral: °F (Humphreys)
 Tnuetral: °F (Auliciems)

Comfortable
 

Comfort Zone Calculation

Summer Comfort



Humidity Level
In Zone

Dry-Bulb Temperature
In Zone

SINGLE & DOUBLE INTERPOLATION AND EXTRAPOLATION CALCULATOR

This interpolation and extrapolation calculator is extremely useful when needing to determine data between known values. Linear interpolation and extrapolation is used.

Interpolate Calculator

Print Close

CALCULATE

Single Double

Interpolation Extrapolation

Linear Analysis

Series 1

	Low Point1	Mid Point1	High Point1
X1	2	3	4
Y1	1	2	3

Series Mid

	Low Mid	Mid Mid	High Mid
X	3	4	5
Y	2	3	4

Series 2

	Low Point2	Mid Point2	High Point2
X1	4	5	6
Y1	3	4	5

FINANCIAL LOAN CALCULATOR

This tool is helpful for quick “cost of money” determinations for project work.

LoanCalc

Loan Amount: 160000

Percent Down: 10 %

Maximum Years: 30

Minimum Years: 30

Max Interest Rate: 8.0 %

Min Interest Rate: 4.0 %

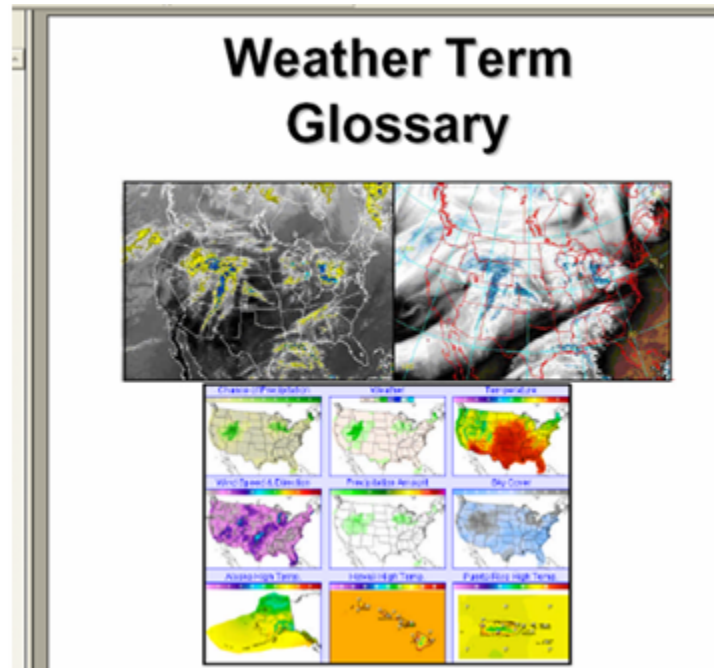
Show Payments Copy

Show Amortization Table Print

Payment	Principal Paid	Interest Paid
\$1,174.02		
1	\$107.35	\$1,066.67
2	\$108.07	\$1,065.95
3	\$108.79	\$1,065.23
4	\$109.51	\$1,064.51
5	\$110.24	\$1,063.78
6	\$110.98	\$1,063.04
7	\$111.72	\$1,062.30
8	\$112.46	\$1,061.56
9	\$113.21	\$1,060.81
10	\$113.97	\$1,060.05

WEATHER TERM GLOSSARY REFERENCE

Meteorologist using Psychrometric Analysis will appreciate the complete weather term glossary provided with one button click.





EXAMPLE PROCESSES

EXAMPLE 1: Moist Air Sensible Heating

Saturated air at 35F enters a heating coil at 20,000cfm. Air leaves coil at 100F. Find the required rate of heat addition.

Solution: 1,503,224 Btu/h

Psychrometric Processes

Apply Add Point Climatic Data... Delete Print Help

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
1	A	20000	ACT	Add State Point	POINT
2	A	20000	ACT	Sensible Heating	POINT

Start Point		Process		Current Point	
1		Sensible Heating		DB 100.000 W 0.00428	
Air Flow	20000	<input type="checkbox"/> Total Heating	125.3	Air Flow	20000
DB	35.000	<input type="checkbox"/> Total Energy	1,503,224	DB	100.000
WB	35.000	<input type="checkbox"/> Sensible Energy	1,503,224	WB	63.586
RH	100.0	<input type="checkbox"/> Latent Energy	0	RH	10.5
W	0.00428	<input type="checkbox"/> Moisture Difference	0.0	W	0.00428
v	12.552	<input type="checkbox"/> Sensible Heat Ratio	1.000	v	14.201
h	13.004	<input type="checkbox"/> Enthalpy/ Humidity Ratio	N/A	h	28.728
DP	35.000			DP	35.000
d	0.0800			d	0.0707
vp	0.2036			vp	0.2036
AW	2.385			AW	2.108

EXAMPLE 2:

Moist Air Cooling & Dehumidification

Problem: Moist air at 85F dry bulb and 50% rh enters a cooling coil at 10,000 cfm and is processed to a final condition at 50F and 100% rh. Find the tons of refrigeration required.

