How to Calculate "As Found" Error using HumiCalc® with Uncertainty

TWO PRESSURE GENERATOR AS FOUND ERROR

This example will perform an "As Found" calculation for a Two-Pressure type generator to see what the effect the pressure and temperature error have on the generated humidity. This is a common question after a calibration of a Two-Pressure type generator, since it is not obvious what influence the different pressure and temperature errors have on the generated humidity. This example will use HumiCalc with Uncertainty's "record" capability so that we can log the calculations over each pressure calibration point within each temperature calibration point.

SET THE HUMICALC MODE TO "CONVERSION WITH AS FOUND ERROR"

• Under the "Options" menu select "HumiCalc Mode" and select "Conversions with As Found Error" from the drop down.

(Ə Hum	iCalc	with Uncertainty		
	File	Opt	ions Help		_
	Confi	%	HumiCalc Mode	•	Conversions with Uncertainty
	Tempe $f_{\mathbf{x}}$ Saturation Vapor Pressure Equation		×	Dry Conversions Only prmal	
	Equilib	Α	Psychrometer Coefficient	۲	nceme Conversions with As Found Error w Poin
	Know	:	Uncertainty	×	d Values (Expanded U with 95.45% Confidence
		8	Generator Configuration	•	Specific Humidity

SET THE MODE TO "TWO PRESSURE" or "TWO TEMPERATURE"

• Configure the application to use either "Two Pressure" or "Two Temperature" Mode using the Mode drop down.

Mode	Nomal	
Known	Nomal	
sed on A	Two Temperature	
pecific Hu	midity	
bsolute Humidity		



SELECT THE DESIRED UNITS

• Select the desired temperature and pressure units.

Units	
Temperature	~ ℃
Pressure	Pa 🔻
Vapor Pressure	psia atm
Density and Abs Humidity	MPa kPa
Enthalpy	Pa
<u> </u>	millibar
	Torr

AS FOUND ERROR

• The "as found error" can be either directly entered into the error field for each known item or through the use of the drop down form. Here we will demonstrate the use of the drop down form to enter the as found results from a calibration.

Note: The user can directly enter the error on the main form, but can not on the drop down form. The drop down form is designed to calculate the error based on an entered standard or reference value and the entered unit under test value. HumiCalc will calculate the error as the amount the unit under test is from the standard or reference (Error = UUT - Standard).

• Click the drop down arrow for the Saturation Temperature

Known Values (As Found Error)					
Saturation Pressure	14.69594878	+0.000 💌			
Saturation Temperature	25.0	+0.000 💌			
Test Pressure	14.69594878	+0.000 💌			
Test Temperature	25.0	+0.000 💌			
	Calcu	Calculate			

• This opens the as found drop down form for this item. We can see that the error is zero because the standard and unit under test have the same value.

Saturation Temperature As Found Data				
Standard or Reference:	25.0 💌			
Unit Under Test:	25.0 💌			
Error: +0.0	Ok			

• Now we will enter the standard or reference value from the calibration as well as the Unit under Test value. Notice the Error value is automatically calculated.

Saturation Temp	perature As
Found D	ata
Standard or Reference:	0.101 •
Unit Under Test:	0.0319 •
Error: -0.0691	Ok

• Click the Ok button

• We now see the Saturation Temperature error that we just entered.

Known Values (As Found Error)					
Saturation Pressure	14.69594878	+0.000	-		
Saturation Temperature	0.0319	-0.0691			
Test Pressure	14.69594878	+0.000	-		
Test Temperature	25.0	+0.000	-		
	Calculate				

• Now repeat the same operation for the Test Temperature (Chamber Temperature)

Known Values (As Found Error)				
Saturation Pressure	14.69594878	+0.000 💌		
Saturation Temperature	0.0319	-0.0691 💌		
Test Pressure	14.69594878	+0.000 💌		
Test Temperature	0.1034	+0.0024 💌		
	Calcu	Calculate		

• Enter the Test Pressure using the lowest pressure calibration point used during the calibration. If this is a 2500 generator you would enter the lowest pressure calibration point for the low range pressure transducer.

