KCE

ThermoFluidProperties

Property Library for Ammonia

FluidEXL *Graphics* Stud with LibNH3_Stud for Excel®

Student Version

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Software for the Calculation of the Properties of Ammonia Including DLL and Add-In for Excel®

FluidEXL*Graphics*Stud LibNH3_Stud

Contents

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0 Package Contents

0.1 Zip file for 64-bit Office®

The following zip file is delivered for your computer running a 64 bit Office® version
"CD_FluidEXL_Graphics_Eng_LibIF97_x64.zip"
including the following files and folders:

setup.exe	- Self-extracting and self-installing program for FluidEXLGraphics
FluidEXL_Graphics_Eng_64_Setup.msi	- Self-extracting and self-installing program
FluidEXL_Graphics_Eng_LibIF97_Docu.pdf	- User's Guide

0.2 Zip file for 32-bit Office®

The following zip file is delivered for your computer running a 32 bit Office® version
"CD_FluidEXL_Graphics_Eng_LibIF97.zip"
including the following files:

setup.exe	- Self-extracting and self-installing program for FluidEXL*Graphics*
FluidEXL_Graphics_Eng_Setup.msi	- Self-extracting and self-installing program
FluidEXL_Graphics_Eng_LibIF97_Docu.pdf	- User's Guide

1. Property Functions

Functional Dependance	Function Name	Property or Function	Unit of the Result
c_p = f(p,t,x)	cp_ptx_NH3_stud	Specific isobaric heat capacity	kJ/(kg K)
η = f(p,t,x)	eta_ptx_NH3_stud	Dynamic viscosity	Pa s
h = f(p,t,x)	h_ptx_NH3_stud	Specific enthalpy	kJ/kg
λ = f(p,t,x)	lambda_ptx_NH3_stud	Thermal conductivity	W/(m K)
p_s = f(t)	ps_t_NH3_stud	Saturation pressure	bar
s = f(p,t,x)	s_ptx_NH3_stud	Specific entropy	kJ/(kg K)
t = f(p,h)	t_ph_NH3_stud	Backward function: Temperature from pressure and enthalpy	°C
t = f(p,s)	t_ps_NH3_stud	Backward function: Temperature from pressure and entropy	°C
t_s = f(p)	ts_p_NH3_stud	Saturation temperature	°C
v = f(p,t,x)	v_ptx_NH3_stud	Specific volume	m³/kg
x = f(p,h)	x_ph_NH3_stud	Backward function: Vapor fraction from pressure and enthalpy	kg/kg
x = f(p,s)	x_ps_NH3_stud	Backward function: Vapor fraction from pressure and entropy	kg/kg

Units: t in °C
p in bar
x in kg saturated steam/kg wet steam

Range of Validity:

Temperature: from - 70 °C to 100 °C
Pressure: from 0.0609422 bar to 10 bar

Reference state:

Saturated liquid t = 0 °C
$h = h'(t = 0\ °C) = 200$ kJ/kg, $s = s'(t = 0\ °C) = 1$ kJ/(kg K)

Details on the vapor fraction *x*:

The wet steam region is calculated automatically by the subprograms. For this purpose the following fixed details on the vapor fraction *x* are to be considered:

Single-phase region

If the state point to be calculated is located in the single-phase region (liquid or superheated steam) x = –1 must be entered as a pro-forma value.

Wet-steam region

If the state point to be calculated is located in the wet steam region, a value for *x* between 0 and 1 (x = 0 for saturated liquid, x = 1 for saturated steam) must be entered. In this case, the backward functions result in the appropriate value between 0 and 1 for *x*. When calculating wet steam either the given value for *t* and p = -1000 or the given value for *p* and t = -1000 and in both cases the value for *x* between 0 and 1 must be entered.

If *p* and *t* and *x* are entered as given values, the program considers *p* and *t* to be appropriate to represent the vapor pressure curve. If this is not the case the calculation for the property of the chosen function results in –1000.

Wet steam region: Temperature ranges from *t* = - 77.65°C to *t* = 100°C

Pressure ranges from *p* = 0.0609422 bar to *p* = 10 bar

Note:

If the calculation results in –1000, the values entered represent a state point beyond the range of validity of LibNH3. For further information on each function and its range of validity see Chapter 3. The same information may also be accessed via the online help pages.