Solution: 51.1 tons

Psychrometric Processes

Apply Add Point Climatic Data... Delete Print Help

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
EAT	AR	10000	ACT	Add State Point	POINT
LAT	AR	10000	ACT	Cooling Coil	POINT

Start Point		Process		Current Point	
EAT		Cooling Coil		DB 50.000	
				RH 100	
Air Flow	10000	<input type="checkbox"/> Total Cooling	-51.1	Air Flow	10000
DB	85.000	<input type="checkbox"/> Total Energy	-613,207	DB	50.000
WB	70.769	<input type="checkbox"/> Sensible Energy	-364,808	WB	50.000
RH	50.0	<input type="checkbox"/> Latent Energy	-248,399	RH	100.0
W	0.01294	<input type="checkbox"/> Dehumidification	-226.1	W	0.00766
v	14.011	<input type="checkbox"/> Sensible Heat Ratio	0.595	v	13.002
h	34.617	<input type="checkbox"/> Enthalpy/ Humidity Ratio	2,712	h	20.298
DP	64.297			DP	50.000
d	0.0723			d	0.0775
vp	0.6074			vp	0.3626
AW	6.465			AW	4.124

EXAMPLE 3:

Moist Air Cooling & Dehumidification Below Freezing

Problem: Moist air at 31F dry bulb and 85% rh enters a cooling coil at 5,000 cfm and is processed to a final condition at 20F and 100% rh. Find the tons of refrigeration required.

Solution: 7.6 tons

Psychrometric Processes

Apply Add Point Climatic Data... Delete Print Help

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
EAT	AR	5000	ACT	Add State Point	POINT
LAT	AR	5000	ACT	Cooling Coil	POINT

Start Point		Process		Current Point	
EAT		Cooling Coil		DB 20.000 RH 100	
Air Flow	5000	<input type="checkbox"/> Total Cooling	-7.6	Air Flow	5000
DB	31.000	<input type="checkbox"/> Total Energy	-91,188	DB	20.000
WB	29.480	<input type="checkbox"/> Sensible Energy	-63,990	WB	20.000
RH	85.0	<input type="checkbox"/> Latent Energy	-27,198	RH	100.0
W	0.00307	<input type="checkbox"/> Dehumidification	-22.2	W	0.00215
v	12.426	<input type="checkbox"/> Sensible Heat Ratio	0.702	v	12.130
h	10.743	<input type="checkbox"/> Enthalpy/ Humidity Ratio	3,955	h	7.104
DP	27.487			DP	20.000
d	0.0807			d	0.0826
vp	0.1465			vp	0.1028
AW	1.731			AW	1.242

EXAMPLE 4:

Adiabatic Mixing of Two Moist Airstreams

Problem: A stream of 5000 cfm outdoor air at 40F dry-bulb temperature and 35F wet-bulb temperature is adiabatically mixed with 15,000 cfm of 75F dry-bulb temperature air and 50% rh. Find the resulting dry-bulb and wet-bulb temperatures.

Solution: 65.8°Fdb & 56.6°Fwb

Psychrometric Processes

Apply Add Point Climatic Data... Delete Print Help

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
P1	AR	5000	ACT	Add State Point	POINT
P2	AR	15000	ACT	Add State Point	POINT
M1	AR	19999	ACT	Air Mixing	POINT

Start Point		Air Mixing (Second Point)		Current Point	
P1	P2			DB	65.8
				W	.0077
Air Flow	5000	Air Flow	15000	Air Flow	19999
DB	40.000	DB	75.000	DB	65.800
WB	35.000	WB	62.539	WB	56.630
RH	60.7	RH	50.0	RH	56.9
W	0.00315	W	0.00927	W	0.00770
v	12.656	v	13.675	v	13.406
h	13.002	h	28.149	h	24.187
DP	28.037	DP	55.125	DP	50.137
d	0.0793	d	0.0738	d	0.0752
vp	0.1503	vp	0.4379	vp	0.3645
AW	1.744	AW	4.748	AW	4.021

EXAMPLE 5:

Adiabatic Mixing of Water Injected into Moist Air

Problem: Moist Air at 70F dry-bulb and 45F wet-bulb is to be processed to a final dew-point temperature of 55F by adiabatic injection of saturated steam at 230F. The rate of dry airflow is 200lbda/min and the final dry-bulb temperature is 72.267. Find the rate of steam flow required.

