



Psychrometric Analysis

Professional Edition User Manual

Version 7

Released Aug-2011

Authored and Produced By:



The Psychrometric Source™



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MENU & TOOLBARS

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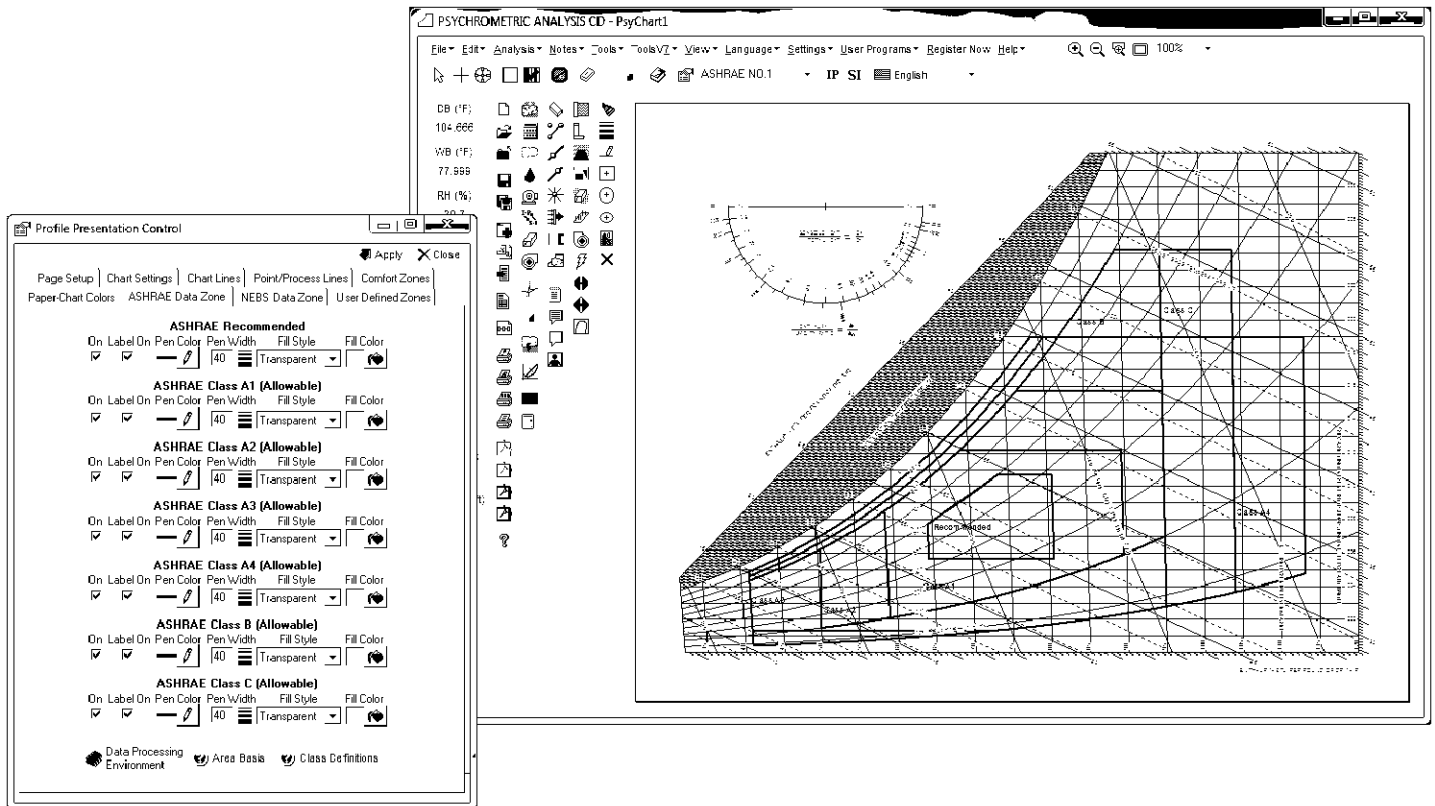
LICENSE INFORMATION
DISCLAIMER OF WARRANTIES



PROGRAM FEATURES

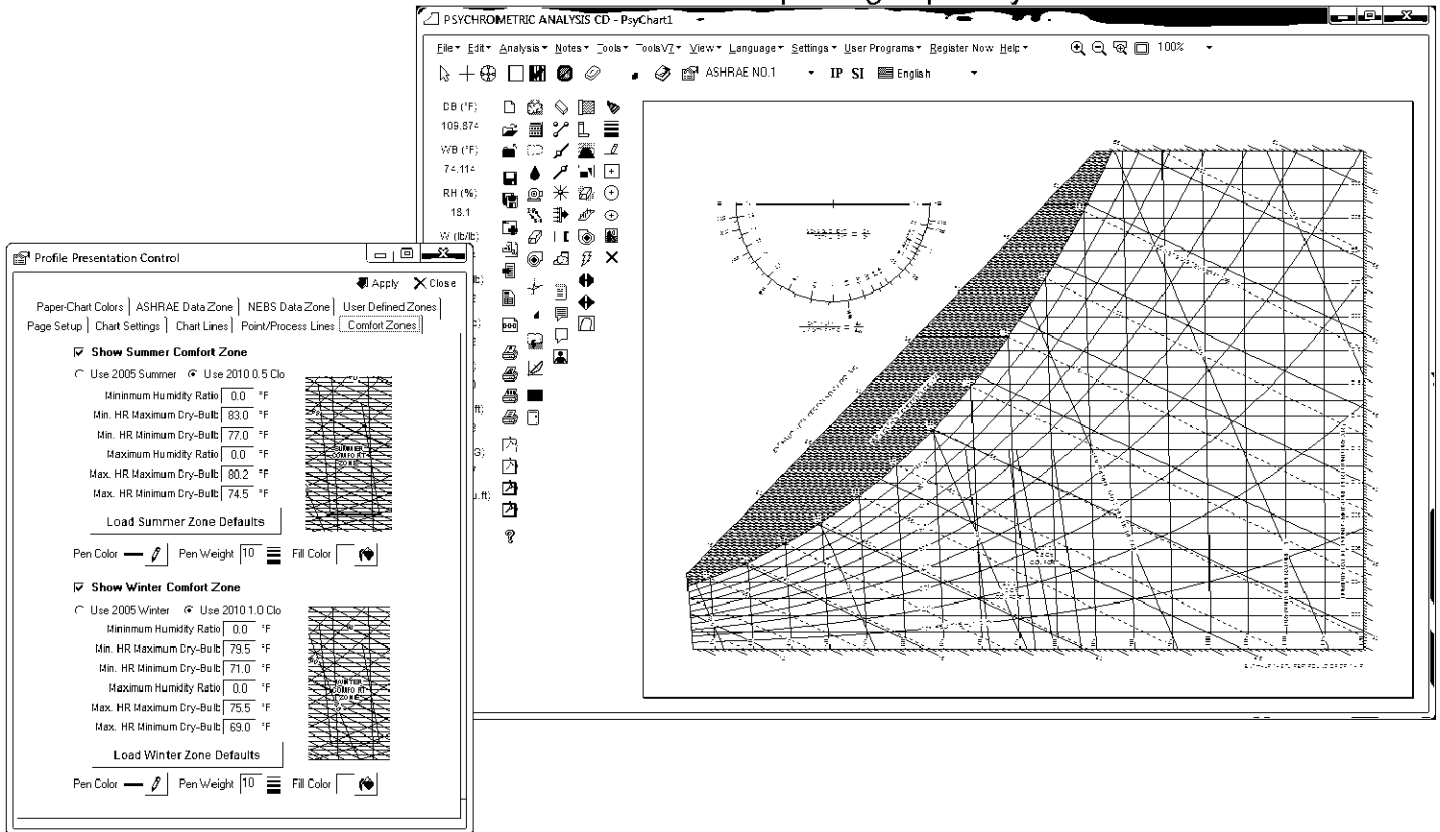
NEW VERSION 7 FEATURES!

NEW!! Updated ASHRAE Datacenter Zones to 2011 Thermal Guidelines!!
Now with ASHRAE Class A1, Class A2, Class A3, Class A4, Class B & Class C!



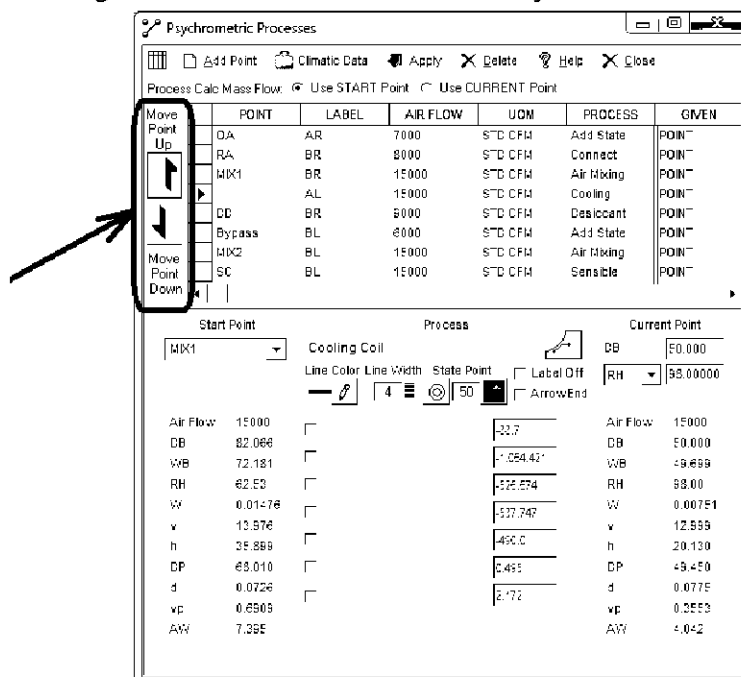
NEW !! Updated ASHRAE 2010 Comfort Zones!!

Now with the new ASHRAE 2010 Comfort Zone plotting capability!!



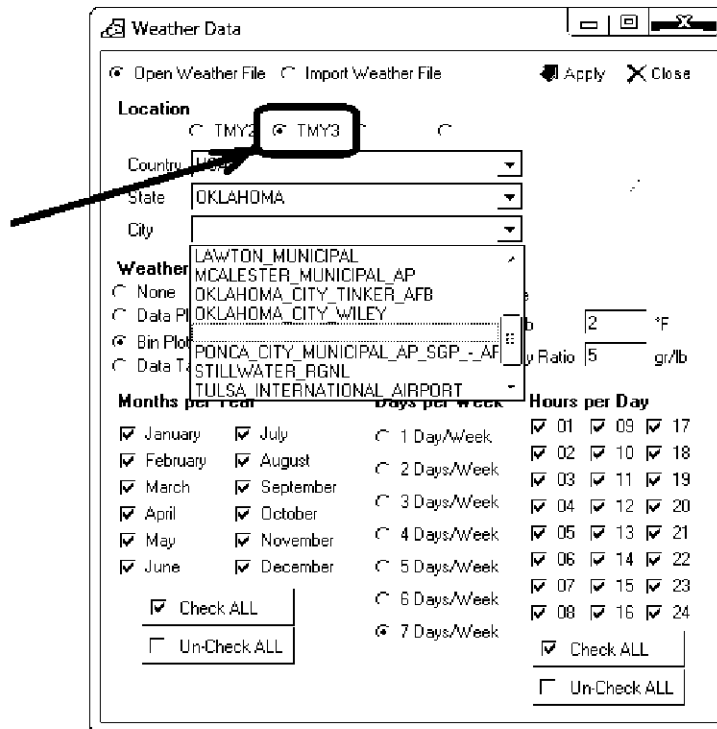
NEW !! Re-arrange or Re-order Points on the Fly with One Button Click!!

Now You Can Re-arrange or Re-order Points on the Fly with One Button Click!!



NEW !! TMY2 & TMY3 Bin Weather USA Locations Added!!

TMY2 & TMY3 Bin Weather USA Locations Added!!



Weather Data

Open Weather File Import Weather File Apply Close

Location

☐ TMY2 ☒ TMY3

Country: USA

State: OKLAHOMA

City: LAWTON MUNICIPAL, MCALISTER MUNICIPAL AP, OKLAHOMA CITY TINKER AFB, OKLAHOMA CITY WILEY, PONCA CITY MUNICIPAL AP SGP, STILLWATER RGNL, TULSA INTERNATIONAL AIRPORT

Weather

☐ None ☐ Data Plot ☒ Bin Plot ☐ Data Table

Bin Size: 2 °F

Humidity Ratio: 5 gr/lb

Months per Year

☒ January ☒ July ☐ 1 Day/Week

☒ February ☒ August ☐ 2 Days/Week

☒ March ☒ September ☐ 3 Days/Week

☒ April ☒ October ☐ 4 Days/Week

☒ May ☒ November ☐ 5 Days/Week

☒ June ☒ December ☐ 6 Days/Week

☒ 7 Days/Week

☒ Check ALL ☐ Un-Check ALL

Hours per Day

☒ 01 ☒ 09 ☒ 17

☒ 02 ☒ 10 ☒ 18

☒ 03 ☒ 11 ☒ 19

☒ 04 ☒ 12 ☒ 20

☒ 05 ☒ 13 ☒ 21

☒ 06 ☒ 14 ☒ 22

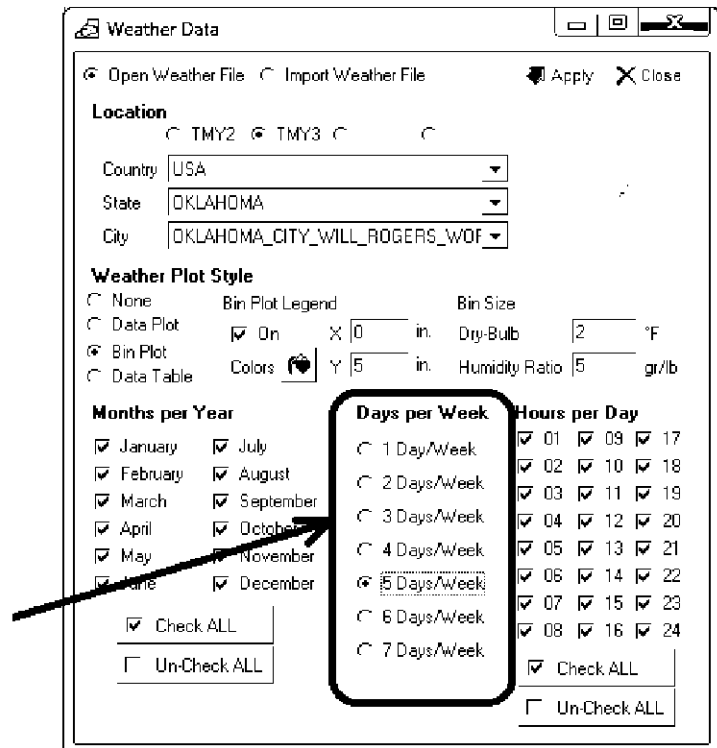
☒ 07 ☒ 15 ☒ 23

☒ 08 ☒ 16 ☒ 24

☒ Check ALL ☐ Un-Check ALL

NEW !! Ability to Select Days Per Week for Bin Weather Data & Plots!!

Ability to Select Days Per Week for Bin Weather Data & Plots!!



Weather Data

Open Weather File Import Weather File Apply Close

Location

☐ TMY2 ☒ TMY3

Country: USA

State: OKLAHOMA

City: OKLAHOMA_CITY_WILL_ROGERS_WDF

Weather Plot Style

☐ None ☐ Data Plot ☒ Bin Plot ☐ Data Table

Bin Plot Legend: ☒ On ☐ Off

Bin Size: 0 in. Dry-Bulb 2 °F

Colors: ☒ Y 5 in. Humidity Ratio 5 gr/lb

Months per Year

☒ January ☒ July ☐ 1 Day/Week

☒ February ☒ August ☐ 2 Days/Week

☒ March ☒ September ☐ 3 Days/Week

☒ April ☒ October ☐ 4 Days/Week

☒ May ☒ November ☐ 5 Days/Week

☒ June ☒ December ☐ 6 Days/Week

☒ 7 Days/Week

☒ Check ALL ☐ Un-Check ALL

Days per Week

☐ 1 Day/Week

☐ 2 Days/Week

☐ 3 Days/Week

☐ 4 Days/Week

☒ 5 Days/Week

☐ 6 Days/Week

☐ 7 Days/Week

Hours per Day

☒ 01 ☒ 09 ☒ 17

☒ 02 ☒ 10 ☒ 18

☒ 03 ☒ 11 ☒ 19

☒ 04 ☒ 12 ☒ 20

☒ 05 ☒ 13 ☒ 21

☒ 06 ☒ 14 ☒ 22

☒ 07 ☒ 15 ☒ 23

☒ 08 ☒ 16 ☒ 24

☒ Check ALL ☐ Un-Check ALL

NEW !! World-Wide Climatic Data Updated to 2009 ASHRAE Fundamentals!!

World-Wide Climatic Data Updated to 2009 ASHRAE Fundamentals!!

HDClimatic - ASHRAE 2009 Fundamentals

☒ COOLING USA

☒ HEATING OK

☒ WIND

WMO# 723530 Hours +/- UTC 6.00 Time Zone NAC Period 8205 Hrs 8-4 PM, 55-69°F 712

SUMMER COOLING			Evaporation			Dehumidification		
DB	MWB	°F db	WB	MDB	°F db	DP	MDB	°F db
0.4%	59.5	74.1	59.5	77.7	50.8	50.8	74.1	83.7
1%	56.8	74.1	56.8	76.7	50.9	50.9	73.0	82.4
2%	54.0	73.8	54.0	75.7	50.8	50.8	72.1	81.4

Extr. Annual Max. DB °F 102.7 Std. Dev. °F 3.8 Mean Daily Range DB °F 20.3

WINTER HEATING			Coldest Month			Extreme Annual Daily		
DB	RH	°F db	WS	MCCB	°F	DB	Std. Dev.	°F
99.6%	11.4	50	11.4	0.4%	21.8	42.4	2.1	5.8
99%	17.4	50	17.4	1%	28.2	41.8		

WIND Coincident with 0.4% DB (cooling) MCWS 12.4 mph PCWD 170 °

Coincident with 99.6% DB (heating) MCWS 13.6 mph PCWD 0 °

Extreme Wind Speed 1% 27.2 mph 2.5% 24.7 mph 5% 22.2 mph

NEW !! Import Your Own Weather Data File Locations into the Chart!!

Import Your Own Weather Data File Locations into the Chart!!

Weather Data

☐ Open Weather File ☒ Import Weather File

Import Weather File (*.csv)

Note: .csv file MUST be structured properly

☒ Click Here to See File Format Structure

Target File Name:

Weather Plot Style

☐ None ☐ Bin Plot Legend ☐ Bin Size

☐ Data Plot ☒ On ☐ X 0 in. Dry-Bulb 2 °F

☐ Bin Plot ☐ Colors ☐ Y 5 in. Humidity Ratio 5 g

Import Weather File (*.csv)

Example Weather Import File.csv

own Below

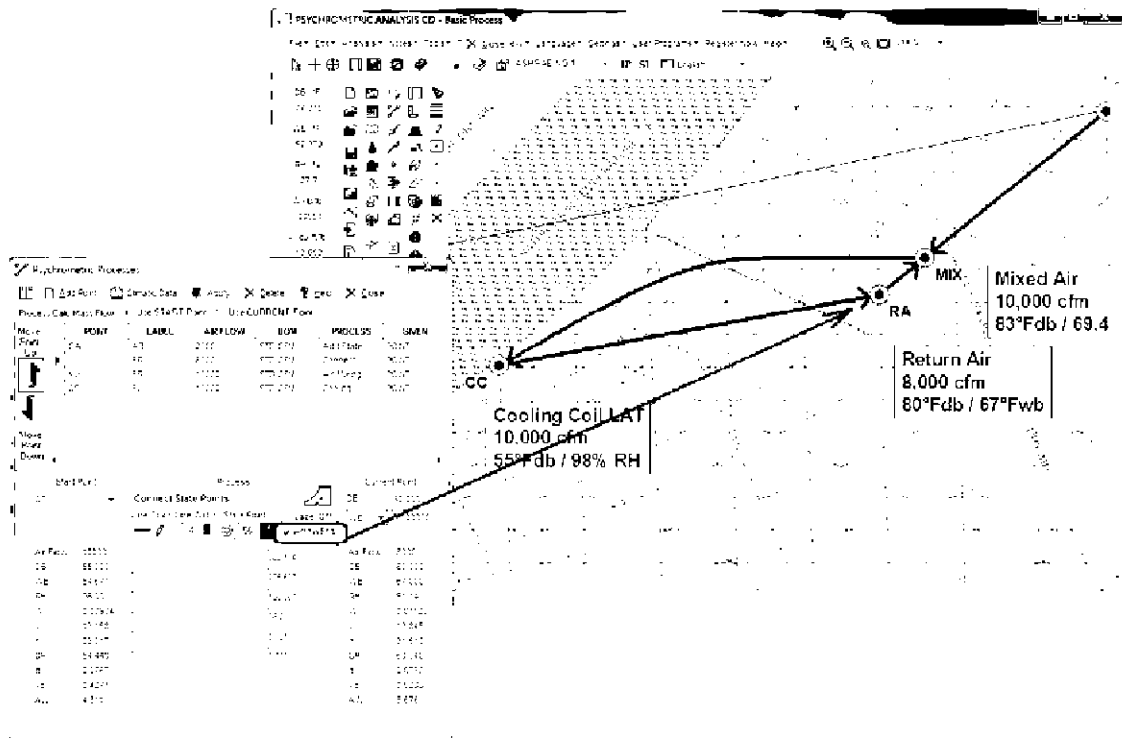
port File.csv

s Data Window Help Adobe PDF

Hour No. (1 to 24)	DryBulb (°F or °C)	DewPoint (°F or °C)
1	53.0	19.2
2	50.0	20.2
3	48.0	22.0
4	47.0	22.0
5	47.0	21.9
6	47.0	22.9
7	46.0	25.2
8	50.0	22.9
9	60.0	28.1
10	65.0	26.7
11	71.0	26.0
12	76.0	24.0

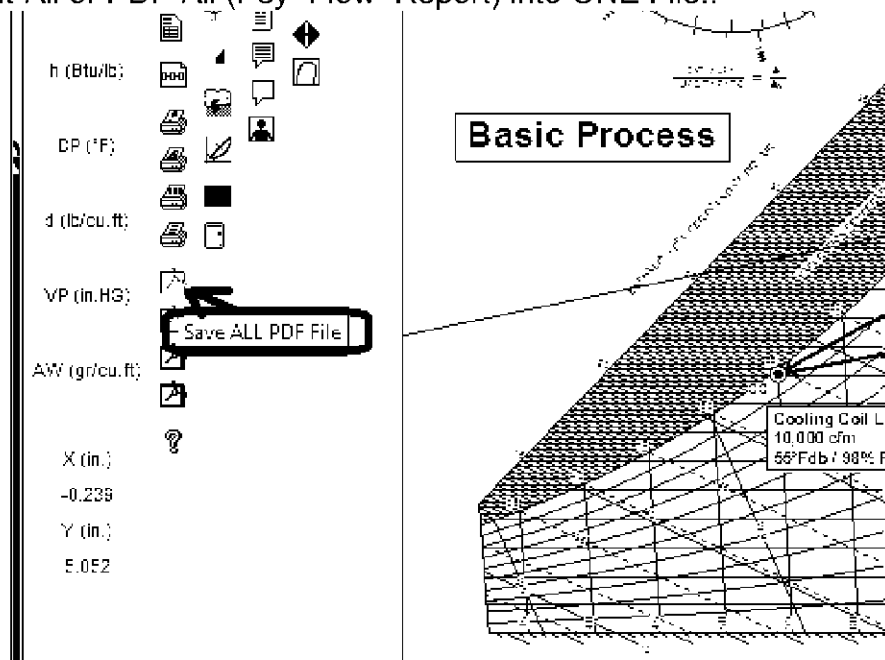
Optional Process Directional Arrowheads on Process Lines!!

Optional Process Directional Arrowheads on Process Lines!!



Ability to Print-All or PDF-All (Psy+Flow+Report) into ONE File!!

Ability to Print-All or PDF-All (Psy+Flow+Report) into ONE File!!

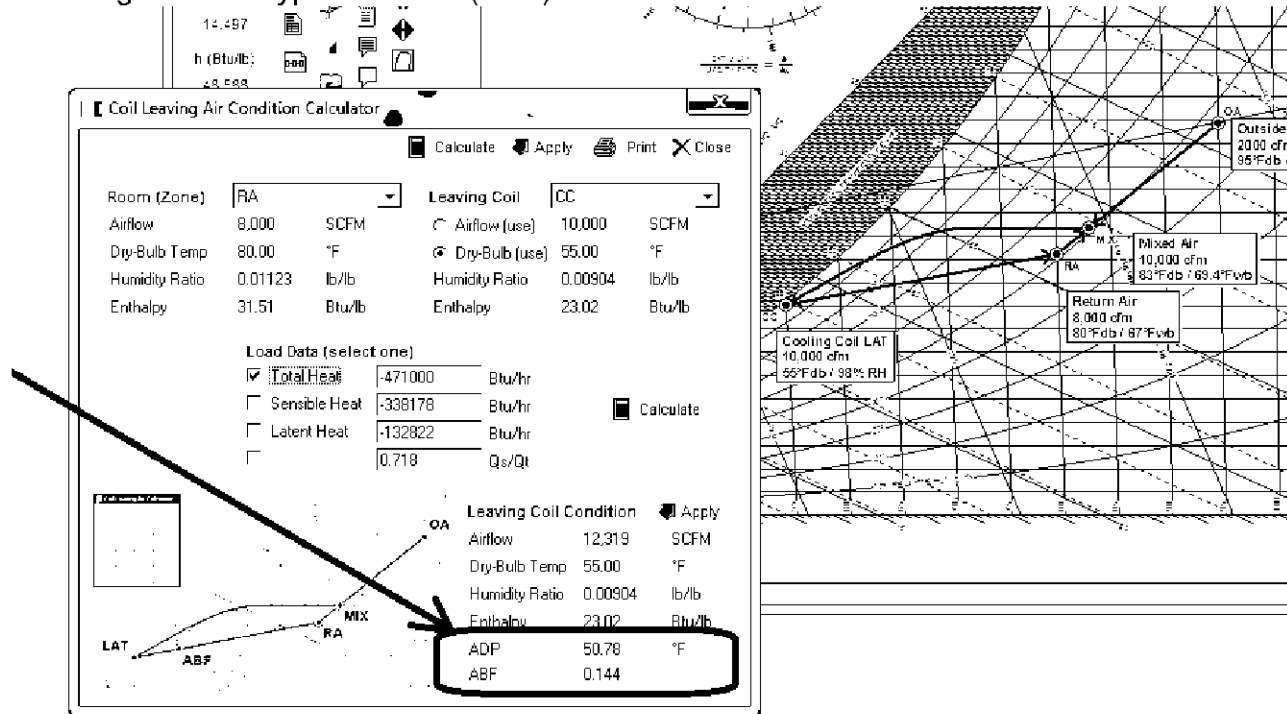


NEW !! Cooling Coil Apparatus Dew Point (ADP) Calculator!!

Cooling Coil Apparatus Dew Point (ADP) Calculator!!

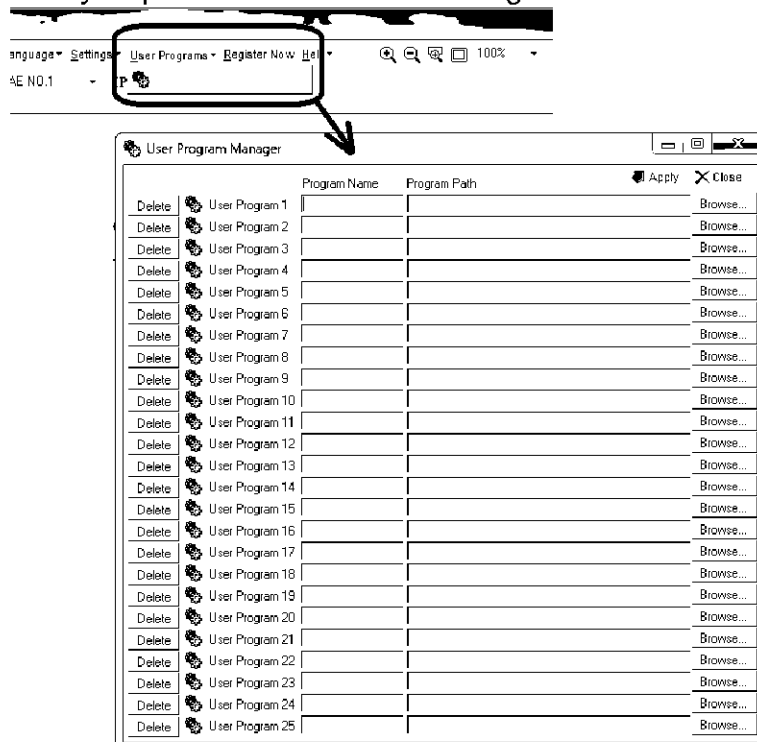
NEW !! Cooling Coil Air Bypass Factor (ABF) Calculator!!

Cooling Coil Air Bypass Factor (ABF) Calculator!!



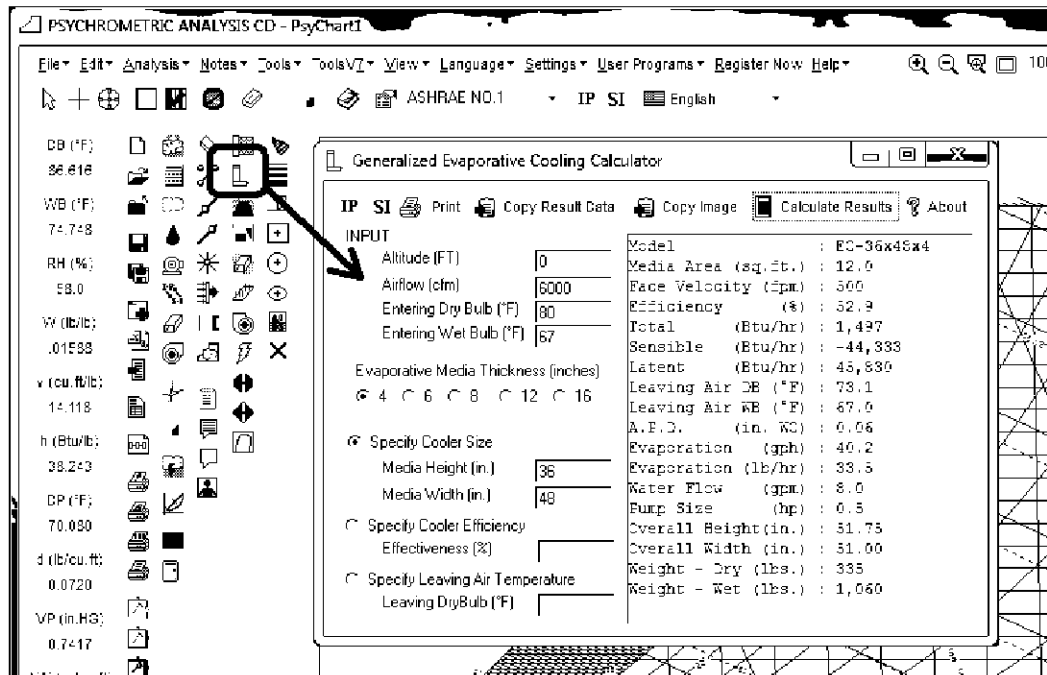
NEW !! User Program Quantity Expanded from 15 to 25 Programs!!

User Program Quantity Expanded from 15 to 25 Programs!!



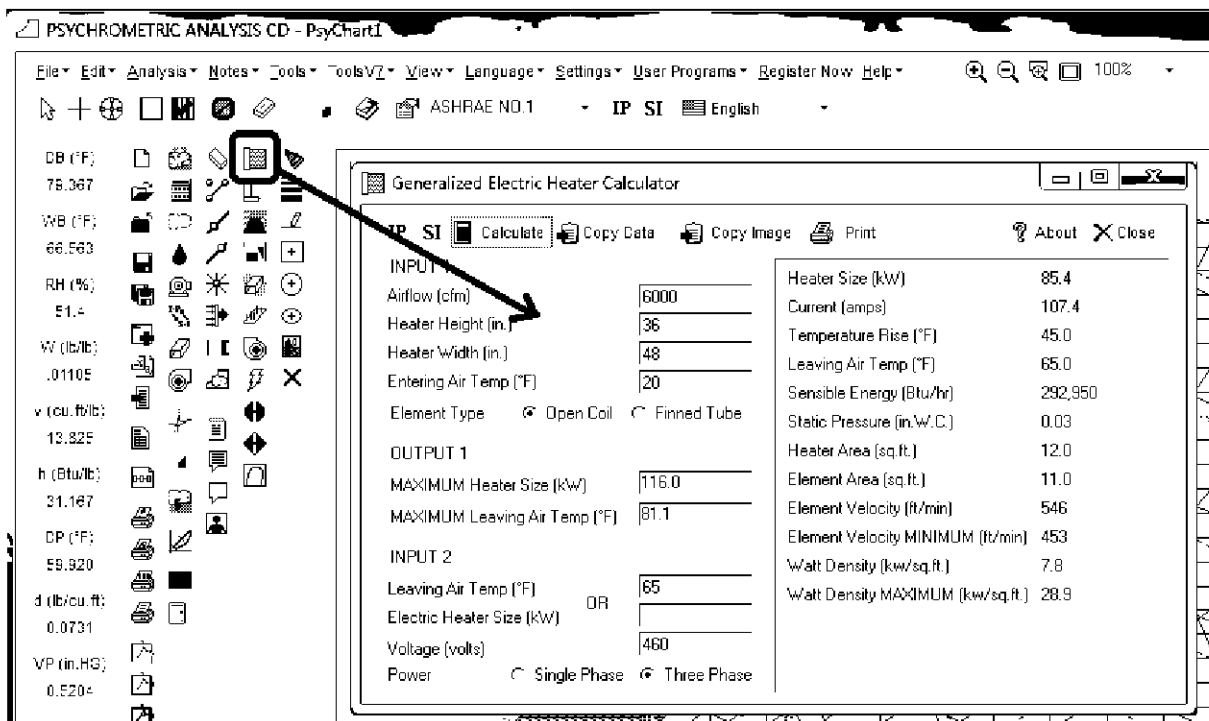
NEW !! Evaporative Cooling Detailed Performance Calculator!!

Evaporative Cooling Detailed Performance Calculator!!



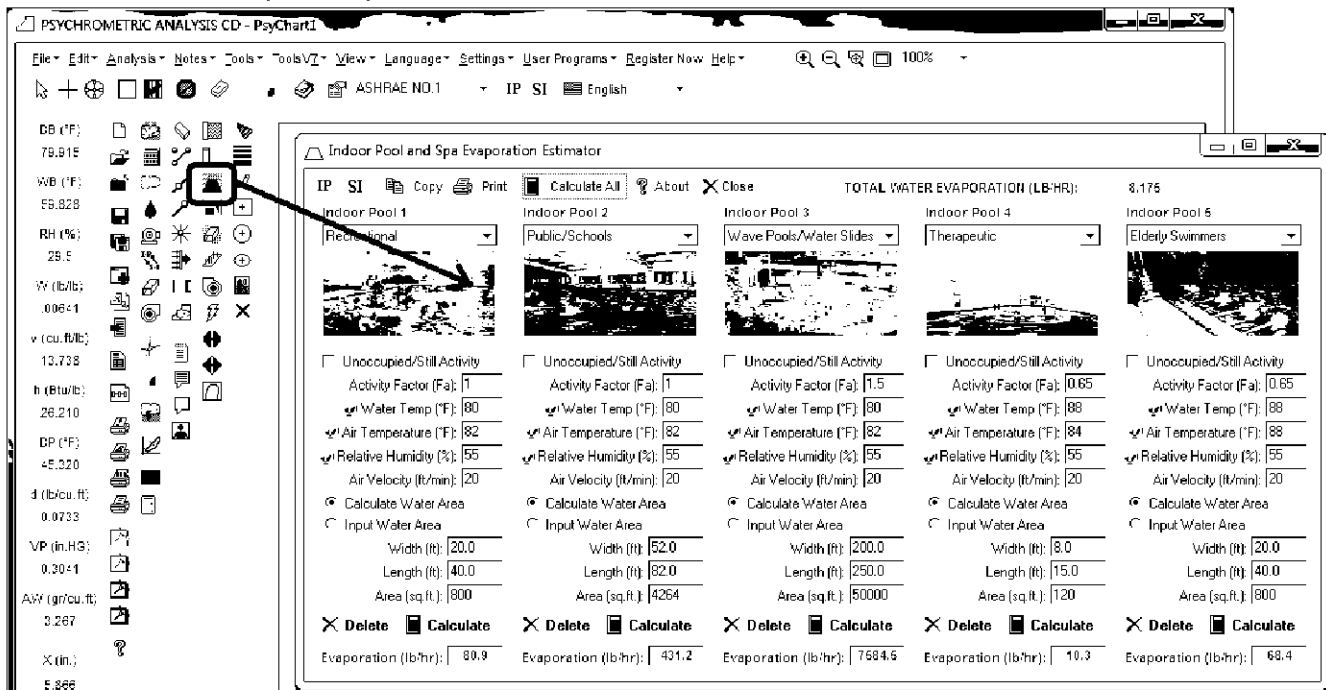
NEW !! Electric Heater Detailed Performance Calculator!!

Electric Heater Detailed Performance Calculator!!



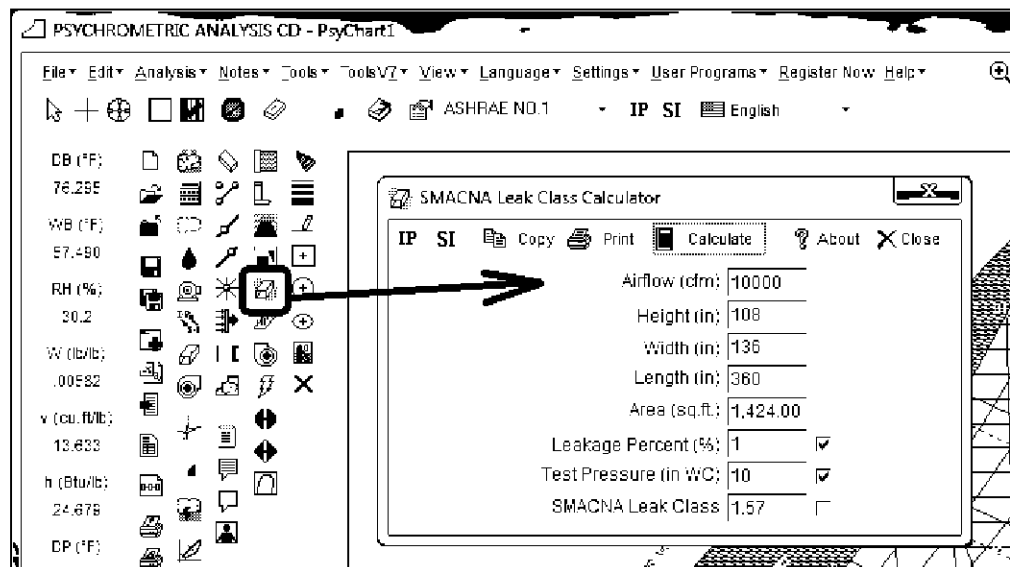
NEW !! Indoor Pool & Spa Evaporation Calculator!!

Indoor Pool & Spa Evaporation Calculator!!



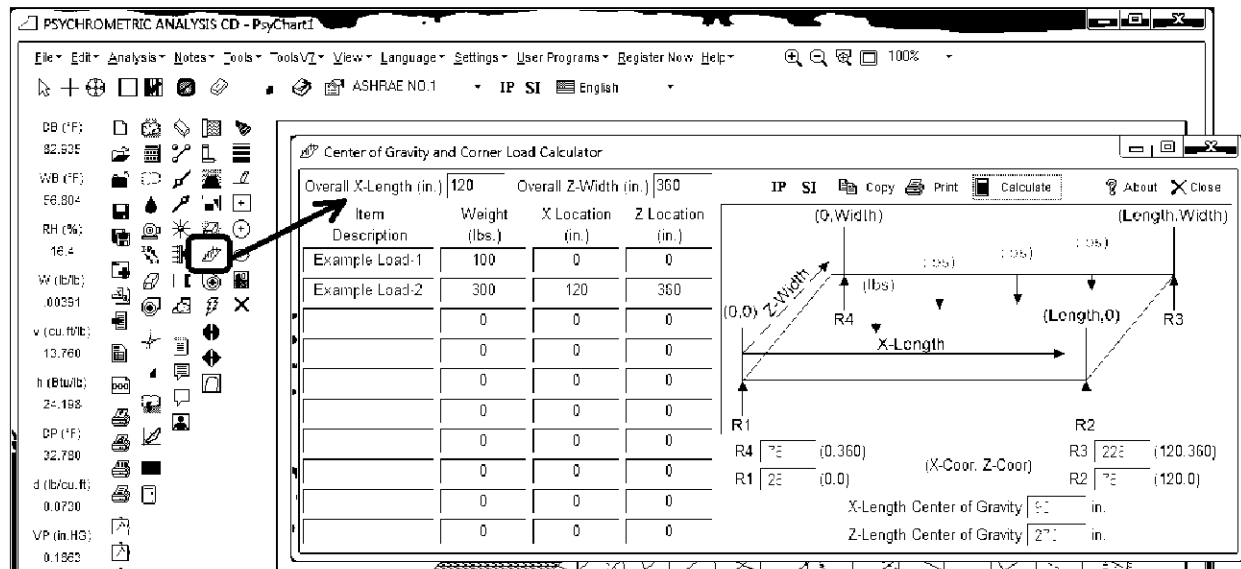
NEW !! SMACNA Air Leak Class Calculator!!

SMACNA Air Leak Class Calculator!!



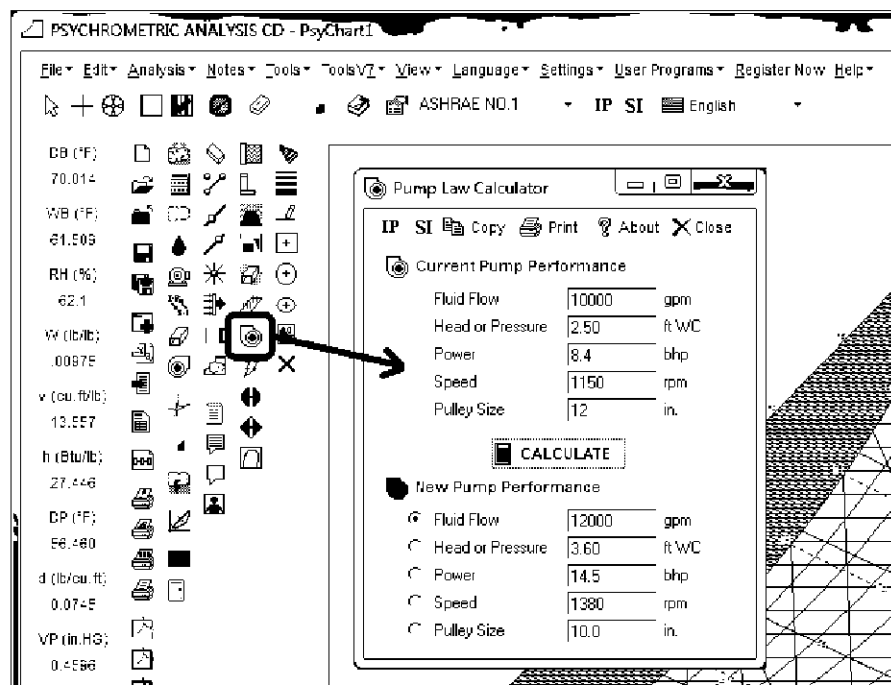
NEW !! Center of Gravity - Corner Load Calculator!!

