Humidity Calculator Web Application

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Atkinson Science welcomes your comments on this User Guide. Please send an email to keith.atkinson@atkinsonscience.co.uk.

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1 Introduction

You can find the Atkinson Science Humidity Calculator web application at the web address https://atkinsonscience.co.uk/WebApps/Construction/HumidityCalculator.aspx.

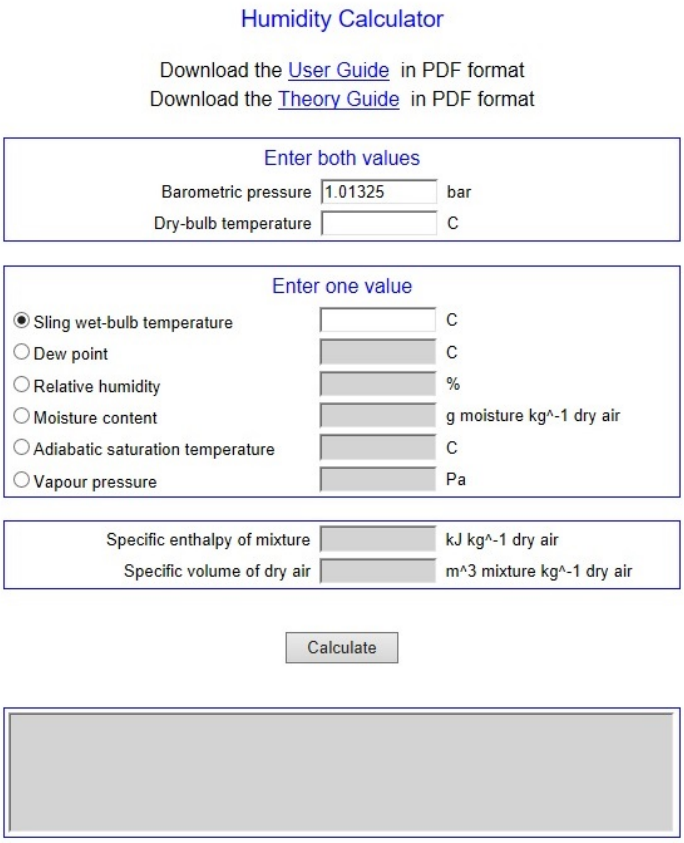
The Humidity Calculator is a web application that enables designers of air conditioning equipment to calculate the properties of moist air. The user must supply the barometric (atmospheric) pressure and the dry-bulb temperature of the air and one other property selected from a list, such as the wet-bulb temperature or the relative humidity. The Humidity Calculator returns the other properties in the list plus two other properties, the specific enthalpy of the moist air and the specific volume of dry air.

This guide provides instructions on how to use the application. The formulae that connect the properties are described in the the document *Humidity Calculator Web Application Theory Guide*, 22 September 2020, which can be downloaded from the Atkinson Science web site https://atkinsonscience.co.uk.

2 Using the Humidity Calculator

The user interface of the Humidity Calculator is shown in Figure 1.

Figure 1 User interface of the Humidity Calculator



The user must enter the barometric (atmospheric) pressure in bars and the dry-bulb temperature in Celsius. Then the user must click the radio button for one other property from a list of six properties and enter the value of the property in the corresponding text box. When the user clicks the Calculate button the values of all the other properties in the list will be displayed, plus the values of two other properties, the specific enthalpy of the mixture and the specific volume of dry air.

The range of permitted values for each input property is shown in Table 1. The application will not allow the user to enter a value of sling wet-bulb temperature or dew point or moisture content or adiabatic saturation temperature or vapour pressure that will return a value of relative humidity less than 0.1%. If the user's input would result in RH $< 0.1\%$, then the application and will display an error message and give the value of the property corresponding to RH $= 0.1\%$. The application will not allow the user to enter a value of moisture content or vapour pressure that will return a relative humidity greater than 100%. If the user's input would result in RH $> 100\%$, then the application and will display an error message and give the value of the property corresponding to RH $= 100\%$.

Table 1 Range of permitted values for each input property

Property	Units	Minimum	Maximum
Barometric pressure	bar	0.9 × 1.01325 bar (0.9 × 1 atm.)	1.1 × 1.01325 bar (1.1 × 1 atm.)
Dry-bulb temperature	Celsius	−10	60
Sling wet-bulb temperature	Celsius	Value that makes the relative humidity equal to 0.1%	Dry-bulb temperature
Dew point	Celsius	Value that makes the relative humidity equal to 0.1%	Dry-bulb temperature
Relative humidity	%	0.1	100
Moisture content	g moisture kg^{-1} dry air	Value that makes the relative humidity equal to 0.1%	Value that makes the relative humidity equal to 100%
Adiabatic saturation temperature	Celsius	Value that makes the relative humidity equal to 0.1%	Dry-bulb temperature
Vapour pressure	Pa	Value that makes the relative humidity equal to 0.1%	Value that makes the relative humidity equal to 100%

Figure 2 shows the Humidity Calculator after the user has entered a barometric pressure of 1.1 bar, a dry-bulb temperature of 25°C and a wet-bulb temperature of 17°C and clicked the Calculate button. The user has entered a realistic set of values and the Humidity Calculator returns a relative humidity of 42.7%.