Solution: 102.3 lb/h

The screenshot shows the 'Psychrometric Processes' software window. The 'Process' tab is selected, and the process is 'Humidification and Heating'. The 'Start Point' is P1 (70.000 DB, 45.000 WB) and the 'Current Point' is P2 (72.267 DB, 55.00000 DP). The 'Air Flow' is 200 LBS/MIN. The 'Humidification Rate - Mass' is 102.3, which is the required steam flow rate.

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN
P1	AR	200	LBS/MIN	Add State Point	POINT
P2	AR	200	LBS/MIN	Humidification and Heating	POINT

Start Point		Process		Current Point	
P1		Humidification and Heating		P2	
Air Flow	200	Total Energy	118,362	Air Flow	200
DB	70.000	Sensible Energy	6,640	DB	72.267
WB	45.000	Latent Energy	111,722	WB	61.516
RH	4.6	Humidification Rate - Mass	102.3	RH	54.6
WV	0.00071	Humidification Rate - Volume	12.26	WV	0.00923
v	13.363	Enthalpy/Humidity Ratio	1,157	v	13.604
h	17.572	Sensible Energy Per Dehumidification	64.9	h	27.435
DP	-2.058			DP	55.000
d	0.0749			d	0.0742
vp	0.0338			vp	0.4359
AWV	0.370			AWV	4.750



TERMINOLOGY

PSYCHROMETRIC TERM DEFINITIONS

Absolute Humidity

The ratio of the mass of water vapor to the total volume of a sample. The term "water vapor density" is also used for this value.

DB
119.0
WB
86.9
RH
28.3
W
.0205
v
15.07
h
51.41
DP
77.5
d
0.0664
vp
0.952
AW
9.530
X
10.171
Y
2.935

Absolute Humidity

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Atmospheric Air

Air containing water vapor and many gaseous components such as smoke, pollen, gaseous pollutants, etc.

Density

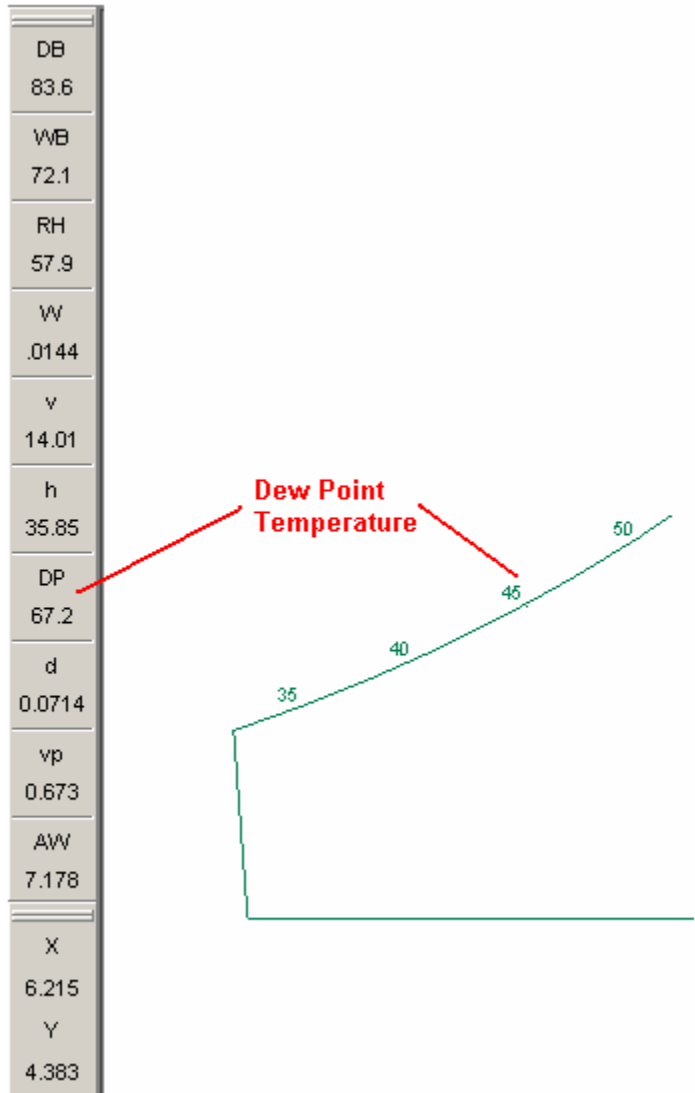
The ratio of the total mass of a sample to the total volume of the sample. For moist air, water vapor and air are included in the totals.

DB
81.9
WB
71.9
RH
61.9
W
.0145
v
13.97
h
35.61
DP
67.6
d
0.0716
vp
0.680
AWW
7.280
X
6.024
Y
4.345

Density

Dew Point Temperature

The temperature of moist air saturated at the same pressure and humidity ratio. Or more simply the temperature at which water vapor will begin to condense from a sample of air.