Center of Gravity - Corner Load Calculator!!



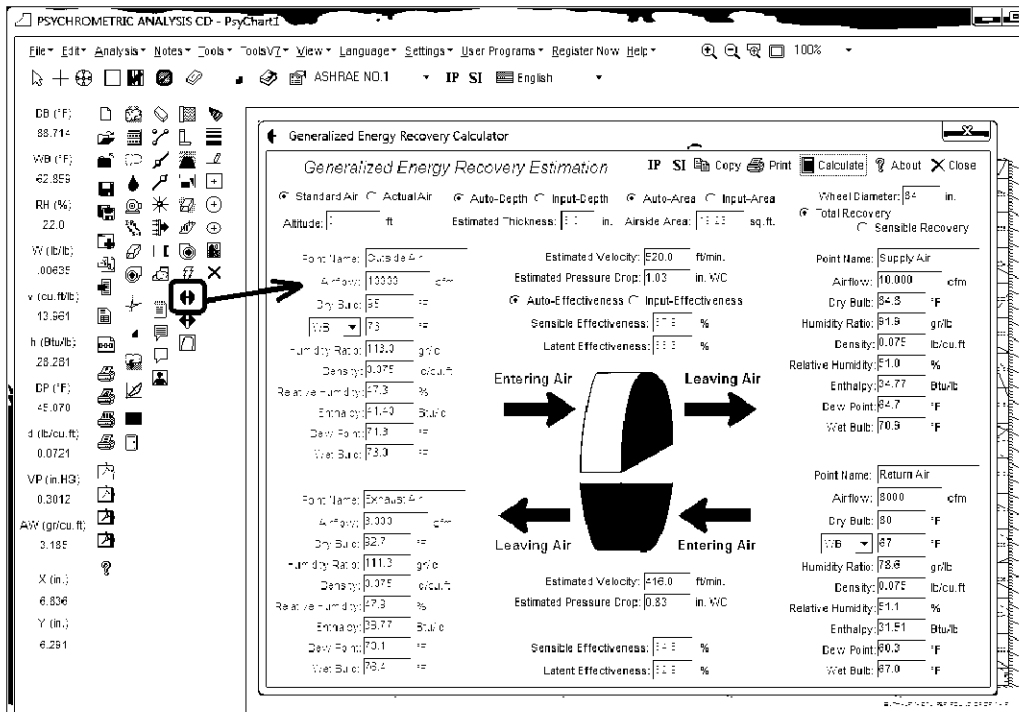
NEW !! Pump Law Calculator!!

Pump Law Calculator!!

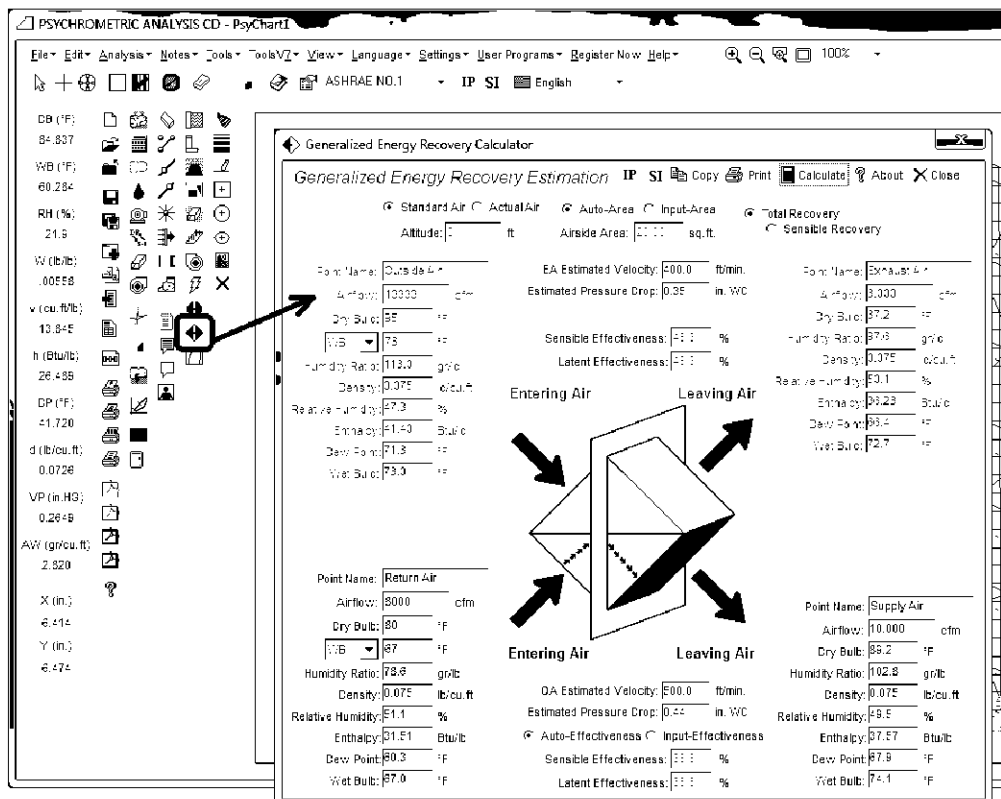




NEW !! Total & Sensible Wheel Energy Recovery Performance Calculator!! Total & Sensible Wheel Energy Recovery Performance Calculator!!



NEW !! Plate Heat Exchanger Energy Recovery Performance Calculator!! Plate Heat Exchanger Energy Recovery Performance Calculator!!



NEW !! Fluid & Mixture Thermo-Physical Property Calculator!!

Fluid & Mixture Thermo-Physical Property Calculator!!

PSYCHROMETRIC ANALYSIS CD - PsyChart1

File Edit Analysis Notes Tools ToolsV7 View Language Settings User Programs Register Now Help

ASHRAE NO.1 IP SI English

DB (°F): 30.235
WB (°F): 58.675
RH (%): 28.4
W (lb/lb): 0.0623
v (cu. ft/lb): 13.743
h (Btu/lb): 26.104
DP (°F): 44.530
d (lb/cu. ft): 0.0732
VP (in. HG): 0.2957
AW (gr/cu. ft): 3.175
X (in.): 5.555

NIST Fluid Properties

IP SI Print Copy About

Fluid Name: **Ammonia**

Temperature: 300 °F

Pressure: 10 psia

Calculate

Density	0.020930	lbm/cu. ft
Enthalpy	845.94	BTU/lbm
Entropy	1.9203	BTU/lbm·°R
Cv	0.43648	BTU/lbm·°R
Cp	0.55437	BTU/lbm·°R
Cp/Cv	1.2701	
Critical Point	270.05	°F
Triple Point	-107.78	°F
Quality	Superheated	lbm/lbm
Thermal Conduct	0.023415	BTU/h·ft·°F
Viscosity	0.000009661	lbm/ft·s
Volume	47.778	cu. ft/lbm
Int. Energy	757.47	BTU/lbm
Sound Speed	1675.1	ft/s

Ammonia	R23	R318	R405A	R414B
Argon	R32	R227ea	R406A	R416A
Butane	R41	R236ea	R407A	R417A
Carbon dioxide	R113	R236la	R407B	R500
Ethane	R114	R245ca	R407C	R501
Isobutene	R115	R245fa	R407D	R502
Methane	R116	Water	R407E	R503
Nitrogen	R123	Air	R408A	R504
Oxygen	R124	R401A	R409A	R507A
Propane	R125	R401B	R409B	R508A
Propylene	R134a	R401C	R410A	R508B
R11	R141b	R402A	R410B	R509A
R12	R142b	R402B	R411A	
R13	R143a	R403A	R411B	
R14	R152a	R403B	R412A	
R22	R218	R404A	R413A	

NEW !! Rectangle & Round Duct Fittings added to HDDuctDesigner!!

Rectangle & Round Duct Fittings added to HDDuctDesigner!!

PSYCHROMETRIC ANALYSIS CD - PsyChart1

File Edit Analysis Notes Tools ToolsV7 View Language Settings User Programs Register Now Help

ASHRAE NO.1 IP SI English

DB (°F): 37.406
WB (°F): 64.737
RH (%): 28.7
W (lb/lb): 0.0796
v (cu. ft/lb): 13.963
h (Btu/lb): 29.731
DP (°F): 51.010
d (lb/cu. ft): 0.0722
VP (in. HG): 0.3765
AW (gr/cu. ft): 3.550
X (in.): 6.682
Y (in.): 5.511

Duct Design Tool

CALCULATE IP SI Print About Close

Air Condition

Airflow: 2000 cfm

STD Air ACTUAL Air

Density: 0.0750 lb/cu. ft

Duct Fittings

Type: Round

Name: Std. 90° L (R/D=75)

Delta-h: Delta-h/L=0.1 in./W.C./100 ft

Equivalent Length: 30.0 ft

Qty: 1

Pressure Drop: 0.19 in./W.C.

Duct Material

Uncoated Carbon Steel, Clean

Roughness Factor: 0.00015 ft

Rectangular Duct

Side 1: 12 in. Side 2: 12 in. Duct Length: 100 ft

Equal Diameter: 13.1 in. Area: 1.0 sq. ft. Velocity: 2000 ft/min

Velocity Pressure: 0.25 in./W.C.

Static Pressure: 0.415 in./W.C./100ft Total Static Pressure: 0.41 in./W.C.

Round Duct

Diameter: 12 in. Duct Length: 100 ft

Area: 0.8 sq. ft. Velocity: 2546 ft/min

Velocity Pressure: 0.40 in./W.C.

Pressure Drop: 0.638 in./W.C./100ft Total Pressure Drop: 0.64 in./W.C.

Oval Duct

Side 1: 12 in. Side 2: 12 in. Duct Length: 100 ft

Equal Diameter: 12.0 in. Area: 0.8 sq. ft. Velocity: 2546 ft/min

Velocity Pressure: 0.40 in./W.C.

Pressure Drop: 0.638 in./W.C./100ft Total Pressure Drop: 0.64 in./W.C.

Temp Gain/Loss Weight Calc Pitot Calc

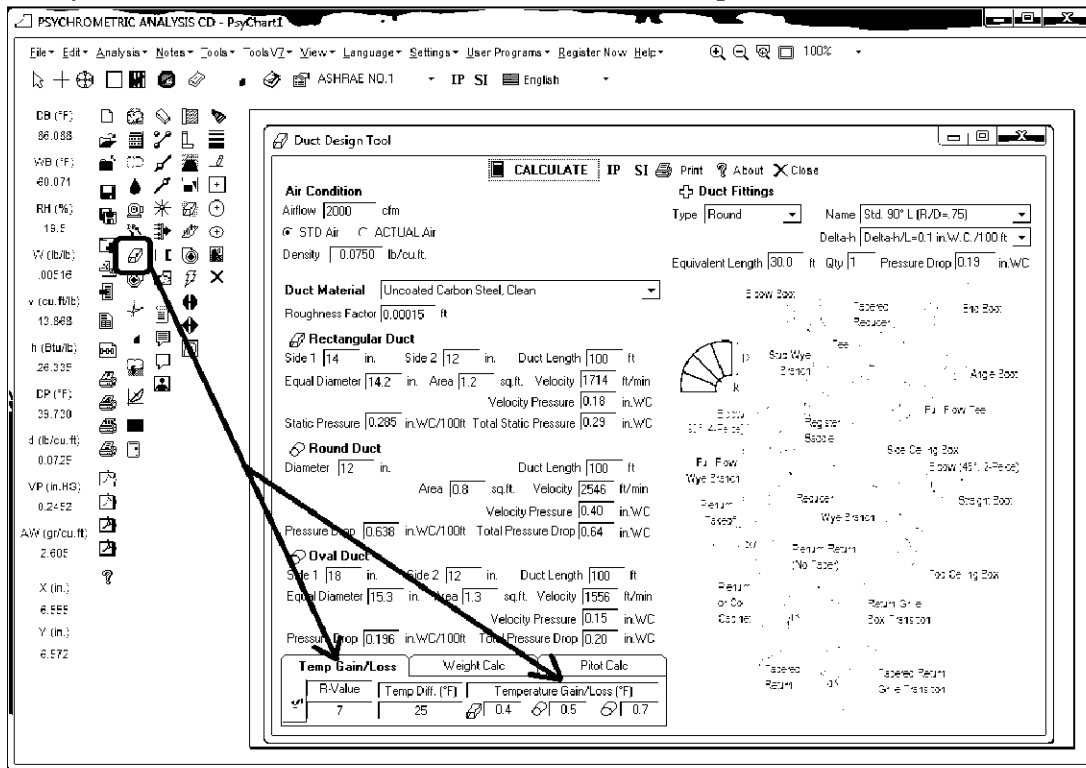
Temp Gain/Loss: (in./W.C.)

Weight Calc: (in./W.C.)

Pitot Calc: Airflow (CFM) (in./W.C.)

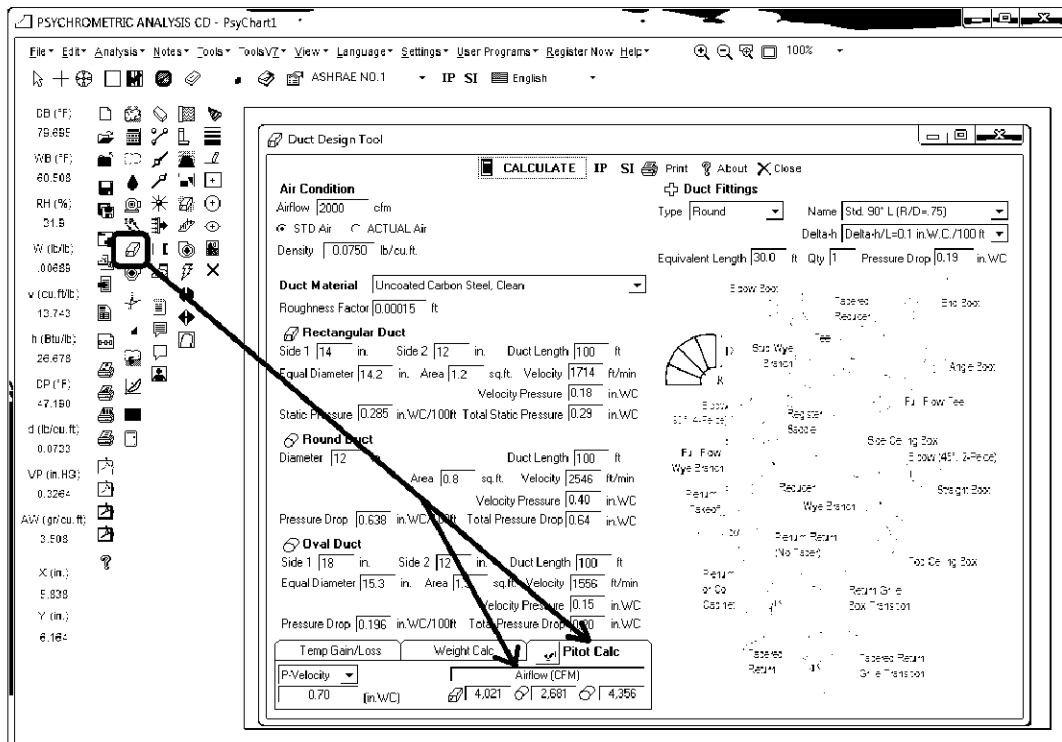
NEW !! Duct Temp Gain/Loss Calculator added to HDDuctDesigner!!

Duct Temp Gain/Loss Calculator added to HDDuctDesigner!!



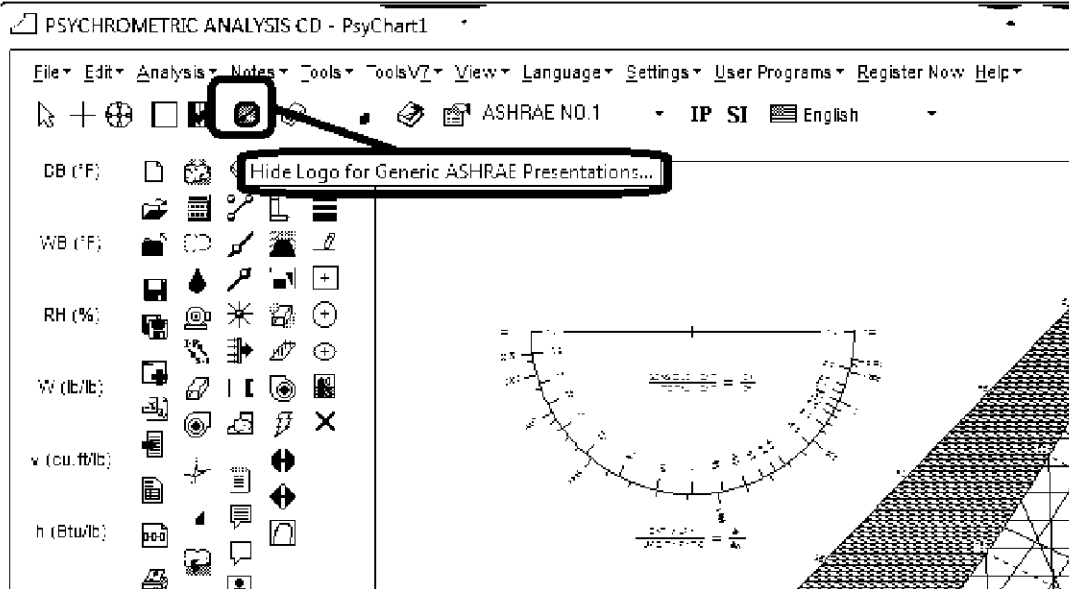
NEW !! Duct Pitot Airflow Calculator added to HDDuctDesigner!!

Duct Pitot Airflow Calculator added to HDDuctDesigner!!



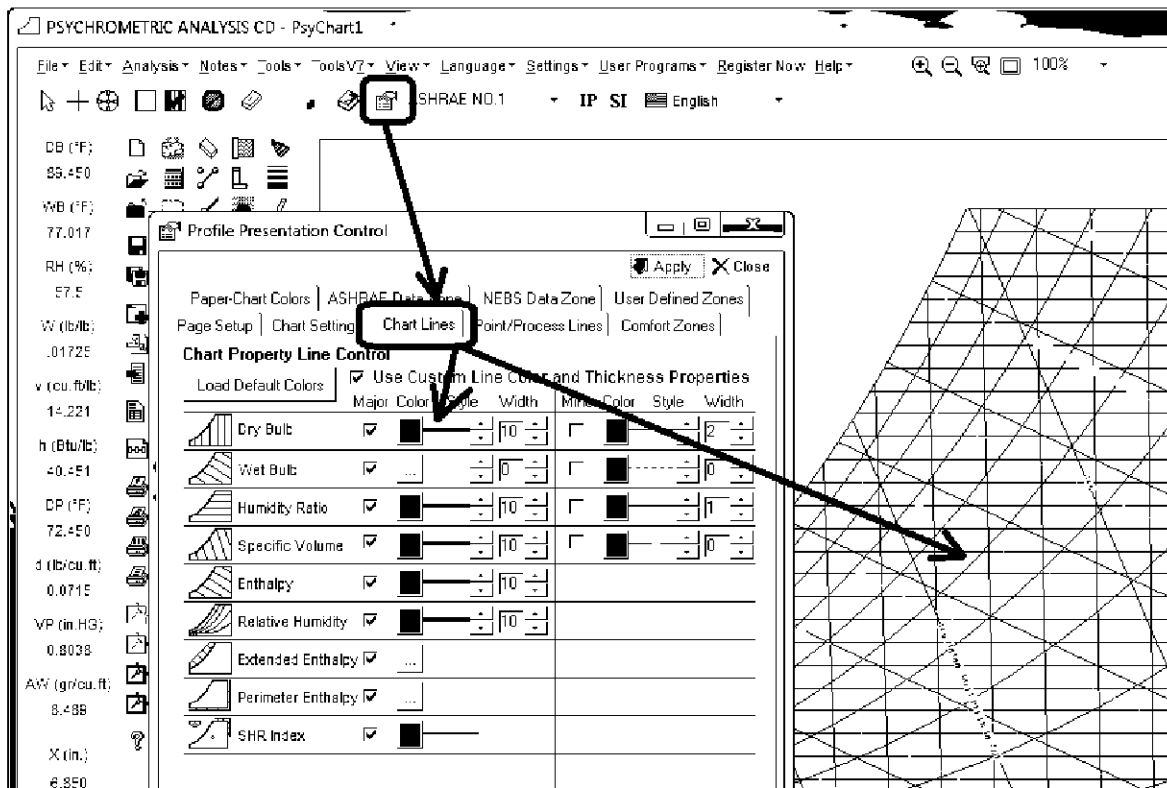
NEW !! Ability to Turn Logo On & Off, for ASHRAE Meeting “Generic” Presentations!!

Ability to Turn Logo On & Off, for ASHRAE Meeting “Generic” Presentations!!



NEW !! Customize Psychrometric Charts with your own Colors!!

Customize Psychrometric Charts with your own Colors!!



NEW !! Change Any Chart Property Lines to Any COLOR You Choose!!

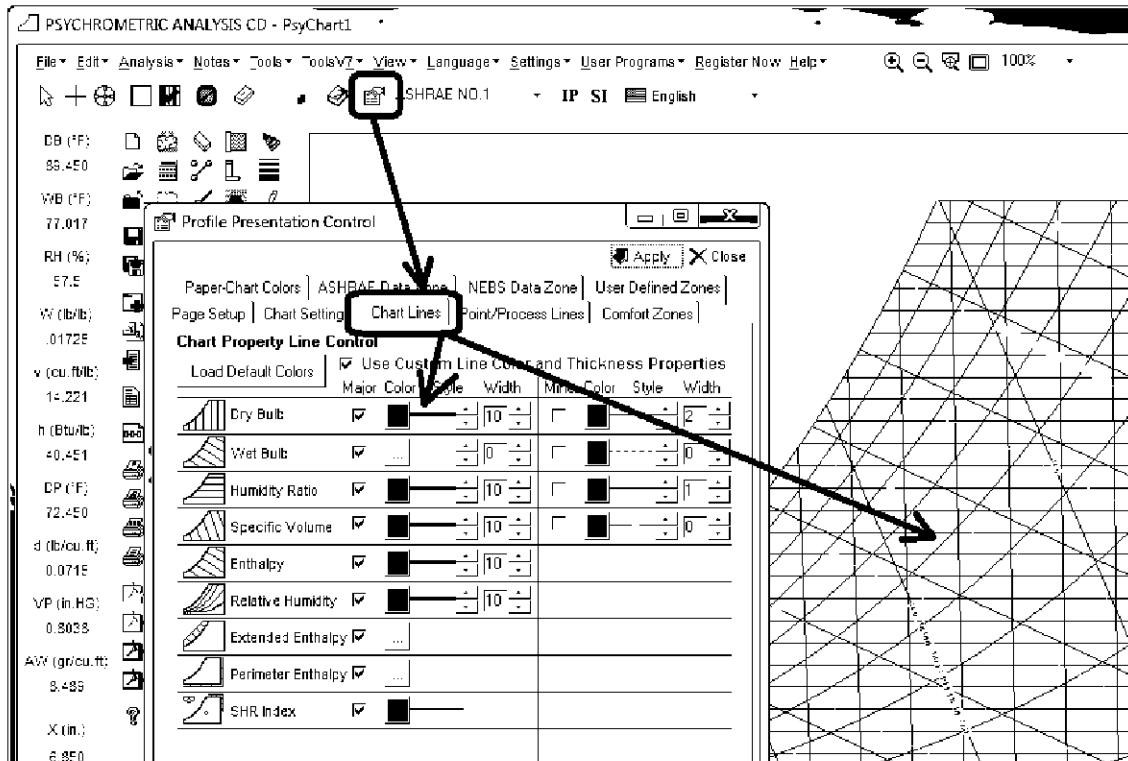
Change Any Chart Property Lines to Any COLOR You Choose!!

NEW !! Change Any Chart Property Lines to Any LINE TYPE You Choose!!

Change Any Chart Property Lines to Any LINE TYPE You Choose!!

NEW !! Change Any Chart Property Lines to Any LINE THICKNESS You Choose!!

Change Any Chart Property Lines to Any LINE THICKNESS You Choose!!



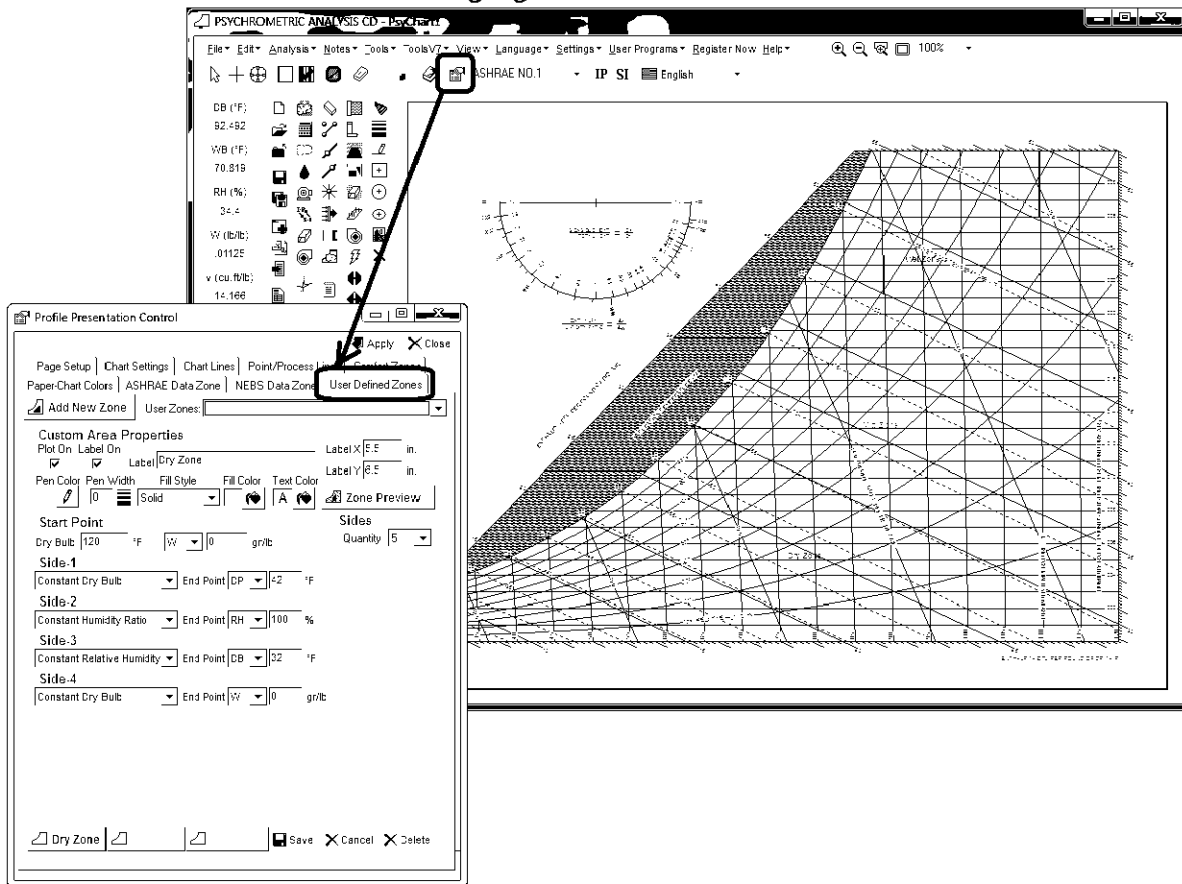
NEW !! Improved Toolbar and Menu Control Setup!!

Improved Toolbar and Menu Control Setup!!



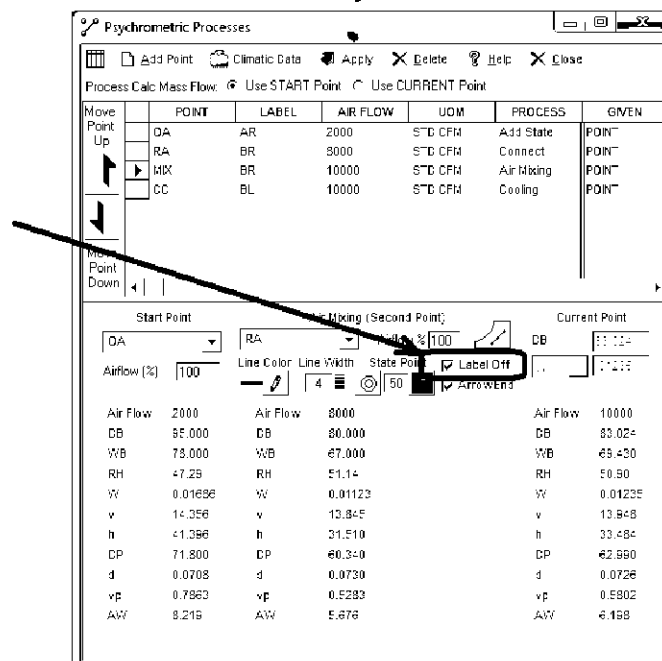
NEW !! User-Defined Custom Area Shading right on the Chart!!

User-Defined Custom Area Shading right on the Chart!!



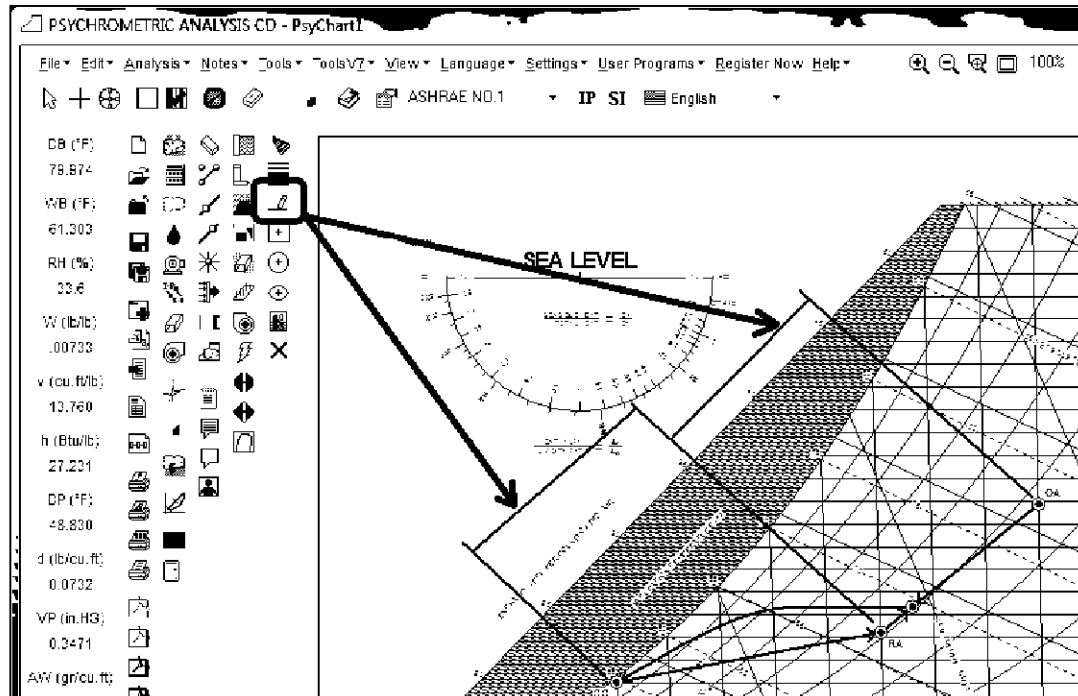
NEW !! Ability to Hide State Point Label on a Point-By-Point basis!!

Ability to Hide State Point Label on a Point-By-Point basis!!



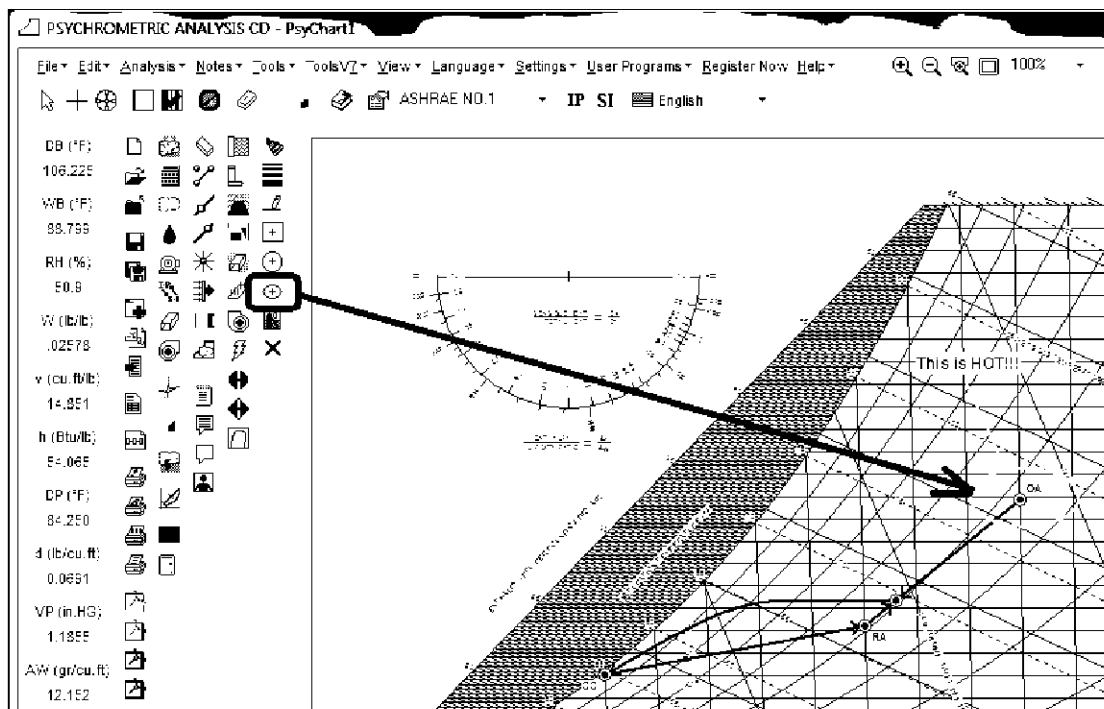
NEW !! Draw Your Own Lines Anywhere You Want!!

Draw Your Own Lines Anywhere You Want!!



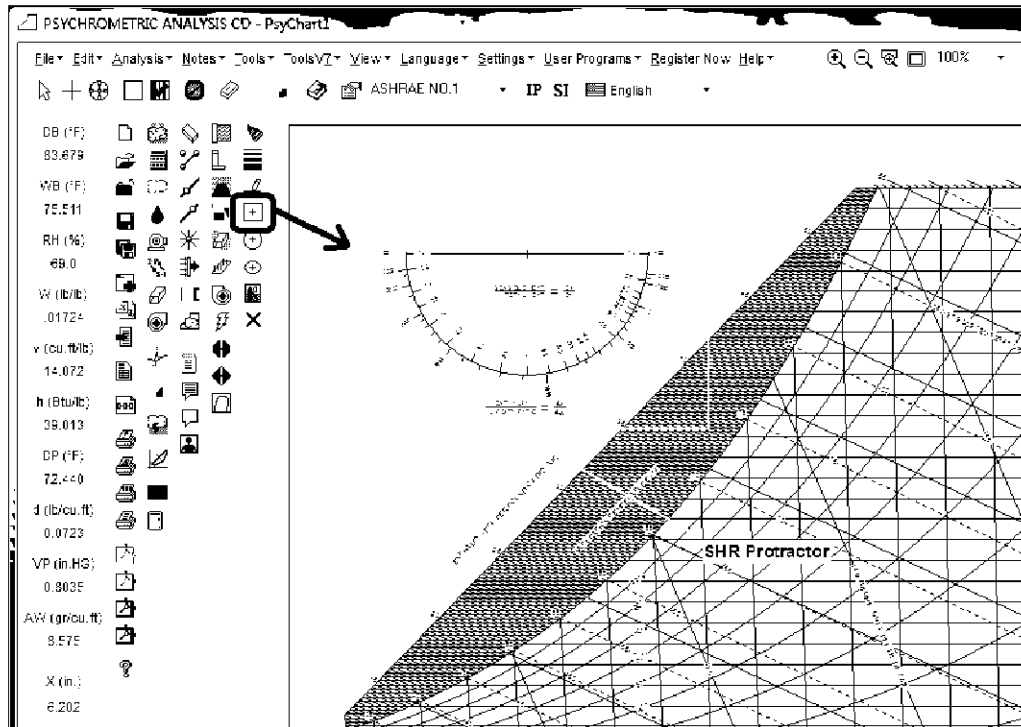
NEW !! Draw Your Own Ellipses Anywhere You Want!!

Draw Your Own Ellipses Anywhere You Want!!



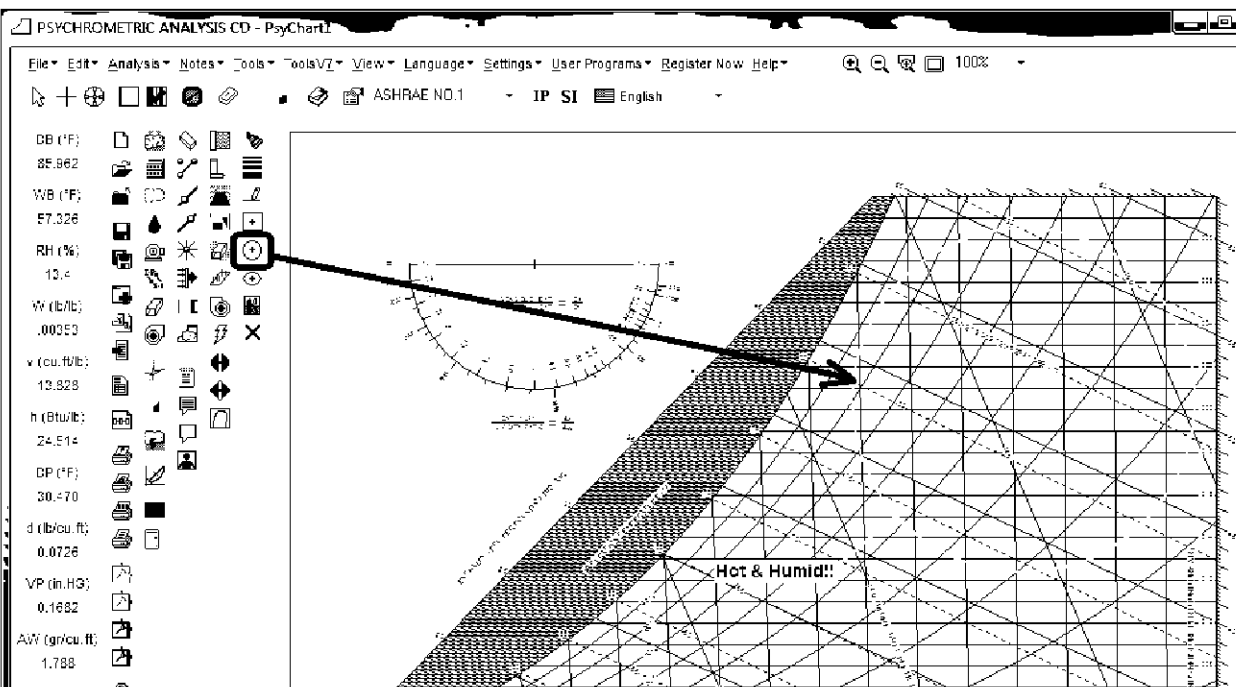
NEW !! Draw Your Own Rectangles Anywhere You Want!!

Draw Your Own Rectangles Anywhere You Want!!



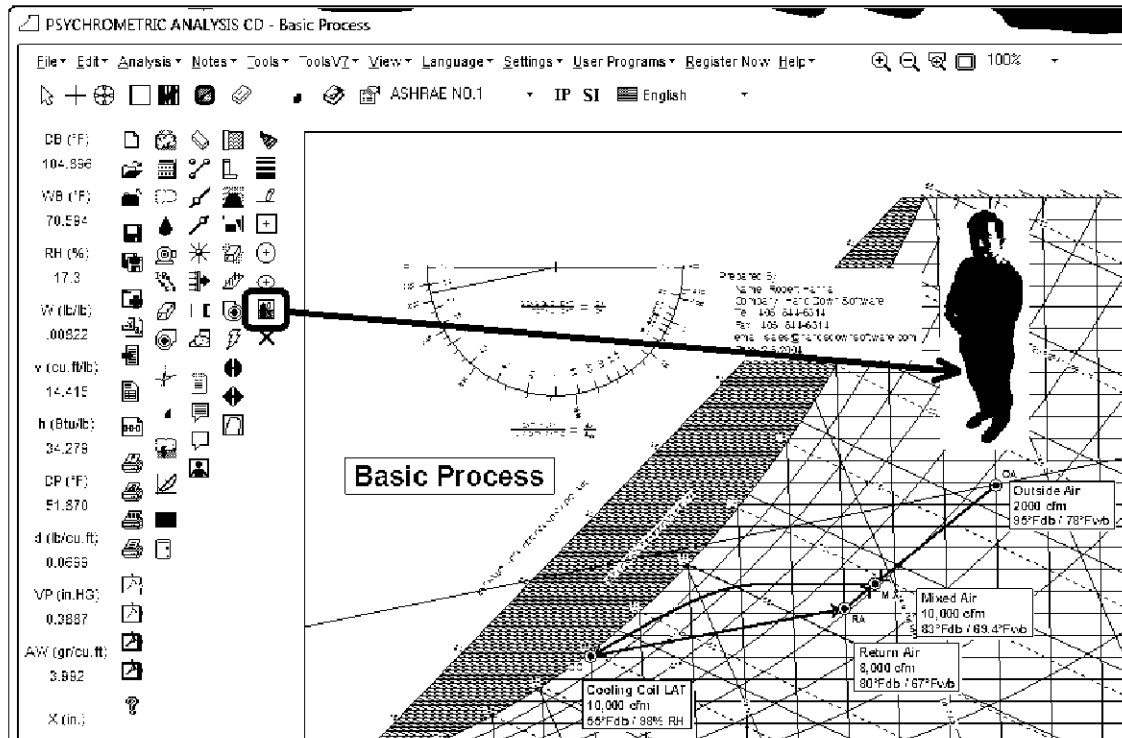
NEW !! Draw Your Own Circles Anywhere You Want!!

Draw Your Own Circles Anywhere You Want!!