2. Application of FluidEXL*Graphics*Stud in Excel®

The FluidEXL*Graphics*Stud Add-In has been developed to calculate thermodynamic properties in Excel® more conveniently. Within Excel®, it enables the direct call of functions from the LibNH3_Stud property library.

2.1 Installing FluidEXL*Graphics*Stud

Complete the following steps for initial installation of FluidEXL*Graphics*Stud.
The installation routine for 32 bit and 64 bit versions of Excel is similar.
The following instructions are valid for both versions.

After you have downloaded and extracted the zip-file

for 64-bit version of Excel:

"CD_FluidEXL_Graphics_Stud_LibNH3_64.zip"

for 32-bit version of Excel:

"CD_FluidEXL_Graphics_Stud_LibNH3.zip"

you will see the folder

for 64-bit version of Excel:

\CD_FluidEXL_Graphics_Stud_LibNH3_64\

for 32-bit version of Excel:

\CD_FluidEXL_Graphics_Stud_LibNH3\

in your Windows Explorer, Norton Commander etc.

Now, open this folder by double-clicking on it.
Within this folder you will see the following files for 64 bit version of Excel

FluidEXL_Graphics_Stud_LibNH3_Docu
FluidEXL_Graphics_Stud_Setup_64.msi
Setup_Stud_64.exe

or for 32-bit version of Excel

FluidEXL_Graphics_Stud_LibNH3_Docu
FluidEXL_Graphics_Stud_Setup.msi
Setup_Stud.exe.

In order to run the installation of FluidEXL*Graphics*Stud double-click the file

Setup_Stud_64.exe (for 64 bit version of Excel)

or

Setup_Stud.exe. (for 32 bit version of Excel).

If problems with Visual C++ runtime library appear then doubleclick the following

FluidEXL_Graphics_Stud_Setup_64.msi (for 64 bit version of Excel)
FluidEXL_Graphics_Stud_Setup.msi (for 32 bit version of Excel)

to install FluidEXL*Graphics*Stud.

The installation of FluidEXL*Graphics*Stud starts with a window telling you that the installer will guide you through the installation. Click the "Next >" button to continue.

In the following dialog box, "Select Installation Folder," the default path offered automatically for the installation of FluidEXL*Graphics*Stud is

C:\Program Files\FluidEXL_Graphics_Stud (for 64 bit version of Excel)
C:\Program Files (x86)\FluidEXL_Graphics_Stud (for 32 bit version of Excel)

By clicking the "Browse…" button, you can change the installation directory prior to installation (see Figure 2.1).