Dry Air

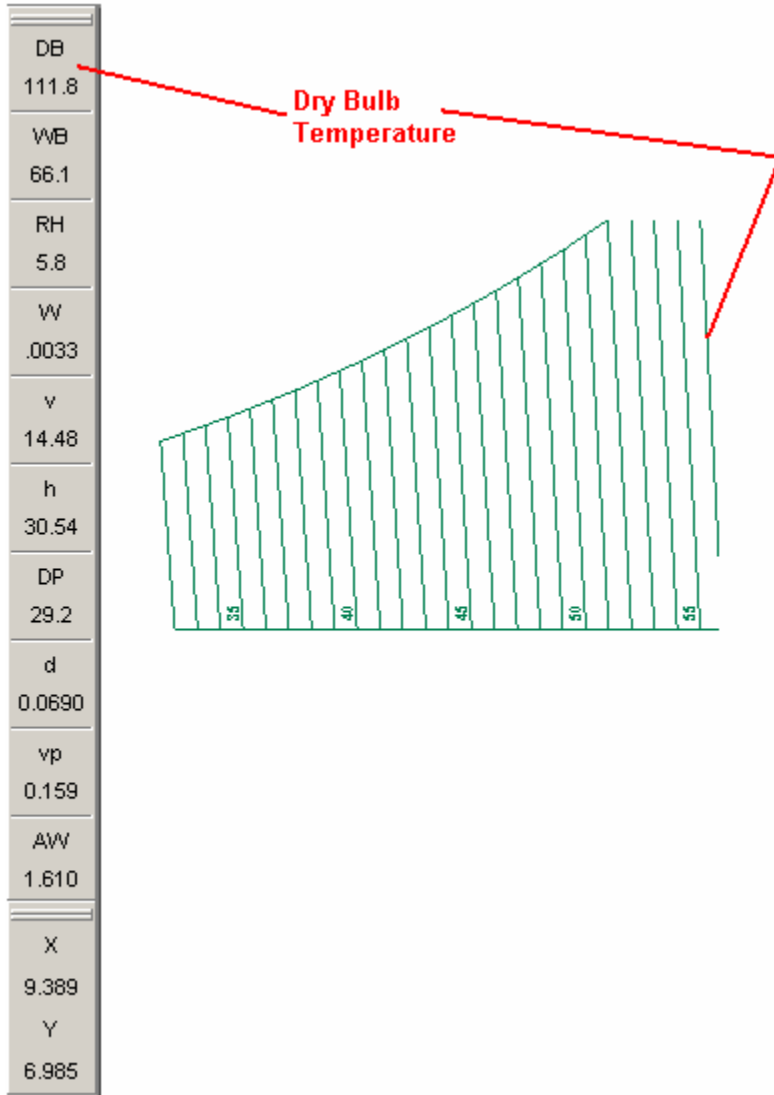
Atmospheric air with all water vapor and contaminants removed.

The approximate percentage by volume of dry air is as follows:

78.084	% Nitrogen
20.9476	% Oxygen
0.934	% Argon
0.0314	% Carbon Dioxide
0.001818	% Neon
0.000524	% Helium
0.00015	% Methane
0.00010	% Sulfur Dioxide
0.00005	% Hydrogen
0.00020	% Other (Krypton, Xenon, Ozone, etc.)