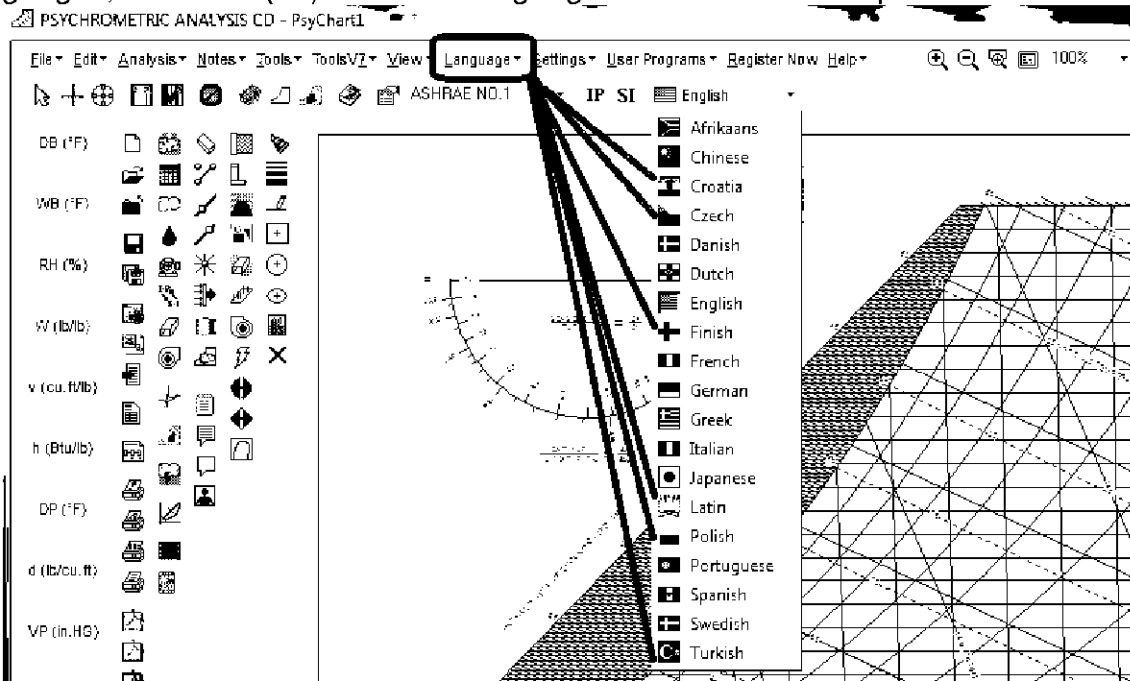
NEW !! Insert Your Own Pictures Anywhere You Want!!

Insert Your Own Pictures Anywhere You Want!!



NEW !! Languages, Now with (19) Different Languages on Charts and Reports with one button click!!

Languages, Now with (19) Different Languages on Charts and Reports with one button click!!



NEW !! Point Color Control when Importing Data from Excel (*.csv) files!!

Point Color Control when Importing Data from Excel (*.csv) files!!

NEW !! Point Size Control when Importing Data from Excel (*.csv) files!!

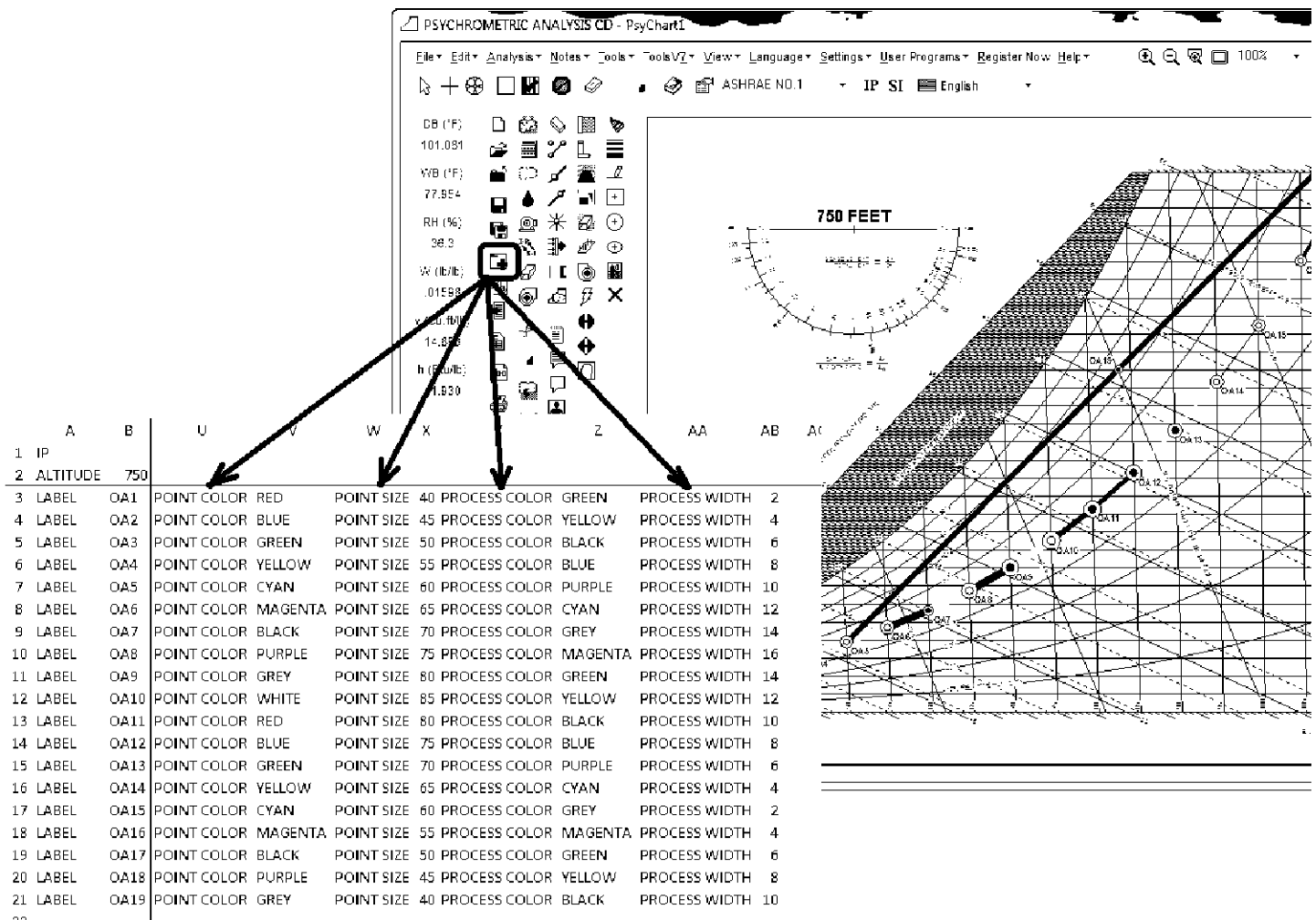
Point Size Control when Importing Data from Excel (*.csv) files!!

NEW !! Process Line Color Control when Importing Data from Excel (*.csv) files!!

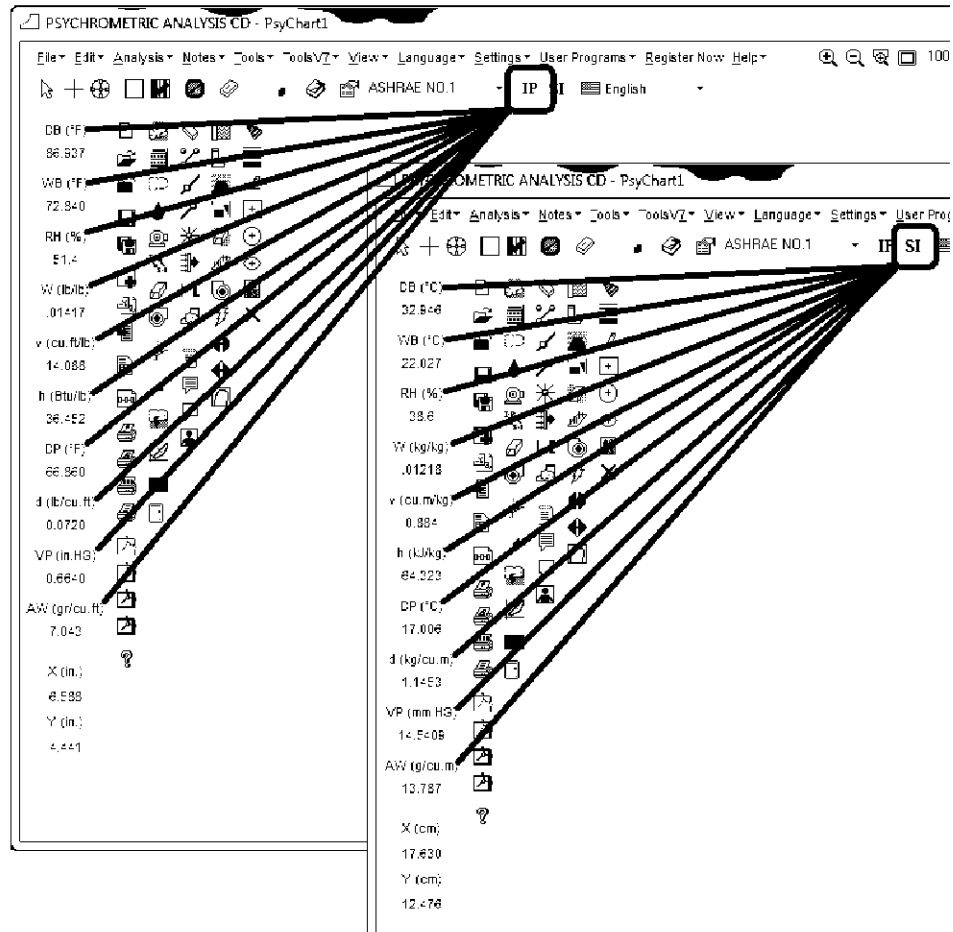
Process Line Color Control when Importing Data from Excel (*.csv) files!!

NEW !! Process Line Width Control when Importing Data from Excel (*.csv) files!!

Process Line Width Control when Importing Data from Excel (*.csv) files!!



NEW !! Point property toolbar display now includes units of measure!!
 Point property toolbar display now includes units of measure!!



NEW !! Thermal Comfort Terms Definition PDF Manual!!

Thermal Comfort Terms Definition PDF Manual!!

The screenshot displays the HDPsyChart software interface. The main window is the 'Thermal Comfort Calculator', which is divided into several sections for inputting environmental and personal conditions. A 'Help' button is visible in the top right corner of the calculator window. To the right of the calculator, a PDF document titled 'Thermal Comfort Terms and Definitions' is open, showing a list of terms and their definitions. Arrows indicate the relationship between the software's help function and the PDF document.

Thermal Comfort Calculator Input Data:

Environmental Conditions	Results
Air Temperature: 78.8 °F	ET*: 78.8 °F
MRT: 78.8 °F (Link with Air)	SET*: 75.9 °F
Air Velocity: 39 ft/min	TSENS: 0.2
Relative Humidity: 50 %	DISC: 0.2
Activity: Summer	PMV: -0.32
Metabolic Rate: 1.0 met	PPD: 7 %
Clothing: User Defined	PD: 26 %
Clothing level: 0.5 clo	PS: 53 %
Other Details	TS: 0.3 Neutral
External Work: 0.0 met	Tneutral: 71.5 °F (Humphreys)
Turbulence Intensity: 70 %	Tneutral: 74.8 °F (Aulicisms)
Mean Mo. Outdoor Temp: 15.0 °C	Comfortable: In ISO
Exposure Time: 60 min	Comfort Zone Calculation: Summer Comfort
Barometric Pressure: 760 torr	Humidity Level: In Zone
Weight: 70 kg	Dry-Bulb Temperature: In Zone
Surface Area: 1.2 sq.m	

Thermal Comfort Terms and Definitions:

Below are listed a number of terms commonly used literature, standards, etc.

Acceptable Thermal Environment
An environment that at least 80% of the occ acceptable. (ASHRAE 55-92)

Air Movement
Combined effect of air velocity and turbulence and flow direction.

Air Motion
Same as air movement.

Air Speed
Same as air velocity except without regard to

Air Temperature
Is the dry-bulb temperature of the air (ASHRAE 55-92).

Air Velocity

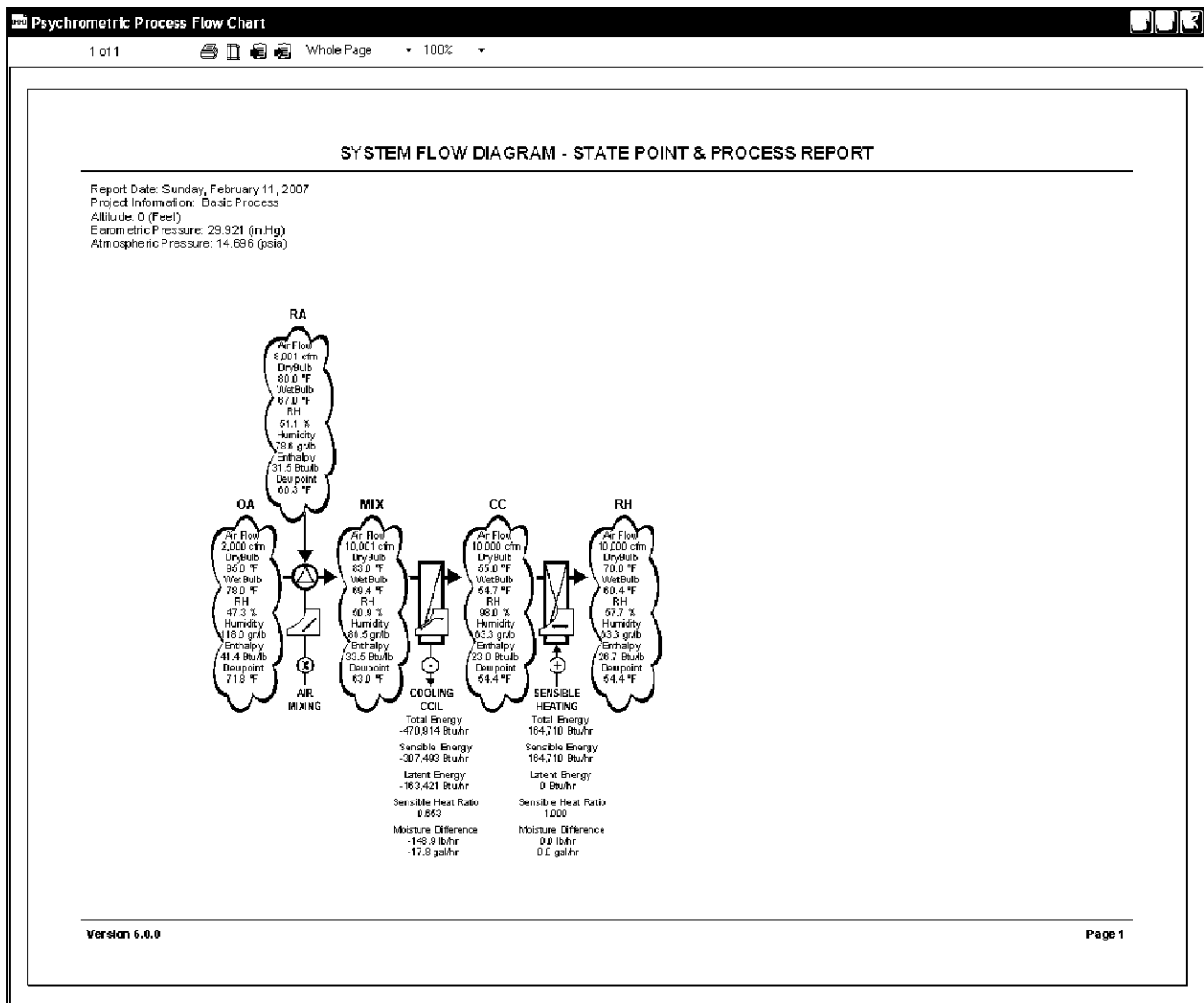


PROGRAM FEATURES

MORE PROFESSIONAL EDITION FEATURES!

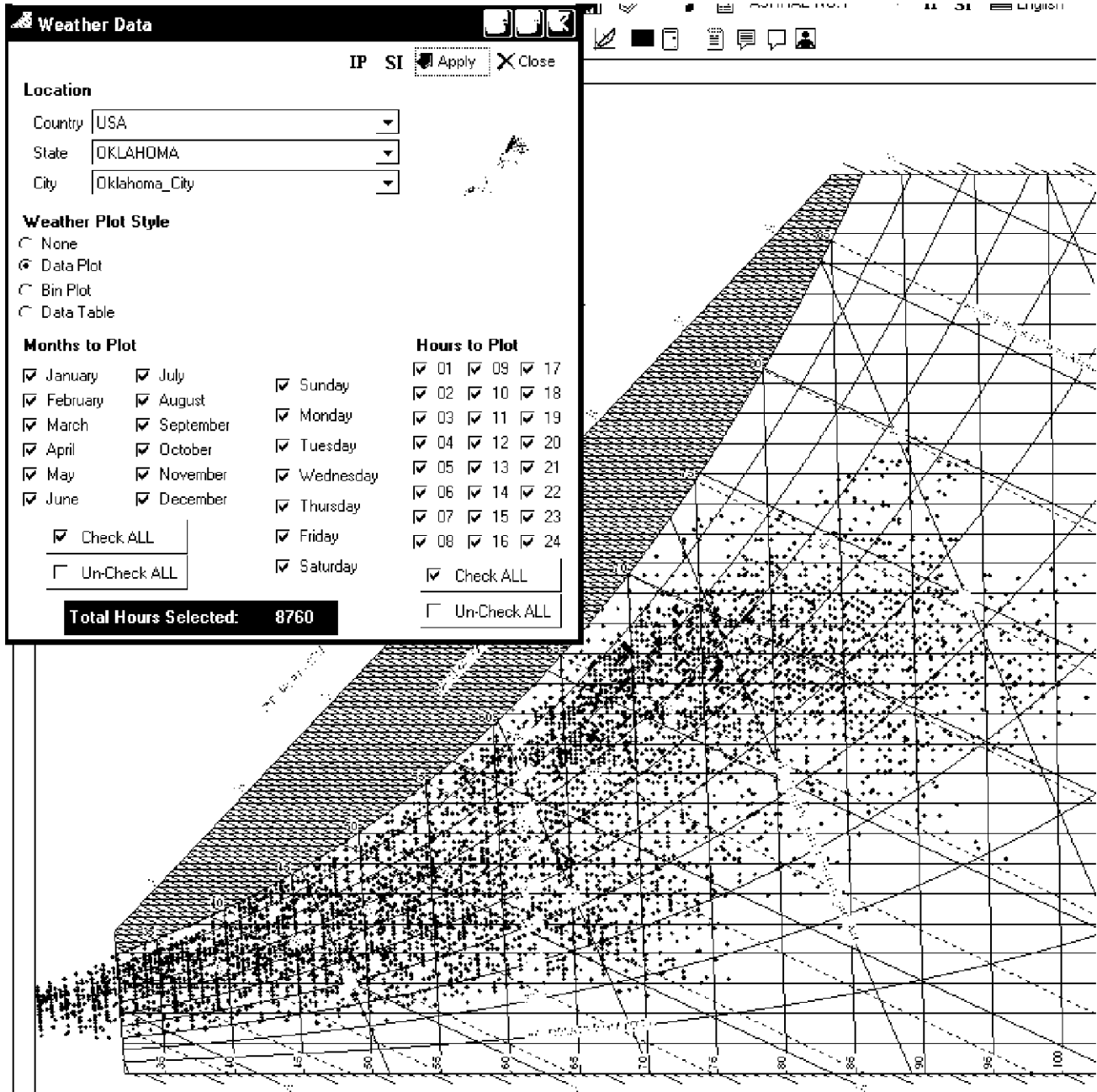
Auto Flow Chart Diagram!

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!



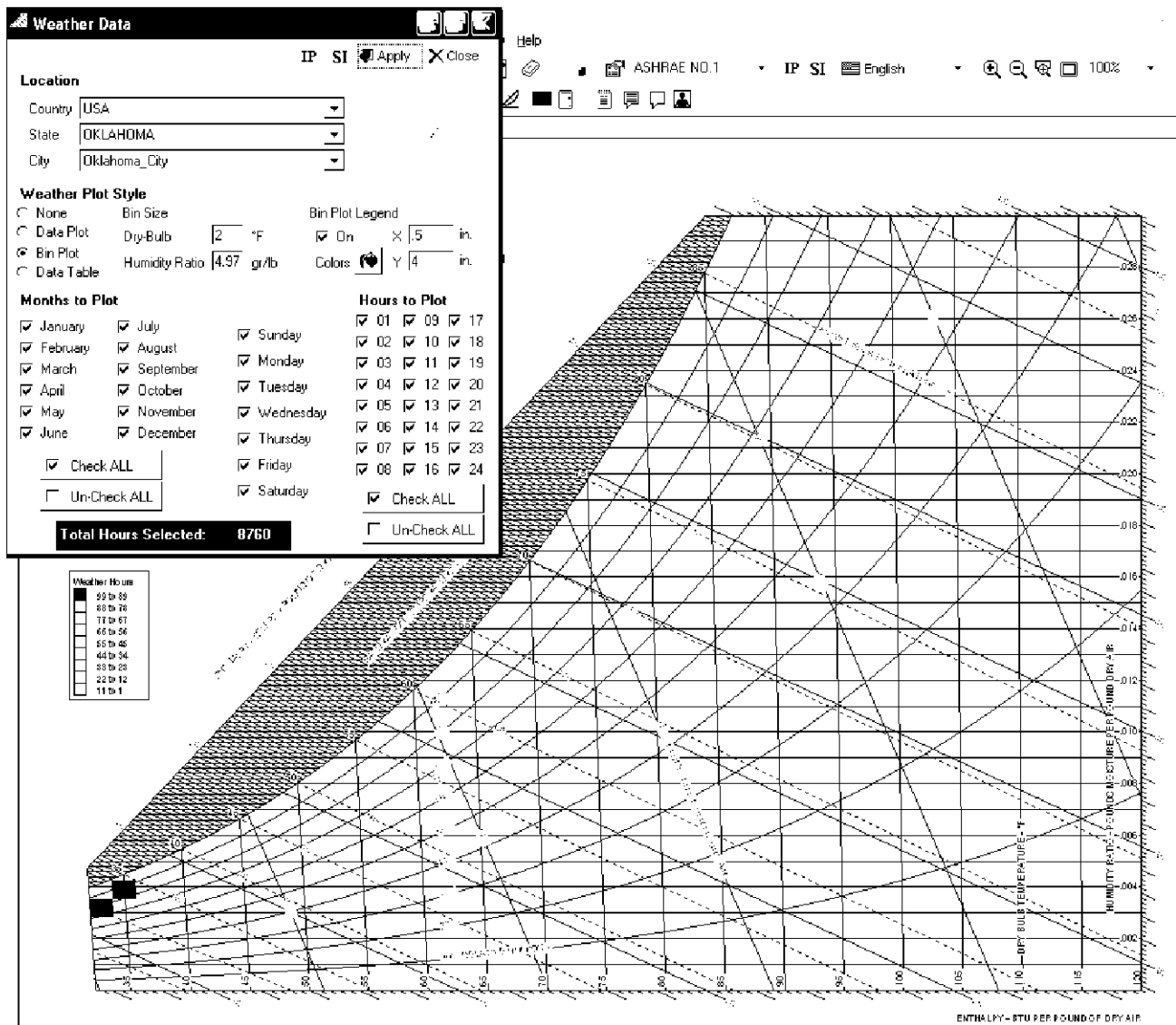
Weather Data Plotting with Complete Global Weather Files!!

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



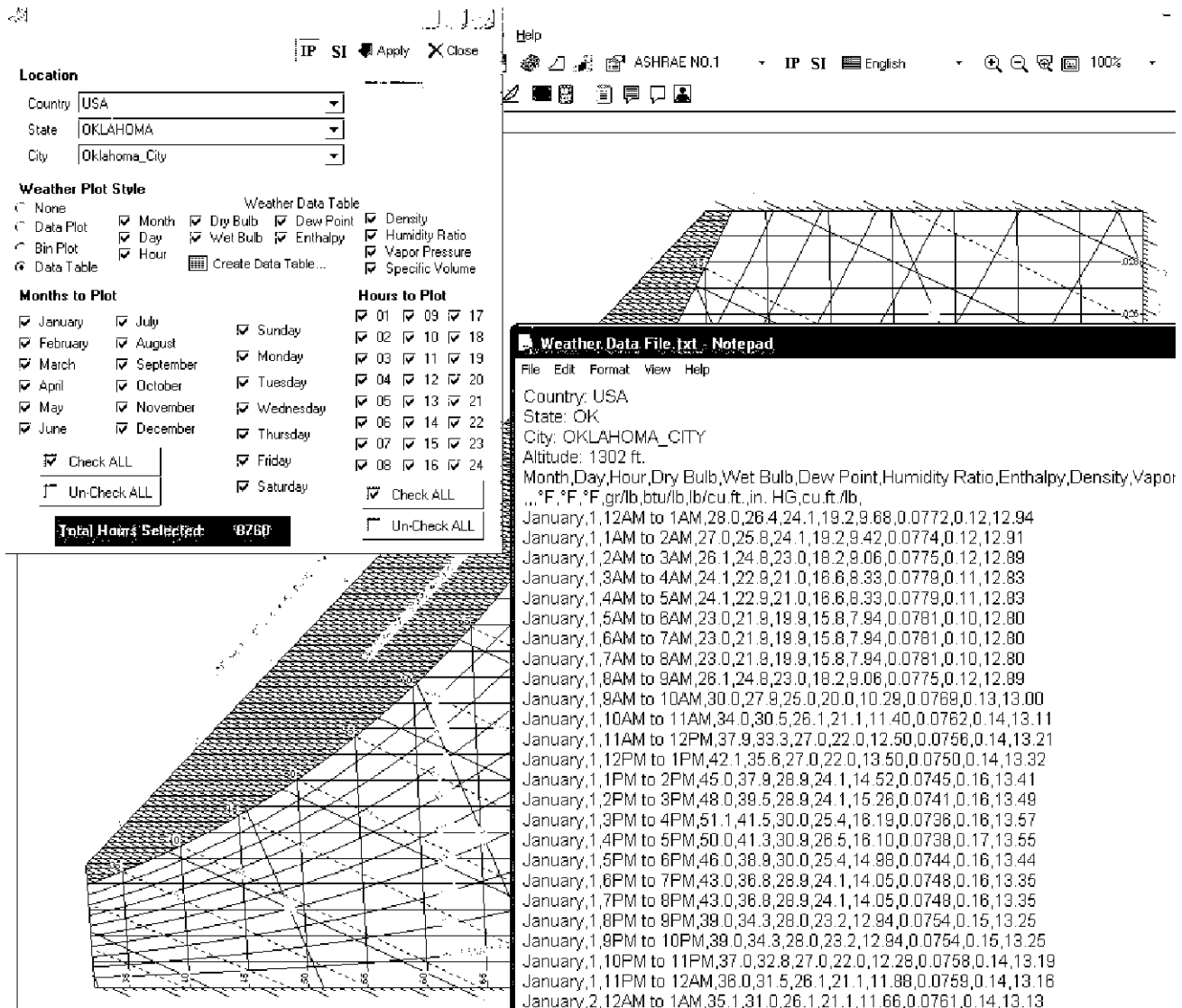
Weather Bin Shade Plotting with Complete Control!!

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!!



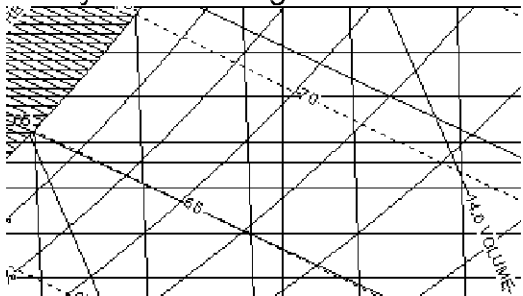
Global Weather Data Table Access!!...CREATE YOUR OWN BIN TABLES!!

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!!

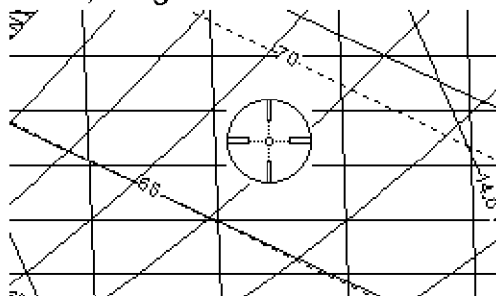


Mouse Icon Control!!

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



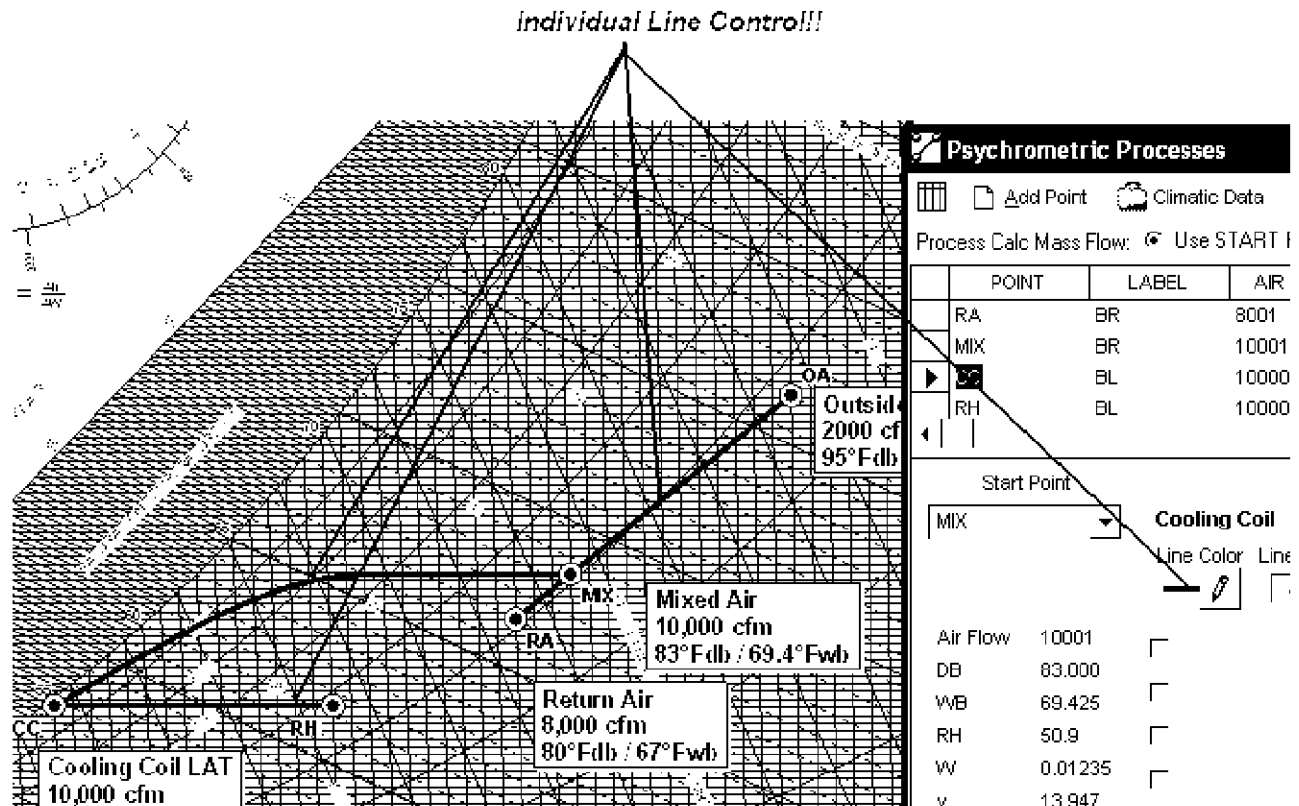
Cross-Hair Mouse (just like CAD!!)



Or Target Style!!

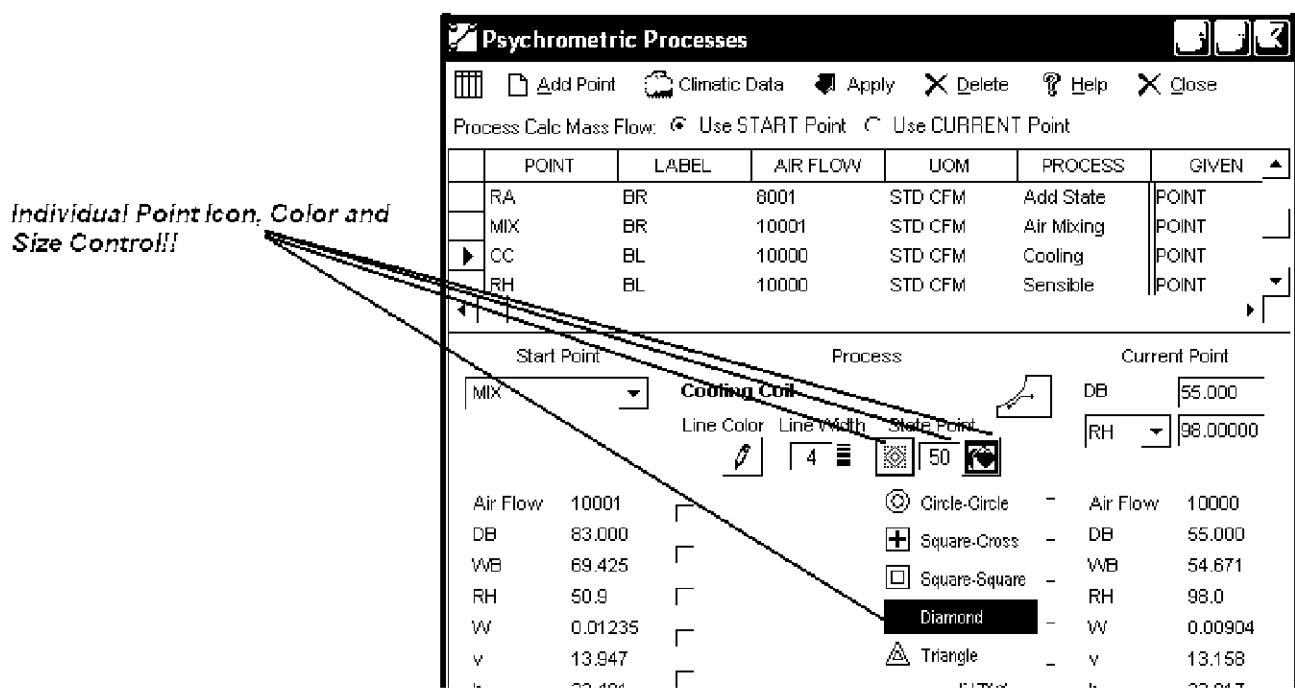
Individual Process Line Color Control!

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



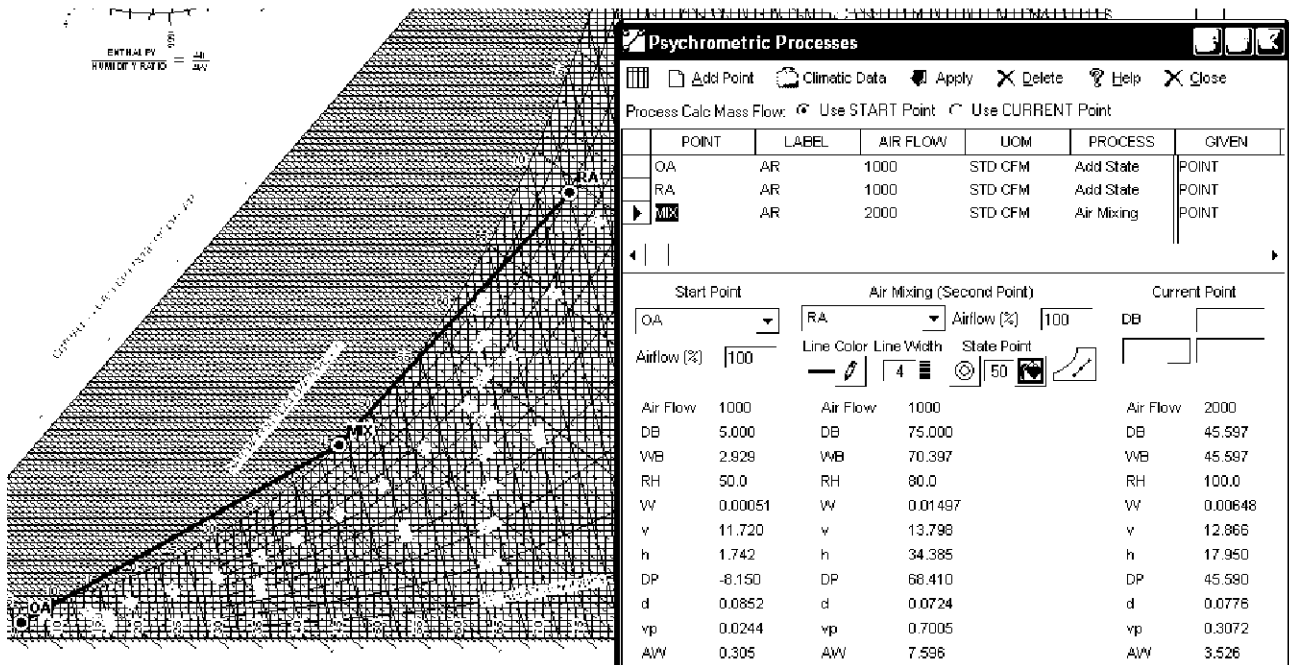
Individual Point Color, Shape and Size Control!

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



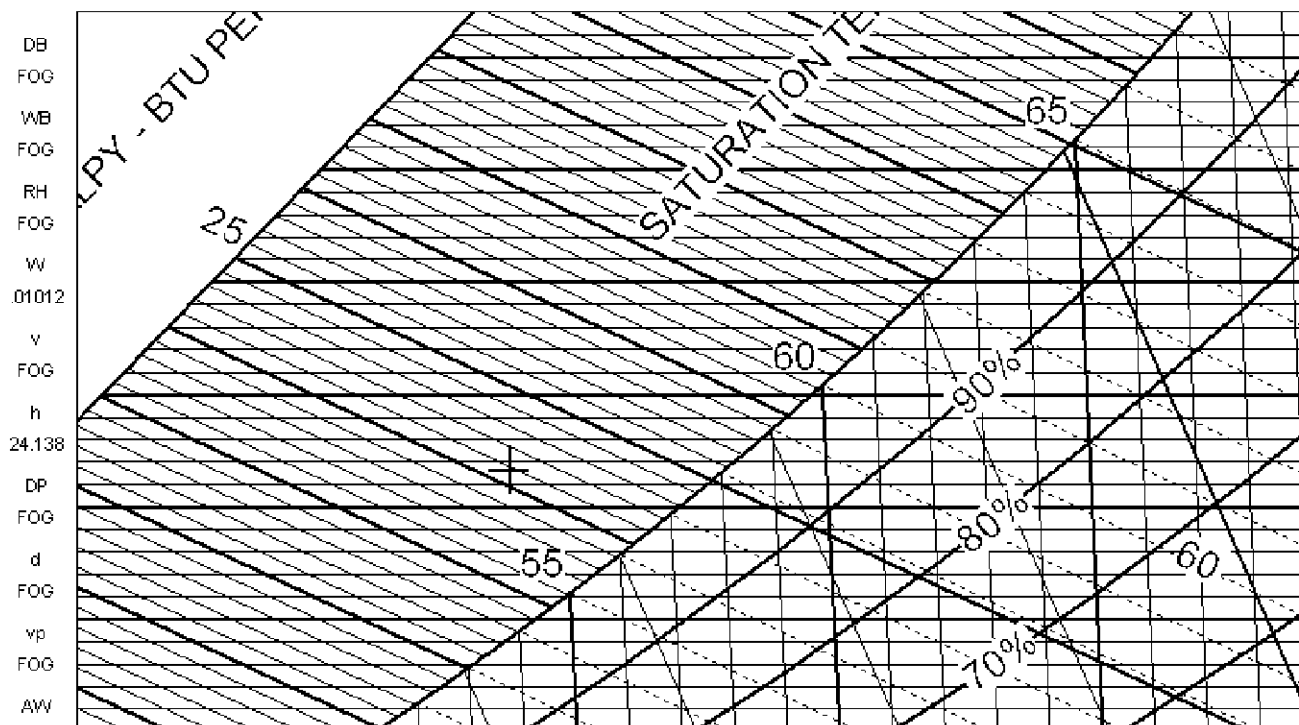
Winter "V" Air Mixing Capability!

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



Fog Region Property Display!!

Now you can read fog region properties!!



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!!