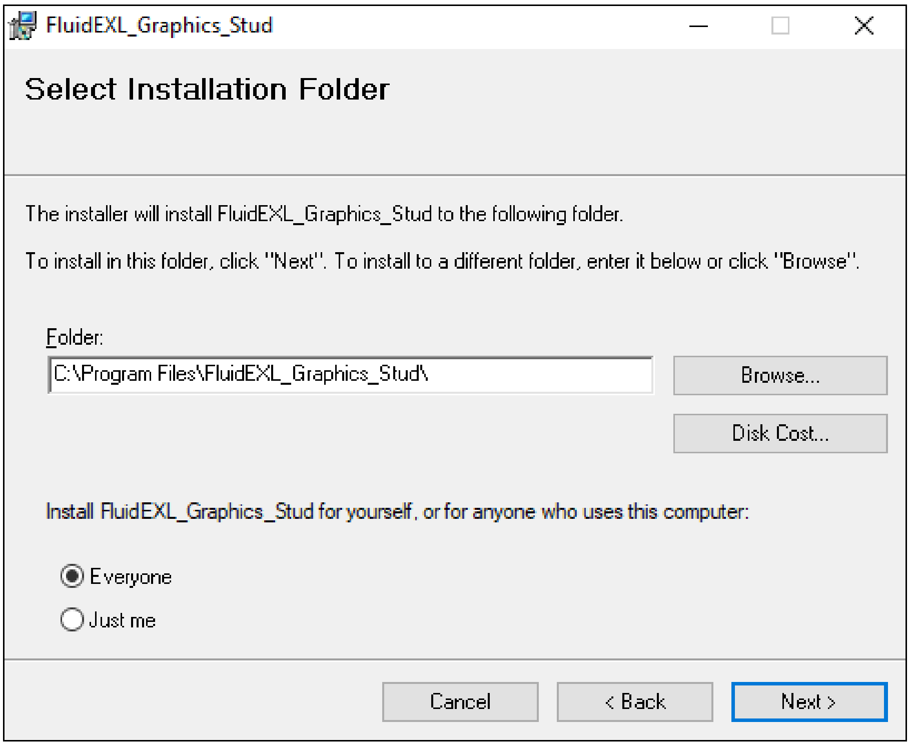


Figure 2.1: Choosing the Installation Folder of FluidEXL*Graphics*Stud

Finally, click on "Next >" to continue installation; click "Next >" again in the "Confirm Installation" window which follows in order to start the installation of FluidEXL*Graphics*Stud.

After FluidEXL*Graphics*Stud has been installed, you will see the sentence "FluidEXL_Graphics_Stud has been successfully installed". Confirm this by clicking the "Close" button.

Note:

The standard file path for the 32 bit and the 64 bit versions of FluidEXL*Graphics*Stud is different. In the following sections the standard path file from the 64 bit version is used.

2.2 Registering FluidEXL^{Graphics}Stud as Add-In in Excel®

After installation in Windows®, FluidEXL^{Graphics}Stud must be registered in Excel® as an Add-In. To do this, start Excel® and carry out the following steps:

- Click the "File" button in the upper left hand corner of Excel® (see Figure 2.2)

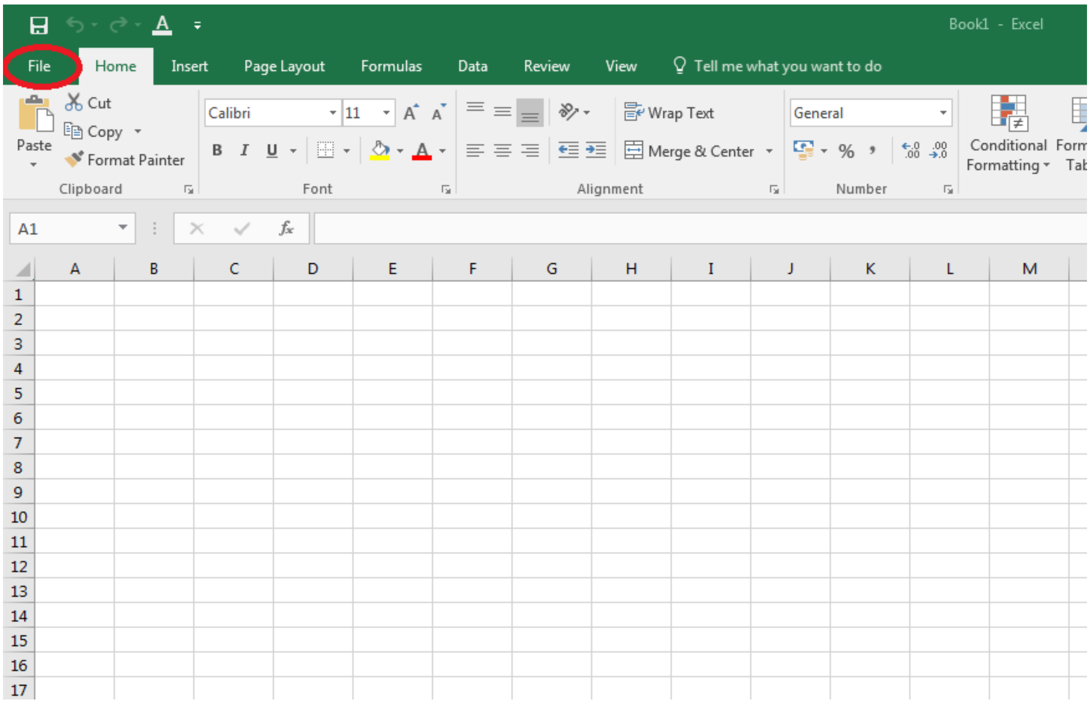


Figure 2.2: Registering FluidEXL^{Graphics}Stud as Add-In in Excel®

- Click on the "Options" button in the menu which appears (see Figure 2.3)