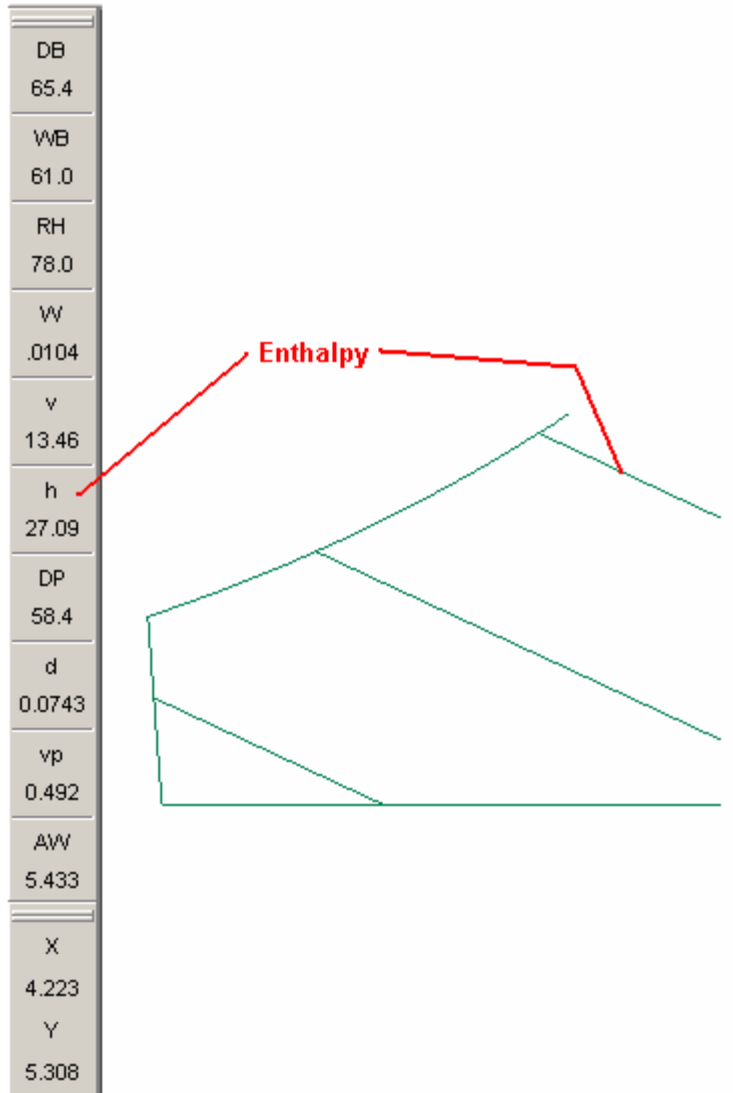
Dry Bulb Temperature

The temperature of air read on a standard thermometer indicating it's thermal state.



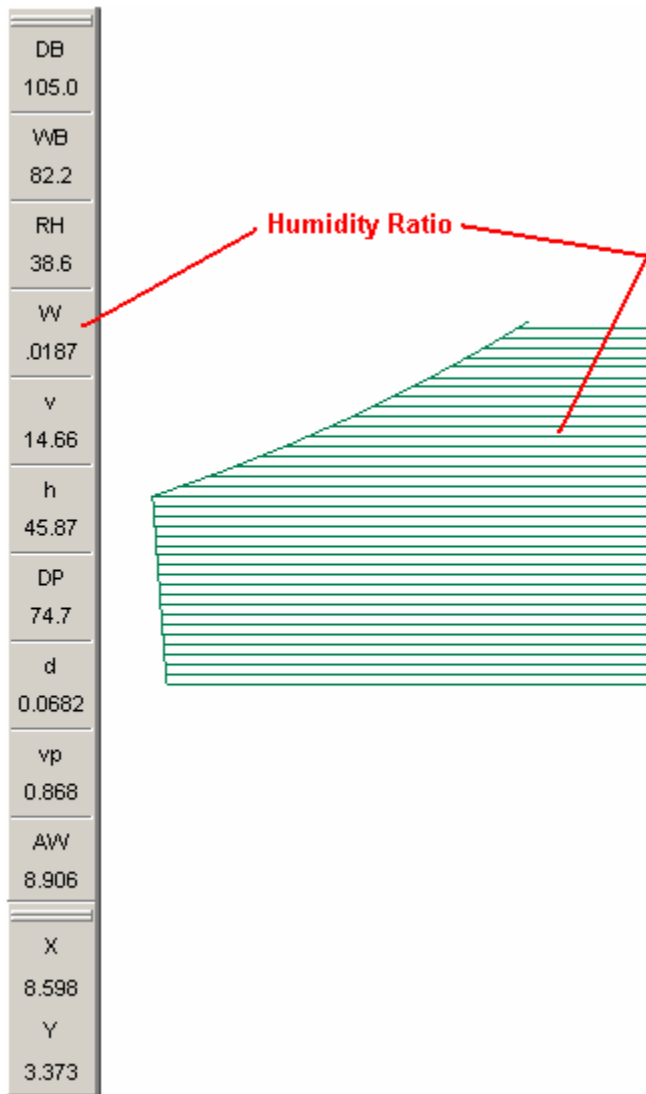
Enthalpy

The thermodynamic property defined as energy per unit mass commonly used to define the internal energy of moist air. The enthalpy of a sample of moist air is the sum of enthalpies of the air and the water vapor. On the psychrometric chart Enthalpy is expressed in terms of energy per weight of DRY air.



Humidity Ratio

The ratio of the mass of water vapor to the mass of dry air of a sample.