Humidity Ratio Units

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

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

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

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
☒	80			5
☒	55			40
☐				
☐				
☐				

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

In

ISO

Comfort Zone Calculation

Summer Comfort

Humidity Level

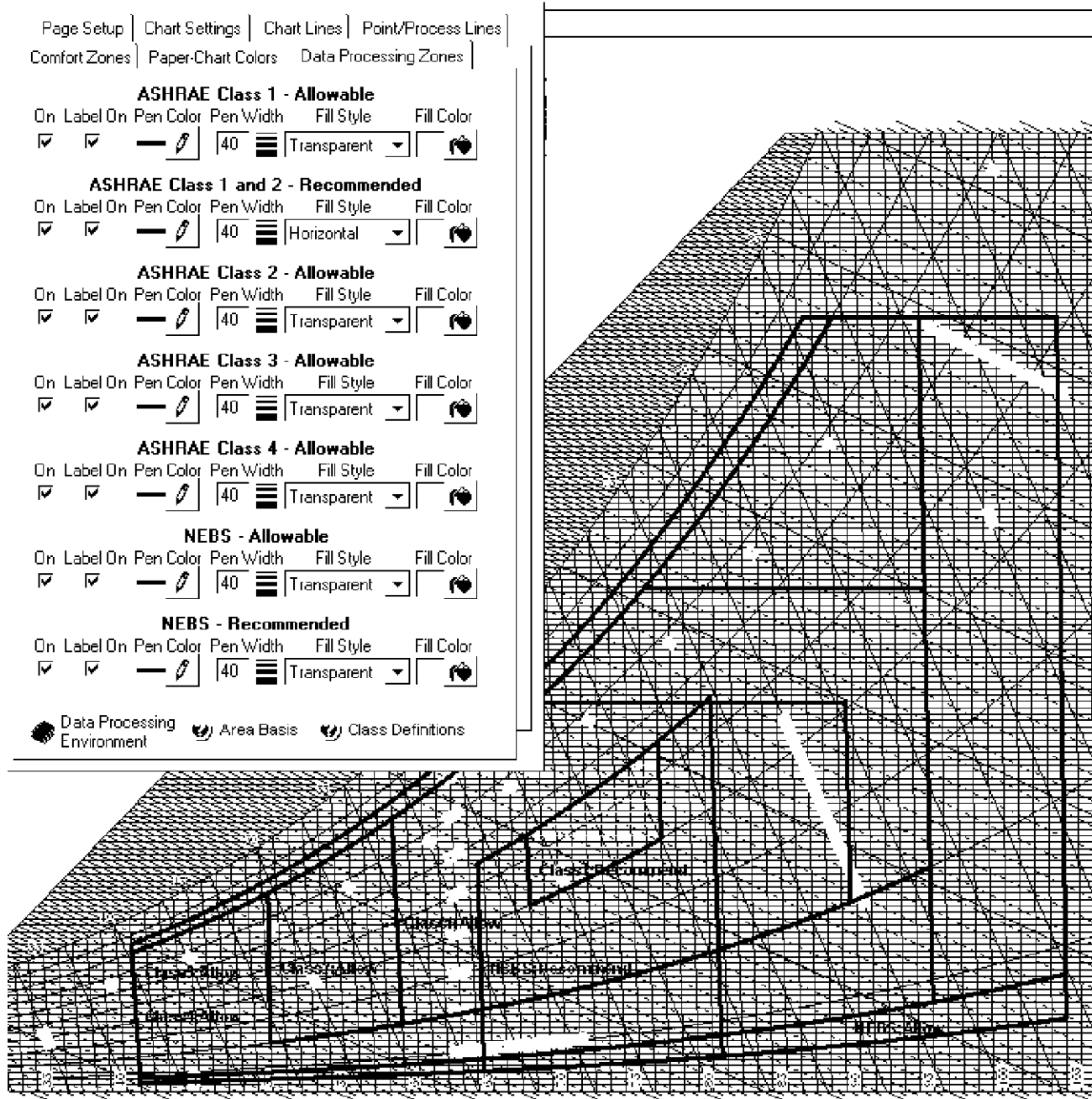
In Zone

Dry-Bulb Temperature

In Zone

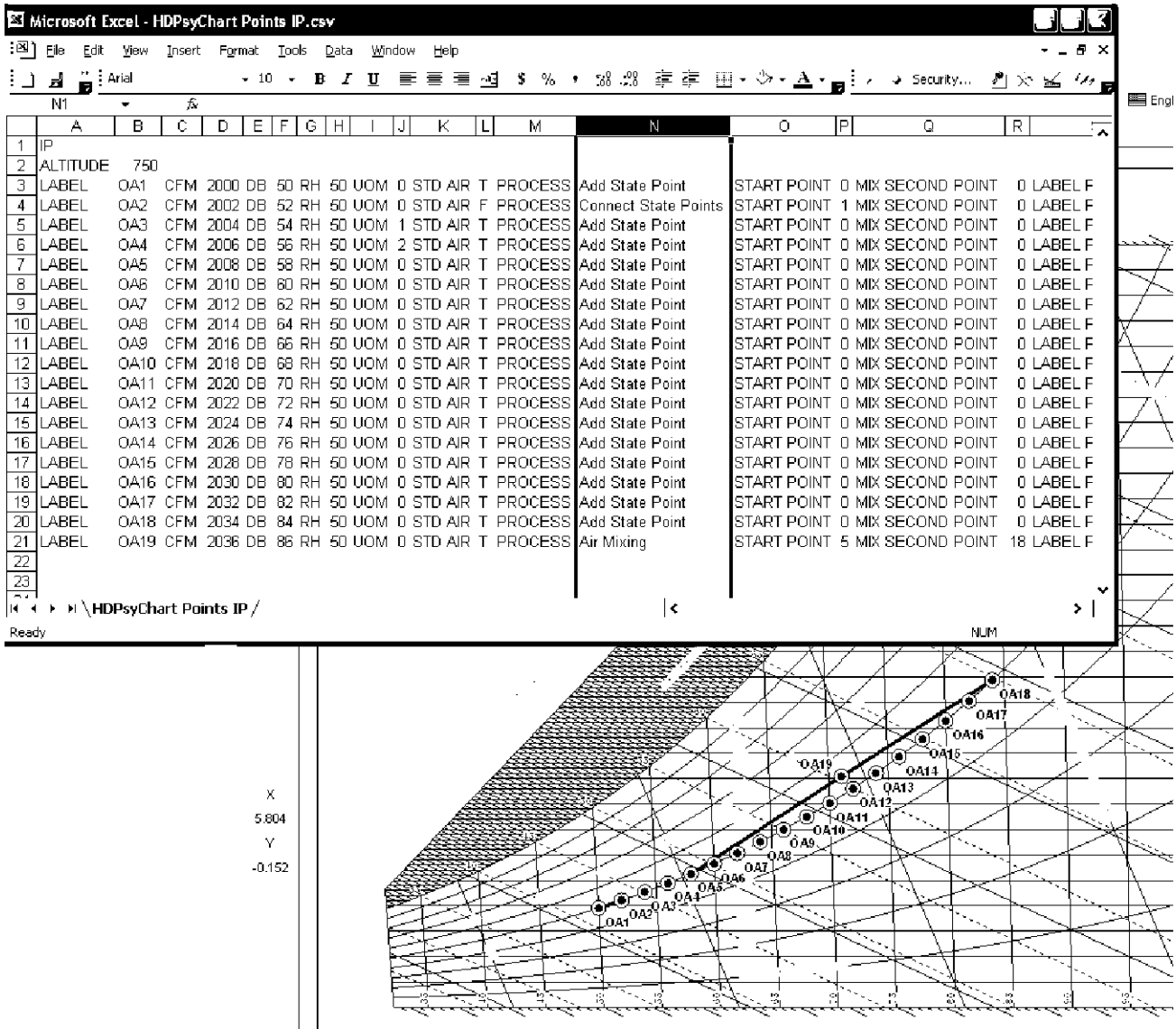
ASHRAE Class 1 through 4 Datacenter Zones (allowed & recommended) and NEBS Datacenter Zones (allowed & recommended)!!

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



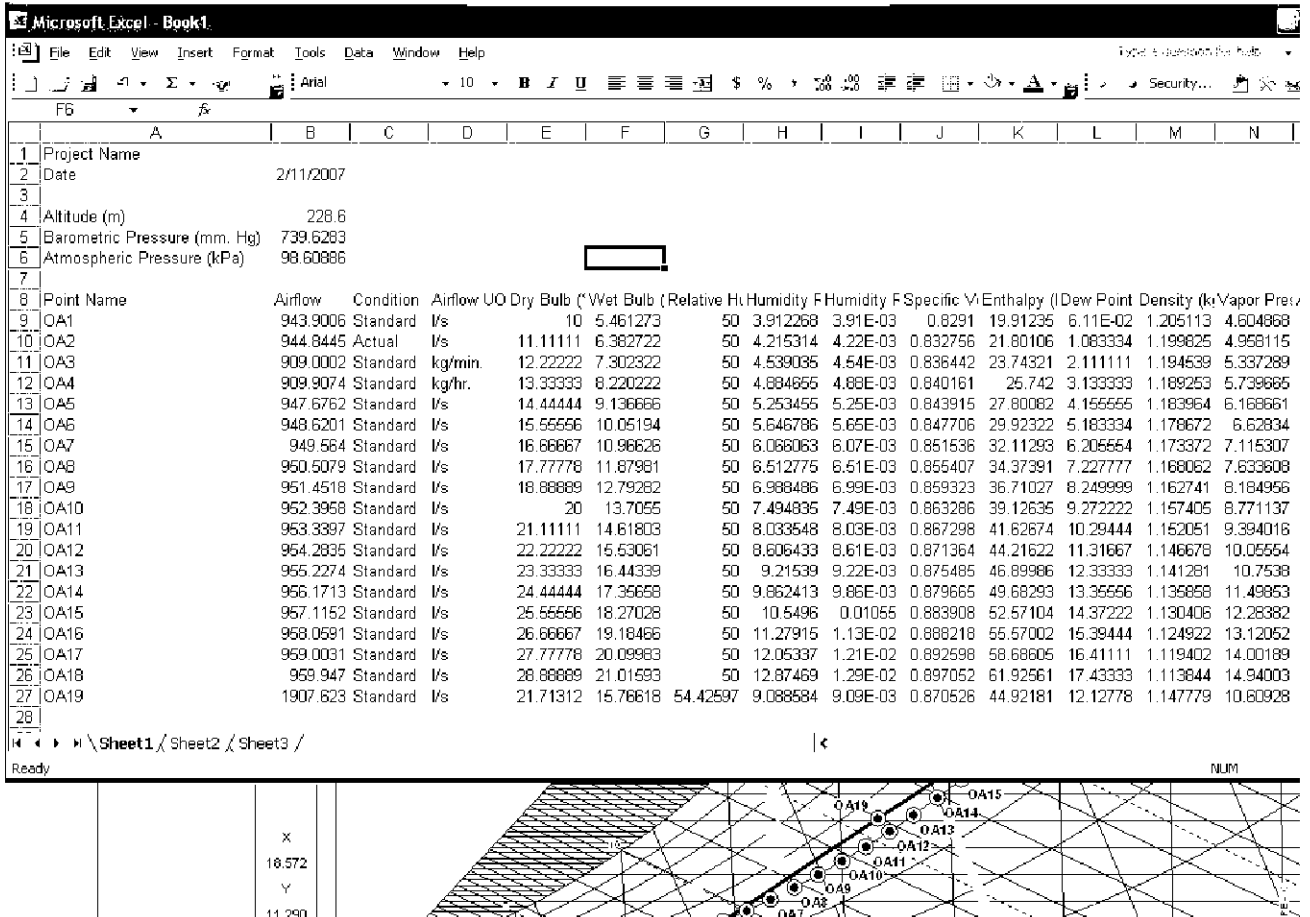
Process Control added to Data Import Function!!

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



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

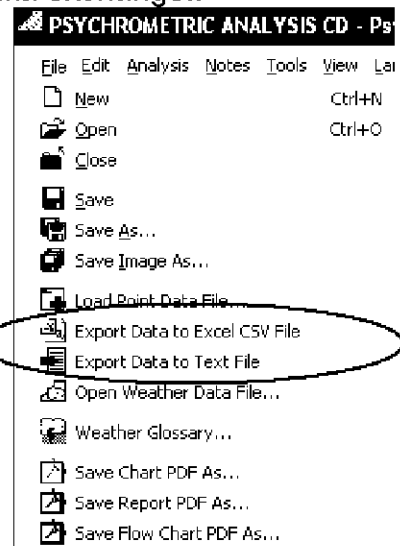
Now when you're exporting data text or Excel spreadsheet data, you can export out in SI units of measure!!



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!!



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
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

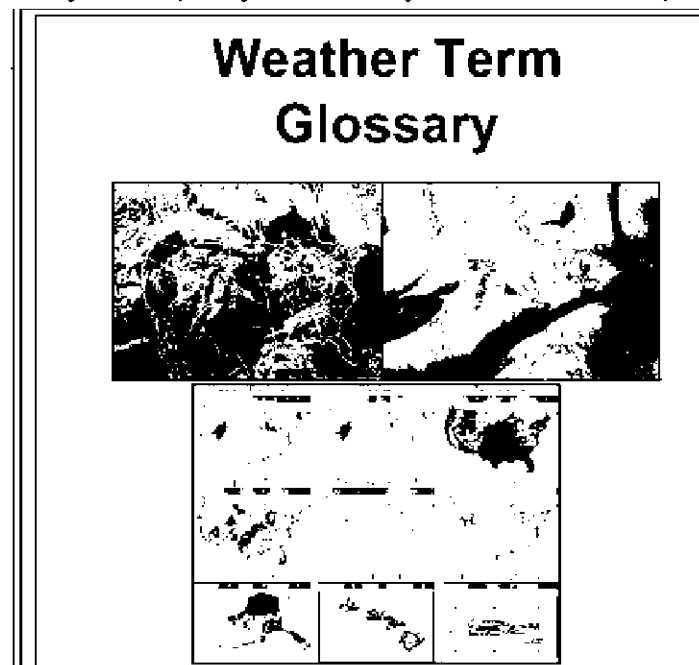
AIR CLASS
Air Class = 1
 Class Definition

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

Weather Term Glossary!!

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



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

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	5
99%	15	50	14.72	1% 26	37		

WIND

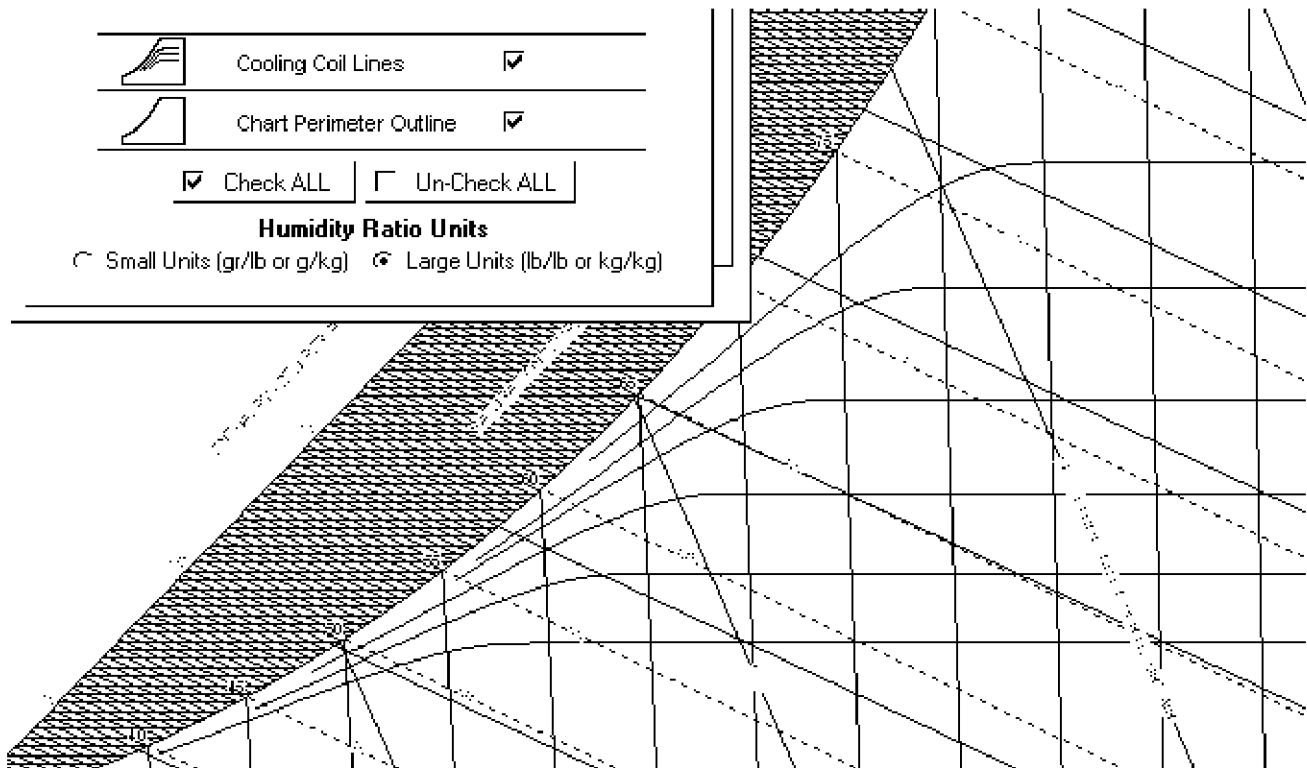
Coincident with 0.4% DB (cooling) MCWS 13 mph PWD 180 deg.

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

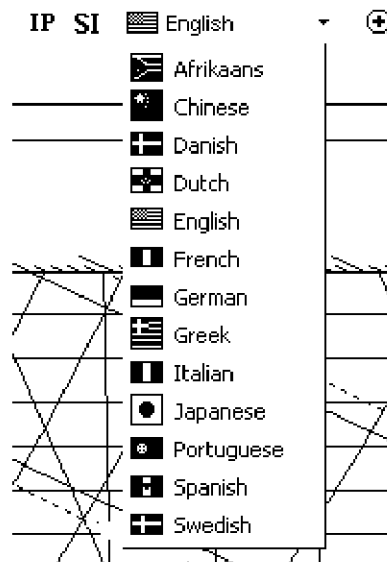
Cooling Coil Performance Line Control!!

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



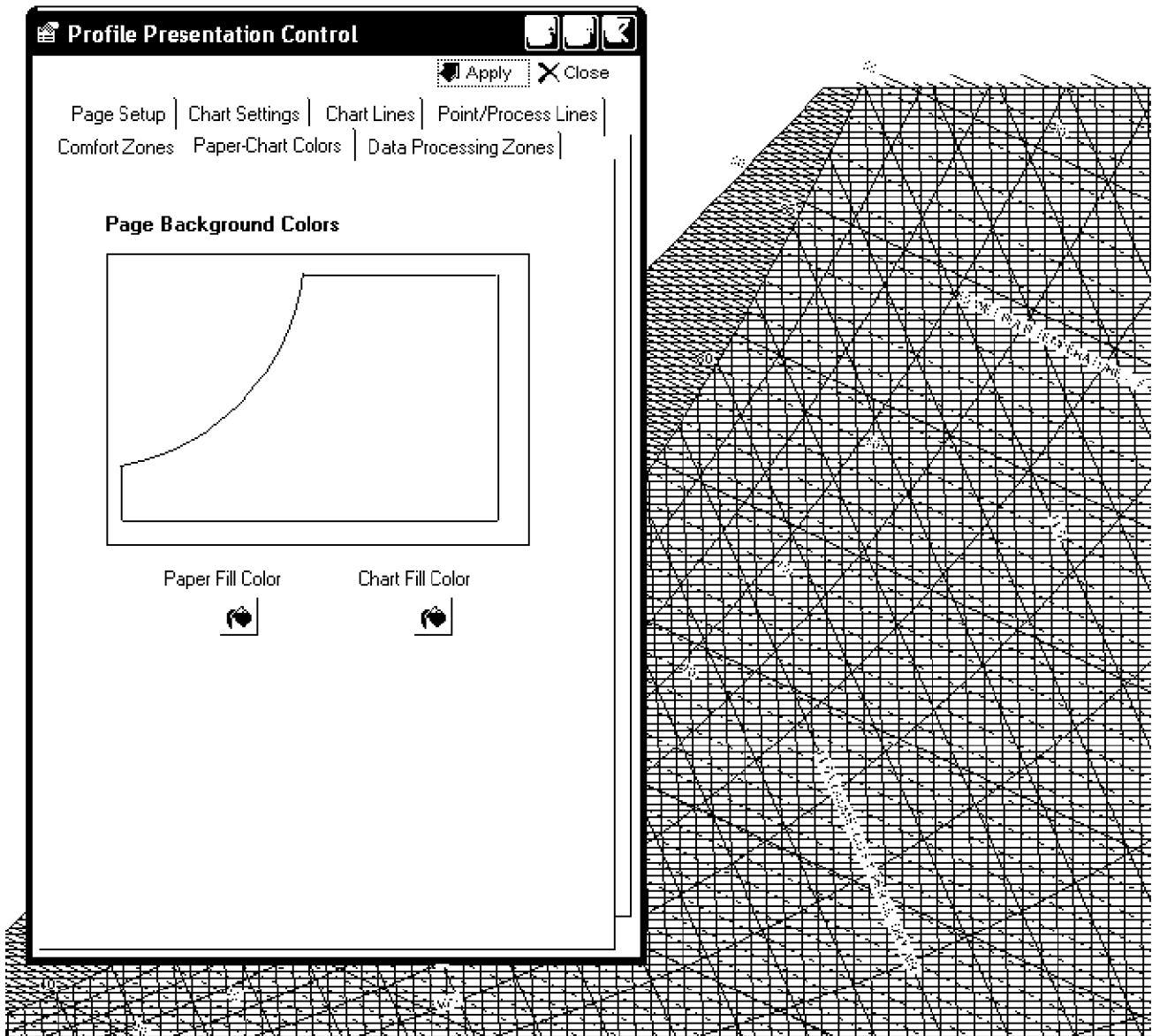
Greek, Japanese and Dutch Languages Added!!

Now Psychrometric Analysis supports (13) Languages!!



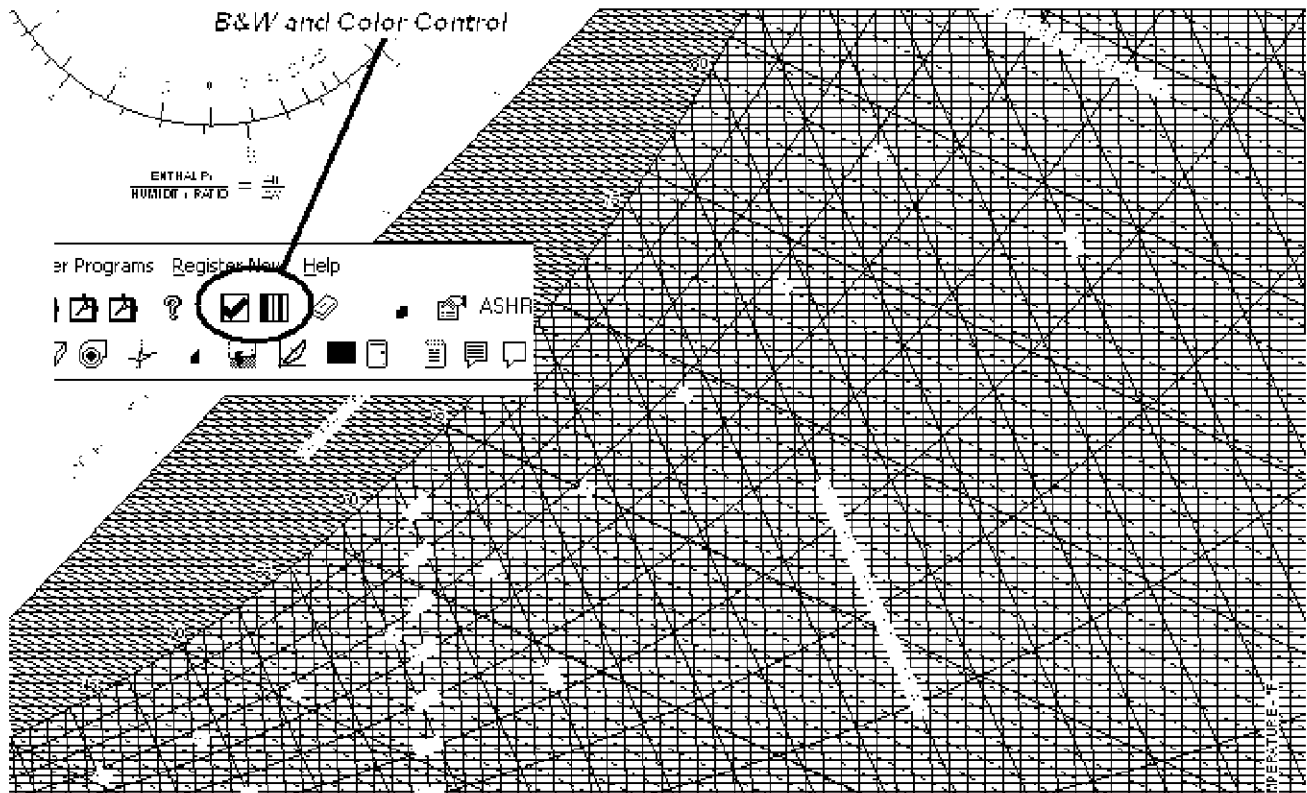
Page and Chart Area Color Control!!

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



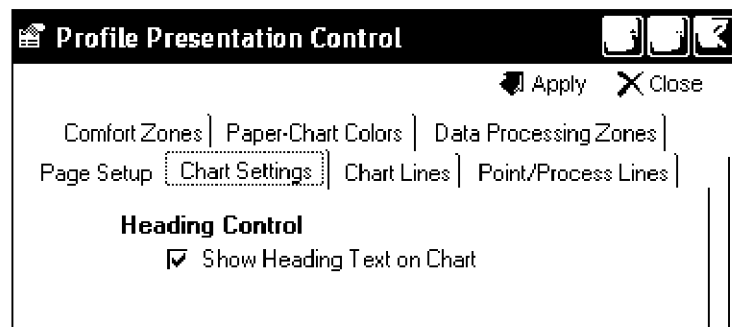
Black & White <=> Color Display & Print Control!!

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



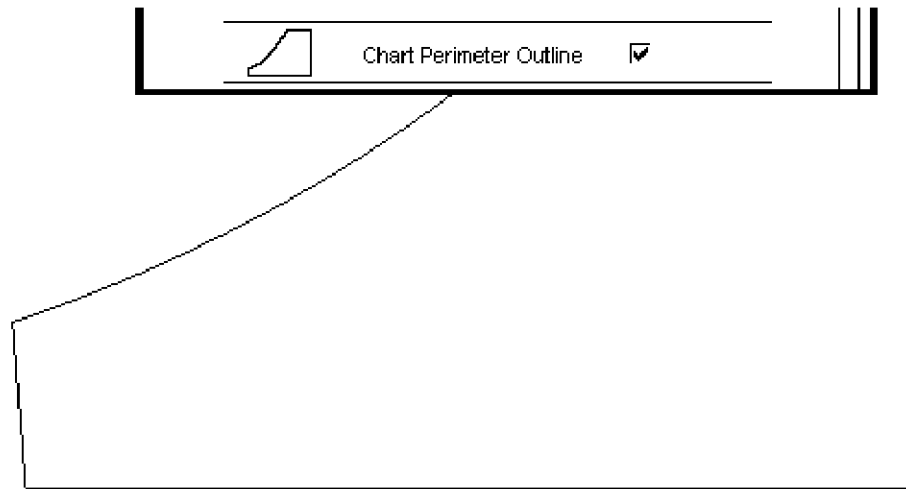
Heading On/Off Control!!

Now you can turn Headings On or Off!!



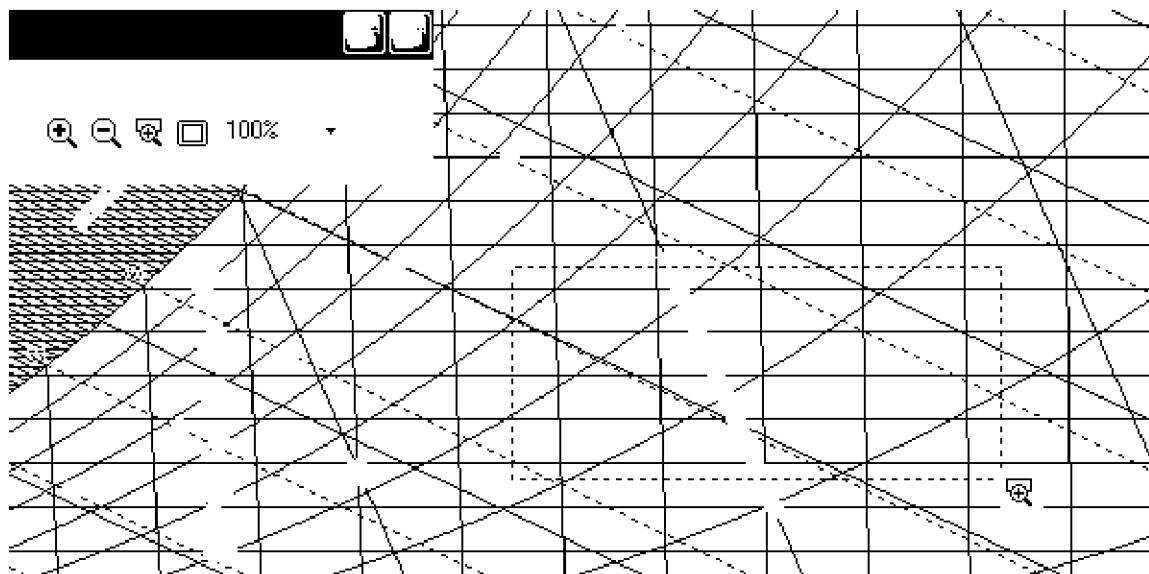
Psychrometric Chart Outline Control!!

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



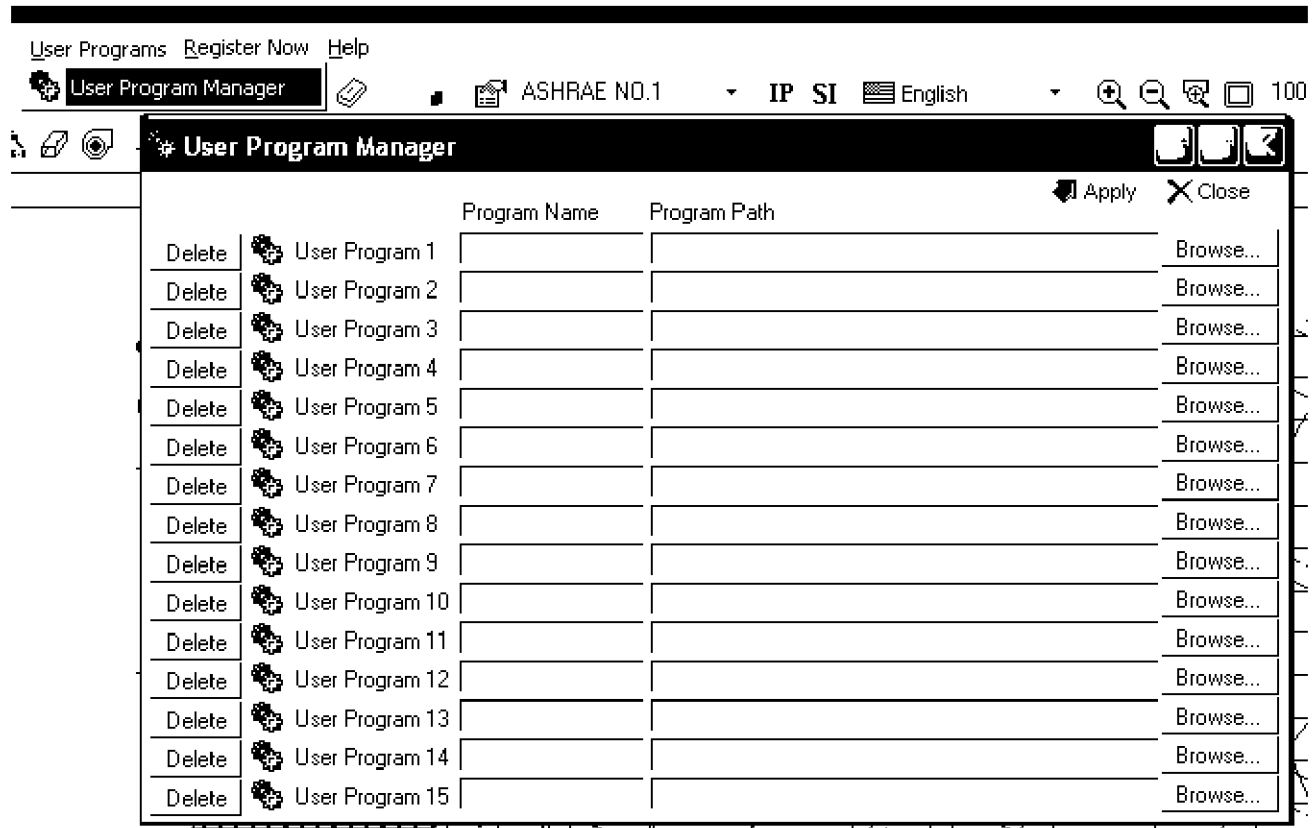
Zoom Window Control!!

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



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!!



Single & Double Interpolation and Extrapolation Calculator!!

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

Interpolate Calculator

Print

Close

CALCULATE

Y2

Y1

X1

X2

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

2000

Series Mid

Low Mid

Mid Mid

High Mid

Value

X

3

X

4

X

5

Y

2

Y

3

Y

4

2250

Series 2

Low Point2

Mid Point2

High Point2

Value

X1

4

X

5

X2

6

Y1

3

Y

4

Y2

5

2500

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

Airflow

12000

cfm

Static Pressure

3.60

in. WC

Power

14.5

bhp

Speed

1380

rpm

Pulley Size

10.0

in.

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

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

Complete State Point & Process Report!!

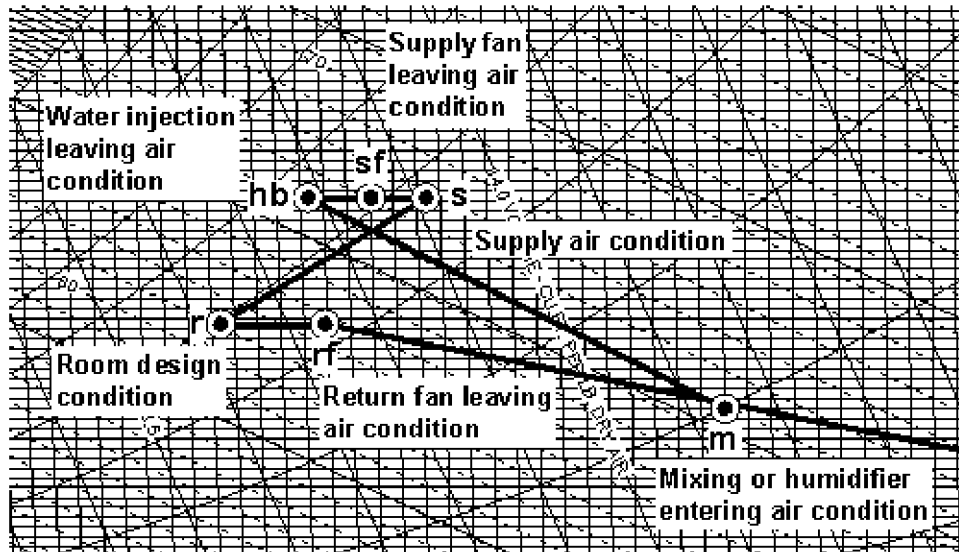
Complete state point and process report with the ability to copy EITHER the report IMAGE or the DATA to the clipboard so you can paste it right into your proposals, presentations or the data into spreadsheets!!

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: (408) 844-6314 Fax: (408) 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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	75.000	65.940	44.5	0.01422	13.004	29.141	47.7652	0.0729	4.4817	0.0222	
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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	90.000	65.940	22.6	0.00494	14.253	29.500	45.7687	0.0513	0.3245	0.0050	
Process: Desiccant Dehumidification											
Start Point Name	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)	Sensible Energy For Dehumidification (Btu/hr)				
RA	-314	19,463	19,207	18.8	31.012	32	-1,063.1				
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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	85.000	65.440	47.4	0.01422	13.430	29.436	47.7652	0.0745	4.4817	0.0222	
Process: Sensible Cooling											
Start Point Name	Total Cooling Btu/hr	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Moisture Removal (lb/hr)	Sensible Heat Ratio	Enthalpy Humidity Ratio (Btu/lb, lb/lb)				
RA	10.9	-11,555	-11,555	0	0.0	1.000	NA				
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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	80.000	68.430	32.8	0.01422	14.049	32.340	47.7652	0.0714	4.4817	0.0237	
Process: Sensible Heating											
Start Point Name	Total Heating Btu/hr	Total Energy (Btu/hr)	Sensible Energy (Btu/hr)	Latent Energy (Btu/hr)	Moisture Removal (lb/hr)	Sensible Heat Ratio	Enthalpy Humidity Ratio (Btu/lb, lb/lb)				
RA	14	10,850	10,850	0	0.0	1.000	NA				
5. CO											
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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	85.000	64.870	46.5	0.01422	13.100	29.290	47.7652	0.0749	4.4817	0.0220	
Process: Cooling Coil											
Start Point Name	Total Cooling Btu/hr	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	-2.7	-21,210	-21,045	-5,434	-4.9	0.922	0.312				
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)	Leak Point (F)	Density (lb/cu ft)	Vapor Pressure (in Hg)	Absolute Humidity (lb/lb)	
1.000	95.000	62.980	24.8	0.00493	12.386	29.230	45.7687	0.0531	0.3245	0.0050	
Process: Evaporative Cooling											

Version 5.0.0
Page 1

Complete Project Information & Note Control!!

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!!



Complete User Data Control for Reports and Graphs!!

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	Add User Data to Current Chart
☒ Show on report	
User Name	Robert Hanna
Company Name	Hand-Down Software
Telephone No	(405) 844-6314
Fax No	(405) 844-6314
email address	sales@hand-downsoftware.com

Prepared by	
Name	Robert Hanna
Company	Hand-Down Software
Phone	(405) 844-6314
Fax	(405) 844-6314
email	sales@hand-downsoftware.com
Date	5/12/2004

Complete Chart Presentation Control!!

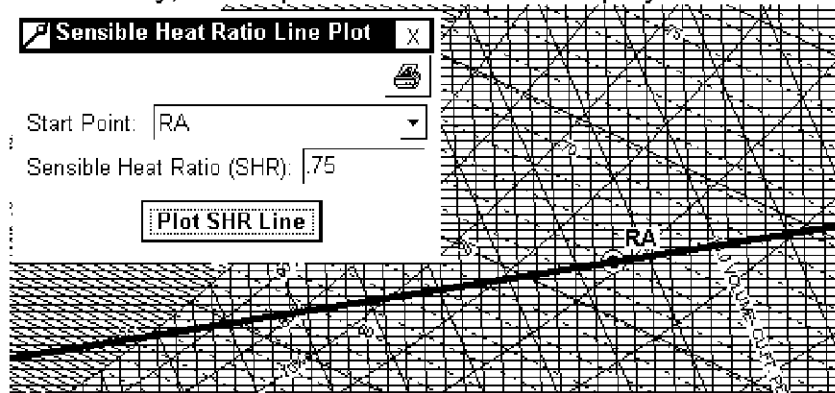
Complete Chart control including virtually any Altitude or Pressure, Dry-Bulb and Humidity Ratio Axis Limit Control, turning Lines ON & OFF, Process line color and width, state point icon and size, state point label font control, Comfort & Data Center Zones, Page Setup and more!!

The following table summarizes the configuration options shown in the screenshots:

Section	Options
Margins	LANDSCAPE: Chart Area Margin (0.7), Logo Margin (Top: 0.3, Left: 0.3, Right: 0.7, Bottom: 0.7), Portrait: Chart Area Margin (3.6), Logo Margin (Top: 0.25, Left: 1.82, Right: 0.7, Bottom: 0.7). Includes 'Load Margin Defaults' button.
Heading Control	Show Heading Text on Chart (checked), Use Custom Altitude (feet) (checked, 0, Altitude dropdown), Use Custom Axis (checked, Minimum Dry-Bulb Temp: 32 °F, Maximum Dry-Bulb Temp: 120 °F, Maximum Humidity Ratio: 0.0300 lb/lb, Load Axis Range Defaults button), Use Custom Chart Label Settings (checked, Chart Line Label Font Size: 6, Line Titles OFF, Line Labels OFF, Label Line Breaks OFF, Load Font Size Default button).
Chart Property Line Control	Table with Major/Minor checkboxes for Dry Bulb, Wet Bulb, Humidity Ratio, Specific Volume, Enthalpy, Relative Humidity, Extended Enthalpy, Perimeter Enthalpy, SHR Index, Cooling Coil Lines, Chart Perimeter Outline. Includes Check ALL / Un-Check ALL buttons.
Humidity Ratio Units	Small Units (gr/lb or g/kg) or Large Units (lb/lb or kg/kg).
Page Background Colors	Page Setup Chart Settings Chart Lines Point/Process Lines Comfort Zones Paper-Chart Colors Data Processing Zones. Includes Paper Fill Color and Chart Fill Color selection.
Process Line Color Control	Process Line Color (dropdown), Process Line Width (4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100). Includes State Point Style Control (State Point Color, State Point Size, State Point Label Control: Label ON, Label Line Break ON, Line Break Color: A, Label Font Control: Arial, 10, Bold, Italic, Underline).
Comfort Zones	Show Summer Comfort Zone (checked, Minimum Dewpoint Temp: 36.0 °F, Maximum DP Dry-Bulb: 81.0 °F, Minimum WY Dry-Bulb: 74.0 °F, Maximum Wet-Bulb Temp: 68.0 °F, Maximum WAB Dry-Bulb: 79.0 °F, Minimum WAB Dry-Bulb: 73.0 °F, Load Summer Zone Defaults button), Show Winter Comfort Zone (checked, Minimum Dewpoint Temp: 36.0 °F, Maximum DP Dry-Bulb: 76.0 °F, Minimum CP Dry-Bulb: 69.0 °F, Maximum Wet-Bulb Temp: 64.0 °F, Maximum WAB Dry-Bulb: 74.0 °F, Minimum WAB Dry-Bulb: 68.0 °F, Load Winter Zone Defaults button).
ASHRAE/NEBS Classifications	ASHRAE Class 1 - Allowable, ASHRAE Class 1 and 2 - Recommended, ASHRAE Class 2 - Allowable, ASHRAE Class 3 - Allowable, ASHRAE Class 4 - Allowable, NEBS - Allowable, NEBS - Recommended. Each includes On, Label, On, Pen Color, Pen Width, Fill Style, Fill Color settings.

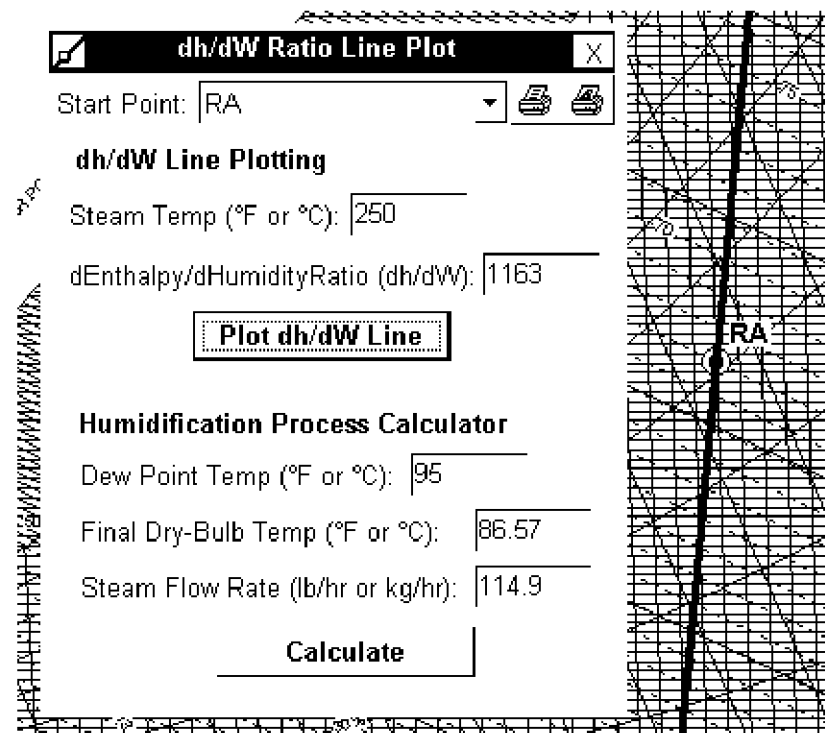
Sensible Heat Ratio Line Plotting!!

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!!

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 Control!!

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

RA ▼

Air Flow 1000

DB 75.000

WB 63.940

RH 55.0

W 0.01022

v 13.695

h 29.181

DP 57.759

d 0.0738

vp 0.4817

AW 5.222

Process

Sensible Heating

☒ Sensible Energy

Current Point

DB

1.4 Air Flow 1000

16,506 DB 89.999

16,506 WB 68.746

0 RH 33.8

0.0 W 0.01022

1.000 v 14.079

N/A h 32.849

 DP 57.759

 d 0.0718

 vp 0.4817

 AW 5.080

Complete IP & SI Unit of Measure Control with ONE Button Click!!