Figure 2 Humidity Calculator showing calculated results

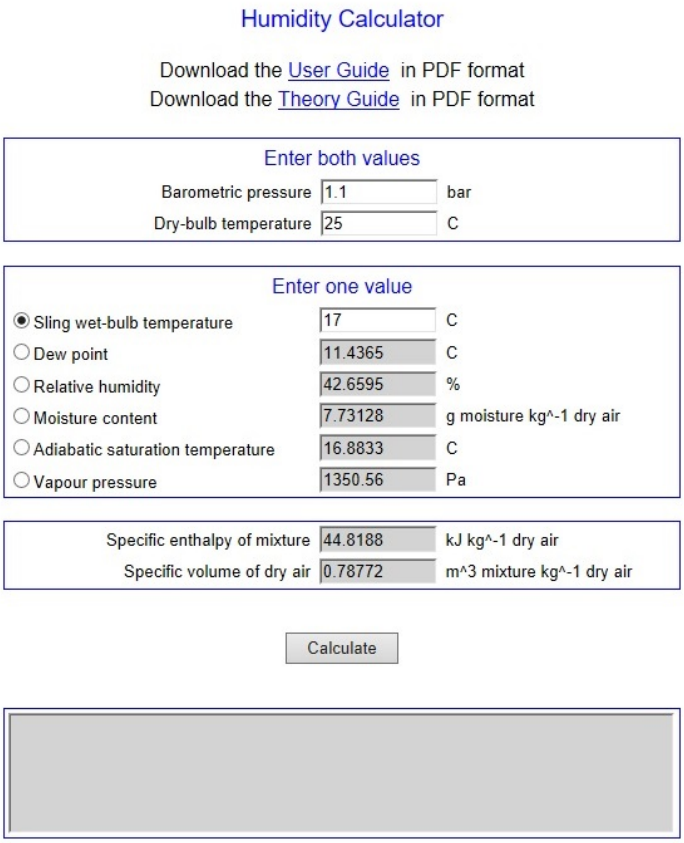


Figure 3 shows the Humidity Calculator after the user has entered a barometric pressure of 0.98bar, a dry-bulb temperature of 22°C and a moisture content of 0.01 g kg^{-1} dry air. In this case the Humidity Calculator returns an error message saying that the moisture content must not be less than 0.01622 g kg^{-1} dry air (corresponding to a relative humidity of 0.1%).

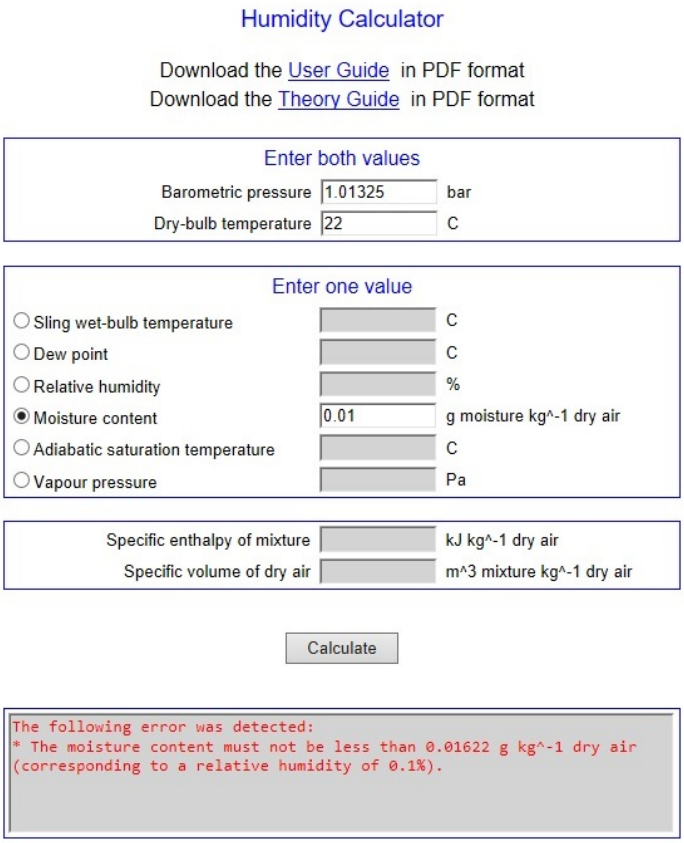



Figure 3 Humidity Calculator displaying an error message