Known Values (As Found Error)					
Saturation Pressure	14.69594878	+0.000 💌			
Saturation Temperature	0.0319	-0.0691 💌			
Test Pressure	14.24	-0.040 💌			
Test Temperature	0.1034	+0.0024 💌			
	Calculate				

• Next we will begin recording the calculation so that we can plot the results using our favorite spreadsheet or word processing applications.

RECORD

• Enable recording by selecting "Record" under the "File" menu.

9	HumiCalc with Uncertainty				
	File	Options Help			
New		•			
		Open	Ctrl+O		
	F.	Save Solution	Ctrl+S		
	Export Solution		Ctrl+E		
	0	Record	Ctrl+R		
	×	Exit			
T		0.0319	-0.0691		

• We can very that HumiCalc is recording by the red indication light on the "Calculate" button.

Known Values (As Found Error)					
Saturation Pressure	14.69594878	+0.00	00	-	
Saturation Temperature	0.0319	-0.06	91	-	
Test Pressure	14.24	-0.04	0	•	
Test Temperature	0.1034	+0.00	024	-	
	Calcu	late		•	
				_	

• Next we will perform calculations on each of the pressure calibration points. On a 2500 this will be the three low range pressure points and the three high range pressure points.

• Enter the first pressure calibration point. Note this is the same value that we entered for the Test Pressure.

Known Values (As Found Error)						
Saturation Pressure	14.24	-0.040 💌				
Saturation Temperature	0.0319	-0.0691 💌				
Test Pressure	14.24	-0.040 💌				
Test Temperature	0.1034	+0.0024 💌				
	Calcu	Calculate 🛛 🌒				

• Press the calculate button.



• Enter the next pressure point and press the calculate button



- Repeat this process for all the remanding pressure calibration points.
- Once completed, stop recording by selecting "Stop Recording" under the "File" menu.



• Select "Yes" when prompted to save the recorded data.

Save Data?	×
?	Would you like to save your recorded data?
	Yes <u>N</u> o

Save Recorded Data A:	5			X
🔾 🗸 🖓 🖉 🖉	ocuments 🔸 Thunder Scientific	Search Hu	ımiCalc Solution Files 👂	
Organize 🔻 New f	older			:= • 🔞
 Public Desktop Downloads Recent Places Libraries Documents Downloads Music 	▲ Name ↓ 1200 ↓ 2500 E	Date modified 1/19/2012 6:10 PM 1/19/2012 6:10 PM	Type File folder File folder	Size
Videos Computer SW_Preload (C:)				
File <u>n</u> ame: Save as <u>t</u> ype: Hu Hu	umiCalc Capture File (*.txt) umiCalc Capture File (*.txt)			•
) Hide Folders			Save	Cancel

• Select the "HumiCalc Capture File (*.txt) save as type and give the file a name.

ANALYZE

 HumiCalc stores the data in a tab delimited format that can be easily imported into most spreadsheet or word processing applications. The data is arranged in columns with each calculation composing of the rows. In this example we are interested in the %RH and %RH Error.

	А	В	С	D	E	F	G	Н	1	J	K
1	Known and Calculated Values (As Found Error):			Error):							
2	Saturatior	(Saturatio	Saturation	(Saturatio	Test Press	(Test Pres	Test Temp	(Test Tem	%RH	(%RH Error)	Frost F
3	14.24	-0.04	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	99.48215836	-0.517841644	
4	29.98	-0.02	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	47.43105218	-0.348603046	-8.67
5	49.98	-0.02	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	28.58778599	-0.217706227	-14.
6	49.98	-0.02	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	28.58778599	-0.217706227	-14.
7	99.99	-0.01	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	14.46195127	-0.114358158	-21.5
8	149.99	-0.01	0.0319	-0.0691	14.24	-0.04	0.1034	0.0024	9.757233823	-0.077406957	-25.5
9											

• This data can then be easily plotted to give an overall picture of the "As Found" error for this temperature point.



• The same steps are then repeated for the rest of the temperature calibration points.

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