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

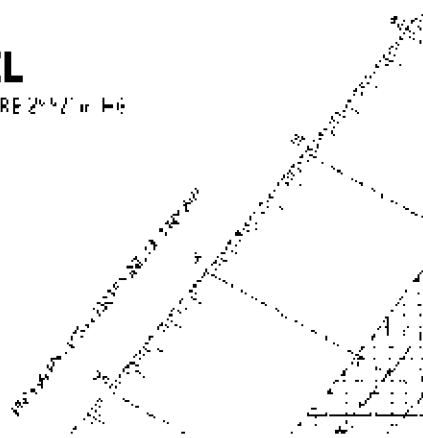
PSYCHROMETRIC CHART

Normal Temperature

IP Units

SEA LEVEL

BAROMETRIC PRESSURE 29.92 in Hg



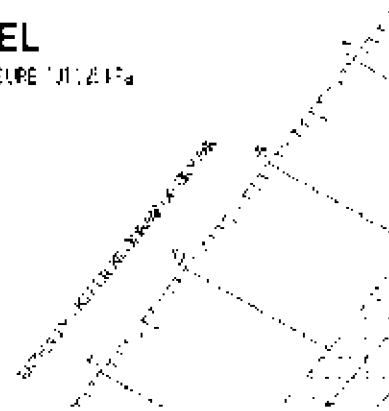
PSYCHROMETRIC CHART

Normal Temperature

SI Units

SEA LEVEL

BAROMETRIC PRESSURE 101.325 kPa



Save Charts and Report as PDF Files that can be easily shared or emailed!!

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

- ☐ Save Chart PDF As...
- ☐ Save Report PDF As...

Select any of (10) Different Languages for Charts and Reports!!

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

- ☒ Afrikaans
- ☐ Chinese
- ☐ Danish
- ☐ English
- ☐ French
- ☐ German
- ☐ Italian
- ☐ Portuguese
- ☐ Spanish
- ☐ Swedish

PSYCHROMETRIC DIAGRAMME

La Température Normale
SI Unites

NIVEAU DE LA MER

BAROMETRIC PRESSURE 101.325 kPa



PSYCHROMETRIC CARTA

Temperatura Normal
SI Unidades

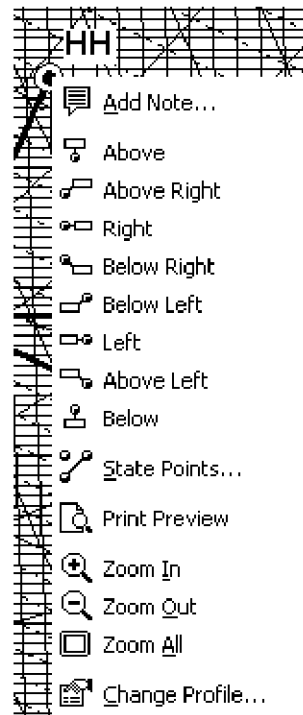
NIVEL DEL MAR

BAROMETRIC PRESSURE 101.325 kPa



Easy-to-Use Right-Click Pop-Up Menu Control!!

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 bottom down and Drag allows you FULL PANNING of the chart!!



Complete Stand Alone Psychrometric Property Calculator!!

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

Psychrometric Calculator - New Project													
Altitude	0	Description		Dry Bulb (°F)	Wet Bulb (°F)	Relative Humidity (%)	Humidity Ratio (lb/lb)	Humidity Ratio (lb/lb)	Specific Volume (cu ft/lb)	Enthalpy (Btu/lb)	Dew Point (°F)	Density (lb/cu ft)	Vapor Pressure (in. Hg)
Barometric Pressure	29.921			95.000	73.000	47.294	0.01086	0.00300	14.3564	41.3955	71.800	0.070850	0.76631
Atmospheric Pressure	14.696			80.000	67.000	51.140	0.01123	0.00300	13.8453	31.5098	60.347	0.073047	0.52840
Dry Bulb Temp.	57			55.000	54.000	98.764	0.01917	0.00300	13.7660	23.0967	54.684	0.076687	0.43061
Wet Bulb Temp.	54.4												
Relative Humidity	98.784												
Humidity Ratio (gr/lb)	0.00912												
Specific Volume	13.1000												
Enthalpy	23.0967												
Dew Point Temp.	54.684												
Density	0.076687												
Vapor Pressure	0.43061												
Atm. Humidity (gr/lb)	0.00089												
Parts Per Million by Weight	9.117												
Parts Per Million by Volume	14.658												

Complete World-Wide Climatic Outside Air Design Data!!

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

☒ COOLING

USA

676 Elevation, Feet

☒ HEATING

Oklahoma

36.2 North Latitude

☒ WIND

Tulsa

95.9 West Longitude

English (IP)

Metric (SI)

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	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 Air Collection Calculator!!

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

LAH

Airflow

1.000

SCFM

Dry-Bulb Temp

90.00

°F

Humidity Ratio

0.00679

lb/lb

Enthalpy

29.07

Btu/lb

Selected Point 3

FC

Airflow

1.000

SCFM

Dry-Bulb Temp

55.00

°F

Humidity Ratio

0.00372

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

Port Label Here

Airflow

5.000

SCFM

Dry-Bulb Temp

71.00

°F

Humidity Ratio

0.00813

lb/lb

Enthalpy

25.92

Btu/lb

Stand Alone Universal Unit of Measure Conversion Calculator!!

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

Unit Conversion Calculator

File

Help

Force

Light

Mass

Power

Pressure

Specific Volume

Acceleration

Angle

Area

Density

Distance

Energy

Flow

Temperature

Time

Velocity

Volume

Volume - Dry

Input

Celsius

Fahrenheit

Kelvin

Rankine

Output

Celsius

Fahrenheit

Kelvin

Rankine

Input:

95.76

Output:

35.42222222222222

Fahrenheit

Celsius

Complete Data Exchange Capabilities with Microsoft Excel, Word, etc!!

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!!

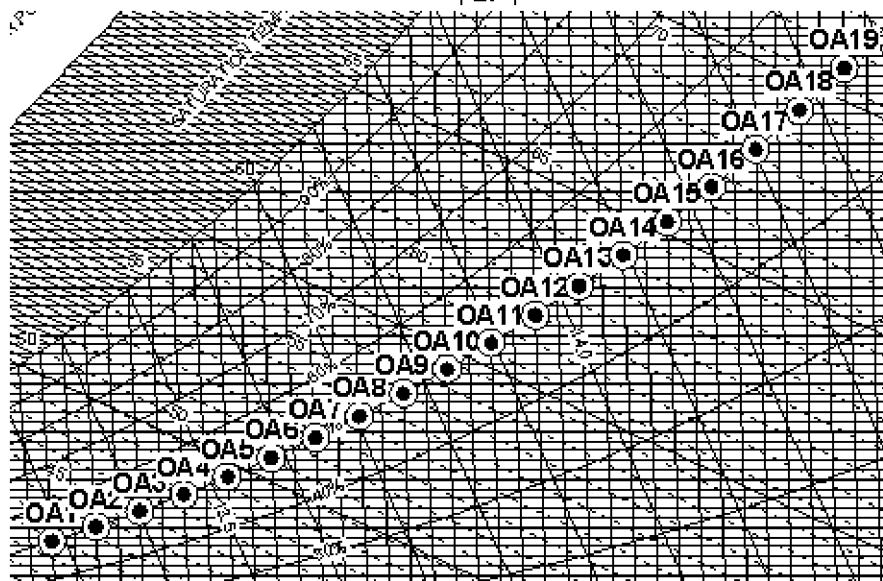
Importing of Data is accomplished with comma delimited ".csv" files which can easily be generated with any text editor or spreadsheet program such as Microsoft Excel!!!

Microsoft Excel - HDPsyChart Points.csv

	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

HDPsyChart Points.csv @ C:\Hands Down

File	Edit	Search	View	Help
ALTITUDE, 750,				
LABEL, OA1, CFM, 2000, DB, 50, RH, 50				
LABEL, OA2, CFM, 2002, DB, 52, RH, 50				
LABEL, OA3, CFM, 2004, DB, 54, RH, 50				
LABEL, OA4, CFM, 2006, DB, 56, RH, 50				
LABEL, OA5, CFM, 2008, DB, 58, RH, 50				
LABEL, OA6, CFM, 2010, DB, 60, RH, 50				
LABEL, OA7, CFM, 2012, DB, 62, RH, 50				
LABEL, OA8, CFM, 2014, DB, 64, RH, 50				
LABEL, OA9, CFM, 2016, DB, 66, RH, 50				
LABEL, OA10, CFM, 2018, DB, 68, RH, 50				
LABEL, OA11, CFM, 2020, DB, 70, RH, 50				
LABEL, OA12, CFM, 2022, DB, 72, RH, 50				
LABEL, OA13, CFM, 2024, DB, 74, RH, 50				
LABEL, OA14, CFM, 2026, DB, 76, RH, 50				
LABEL, OA15, CFM, 2028, DB, 78, RH, 50				
LABEL, OA16, CFM, 2030, DB, 80, RH, 50				
LABEL, OA17, CFM, 2032, DB, 82, RH, 50				
LABEL, OA18, CFM, 2034, DB, 84, RH, 50				
LABEL, OA19, CFM, 2036, DB, 86, RH, 50				



Motor Heat Calculator!!

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!!

Motor Heat Calcul
✕

IP **SI**
☒ Calculate
 Print
 Copy

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

Steam Property Calculator!!

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

Steam Property Ca
✕

IP **SI**
☒ Calculate
 Print
 Copy

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 7 – NEW FEATURES (Release Aug-2011)

NEW PROCESS ANALYSIS CAPABILITIES

- **NEW! Updated ASHRAE Datacenter Zones to 2011 Thermal Guidelines!**
- **NEW! Updated ASHRAE 2010 Comfort Zones!**
- **NEW! Re-arrange or Re-order Points on the Fly with One Button Click!**
- **NEW! TMY2 & TMY3 Bin Weather USA Locations Added!**
- **NEW! Ability to Select Days Per Week for Bin Weather Data & Plots!**
- **NEW! HDCLimatic Updated to 2009 ASHRAE Fundamentals!**
- **NEW! Import Your Own Weather Data File Locations into the Chart!**
- **NEW! Optional Process Directional Arrowheads on Process Lines!**
- **NEW! Ability to Print-All or PDF-All (Psy+Flow+Report) into ONE File!**
- **NEW! Cooling Coil Apparatus Dew Point (ADP) Calculator!**
- **NEW! Cooling Coil Air Bypass Factor (ABF) Calculator!**
- **NEW! Improved Air Mixing Algorithm with both Mass and Energy Balance!**
- **NEW! User Program Quantity Expanded from 15 to 25 Programs!**

NEW TOOLS

- **NEW! Evaporative Cooling Detailed Performance Calculator!**
- **NEW! Electric Heater Detailed Performance Calculator!**
- **NEW! Indoor Pool Evaporation Calculator!**
- **NEW! SMACNA Air Leak Class Calculator!**
- **NEW! Center of Gravity - Corner Load Calculator!**
- **NEW! Pump Law Calculator!**
- **NEW! Complete Inter-Active Element Periodic Chart!**
- **NEW! System Efficiency COP-EER-kW/ton Calculator!**
- **NEW! Total & Sensible Wheel Energy Recovery Performance Calculator!**
- **NEW! Plate Heat Exchanger Energy Recovery Performance Calculator!**
- **NEW! Fluid & Mixture Thermo-Physical Property Calculator!**
- **NEW! Rectangle & Round Duct Fittings added to HDDuctDesigner!**
- **NEW! Duct Temp Gain/Loss Calculator added to HDDuctDesigner!**
- **NEW! Duct Pitot Airflow Calculator added to HDDuctDesigner!**

NEW PRESENTATION CONTROL

- **NEW! Ability to Turn Logo On & Off, for ASHRAE Meeting “Generic” Presentations!**
- **NEW! Customize Psychrometric Charts with your own Colors!**

- **NEW! Change Any Chart Property Lines to Any COLOR You Choose!**
- **NEW! Change Any Chart Property Lines to Any Line TYPE You Choose!**
- **NEW! Change Any Chart Property Lines to Any Line THICKNESS You Choose!**
- **NEW! Improved Toolbar and Menu Control Setup!**
- **NEW! User-Defined Custom Area Shading right on the Chart!**
- **NEW! Updated ASHRAE 2010 Comfort Zones!**
- **NEW! Optional Process Directional Arrowheads on Process Lines!**
- **NEW! Ability to Hide State Point Label on a Point-By-Point basis!!**
- **NEW! Draw Your Own Lines Anywhere You Want!**
- **NEW! Draw Your Own Ellipses Anywhere You Want!**
- **NEW! Draw Your Own Rectangles Anywhere You Want!**
- **NEW! Draw Your Own Circles Anywhere You Want!**
- **NEW! Insert Your Own Pictures Anywhere You Want!**

NEW LANGUAGES

- **NEW! Languages, Now with (19) Different Languages on Charts and Reports with one button click!**
- **NEW! Croatia Language!**
- **NEW! Czech Language!**
- **NEW! Finish Language!**
- **NEW! Latin Language!**
- **NEW! Polish Language!**
- **NEW! Turkish Language!**

NEW DATA EXCHANGE

- **NEW Point Color Control when Importing Data from Excel (*.csv) files!**
- **NEW Point Size Control when Importing Data from Excel (*.csv) files!**
- **NEW Process Line Color Control when Importing Data from Excel (*.csv) files!**
- **NEW Process Line Thickness Control when Importing Data from Excel (*.csv) files!**
- **NEW! Import Your Own Weather Data File Locations into the Chart!**

NEW NOTES

- **NEW! Improved Note Controls!**

GENERAL IMPROVEMENTS

- **NEW! Added Apparatus Dew Point (ADP) to Cooling Coil Leaving Air Calculator!**
- **NEW! Added Air Bypass Factor (ABF) to Cooling Coil Leaving Air Calculator!**
- **NEW! Point property toolbar display now includes units of measure!**
- **NEW! Thermal Comfort Terms Definition PDF Manual!**
- **NEW! Improved Air Density Property Calculation!**

- NEW! Many minor bugs and improvements implemented!

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 <=> 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 $\Leftrightarrow$ 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 inquiries 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

V7 Registration

Version 7 requires a registration code for EACH Seat, (1) Seat is licensed per CD, unless you have purchased a site license.

Psychrometric Analysis Suite
Release 7.0.0
Registration is **REQUIRED** for Version 7
** 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:

Complete Form and Fax or Email to Receive Registration Code

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

[Register Later](#)

[End without Registering](#)

REGISTRATION CODE REQUEST

Print / Fax **E-Mail** **Close**

email or fax to 405.844.6314

Installation Code: 12405.99

Version: ASHRAE Psychrometric Chart

Version Type: Professional Edition

Release: 7.0.0

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 - PsyChart 1

File Edit Analysis Notes Tools View Language Settings Register Now Help

Psychrometric Analysis

email or fax to 405.844.6314

Your Name:

Company:

Version:

Address 1:

Address 2:

City:

State/Prov.:

Postal Code:

Country:

Phone:

Fax:

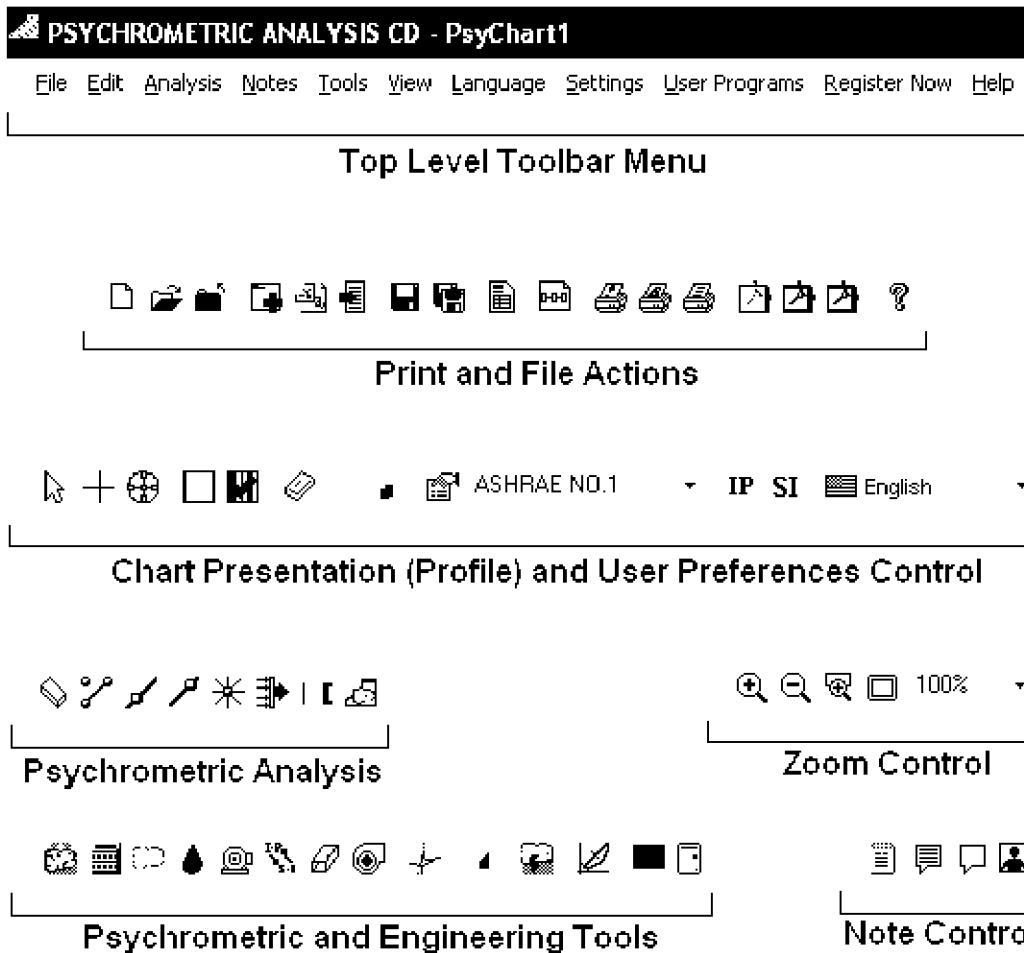
E-Mail:



MENUS AND TOOLBARS

Menus and Toolbars

You can access the Psychrometric Analysis services via a standard Windows menu and tool bar 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.

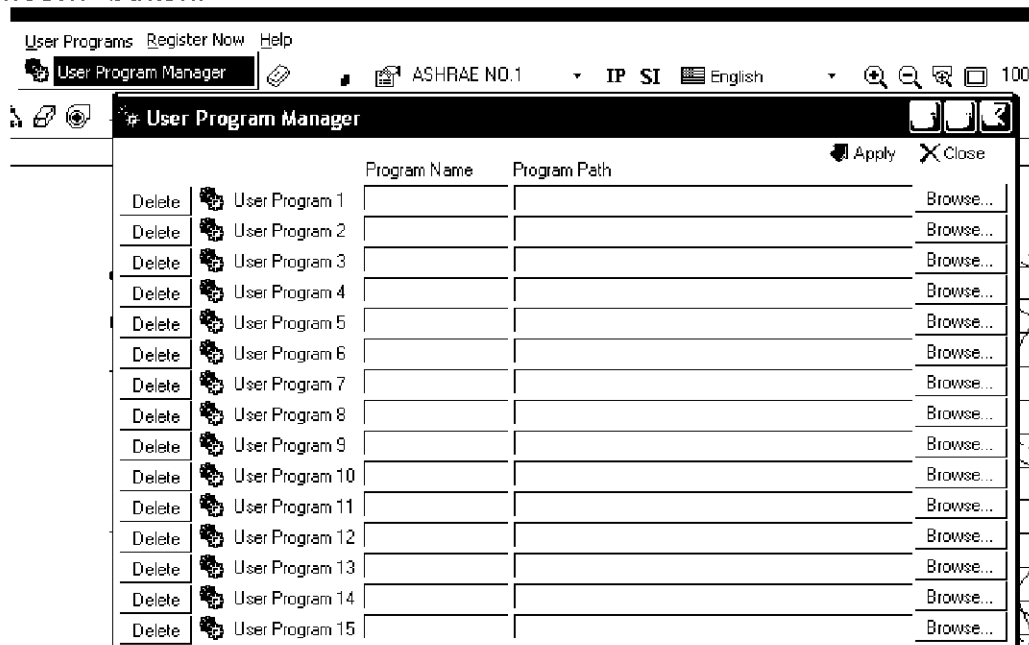


DB
 96.8
 WB
 69.1
 RH
 24.2
 W
 .0090
 v
 14.23
 h
 33.06
 DP
 54.2
 d
 0.0703
 vp
 0.423
 AWW
 4.405
 X
 7.692
 Y
 5.660

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, simply 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!!

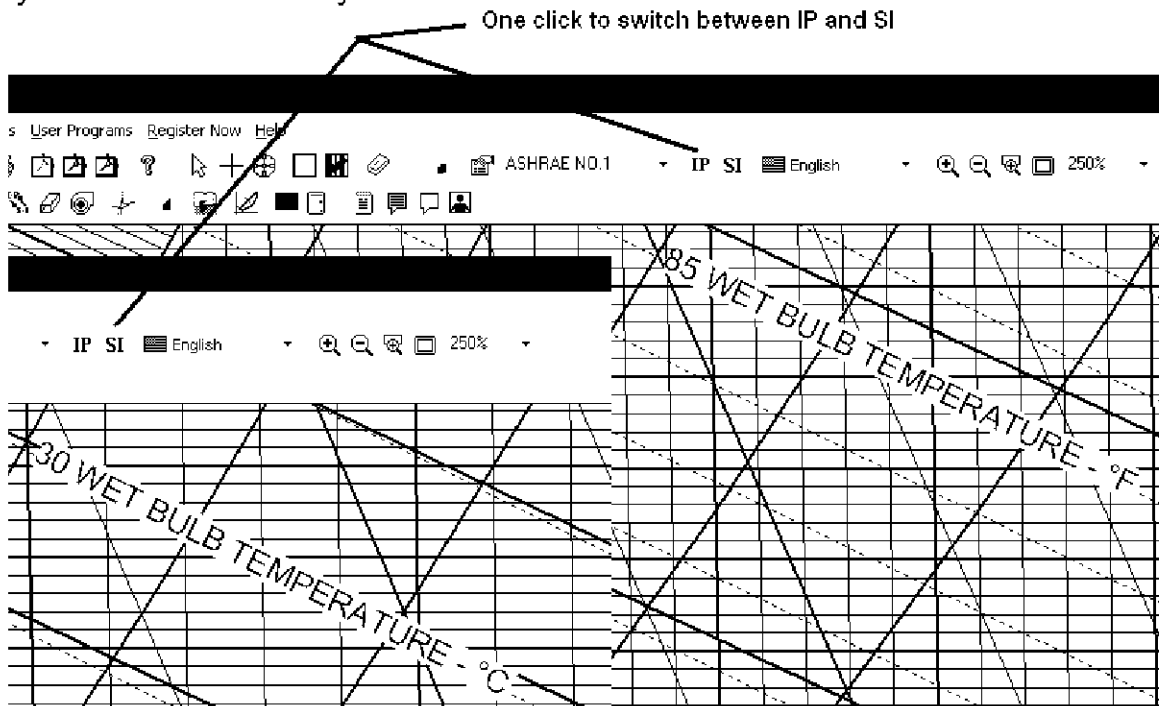
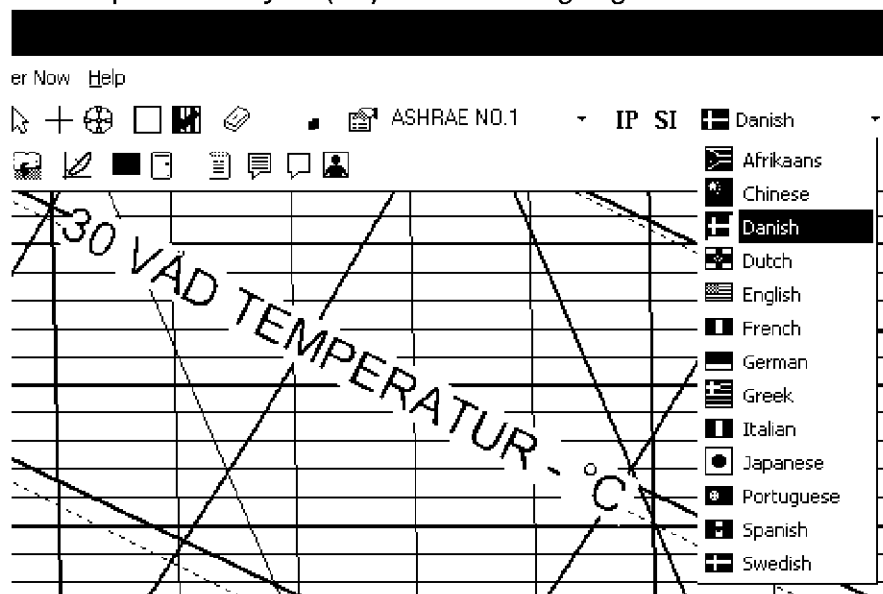


CHART & REPORT LANGUAGE CONTROL

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!

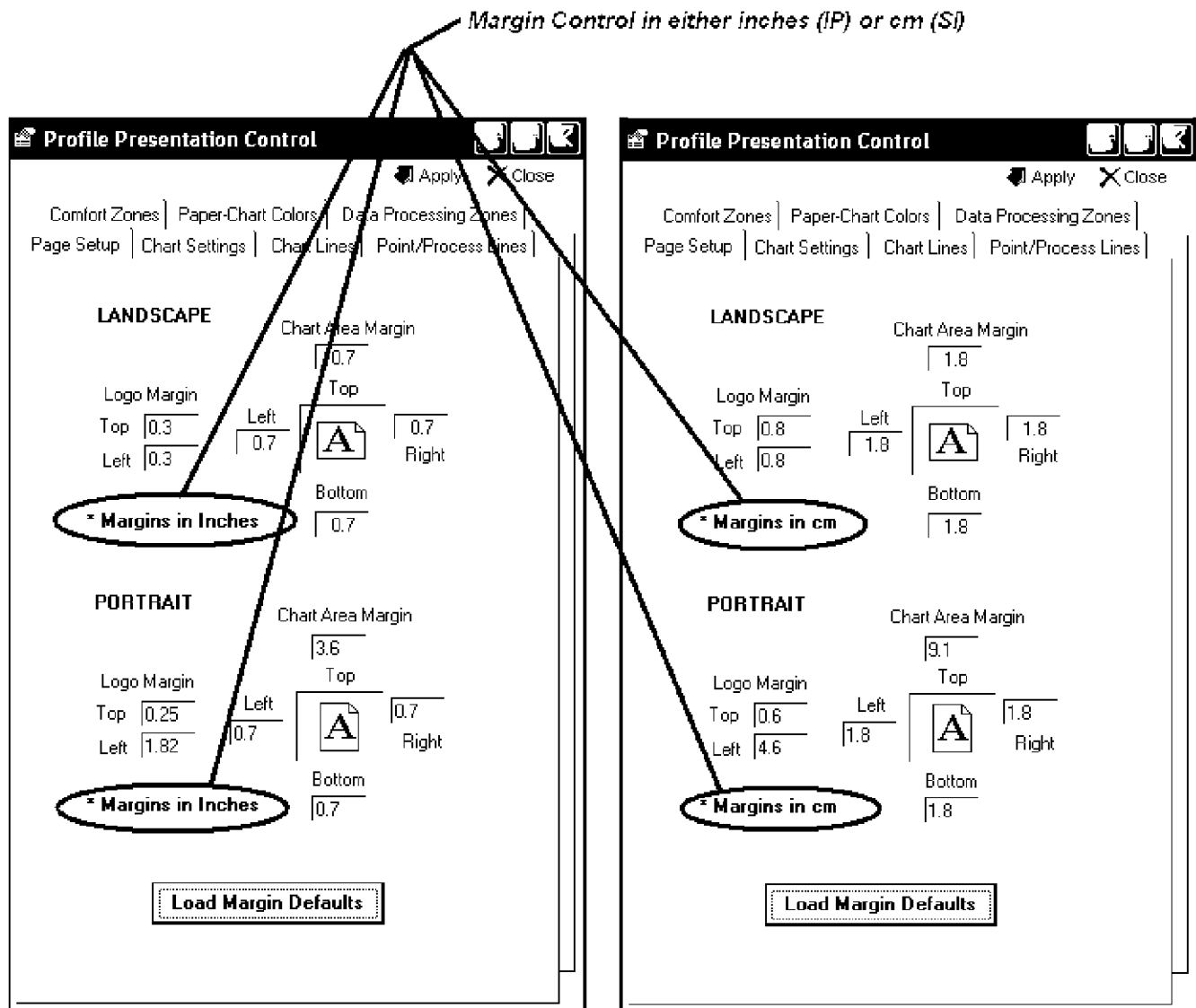


CHART AXIS RANGE CONTROL

Complete Dry-Bulb and Humidity Ratio Range Control!!

☒ Use Custom Axis

Minimum Dry-Bulb Temp: 32 °F
Maximum Dry-Bulb Temp: 120 °F
Maximum Humidity Ratio: 0.0300 lb/lb

Load Axis Range Defaults

☒ Use Custom Axis

Minimum Dry-Bulb Temp: 0 °C
Maximum Dry-Bulb Temp: 50 °C
Maximum Humidity Ratio: 0.0300 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)

29.921 Barometric
Altitude
Barometric
Atmospheric

☒ Use Custom Altitude (kPA)

101.325 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	☒	☒
	Wet Bulb	☒	☒
	Humidity Ratio	☒	☒
	Specific Volume	☒	☒
	Enthalpy	☒	
	Relative Humidity	☒	
	Extended Enthalpy	☒	
	Perimeter Enthalpy	☒	
	SHR Index	☒	
	Dew Point	☒	
	Vapor Pressure	☒	
	Cooling Coil Lines	☒	
	Chart Perimeter Outline	☒	
☒ Check ALL		☐ Un-Check ALL	

HUMIDITY RATIO UNIT CONTROL

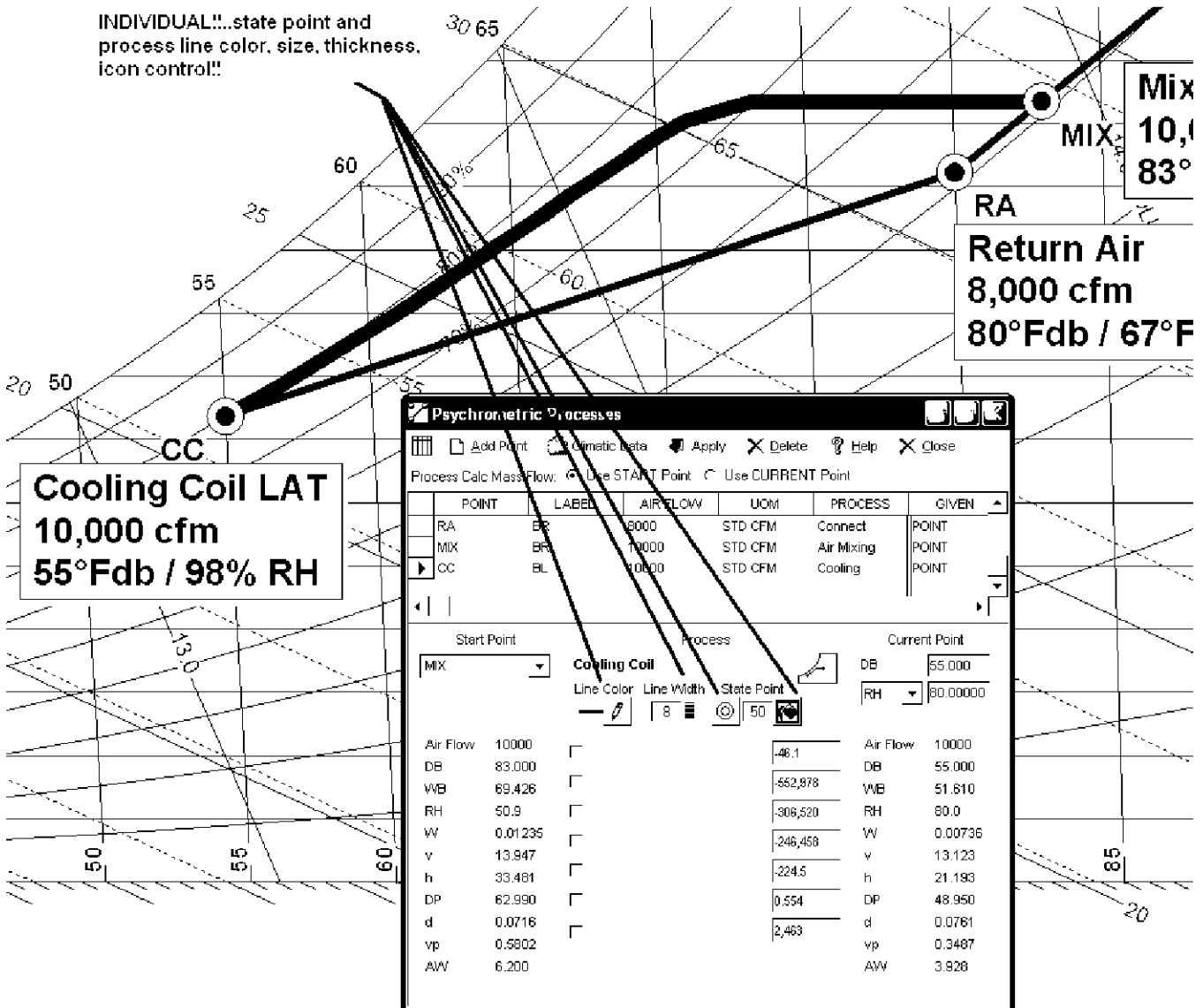
Complete Humidity Ratio Unit of Measure Control!!

Humidity Ratio Units

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

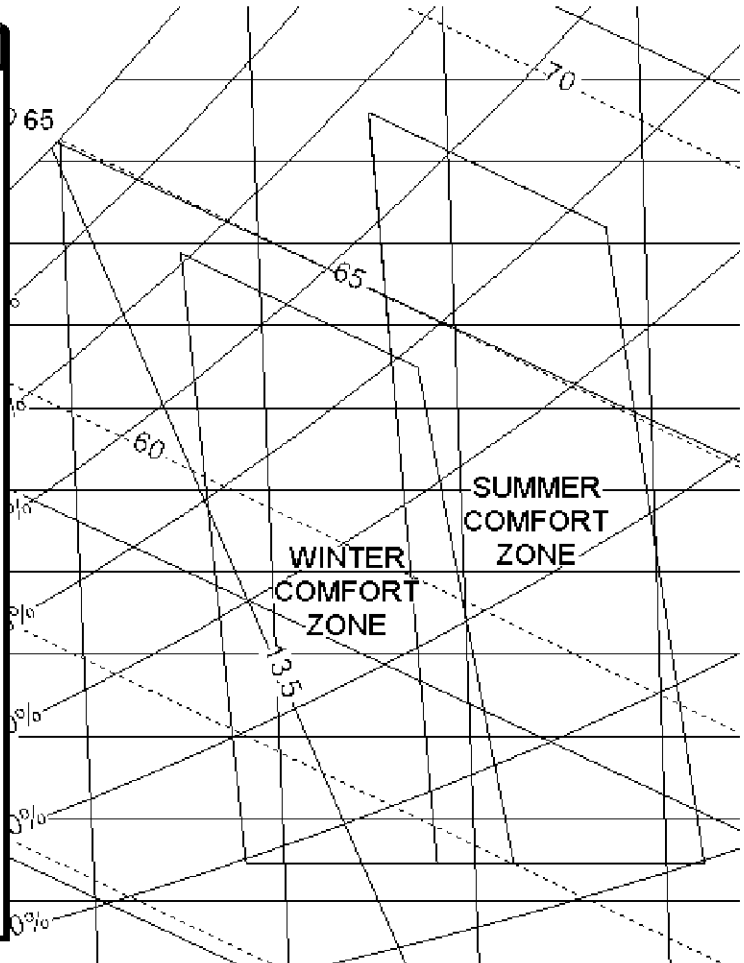
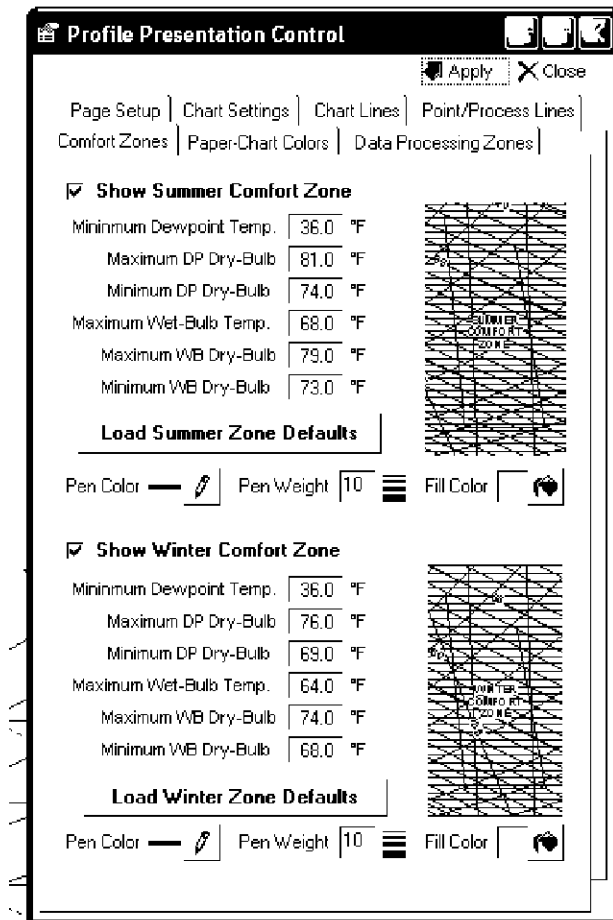
PROCESS LINE & STATE POINT COLOR & SIZE CONTROL

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



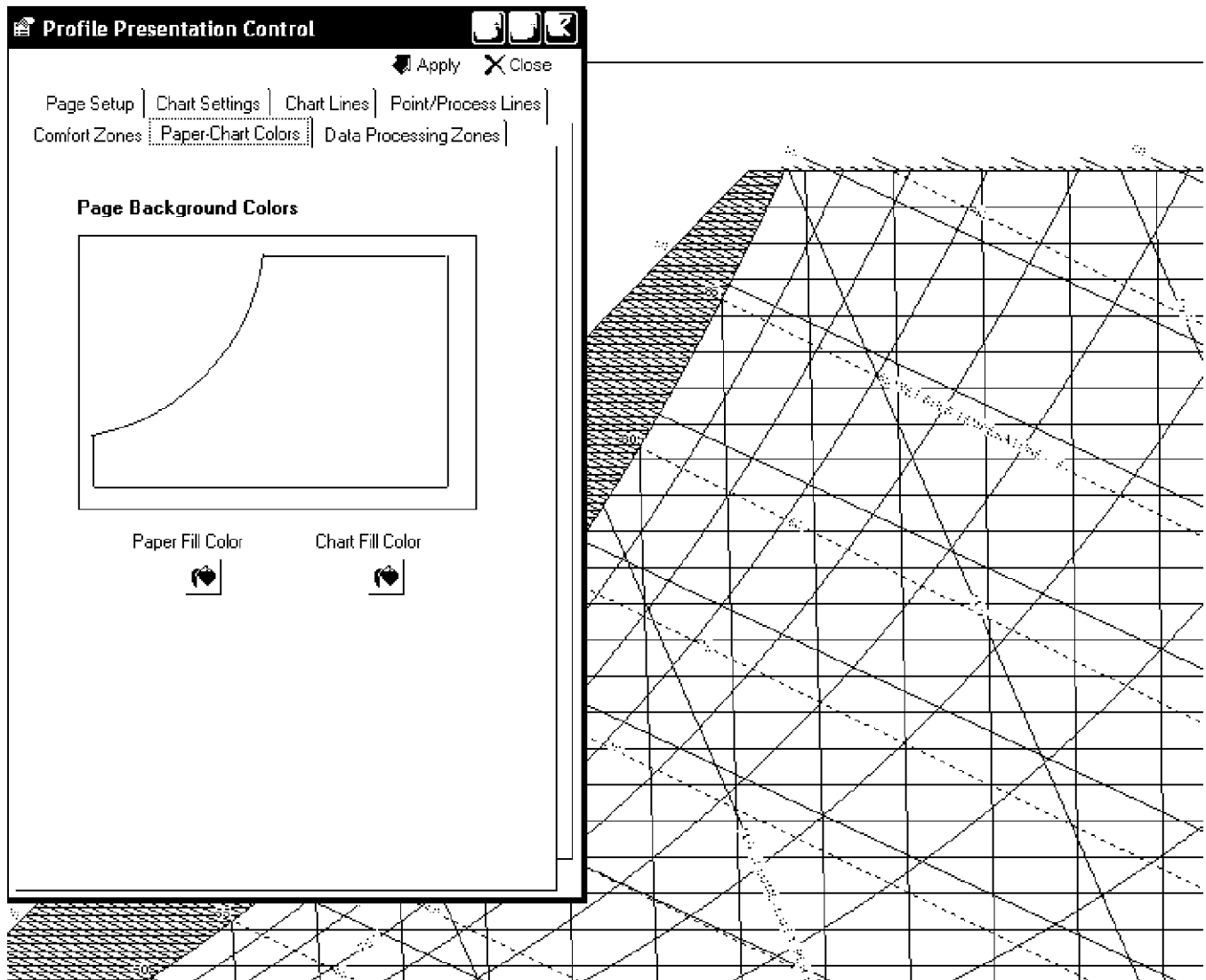
SUMMER & WINTER COMFORT ZONE CONTROL

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!!