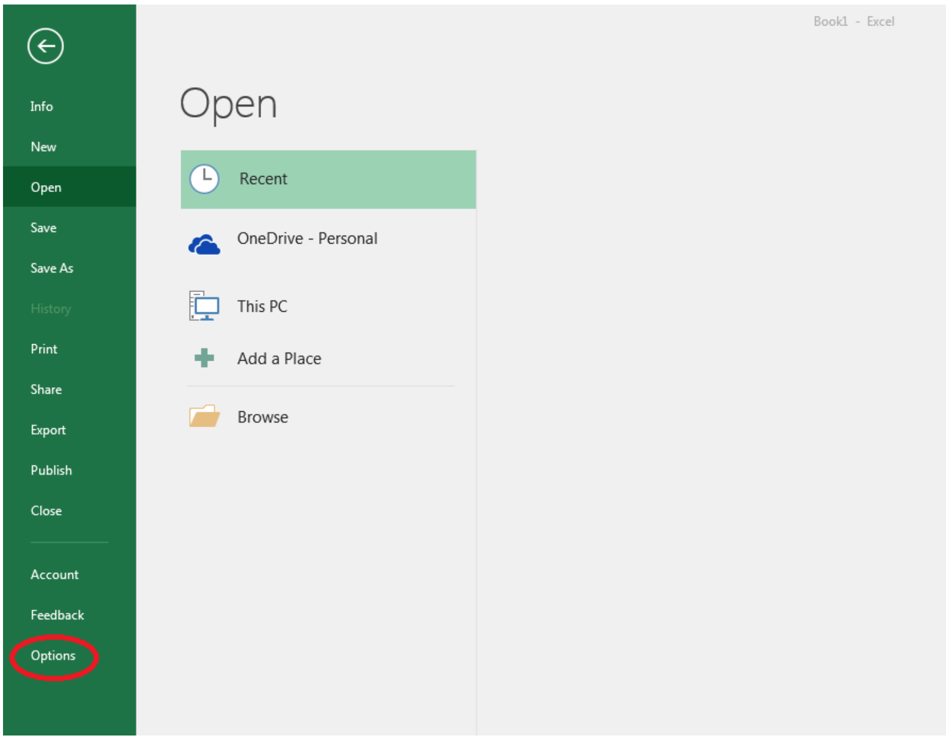


Figure 2.3: Registering FluidEXL^{Graphics}Stud as Add-In in Excel®

- Click on "Add-Ins" in the next menu

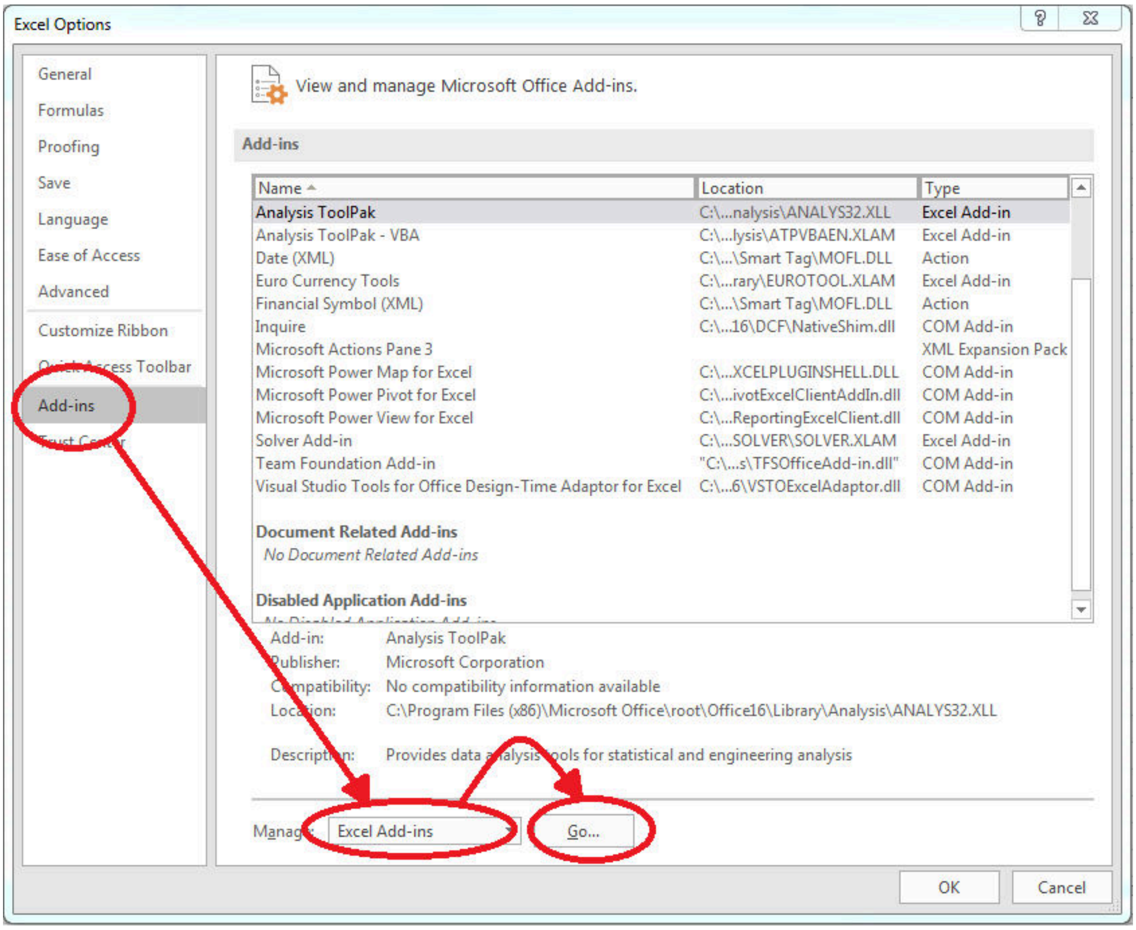


Figure 2.4: Dialog window "Excel Options"

- Should it not be shown in the list automatically, select "Excel Add-ins" (found next to "Manage:" in the lower area of the menu)
- Then click the "Go…" button.
  The dialog box shown in Figure 2.5 appears.

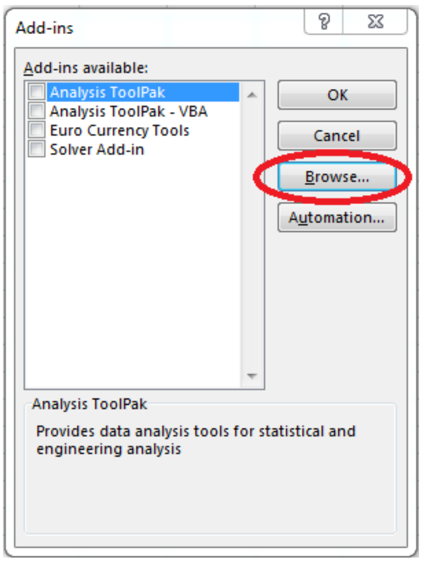


Figure 2.5: Dialog window "Add-Ins available"

Click "Browse" in this window and locate the destination folder, generally

C:\Program Files\FluidEXL_Graphics_Stud\ (for Excel 64 bit) or