Moist Air

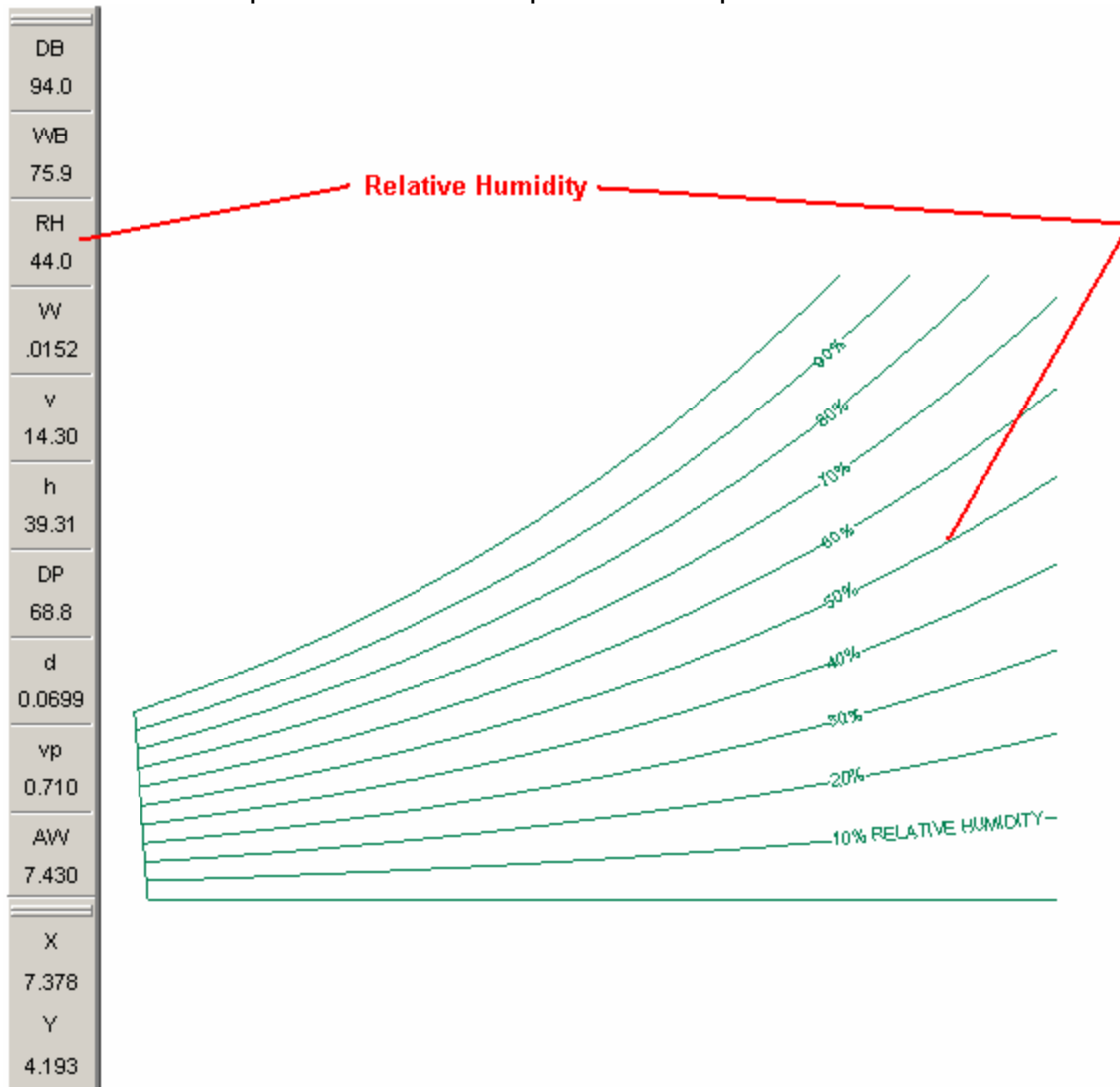
A binary (or two-component) mixture of dry air and water vapor.

Psychrometric Chart

A graphical presentation of the thermodynamic and physical properties of air and water vapor mixtures.

Relative Humidity

The ratio of mole fraction of water vapor in a given moist air sample to the mole fraction in a saturated air sample at the same temperature and pressure.



Saturation

A state of neutral equilibrium between moist air and the condensed water phase (liquid or solid). This state is often referred to as the maximum amount of water vapor in moist air at a given temperature and pressure.