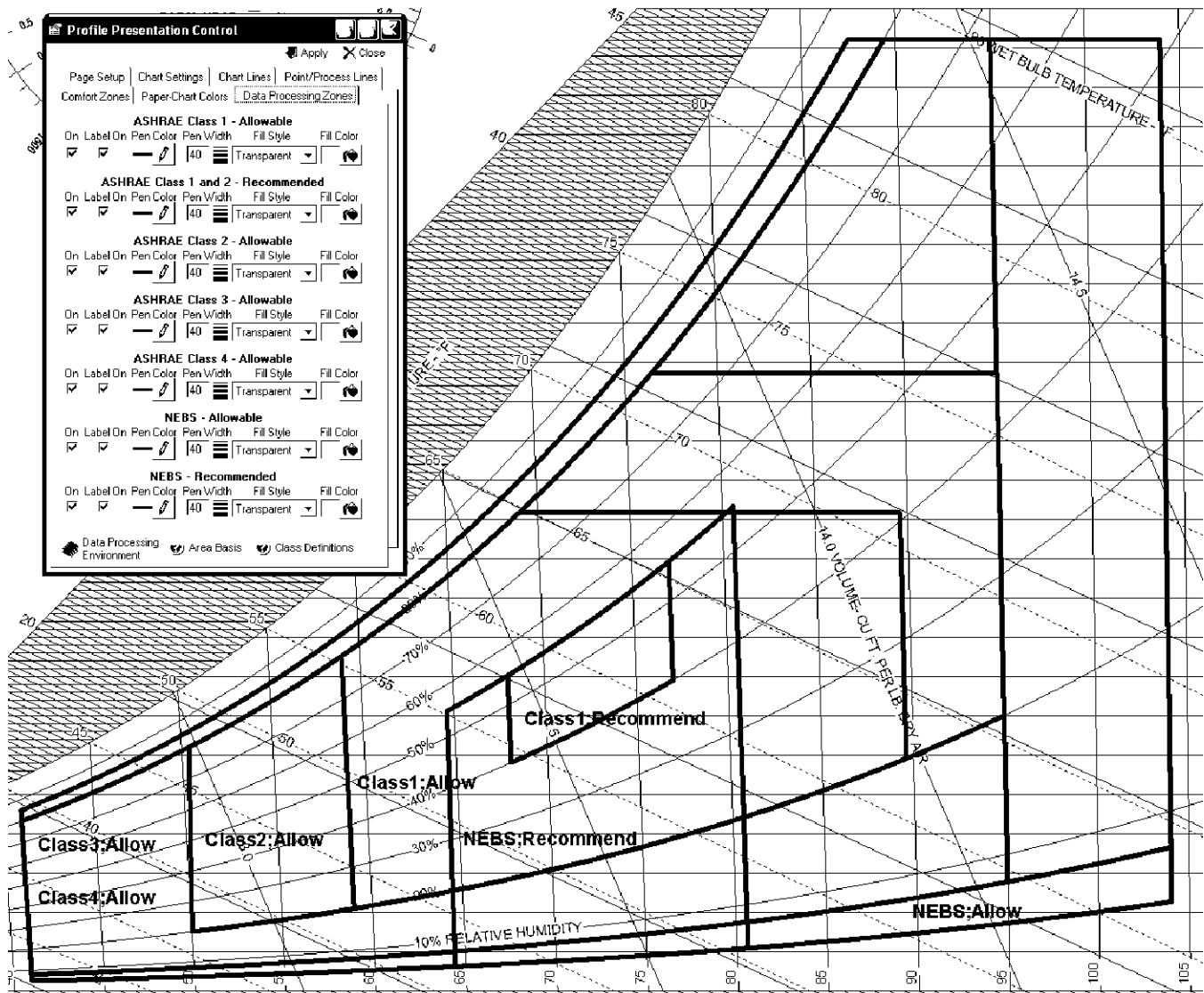
PAPER & CHART AREA COLOR CONTROL

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



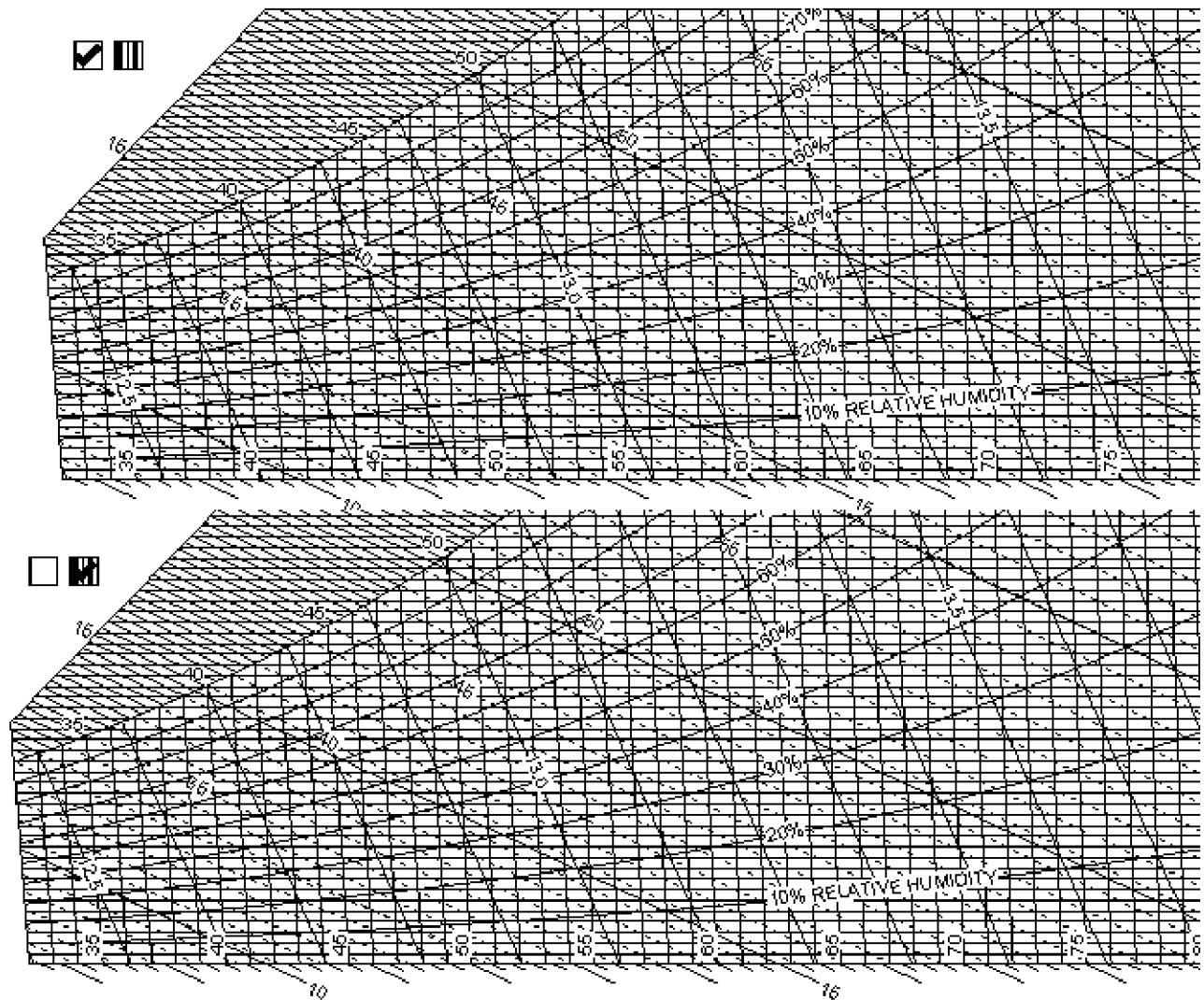
DATA PROCESSING ENVIRONMENT AREA DISPLAY CONTROL

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!!



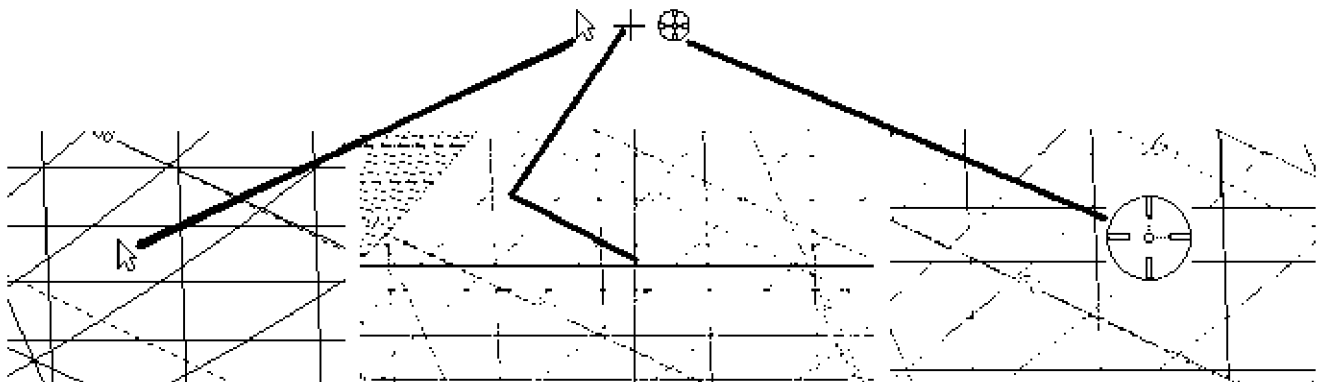
COLOR OR B&W CHART CONTROL

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!!!

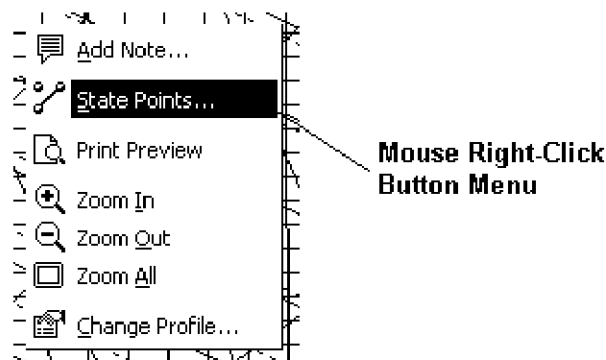
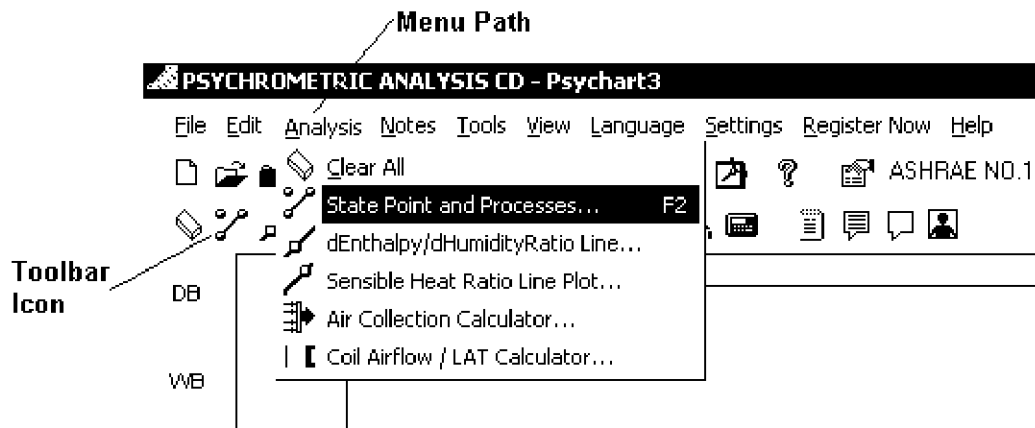




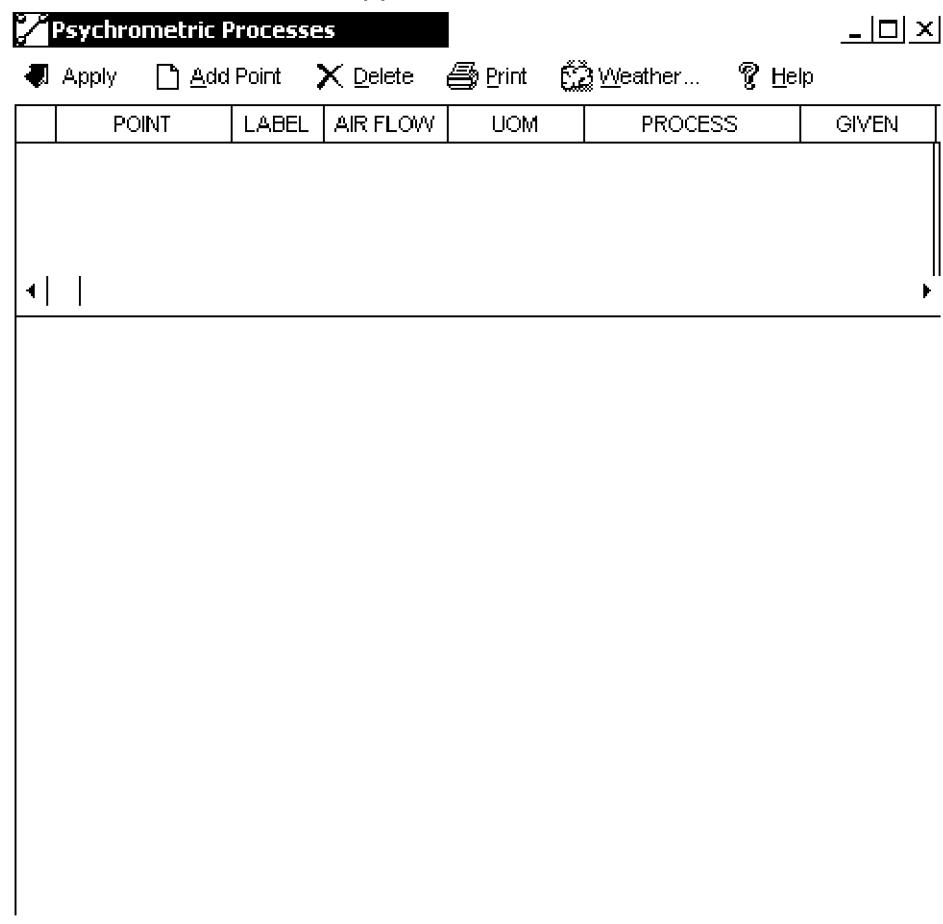
PSYCHROMETRIC ANALYSIS

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.



The screenshot shows the 'Psychrometric Processes' window. It has a title bar with standard window controls. Below the title bar is a menu bar with the following items: Apply, Add Point, Delete, Print, Weather..., and Help. The main area of the window contains a table with the following columns: POINT, LABEL, AIR FLOW, UOM, PROCESS, and GIVEN. The table is currently empty, with only the first row visible. There are scroll bars on the right and bottom of the table area.

POINT	LABEL	AIR FLOW	UOM	PROCESS	GIVEN

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.

Psychrometric Processes

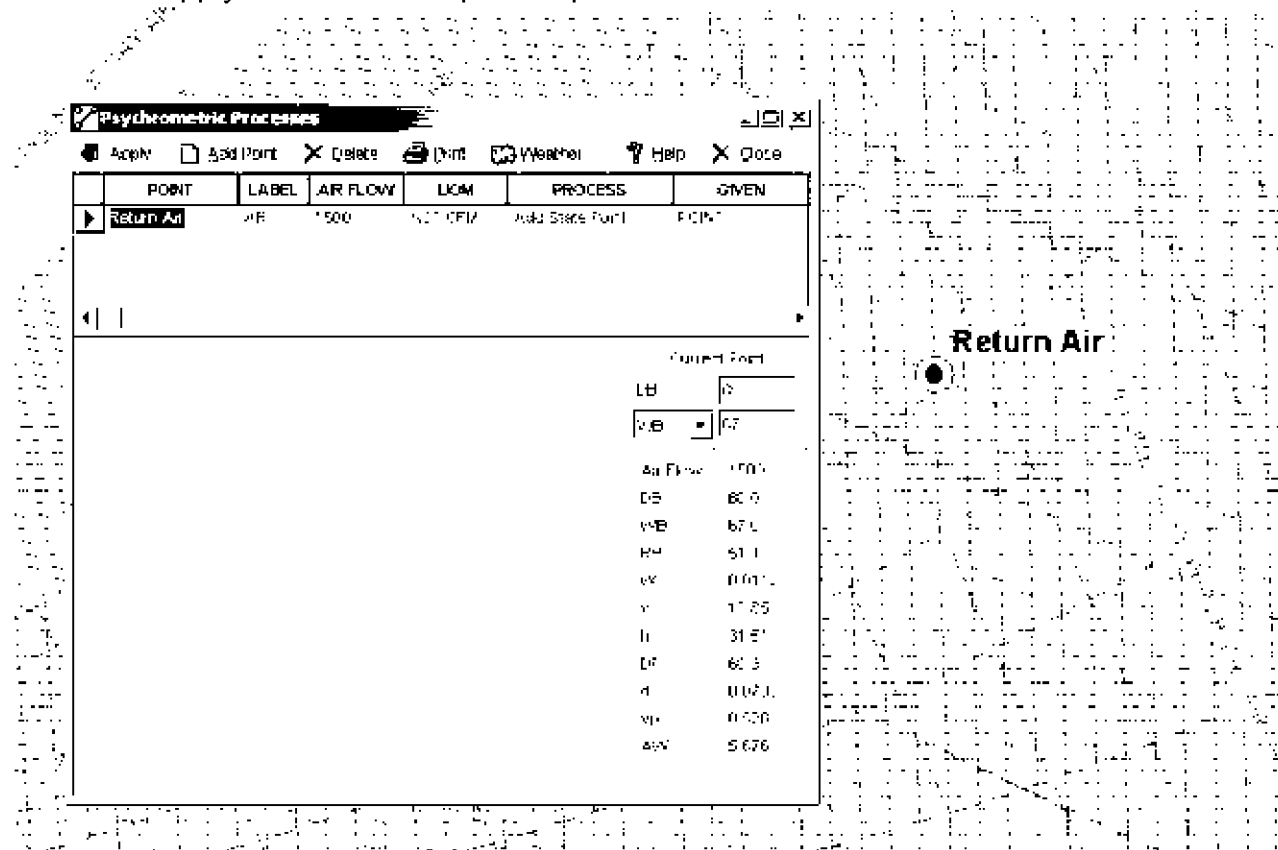
Apply Add Point Delete Print Weather... Help Close

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

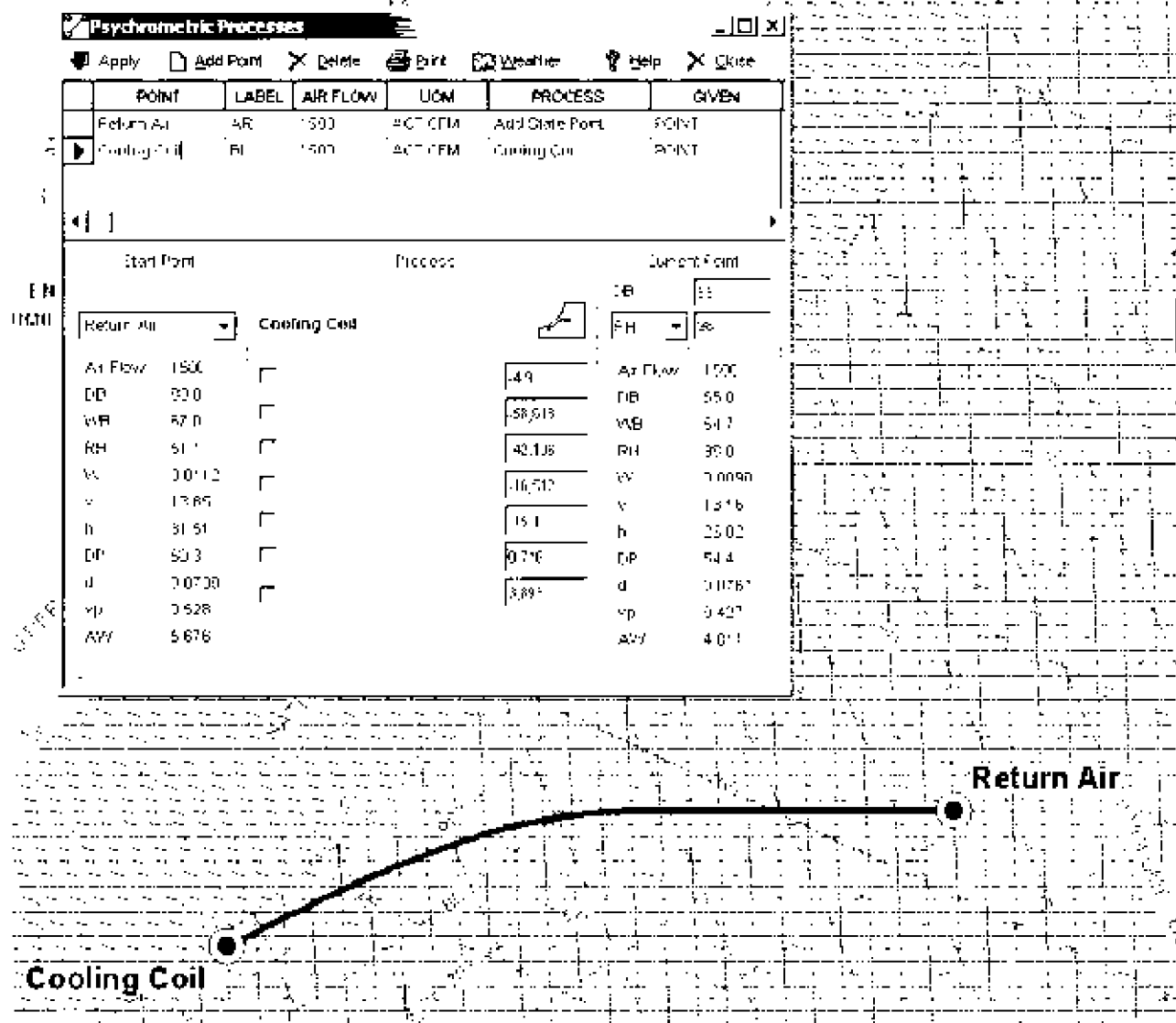
Current Point

DB	80
WB	67
Air Flow	1500
DB	80.0
WB	67.0
RH	51.1
WV	0.0112
v	13.85
h	31.51
DP	60.3
d	0.0730
vp	0.528
AW	5.676

- 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.

Psychrometric Processes

Apply
 Add Point
 Delete
 Print
 Weather...
 Help
 Close

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

◀ | | ▶

Current Point

DB

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%).

Design Data - ASHRAE 1999

Country: [USA] State: [California] City: [Los Angeles] Elevation: [1000] Feet Switch: [Off]

Latitude: [34.0] North Longitude: [118.2] West

Altitude: [1000] Feet

Summer Cooling

Design Condition: [0.4%] Design Temperature: [80.0] °F Design Humidity Ratio: [0.010] Design Enthalpy: [28.0] Btu/lb

Design Wet Bulb Temperature: [68.0] °F Design Dry Bulb Temperature: [80.0] °F

Winter Heating

Design Condition: [99.6%] Design Temperature: [65.0] °F Design Humidity Ratio: [0.010] Design Enthalpy: [28.0] Btu/lb

Design Wet Bulb Temperature: [68.0] °F Design Dry Bulb Temperature: [80.0] °F

Design Data

Design Condition: [0.4%] Design Temperature: [80.0] °F Design Humidity Ratio: [0.010] Design Enthalpy: [28.0] Btu/lb

Design Wet Bulb Temperature: [68.0] °F Design Dry Bulb Temperature: [80.0] °F

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.

Climatic Data - ASHRAE 1999 Parameters

Location: City: State: Country:

Altitude: m (ft)

Latitude: N (S)

Longitude: W (E)

SUMMER COOLING

Load Type	Unit	Value
Sensible	W	1000
Latent	W	2000
Total	W	3000

Coil Type	Unit	Value
Sensible	W	1000
Latent	W	2000
Total	W	3000

WINTER HEATING

Load Type	Unit	Value
Sensible	W	1000
Latent	W	2000
Total	W	3000

Coil Type	Unit	Value
Sensible	W	1000
Latent	W	2000
Total	W	3000

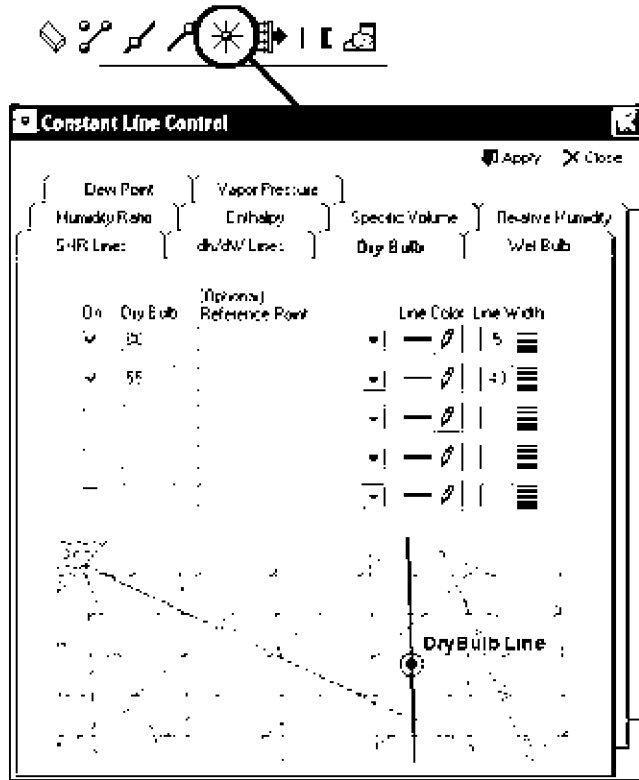
VAPOR

Load Type	Unit	Value
Sensible	W	1000
Latent	W	2000
Total	W	3000

Buttons:

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!!



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!!!

The screenshot displays the HDPsyChart software interface. The main window shows a psychrometric chart with a grid of lines representing various weather parameters. Overlaid on the chart are three dialog boxes for configuring weather data presentation.

Weather Data File.txt - Notepad

```

Country: USA
State: FL
City: MIAMI
Altitude: 6 ft.
Month,Day,Hour,Dry Bulb,Wet Bulb,Dew Point,Humidity Ratio,Enthalpy,Density
°F,°F,°F,gr/lb,gr/lb,gr/lb,lb/cu.ft.,in. HG,cu.ft./lb.
January,1,12AM to 1AM,68.0,62.2,59.0,74.9,27.99,0.0738,0.50,13.53
January,1,1AM to 2AM,69.1,63.3,60.1,77.8,28.72,0.0736,0.52,13.57
January,1,2AM to 3AM,68.0,62.9,60.1,77.8,28.45,0.0738,0.52,13.54
January,1,3AM to 4AM,69.1,63.8,61.0,80.4,29.12,0.0736,0.54,13.57
January,1,4AM to 5AM,68.0,64.7,63.0,86.4,29.78,0.0736,0.58,13.56
January,1,5AM to 6AM,66.9,65.0,64.0,89.8,30.05,0.0737,0.60,13.55
January,1,6AM to 7AM,66.9,65.6,64.9,92.7,30.51,0.0737,0.62,13.56
January,1,7AM to 8AM,66.9,65.6,64.9,92.7,30.51,0.0737,0.62,13.56
  
```

Weather Data Dialog Box

Location: Country: USA, State: FLORIDA, City: Miami

Weather Plot Style: ☒ Data Plot, ☐ Bin Plot, ☐ Data Table

Months to Plot: ☒ January, ☒ February, ☒ March, ☒ April, ☒ May, ☒ June

Weather Plot Style: ☐ None, ☒ Data Plot, ☐ Bin Plot, ☐ Data Table

Months to Plot: ☒ January, ☒ February, ☒ March, ☒ April, ☒ May, ☒ June

Hours to Plot: ☒ 01, ☒ 02, ☒ 03, ☒ 04, ☒ 05, ☒ 06, ☒ 07, ☒ 08, ☒ 09, ☒ 10, ☒ 11, ☒ 12, ☒ 13, ☒ 14, ☒ 15, ☒ 16, ☒ 17, ☒ 18, ☒ 19, ☒ 20, ☒ 21, ☒ 22, ☒ 23, ☒ 24

Total Hours Selected: 8760

Weather Data Dialog Box

Location: Country: USA, State: FLORIDA, City: Miami

Weather Plot Style: ☐ None, ☒ Data Plot, ☐ Bin Plot, ☐ Data Table

Months to Plot: ☒ January, ☒ February, ☒ March, ☒ April, ☒ May, ☒ June

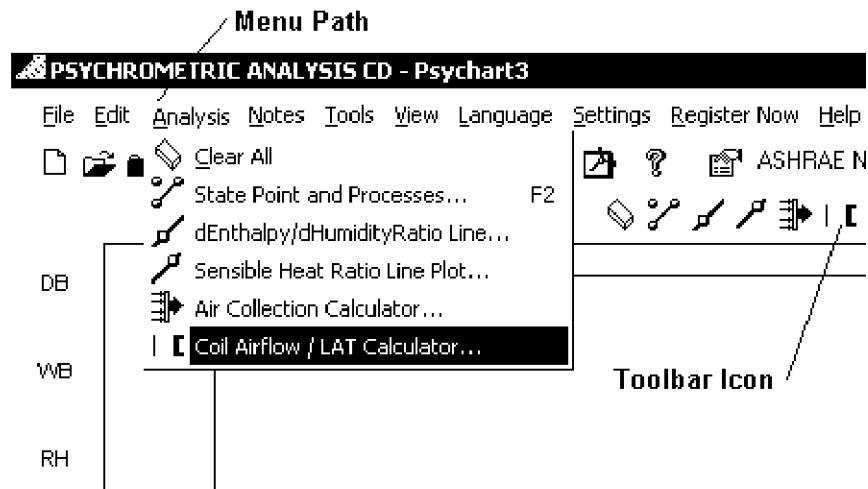
Hours to Plot: ☒ 01, ☒ 02, ☒ 03, ☒ 04, ☒ 05, ☒ 06, ☒ 07, ☒ 08, ☒ 09, ☒ 10, ☒ 11, ☒ 12, ☒ 13, ☒ 14, ☒ 15, ☒ 16, ☒ 17, ☒ 18, ☒ 19, ☒ 20, ☒ 21, ☒ 22, ☒ 23, ☒ 24

Total Hours Selected: 8760

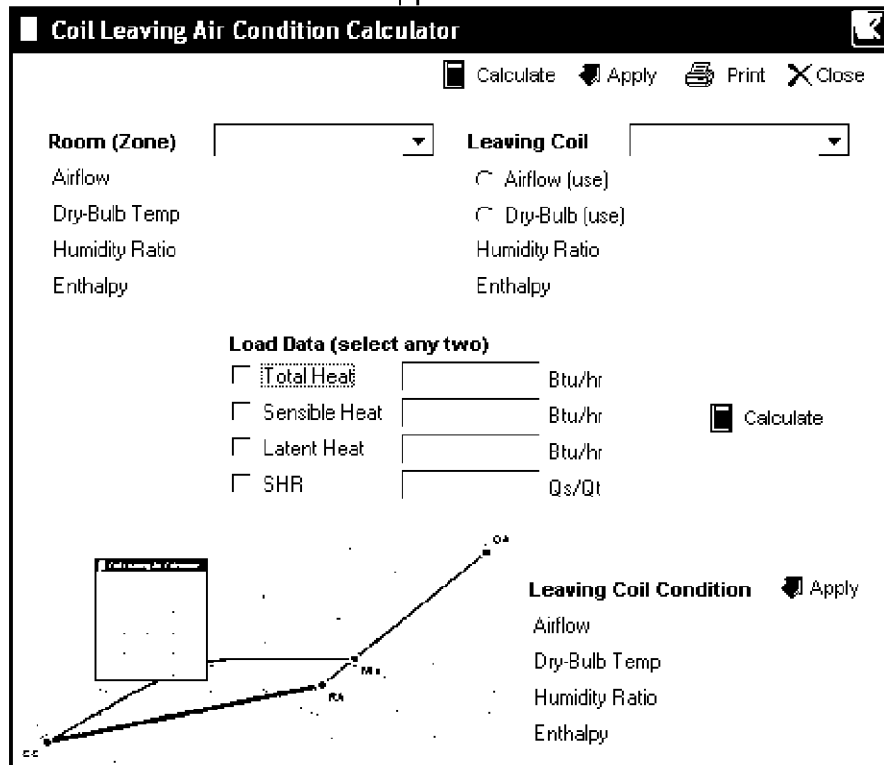
COIL LEAVING AIR CALCULATOR

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

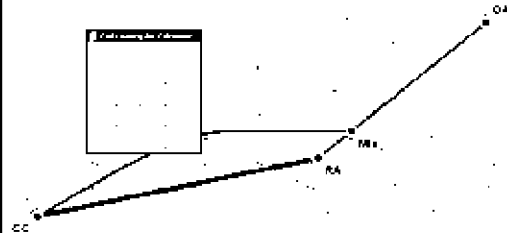
Calculate Apply Print Close

Room (Zone)	RA	Leaving Coil	CC
Airflow	8.000 SCFM	Airflow (use)	10.000 SCFM
Dry-Bulb Temp	80.00 °F	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

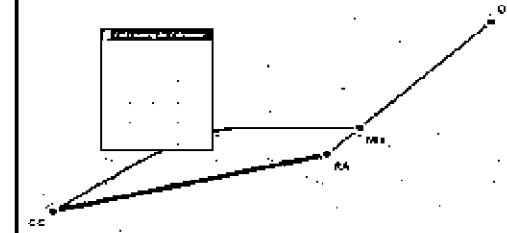
Calculate Apply Print Close

Room (Zone)	RA	Leaving Coil	CC
Airflow	8.000 SCFM	Airflow (use)	10.000 SCFM
Dry-Bulb Temp	80.00 °F	☒ 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)	RA	Leaving Coil	CC
Airflow	8,000 SCFM	☒ Airflow (use)	10,000 SCFM
Dry-Bulb Temp	80.00 °F	☐ Dry-Bulb (use)	55.00 °F
Humidity Ratio	0.01123 lb/lb		0.00736 lb/lb
Enthalpy	31.51 Btu/lb		21.19 Btu/lb

Load Data (select any two)

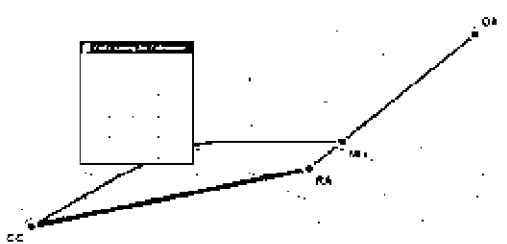
☐ Total Heat Btu/hr

☐ Sensible Heat Btu/hr

☐ Latent Heat Btu/hr

☐ SHR Qs/Qt

Calculate



Leaving Coil Condition Apply

Airflow 10,000 SCFM

Dry-Bulb Temp 55.00 °F

Humidity Ratio 0.00736 lb/lb

Enthalpy 21.19 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)	RA	Leaving Coil	CC
Airflow	8,000 SCFM	☐ Airflow (use)	10,000 SCFM
Dry-Bulb Temp	80.00 °F	☒ Dry-Bulb (use)	55.00 °F
Humidity Ratio	0.01123 lb/lb		0.00736 lb/lb
Enthalpy	31.51 Btu/lb		21.19 Btu/lb

Load Data (select any two)

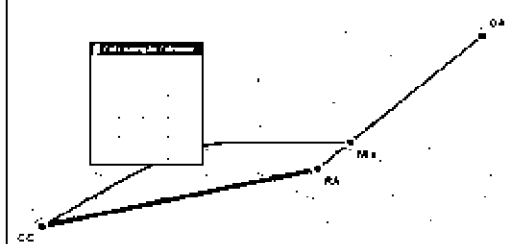
☐ Total Heat Btu/hr

☒ Sensible Heat Btu/hr

☐ Latent Heat Btu/hr

☒ SHR Qs/Qt

Calculate



Leaving Coil Condition Apply

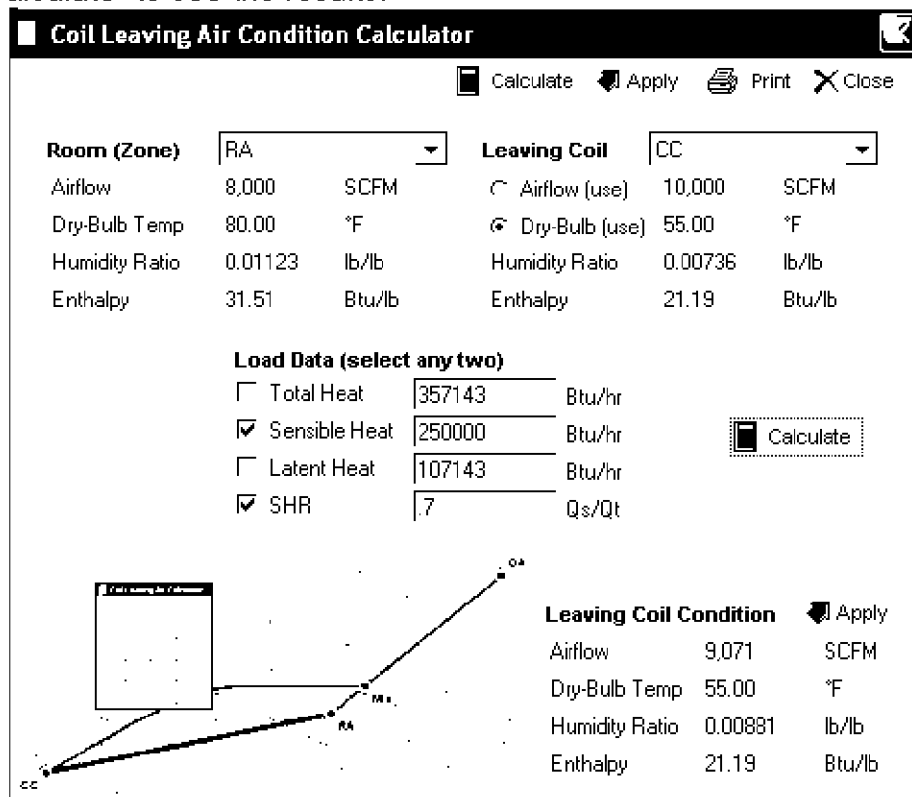
Airflow 10,000 SCFM

Dry-Bulb Temp 55.00 °F

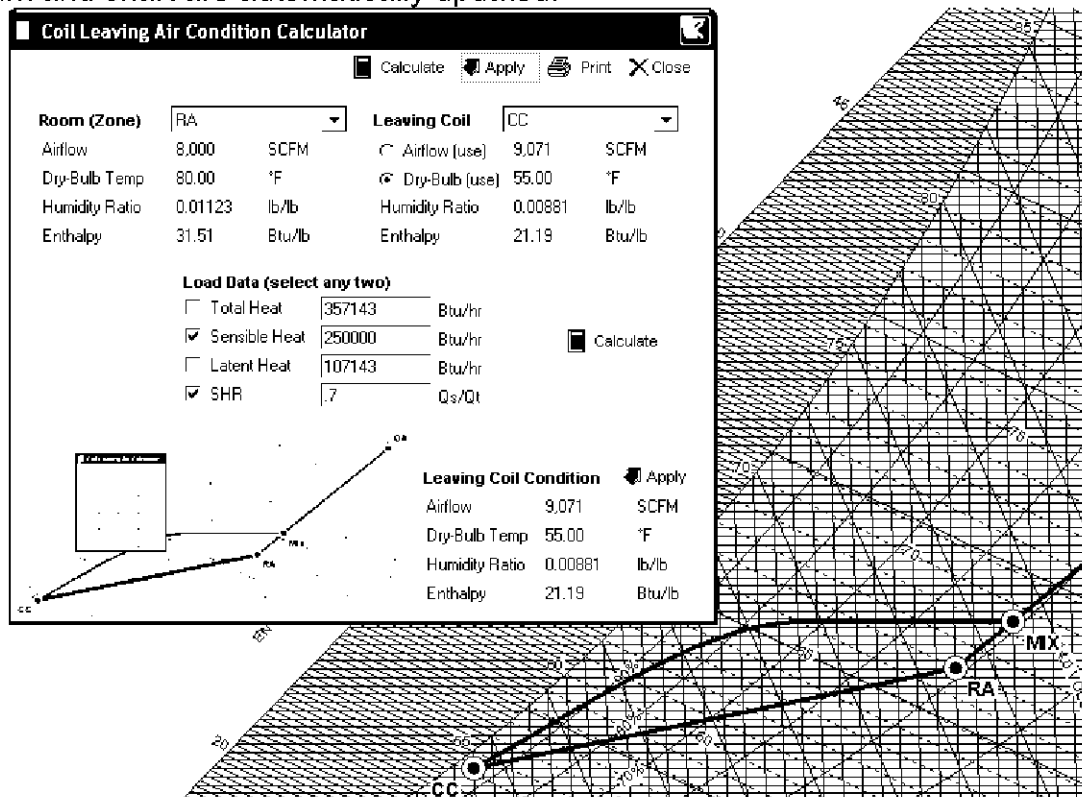
Humidity Ratio 0.00736 lb/lb

Enthalpy 21.19 Btu/lb

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

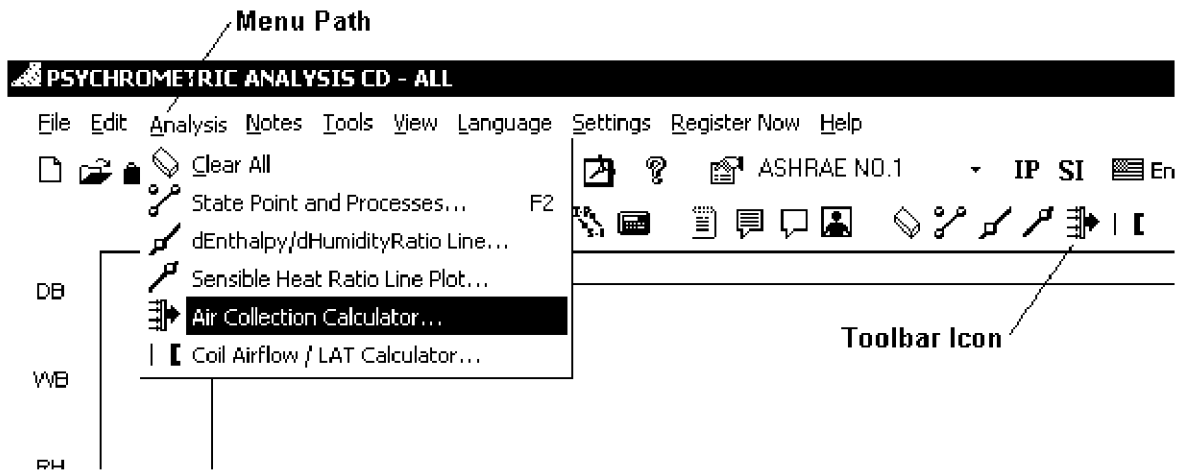


9. To Update the Coil LAT point created with the calculated result, simply click “Apply” on the menu and the point and chart are automatically updated.



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

X

Selected Point 1 ▼
 Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Selected Point 2 ▼
 Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Selected Point 3 ▼
 Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Selected Point 4 ▼
 Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Selected Point 5 ▼
 Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Print
 Close

Apply Point to Chart

Collection Point

Airflow
 Dry-Bulb Temp
 Humidity Ratio
 Enthalpy

Calculate =>

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 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	26.74	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 Point Label Here...

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

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

✕

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	26.74	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

🖨️ Print
✕ Close

➡️ Apply Point to Chart

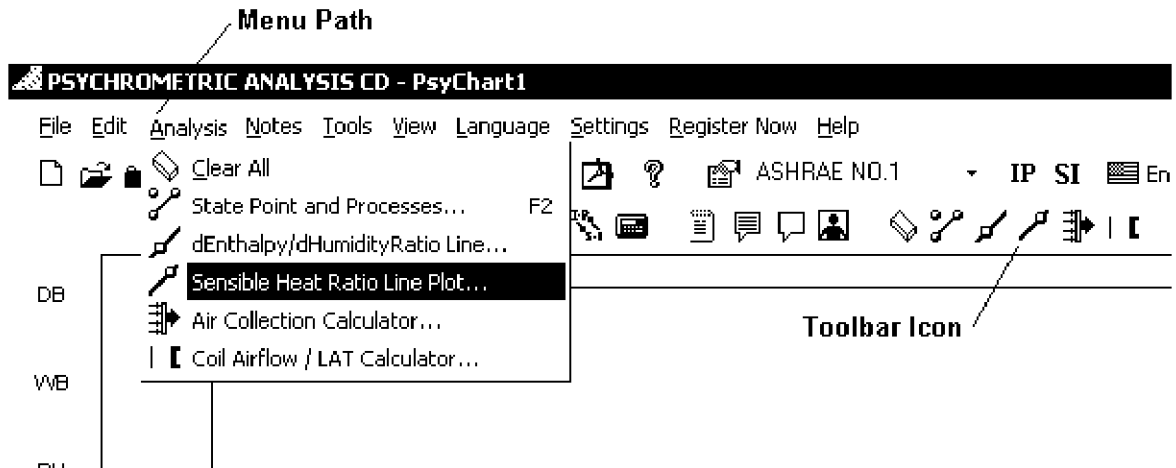
☒ Calculate =>

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

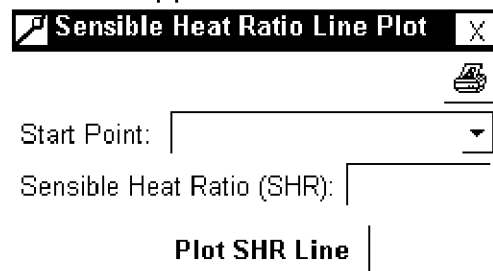
SENSIBLE HEAT RATIO LINE PLOTTING

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.



4. 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.

 **Sensible Heat Ratio Line Plot** X

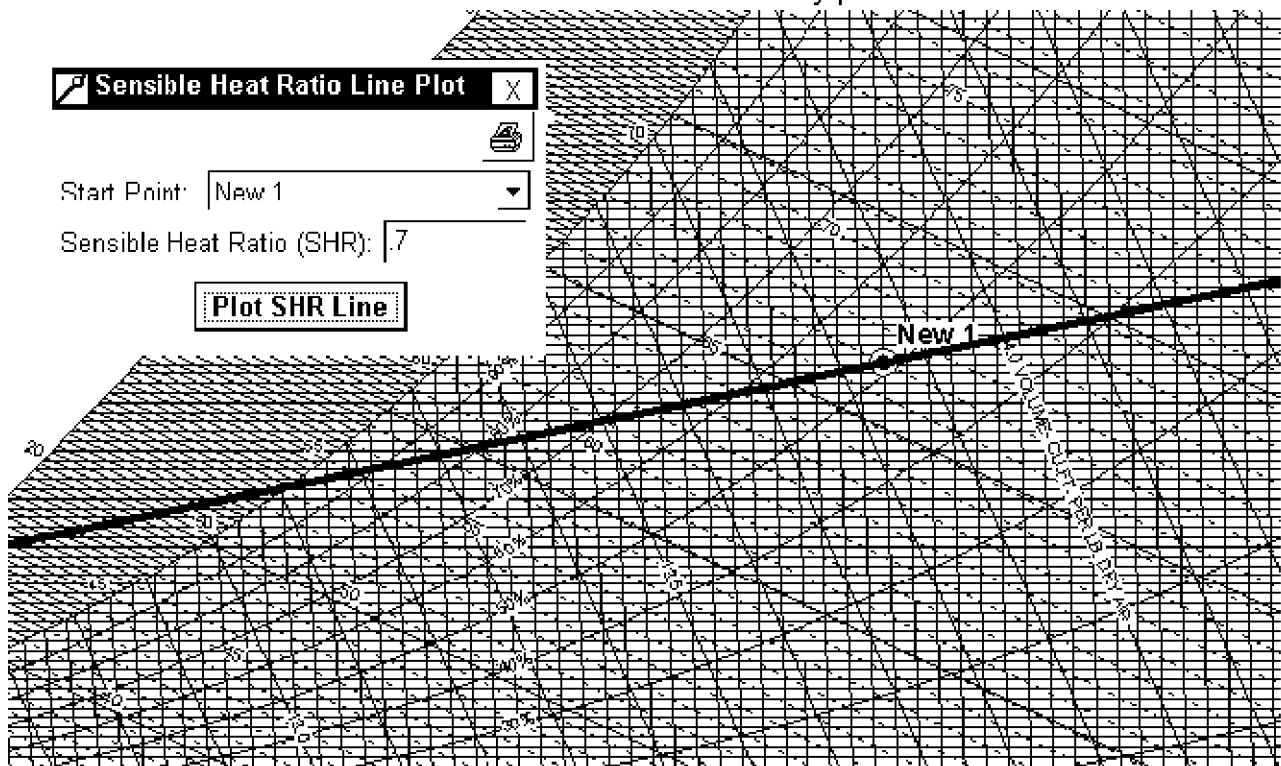


Start Point: New 1

Sensible Heat Ratio (SHR): .7

Plot SHR Line

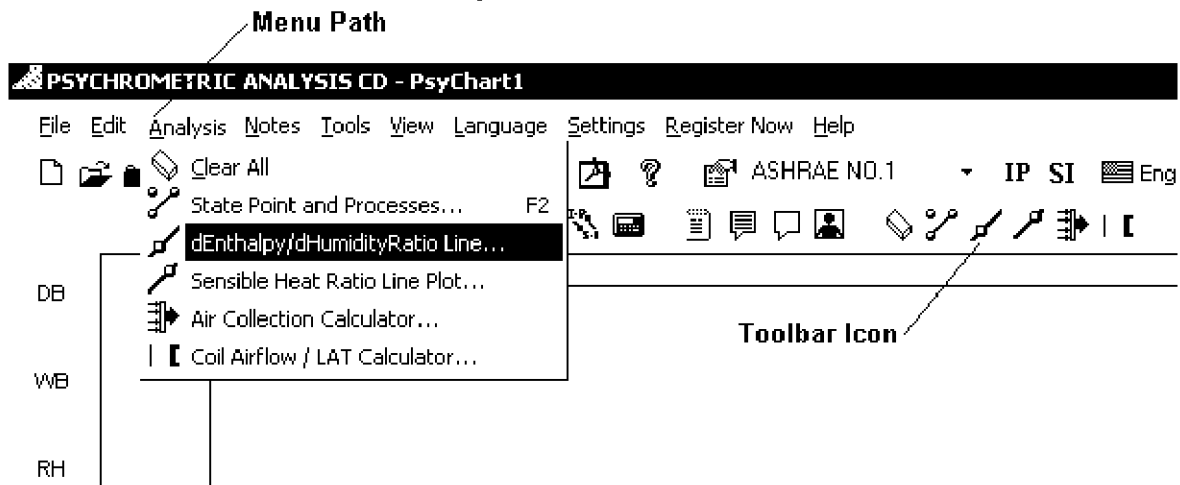
5. Click the “Plot SHR Line” and the SHR Line is automatically plotted across the chart.



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.

dh/dW Ratio Line Plot
✕

Start Point:
🖨️ 📄

dh/dW Line Plotting

Steam Temp (°F or °C):

dEnthalpy/dHumidityRatio (dh/dW):

Humidification Process Calculator

Dew Point Temp (°F or °C):

Final Dry-Bulb Temp (°F or °C):

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

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:



dh/dW Line Plotting

Steam Temp (°F or °C):

dEnthalpy/dHumidityRatio (dh/dW):

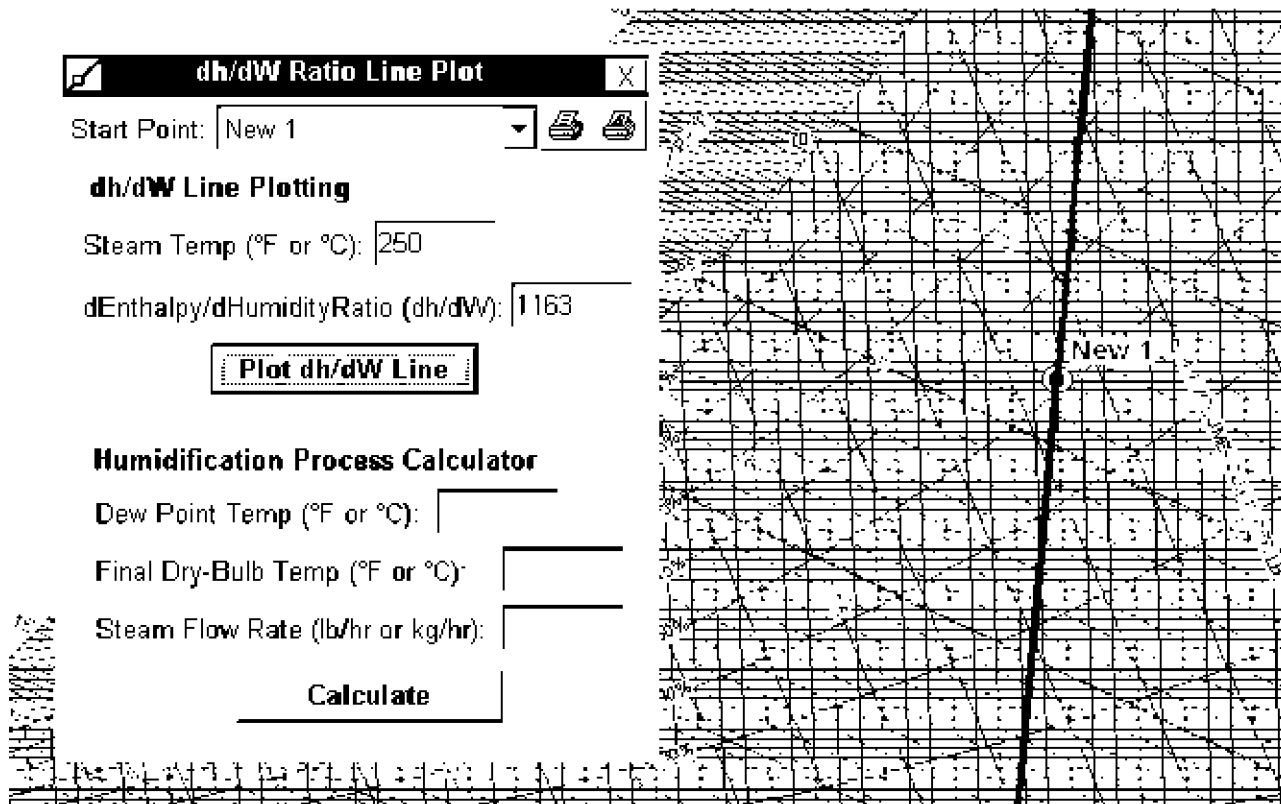
Humidification Process Calculator

Dew Point Temp (°F or °C):

Final Dry-Bulb Temp (°F or °C):

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

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.

dh/dW Ratio Line Plot
X

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):
75

Final Dry-Bulb Temp (°F or °C):
82.02

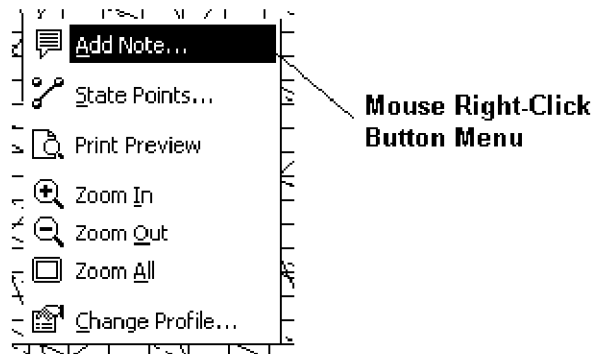
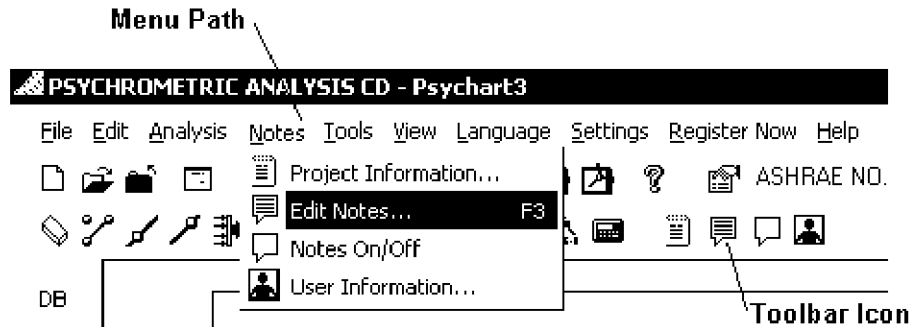
Steam Flow Rate (lb/hr or kg/hr):
34.2

Calculate

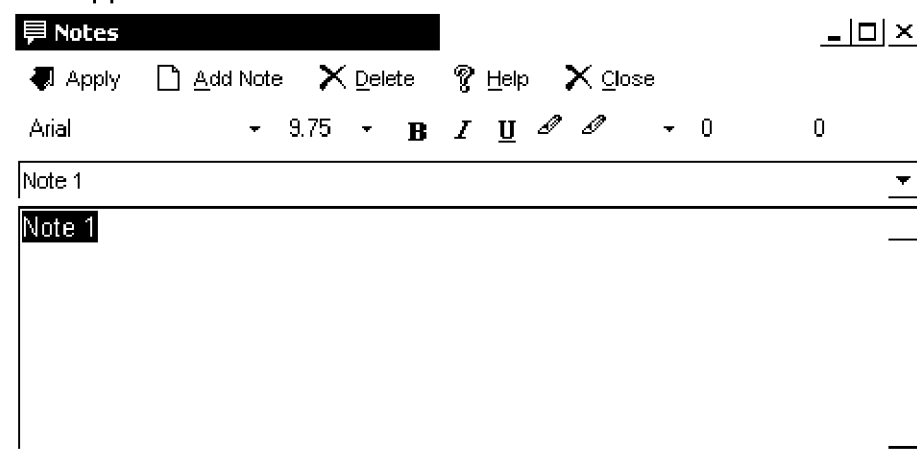
NOTE CONTROLS

CHART NOTES

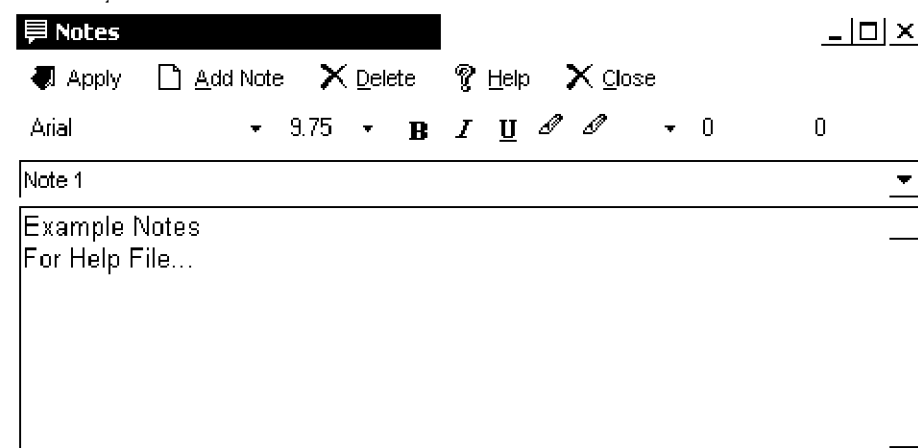
1. Activate "Notes" by any of the three methods shown below or press 'F3':



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

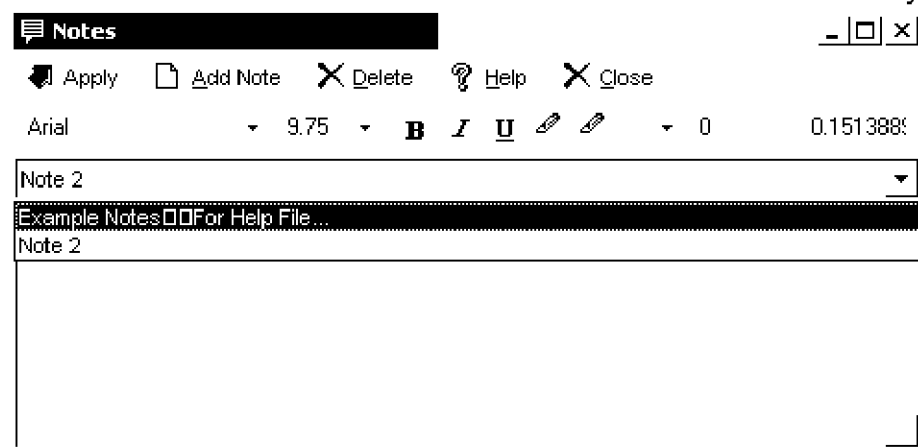


3. To create a new note, enter the desired note text in the "Note Text" field.



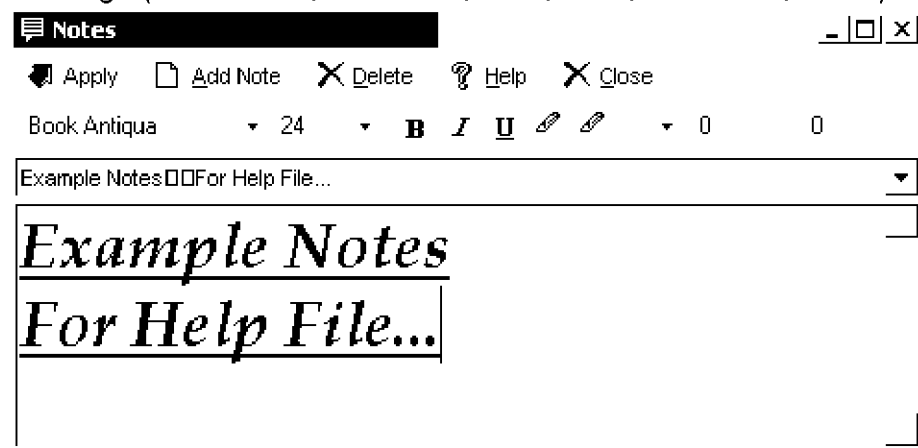
The screenshot shows the 'Notes' dialog box. At the top, there is a title bar with the word 'Notes' and standard window controls. Below the title bar, there is a toolbar with buttons for 'Apply', 'Add Note', 'Delete', 'Help', and 'Close'. The 'Add Note' button is highlighted. Below the toolbar, there is a text field labeled 'Note 1' with a dropdown arrow. The text field contains the text 'Example Notes For Help File...'. Below the text field, there is a large text area for entering the note text.

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.

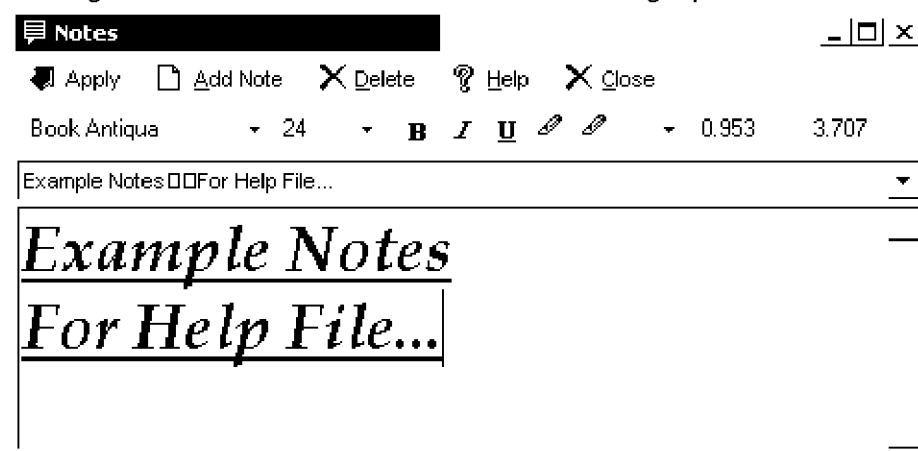


The screenshot shows the 'Notes' dialog box. The 'Selected Note Name' drop-down menu is open, showing a list of existing notes: 'Note 2', 'Example Notes For Help File...', and 'Note 2'. The 'Example Notes For Help File...' note is selected. The 'Note Text' field is empty.

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

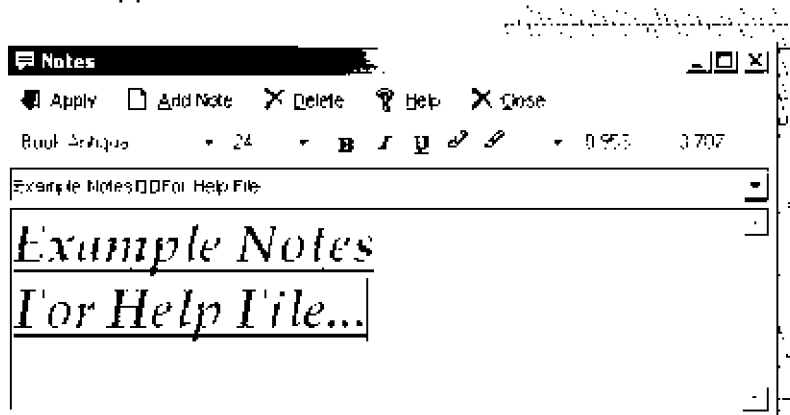


6. Enter the Note X & Y location by either typing the X & Y coordinates in to the appropriate fields or use the left mouse button and click once on the chart, move the mouse to see the coordinates track the mouse location and when the mouse is at the desired location, perform a left mouse button single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

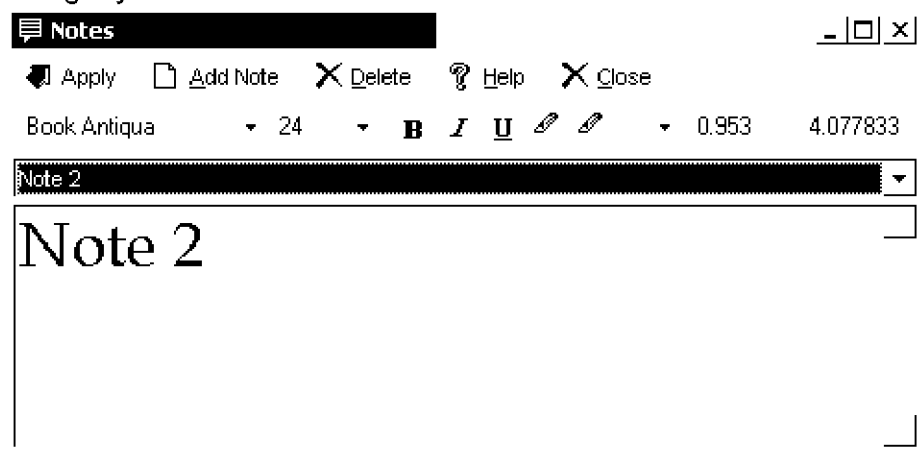


7. Click the "Apply" button and the note will appear on the chart:

*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.

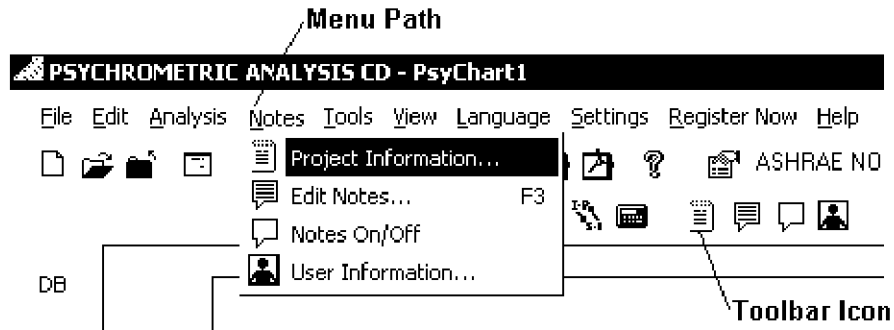
10. Enter your notes in the text box. Use any of the font buttons to adjust the settings. Set the position by clicking on the chart or using the X and Y position settings provided in text box. Now click "Apply" to add the project information to the chart.

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".

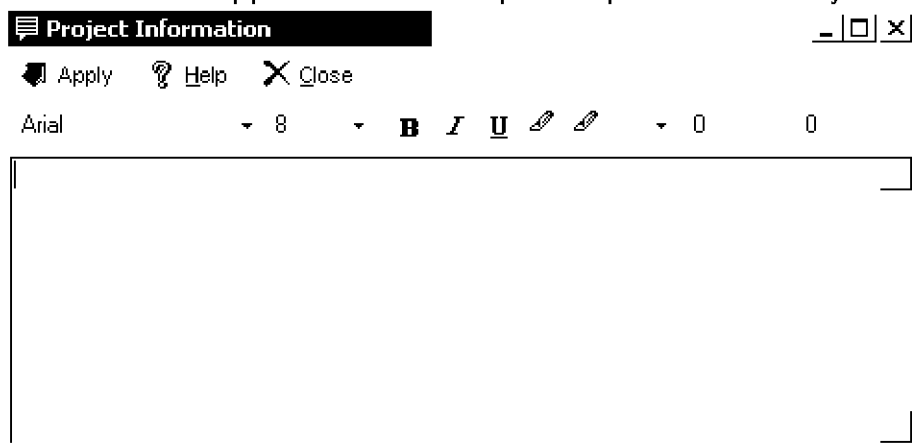
12. You may edit this information, change its font or position at any time. Simply open the Notes window and make the changes.

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.

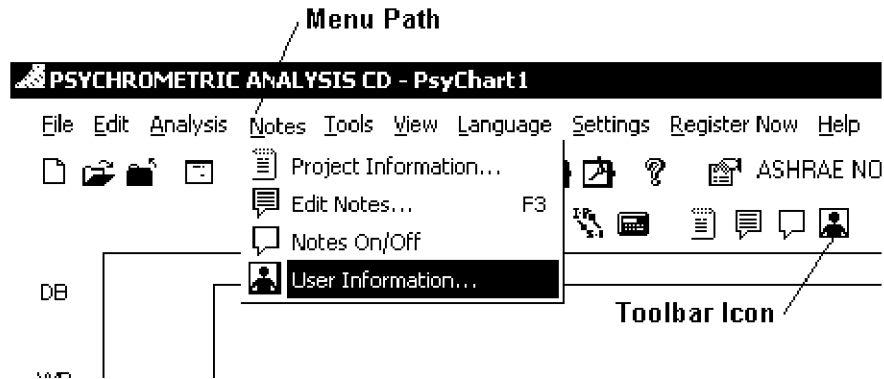


3. Type in the project name you wish, adjust fonts, location, etc. When finished, click the “Apply” button to automatically place on the chart.



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'. The dialog contains the following elements:

- Checkboxes: ☐ Always ADD to Projects on Open, ☐ Show on report
- Buttons: (with a user icon), (with a floppy disk icon), and a help icon (?)
- Input fields:
 - User Name :
 - Company Name :
 - Telephone No. :
 - Fax No. :
 - email address :

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.

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

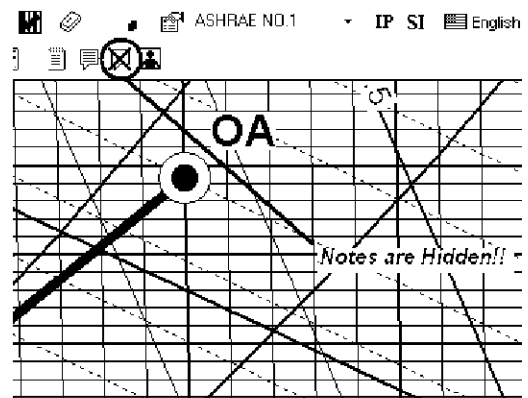
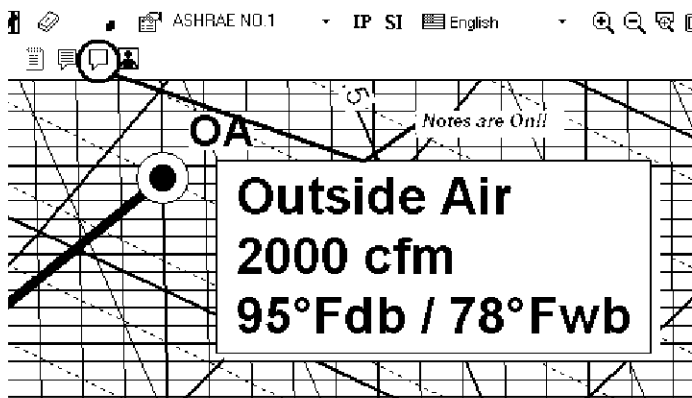
Fax No : (405) 844-6314

email address : sales@handsdownsoftware.com

Prepared by:
 Name: Robert Hanna
 Company: Hands Down Software
 Tel: (405) 844-6314
 Fax: (405) 844-6314
 Email: sales@handsdownsoftware.com
 Date: 10/20/2014

NOTE ON/OFF CONTROL

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

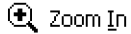




VIEW CONTROLS

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.

100% ▼

4. Move your mouse so the cursor is on the chart and **Double-Click the LEFT mouse button.**

Zoom OUT

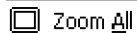


1. Click View on the menu bar, then click the Zoom Out icon.
2. Click the Zoom Out icon on the toolbar.
3. Enter the Zoom Percent into the zoom factor dropdown on the toolbar.

100% ▼

4. Move your mouse so the cursor is on the chart and **Double-Click the RIGHT mouse button.**

Zoom ALL

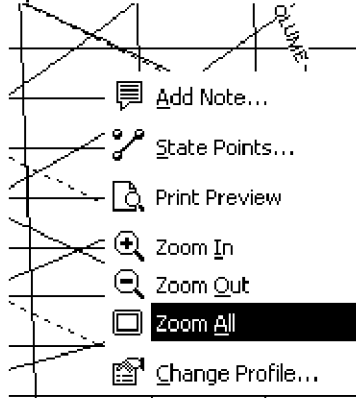


1. Click View on the menu bar, then click the Zoom All icon.
2. Click the Zoom All icon on the toolbar.
3. Enter 100 into the zoom factor dropdown on the toolbar.

100% ▼

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.

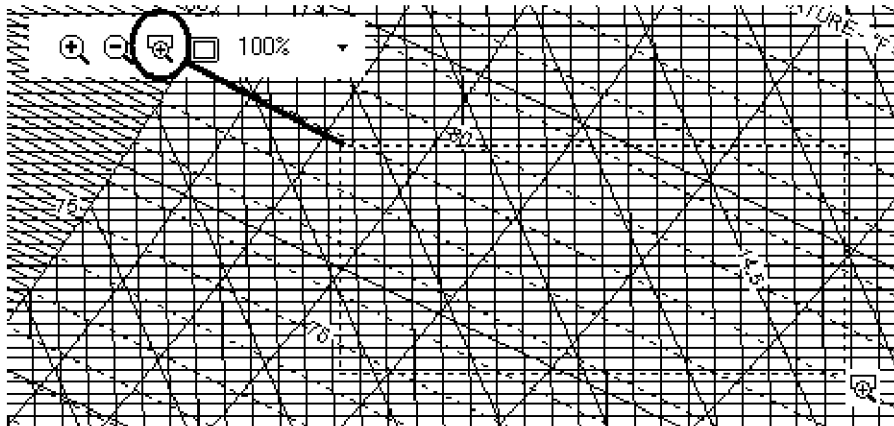


Panning

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.

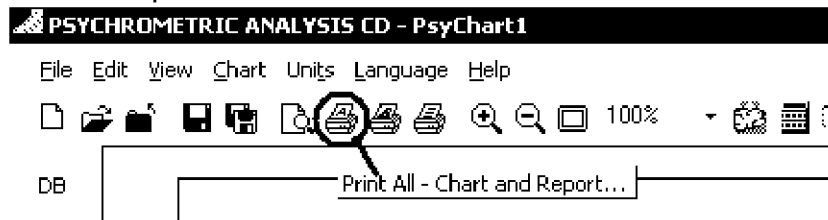


REPORTS

PRINT ALL

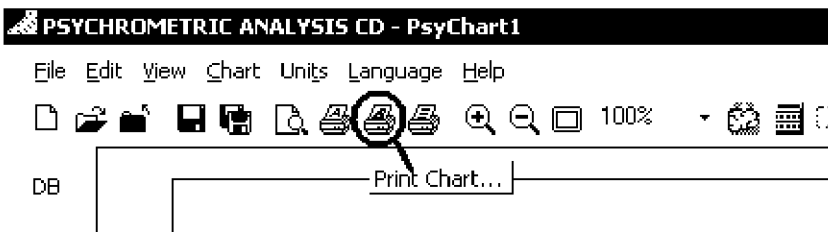
There are four different choices when printing:

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



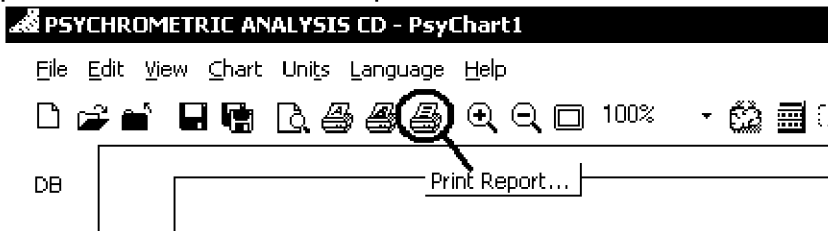
PRINT CHART

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

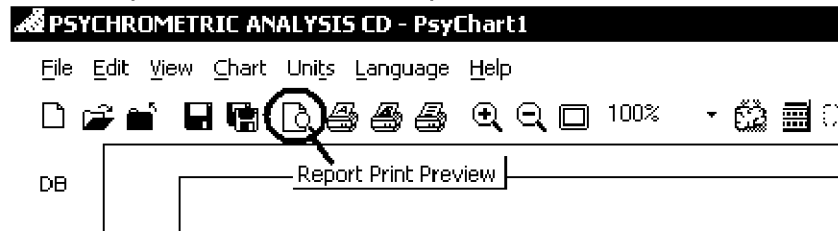


PRINT REPORT

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

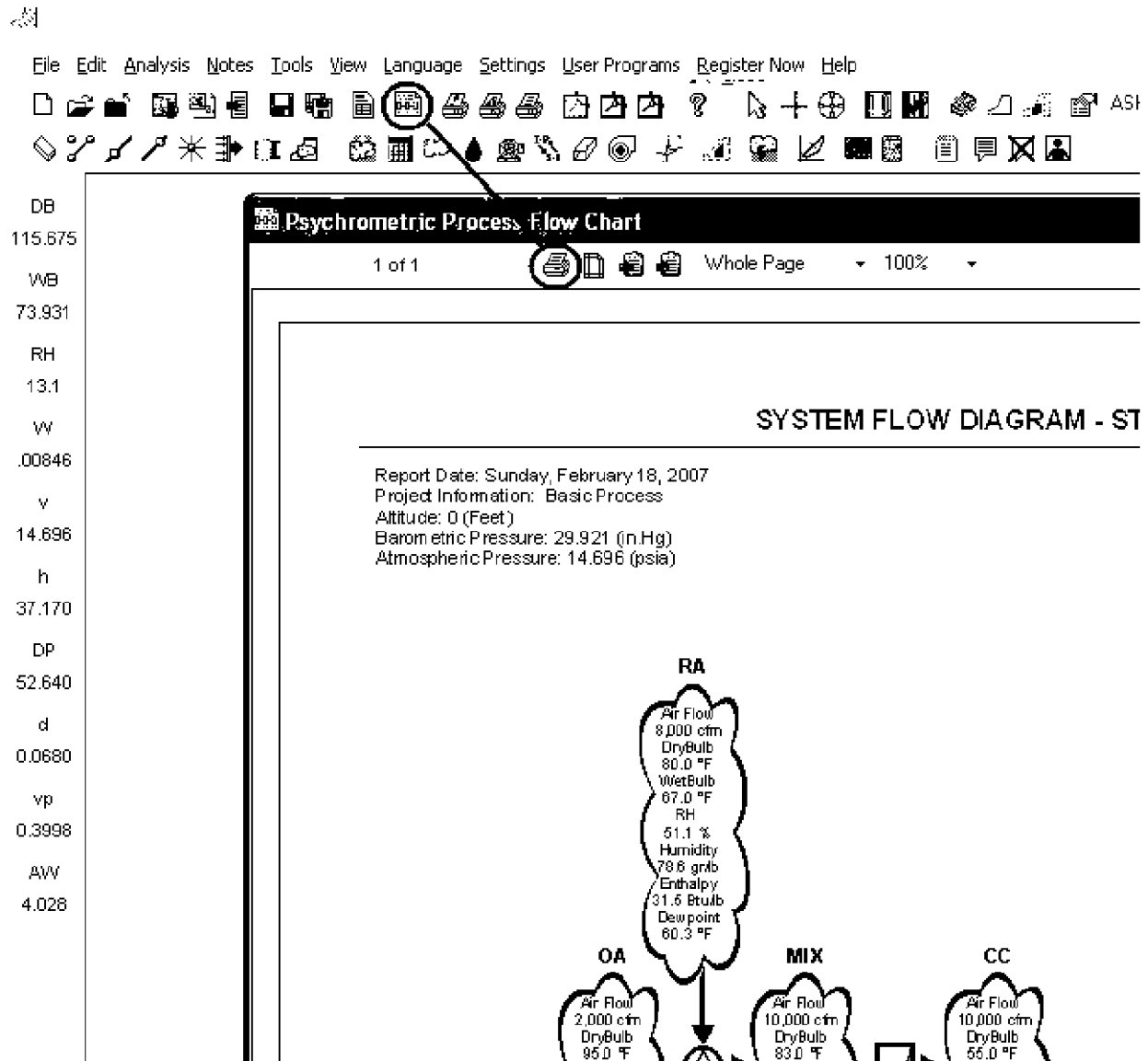


4. Print Preview ONLY the Report. Click on the Report Print Preview icon on the toolbar.



PRINT FLOWCHART

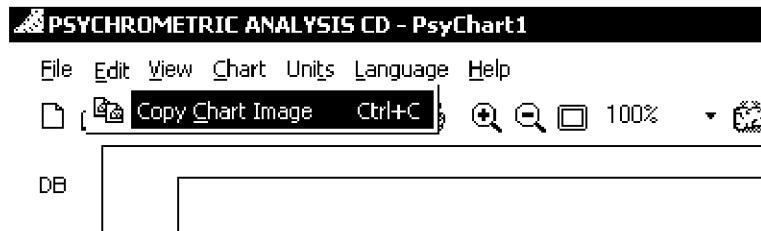
Click the FlowChart icon on the toolbar, and then click the print icon on the flowchart window to print the flowchart.



DATA EXCHANGE

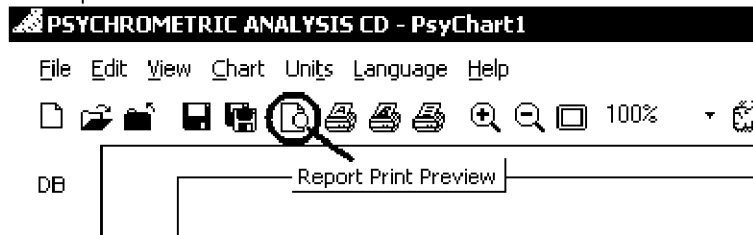
EXPORT/COPY CHART

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.

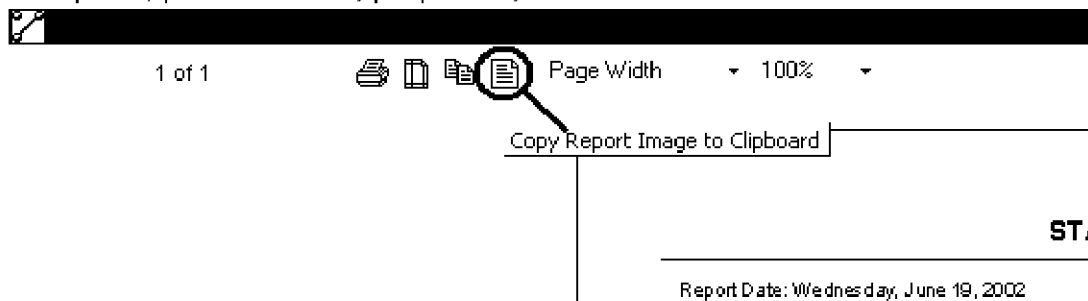


EXPORT/COPY REPORT

From the toolbar, click the Report Print Preview icon.

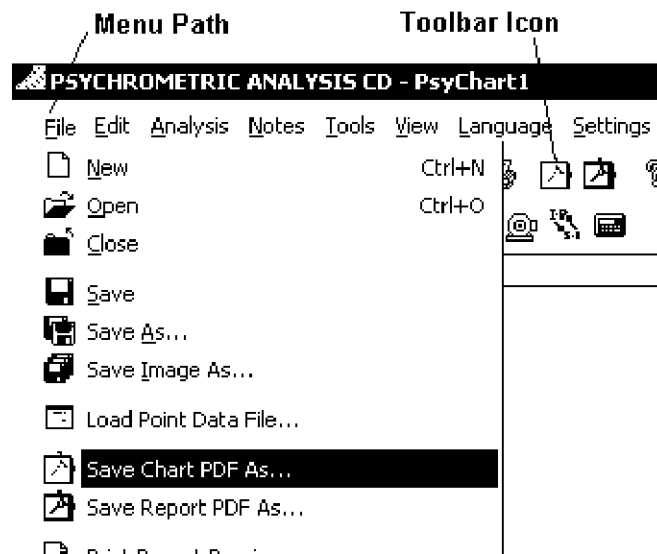


Then from the toolbar on the Report Print Preview, click the Copy Report Data to Clipboard icon. The complete state-point and process report image is automatically placed on your clipboard for you to paste into your reports, presentations, proposals, etc.