Saturation Humidity Ratio

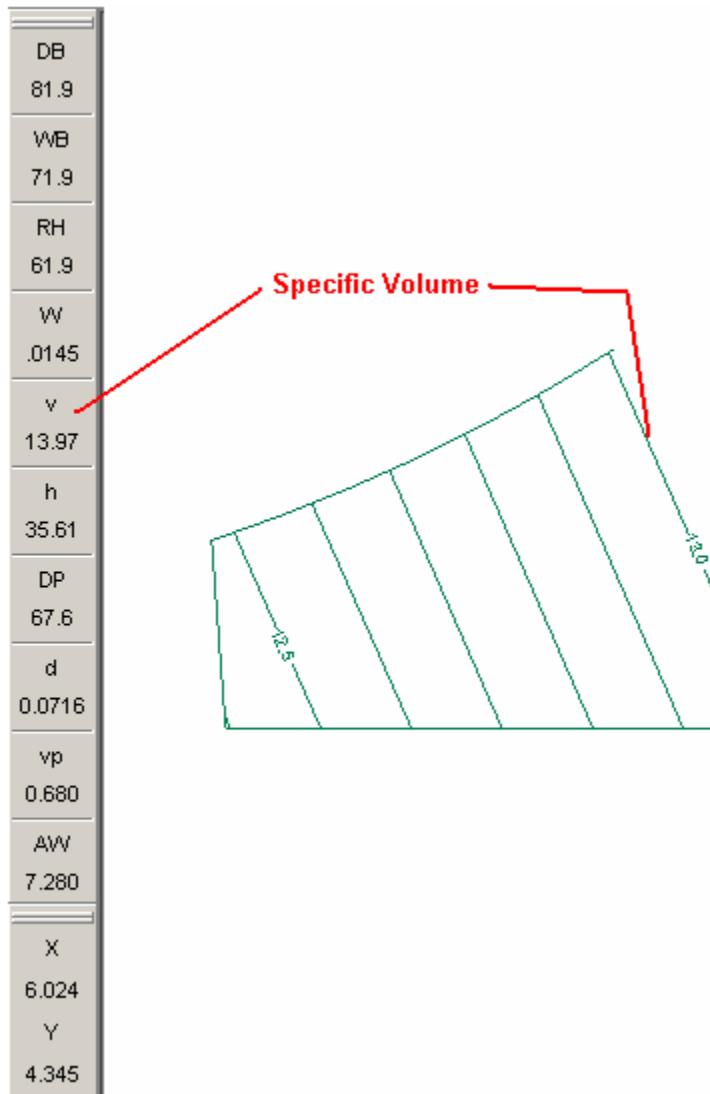
The humidity ratio of moist air saturated with respect to water (or ice) at the same temperature and pressure.

Specific Humidity

The ratio of the mass of water vapor to the total mass of moist air of a sample.

Specific Volume

The ratio of the total volume of air to the mass of dry air in a sample.



Standard Atmosphere

The standard of reference for estimating properties at various altitudes.

For HVAC purposes standard air is taken as 68°F and 29.921 inches Hg atmospheric pressure.

Vapor Pressure

Pressure exerted by a vapor.

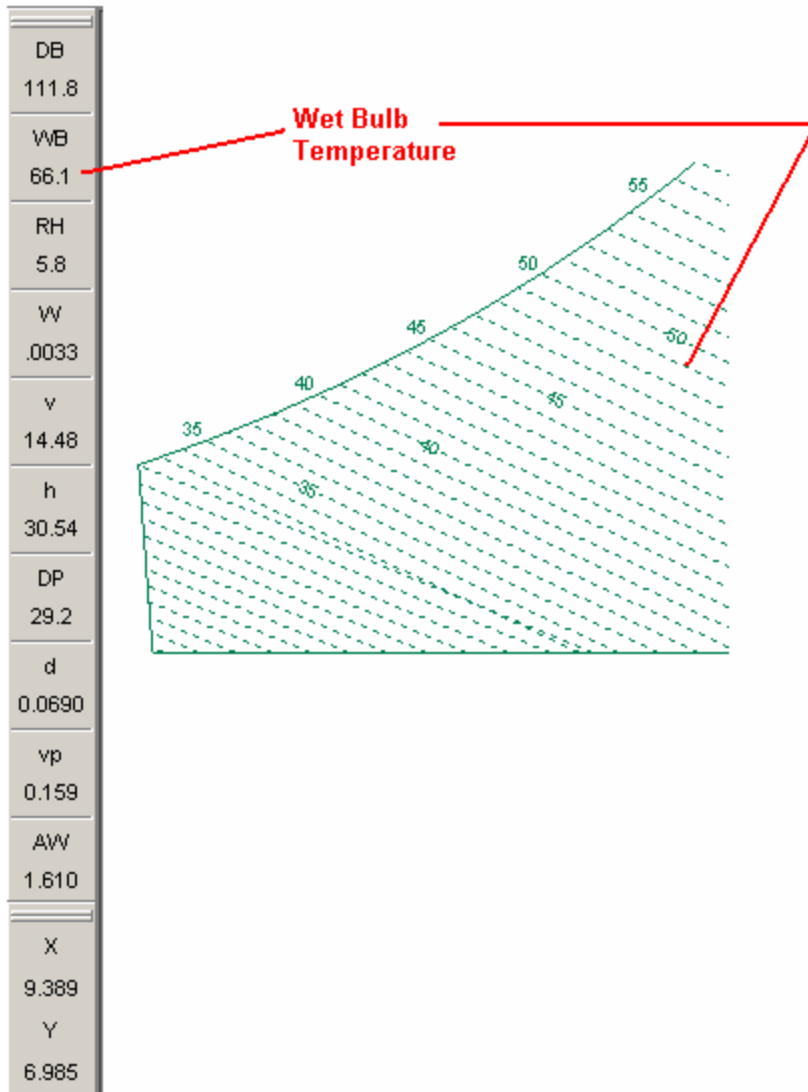
DB
65.4
WB
61.0
RH
78.0
W
.0104
v
13.46
h
27.09
DP
58.4
d
0.0743
vp
0.492
AW
5.433
X
4.223
Y
5.308

Vapor Pressure



Wet Bulb Temperature

The equilibrium temperature reached as water evaporates from a thoroughly wetted psychrometer wick into an airstream. While this process is not one of adiabatic saturation, by applying only small corrections one can obtain the thermodynamic wet-bulb temperature.