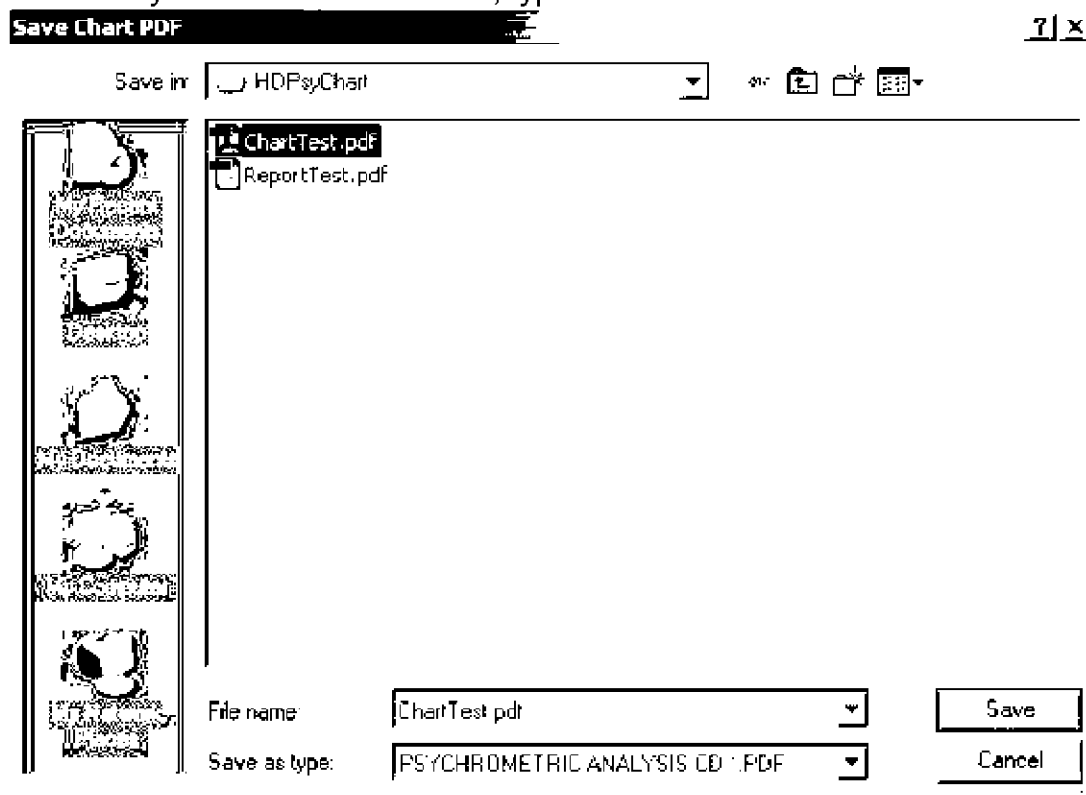


EXPORT/CREATE CHART PDF

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

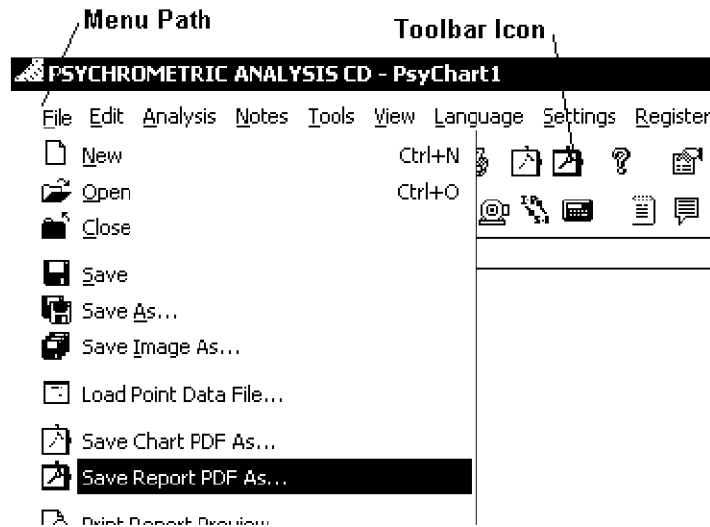


2. Navigate to where you want to save the file, type in the file name and click the "Save" button.

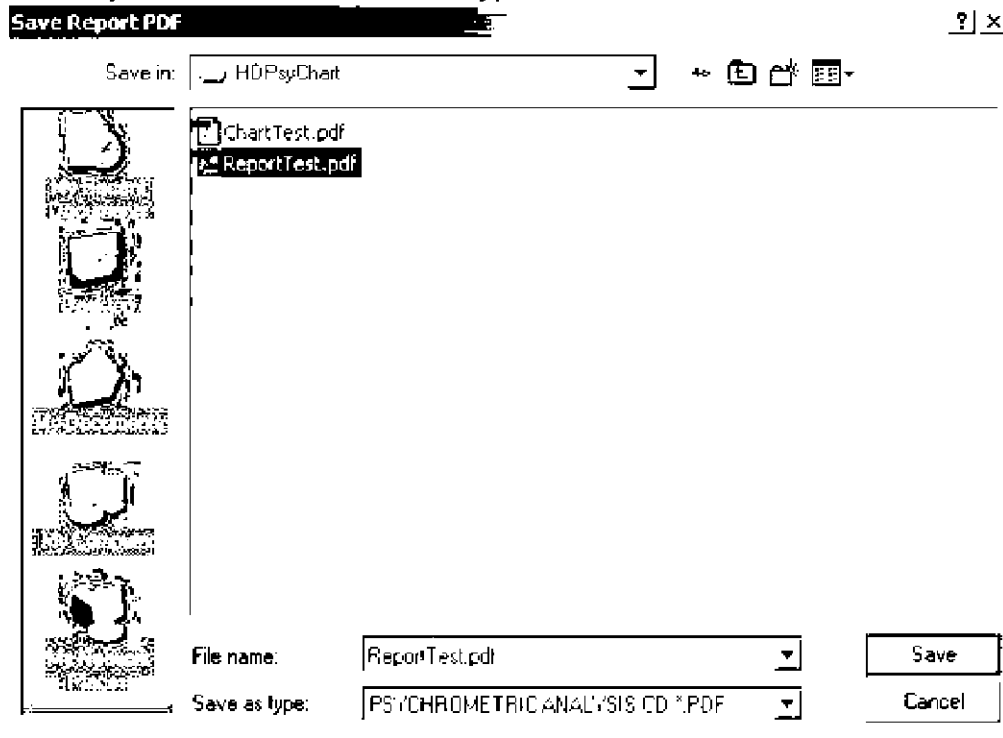


EXPORT/COPY REPORT PDF

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

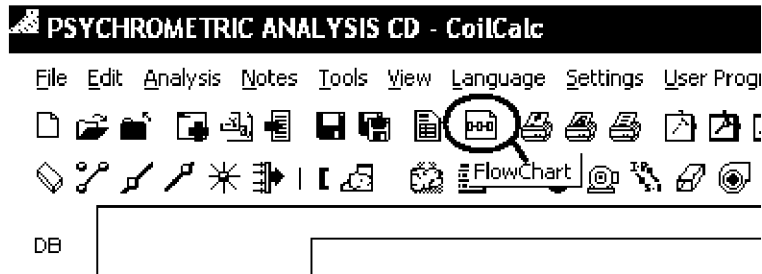


2. Navigate to where you want to save the file, type in the file name and click the "Save" button.

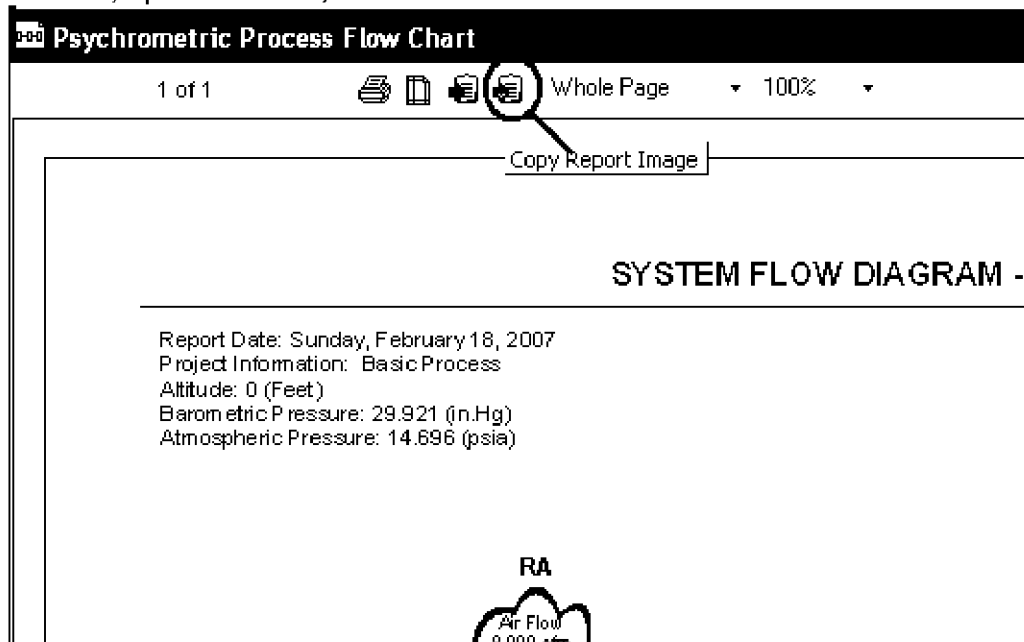


EXPORT/COPY FLOWCHART

From the toolbar, click the Flow Chart icon.

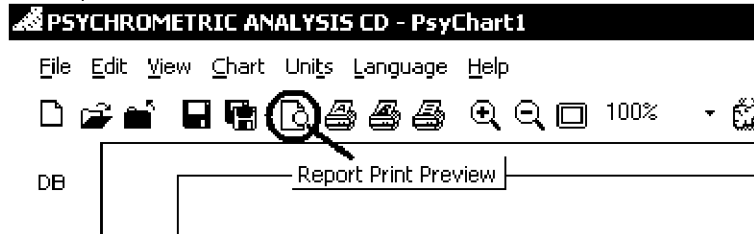


Then from the toolbar on the Flow Chart, click the Copy Report Image to Clipboard icon. The complete flow chart report image is automatically placed on your clipboard for you to paste into your reports, presentations, spreadsheets, etc.

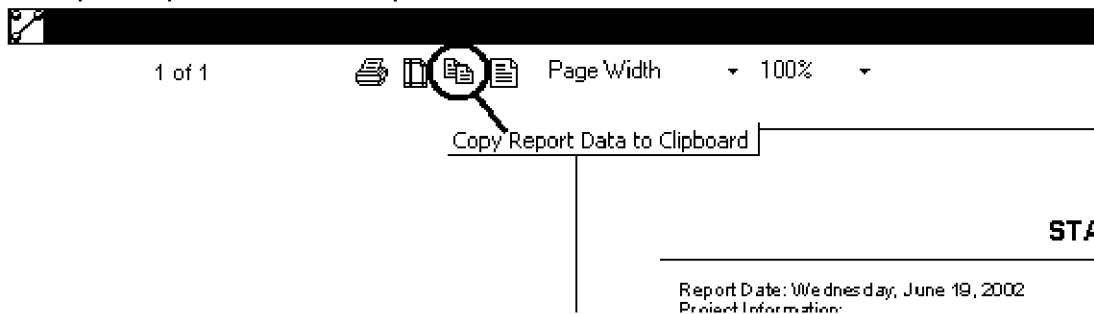


EXPORT/COPY REPORT DATA

From the toolbar, click the Report Print Preview icon.

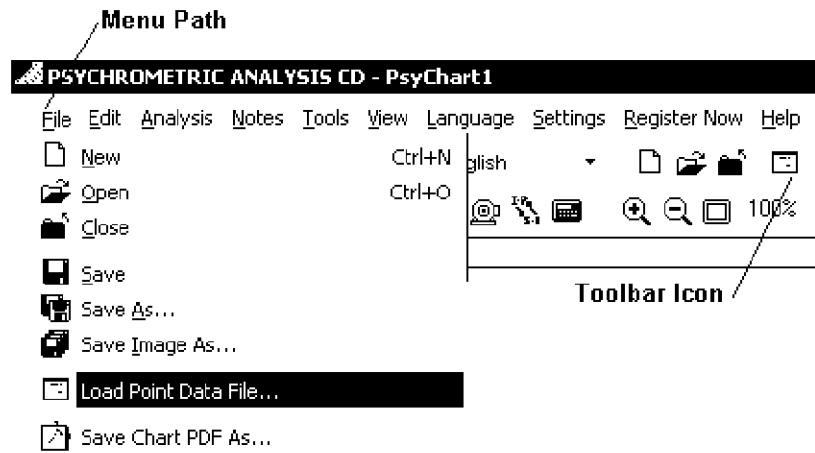


Then from the toolbar on the Report Print Preview, click the Copy Report Data to Clipboard icon. The complete state-point and process report data is automatically placed on your clipboard for you to paste into your reports, presentations, spreadsheets, etc.



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:

The screenshot shows the Microsoft Excel application window titled "Microsoft Excel - DTPsyChart Points.csv". The interface includes a standard menu bar (File, Edit, View, Insert, Format, Tools, Data, Window, Help, Acrobat) and a toolbar with various icons for file operations, editing, and charting. Below the toolbar, there are input fields for "J25" and a formula bar containing "=fx".

	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

Page 118

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

HDPsyChart Points.csv @ C:\Hands Dov

File	Edit	Search	View	Help
	ALTITUDE,750,,,,,,			
	LABEL,OA1,CFM,2000,DB,50,RH,50			
	LABEL,OA2,CFM,2002,DB,52,RH,50			
	LABEL,OA3,CFM,2004,DB,54,RH,50			
	LABEL,OA4,CFM,2006,DB,56,RH,50			
	LABEL,OA5,CFM,2008,DB,58,RH,50			
	LABEL,OA6,CFM,2010,DB,60,RH,50			
	LABEL,OA7,CFM,2012,DB,62,RH,50			
	LABEL,OA8,CFM,2014,DB,64,RH,50			
	LABEL,OA9,CFM,2016,DB,66,RH,50			
	LABEL,OA10,CFM,2018,DB,68,RH,50			
	LABEL,OA11,CFM,2020,DB,70,RH,50			
	LABEL,OA12,CFM,2022,DB,72,RH,50			
	LABEL,OA13,CFM,2024,DB,74,RH,50			
	LABEL,OA14,CFM,2026,DB,76,RH,50			
	LABEL,OA15,CFM,2028,DB,78,RH,50			
	LABEL,OA16,CFM,2030,DB,80,RH,50			
	LABEL,OA17,CFM,2032,DB,82,RH,50			
	LABEL,OA18,CFM,2034,DB,84,RH,50			
	LABEL,OA19,CFM,2036,DB,86,RH,50			

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 Fundamen

[-] [+] [X]

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

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

Psychrometric Calculator - New Project

File Edit View Insert Format Tools Data Window Help Acrobat

Altitude: 0
 Barometric Pressure: 29.921
 Atmospheric Pressure: 14.696
 Dry Bulb Temp: 95
 Wet Bulb Temp: 67
 Relative Humidity: 98.784
 Humidity Ratio (gr/lb): 0.00912
 Specific Volume (cu ft/lb): 13.1820
 Enthalpy: 23.0967
 Dew Point Temp: 54.664
 Density: 0.075497
 Vapor Pressure: 0.43051
 Abs. Humidity (gr/lb): 0.00069
 Parts Per Million by Weight: 9.117
 Parts Per Million by Volume: 14.652

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)
OA	0	29.921	14.696	95	78	47.294	0.01688	0.00000	14.3564
RA	0	29.921	14.696	80	67	51.140	0.01127	0.00000	13.3453
CC	0	29.921	14.696	55	54.671	98.784	0.00912	0.00000	13.1800

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.

Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help Acrobat

D18

	A	B	C	D	E	F	G	H	I
		Altitude	Barometric Pressure	Atmospheric Pressure	Dry Bulb	Wet Bulb	Relative Humidity	Humidity Ratio	Humid
	Description	(ft)	(in. Hg)	(psia)	(°F)	(°F)	(%)	(gr/lb)	Ratio (lb
1	OA	0	29.921	14.696	95	78	47.294	117.9941	0.01688
2	RA	0	29.921	14.696	80	67	51.14	78.5834	0.01127
3	CC	0	29.921	14.696	55	54.671	98	63.311	9.04E-
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.

Steam Property Ca
✕

IP **SI**
☐ Calculate
  Print
  Copy

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.

Motor Heat Calcul
✕

IP **SI**
☐ Calculate
  Print
  Copy

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.

Unit Conversion Calculator

File Help [Print] [Save] [User] [Refresh]

Force | Light | Mass | Power | Pressure | Specific Volume
 Acceleration | Angle | Area | Density | Distance | Energy | Flow
 Temperature | Time | Velocity | Volume | Volume - Dry

Input: Celsius
 Fahrenheit
 Kelvin
 Rankine

Output: Celsius
 Fahrenheit
 Kelvin
 Rankine

Input: 78.6 Fahrenheit
 Output: 25.8888888888889 Celsius

DUCT DESIGNER CALCULATOR

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

Duct Designer

CALCULATE IP SI [Print] [Close]

Air Condition
 Airflow: 2000 cfm
☒ STD Air ☐ ACTUAL Air
 Density: 0.0750 lb/cu.ft.

Duct Material: Uncoated Carbon Steel, Clean
 Roughness Factor: 0.00015 ft

Rectangular Duct
 Side 1: 12 in. Side 2: 12 in. Duct Length: 100 ft
 Equal Diameter: 13.1 in. Area: 1.0 sq.ft. Velocity: 2000 ft/min
 Pressure Drop: 0.415 in.WC/100ft Total Pressure Drop: 0.41 in.WC

Round Duct
 Diameter: 12 in. Duct Length: 100 ft
 Area: 0.8 sq.ft. Velocity: 2376 ft/min
 Pressure Drop: 0.638 in.WC/100ft Total Pressure Drop: 0.64 in.WC

Oval Duct
 Side 1: 12 in. Side 2: 12 in. Duct Length: 100 ft
 Equal Diameter: 12.0 in. Area: 0.8 sq.ft. Velocity: 2376 ft/min
 Pressure Drop: 0.638 in.WC/100ft Total Pressure Drop: 0.64 in.WC

FAN LAW CALCULATOR

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

The screenshot shows the 'Fan Law Calculator' window. It has a title bar with standard window controls. Below the title bar is a menu bar with 'CALCULATE' (highlighted), 'IP', 'SI', 'Print', and 'Close'. The main area is divided into two sections: 'Current Fan Performance' and 'New Fan Performance'. Each section has a radio button to select it. The 'Current Fan Performance' section is active, showing input fields for 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 is inactive, showing input fields for Airflow (12000 cfm), Static Pressure (3.60 in. WC), Power (14.5 bhp), Speed (1380 rpm), and Pulley Size (10.0 in.).

Parameter	Current Fan Performance	New Fan Performance
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 screenshot shows the 'Wind Chill Calculator' window. It has a title bar with standard window controls. Below the title bar is a menu bar with 'Calculate' (highlighted), 'Chart', 'FAQ', 'IP', 'SI', and 'Print'. The main area is divided into two sections: 'Temperature and Wind Condition' and 'Wind Chill and Frostbite Time'. Each section has a radio button to select it. The 'Temperature and Wind Condition' section is active, showing input fields for Temperature (-10 °F) and Wind (45 mph). The 'Wind Chill and Frostbite Time' section is inactive, showing output fields for Wind Chill (-44 °F) and Frostbite Time (10 minutes).

Parameter	Temperature and Wind Condition	Wind Chill and Frostbite Time
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

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

In ISO

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

Y2
 Y1
 X1
 X2

Series 1	Low Point1	Mid Point1	High Point1
Value	X1 2	X 3	X2 4
2000	Y1 1	Y 2	Y2 3

Series Mid	Low Mid	Mid Mid	High Mid
Value	X 3	X 4	X 5
2250	Y 2	Y 3	Y 4

Series 2	Low Point2	Mid Point2	High Point2
Value	X1 4	X 5	X2 6
2500	Y1 3	Y 4	Y2 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 %

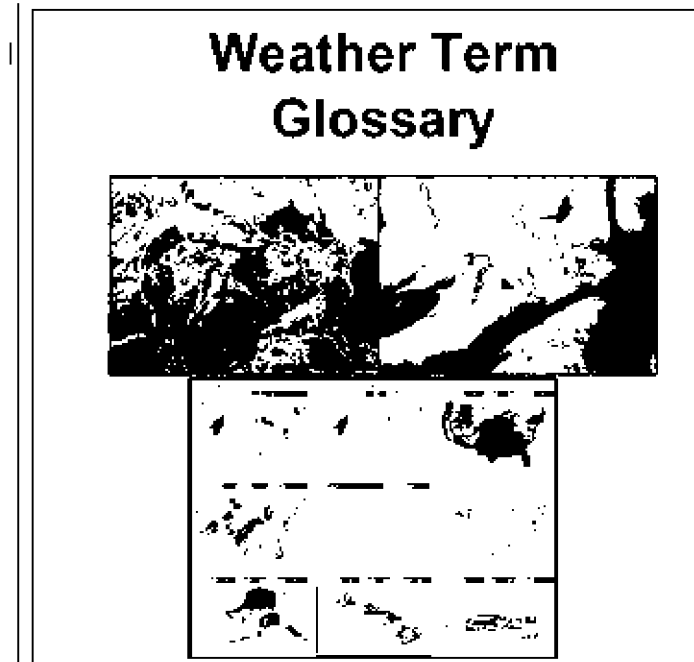
☒ Show Payments
 ☐ Copy

☒ 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

1

POINT

A

20000

ACT

Add State Point

POINT

2

A

20000

ACT

Sensible Heating

POINT

Start Point

Process

Current Point

1

Sensible Heating

Air Flow

20000

DB

35.000

WB

35.000

RH

100.0

W

0.00428

v

12.552

h

13.004

DP

35.000

d

0.0800

vp

0.2036

AW

2.385

125.3

1,503,224

1,503,224

0

0.0

1.000

N/A

Air Flow

20000

DB

100.000

WB

63.586

RH

10.5

W

0.00428

v

14.201

h

28.728

DP

35.000

d

0.0707

vp

0.2036

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

EAT ▼

Air Flow 10000
 DB 85.000
 WB 70.769
 RH 50.0
 W 0.01294
 v 14.011
 h 34.617
 DP 64.297
 d 0.0723
 vp 0.6074
 A/W 6.465

Process

Cooling Coil

Current Point

DB 50.000
 RH 100

Air Flow 10000
 DB 50.000
 WB 50.000
 RH 100.0
 W 0.00766
 v 13.002
 h 20.298
 DP 50.000
 d 0.0775
 vp 0.3626
 A/W 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

EAT

Air Flow 5000
 DB 31.000
 WB 29.480
 RH 85.0
 W 0.00307
 v 12.426
 h 10.743
 DP 27.487
 d 0.0807
 vp 0.1465
 AW 1.731

Process

Cooling Coil

Current Point

DB 20.000

RH 100

Air Flow 5000
 DB 20.000
 WB 20.000
 RH 100.0
 W 0.00215
 v 12.130
 h 7.104
 DP 20.000
 d 0.0826
 vp 0.1028
 AW 1.242

7.6

91,188

63,990

27,198

22.2

0.702

3,955

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

P1

Air Flow

5000

DB

40.000

WB

35.000

RH

60.7

WV

0.00315

v

12.656

h

13.002

DP

28.037

d

0.0793

vp

0.1503

AWV

1.744

Air Mixing (Second Point)

P2

Air Flow

15000

DB

75.000

WB

62.539

RH

50.0

WV

0.00927

v

13.675

h

28.149

DP

55.125

d

0.0738

vp

0.4379

AWV

4.748

Current Point

DB

65.800

WB

56.630

RH

56.9

WV

0.00770

v

13.406

h

24.187

DP

50.137

d

0.0752

vp

0.3645

AWV

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

Psychrometric Processes
_ | □ | ×

Apply
 Add Point
 Climatic Data...
 Delete
 Print
 Help

	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

P1

Air Flow 200
 DB 70.000
 WB 45.000
 RH 4.6
 W 0.00071
 v 13.363
 h 17.572
 DP -2.058
 d 0.0749
 vp 0.0338
 A/W 0.370

Process

Humidification and Heating

Current Point

DB 72.267

DP 55.00000

Air Flow 200
 DB 72.267
 WB 61.516
 RH 54.6
 W 0.00923
 v 13.604
 h 27.435
 DP 55.000
 d 0.0742
 vp 0.4359
 A/W 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	
WV	
.0205	
v	
15.07	
h	
51.41	
DP	
77.5	
d	
0.0664	
vp	
0.952	
AW	Absolute Humidity
9.530	
X	
10.171	
Y	
2.935	

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.

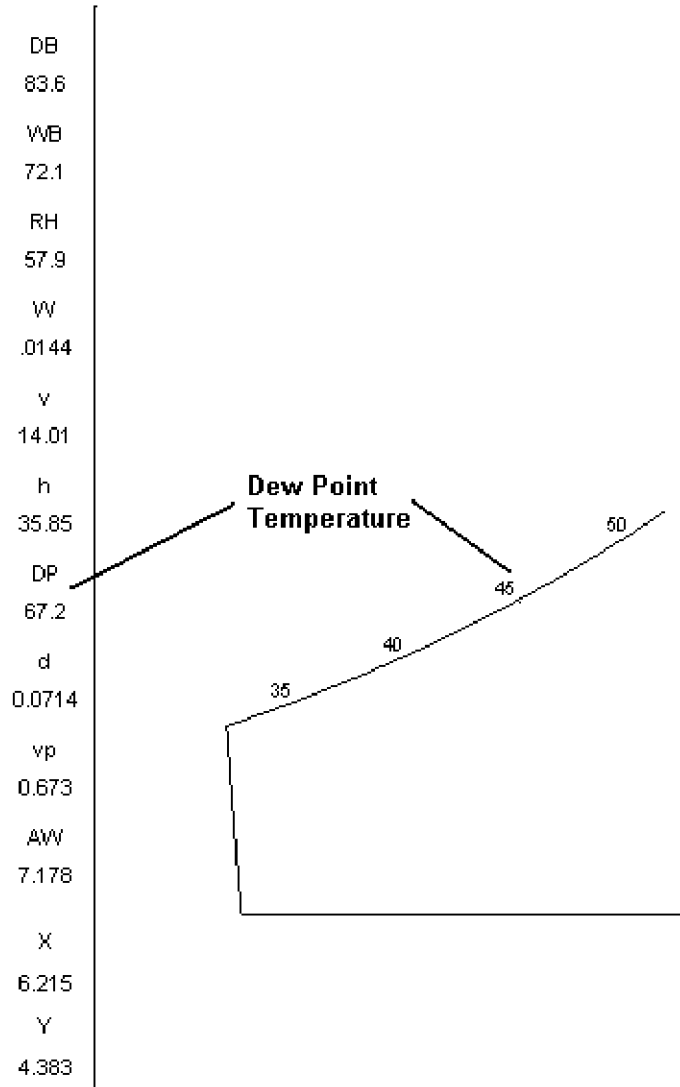
Density

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	Density
0.0716	
vp	
0.680	
AWV	
7.280	
X	
6.024	
Y	
4.345	

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

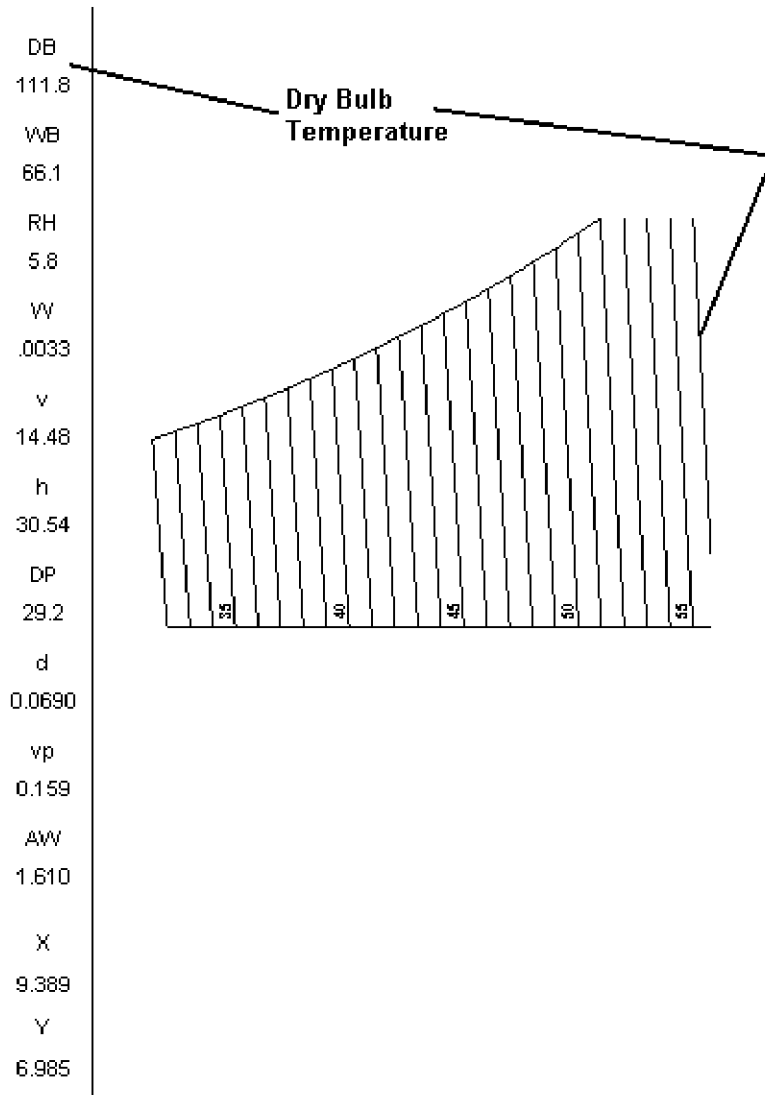
Atmospheric air with all water vapor and contaminants removed.

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.)

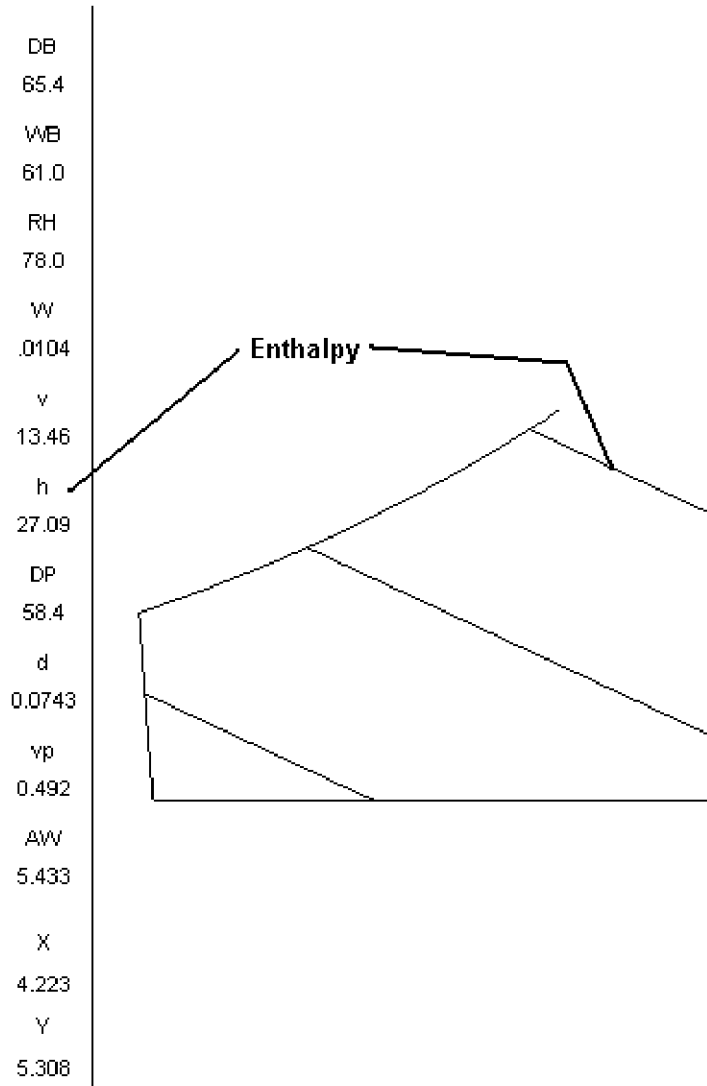
Dry Bulb Temperature

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



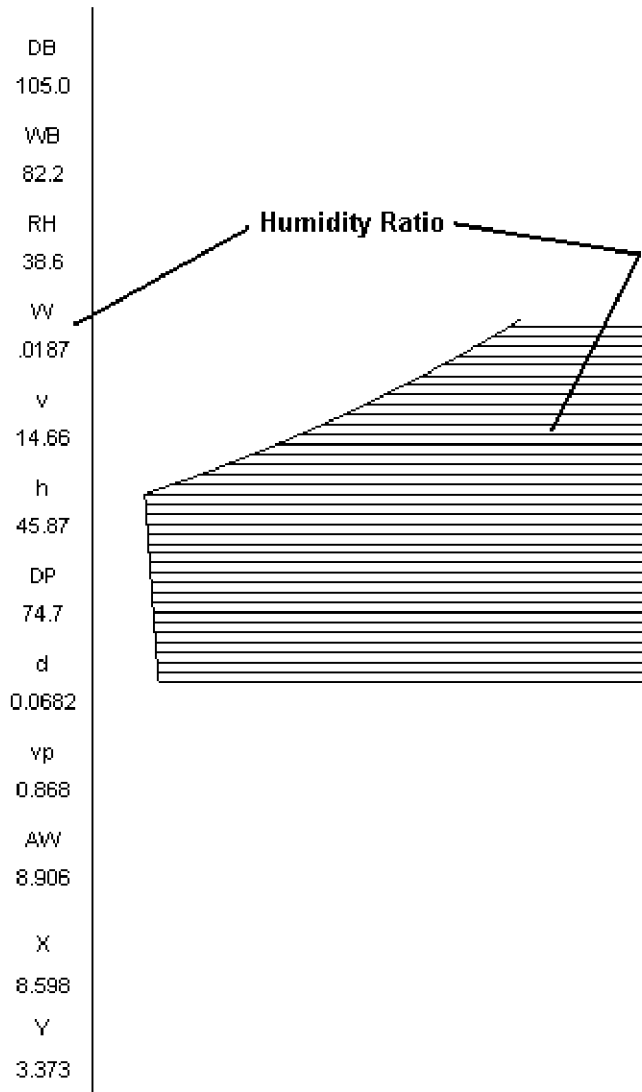
Enthalpy

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

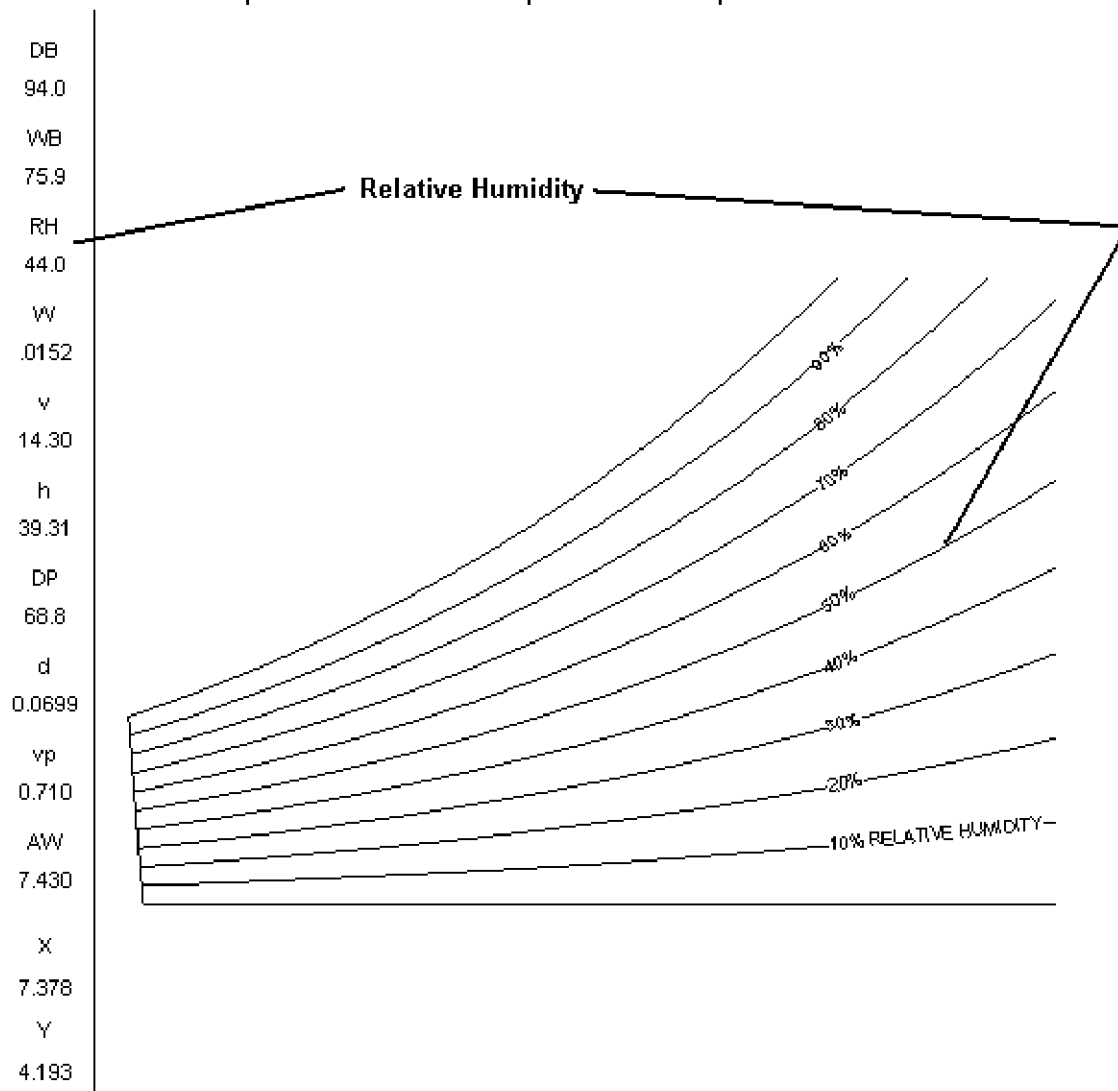
A binary (or two-component) mixture of dry air and water vapor.

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

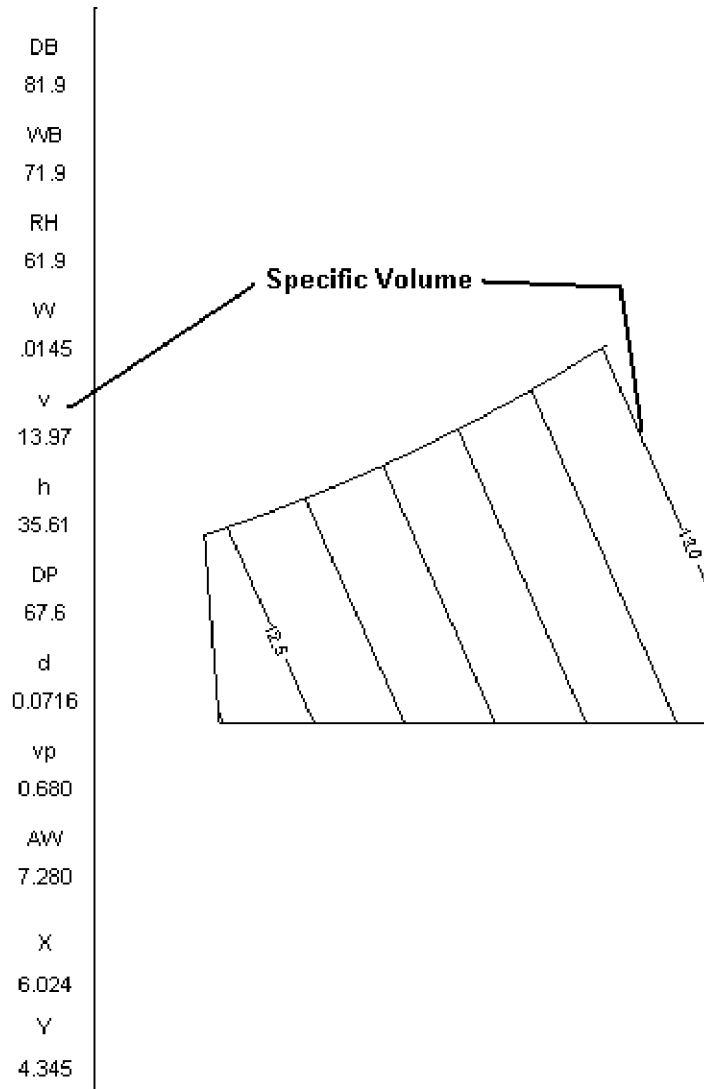
The humidity ratio of moist air saturated with respect to water (or ice) at the same temperature and pressure.

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.

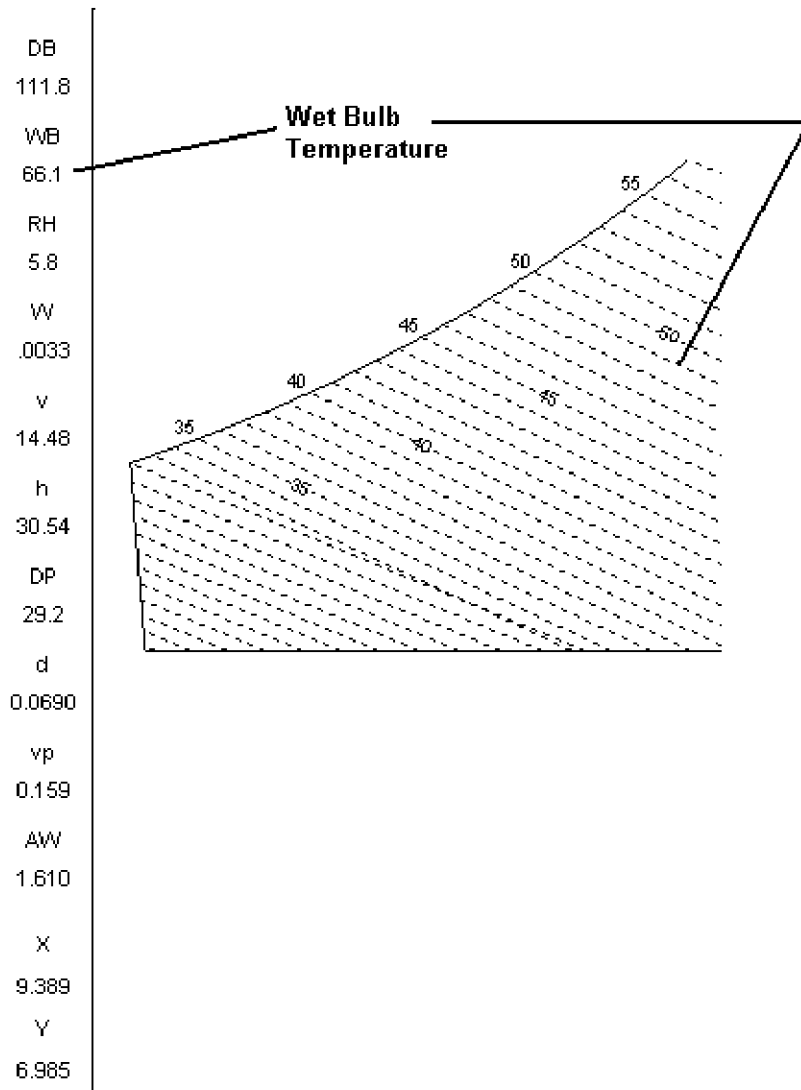
Vapor Pressure

Pressure exerted by a vapor.

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

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, $^\circ\text{F}$

t = dry-bulb temperature of moist air, $^\circ\text{F}$

c_p = specific heat of moist air, Btu/lb $^\circ\text{F}$

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, $^\circ\text{F}$

t = dry-bulb temperature of moist air, $^\circ\text{F}$

c_p = specific heat of moist air, Btu/lb $^\circ\text{F}$

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, $^\circ\text{F}$

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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