ALGORITHMS

PSYCHROMETRIC ALGORITHMS

The following is the methodology the program uses in determining the psychrometric properties of moist air:

Atmospheric Pressure

$$p = Atm \times (1 - 6.8753 \times 10^{-6} \times Z)^{5.2559}$$

p = inches of Mercury

Atm = 29.921299597519

Z = elevation in feet

Water Vapor Saturation Pressure

For $311.67^\circ\text{R} \leq T \leq 491.67^\circ\text{R}$

$$pws = \exp(C_1 \div T + C_2 + C_3 \times T + C_4 \times T^2 + C_5 \times T^3 + C_6 \times T^4 + C_7 \times \ln(T))$$

T = absolute temperature, $^\circ\text{R} = ^\circ\text{F} + 459.67$

$$C_1 = -1.0214165 \times E^4$$

$$C_2 = -4.8932428 \times E^0$$

$$C_3 = -5.3765794 \times E^{-3}$$

$$C_4 = 1.9202377 \times E^{-7}$$

$$C_5 = 3.5575832 \times E^{-10}$$

$$C_6 = -9.0344688 \times E^{-14}$$

$$C_7 = 4.1635019 \times E^0$$

For $491.67^\circ\text{R} < T \leq 851.67^\circ\text{R}$

$$pws = \exp(C_8 \div T + C_9 + C_{10} \times T + C_{11} \times T^2 + C_{12} \times T^3 + C_{13} \times \ln(T))$$

T = absolute temperature, $^\circ\text{R} = ^\circ\text{F} + 459.67$

$$C_8 = -1.0440397 \times E^4$$

$$C_9 = -1.1294650 \times E^1$$

$$C_{10} = -2.7022355 \times E^{-2}$$

$$C_{11} = 1.2890360 \times E^{-5}$$

$$C_{12} = -2.4780681 \times E^{-9}$$

$$C_{13} = 6.5459673 \times E^0$$

Saturated Humidity Ratio

$$W_s = \frac{0.62198 \times f \times p_{ws}}{p - f \times p_{ws}}$$

p = total pressure of moist air

f = enhancement factor

p_{ws} = pressure of saturated pure water

Enhancement Factor

f = calculated in accordance with Hyland and Wexler (1973, "The Second")

Humidity Ratio

For $t^* > 32^\circ\text{F}$

$$W = \frac{(1093 - 0.556 \times t^*) \times W_s^* - c_p \times (t - t^*)}{1093 + 0.444 \times t - t^*}$$

t^* = thermodynamic wet-bulb temperature of moist air, °F

t = dry-bulb temperature of moist air, °F

c_p = specific heat of moist air, Btu/lb°F

W_s^* = humidity ratio of moist air at saturation at thermodynamic wet-bulb temperature

For $t^* \leq 32^\circ\text{F}$

$$W = \frac{(1061 + 0.444 \times t^* - (-143.34 + 0.5 \times (t^* - 32))) \times W_s^* - c_p \times (t - t^*)}{1061 + 0.444 \times t^* - (-143.34 + 0.5 \times (t^* - 32))}$$

t^* = thermodynamic wet-bulb temperature of moist air, °F

t = dry-bulb temperature of moist air, °F

c_p = specific heat of moist air, Btu/lb°F

W_s^* = humidity ratio of moist air at saturation at thermodynamic wet-bulb temperature

Specific Heat

$$c_p = -2.0921943 \times 10^{-14} \times t^4 + 2.5588383 \times 10^{-11} \times t^3 + 1.2900877 \times 10^{-8} \times t^2 + 5.8045267 \times 10^{-6} \times t + 0.23955919$$

t = dry-bulb temperature of moist air, °F

Specific Volume

$$v = \frac{0.7543 \times (t + 459.67) \times (1 + 1.6078 \times W)}{p}$$

t = dry-bulb temperature of moist air, °F

W = humidity ratio of moist air, mass of water per unit mass of dry air

p = total pressure of moist air

Enthalpy

$$h = c_p \times t + W \times (1061 + 0.444 \times t)$$

t = dry-bulb temperature of moist air, °F

W = humidity ratio of moist air, mass of water per unit mass of dry air

c_p = specific heat of moist air, Btu/lb°F

Wet Bulb

Iterative calculation calling **Humidity Ratio** function

Dew Point

Iterative calculation calling **Saturated Humidity Ratio** function



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