C:\Program Files (x86)\FluidEXL_Graphics_Stud\ (for Excel 32 bit).

Now click on the file

"FluidEXL_Graphics_Stud.xla"

and then click "OK."

- Now, "FluidEXL Graphics Eng" will be shown in your list of Add-Ins; see Figure 2.6. (If a checkmark is in the box next to the name "FluidEXL Graphics Eng“, this Add-In will automatically be loaded whenever Excel starts. This will continue to occur unless the checkmark is removed from the box by clicking on it.)
- In order to register the Add-In click the "OK" button in the "Add-Ins" window.

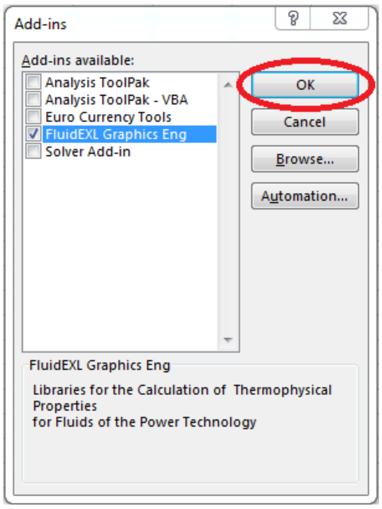


Figure 2.6: Dialog window "Add-Ins"

In order to use FluidEXL*Graphics*Stud in the following example, click on the menu item "Add-Ins" shown in Figure 2.7.

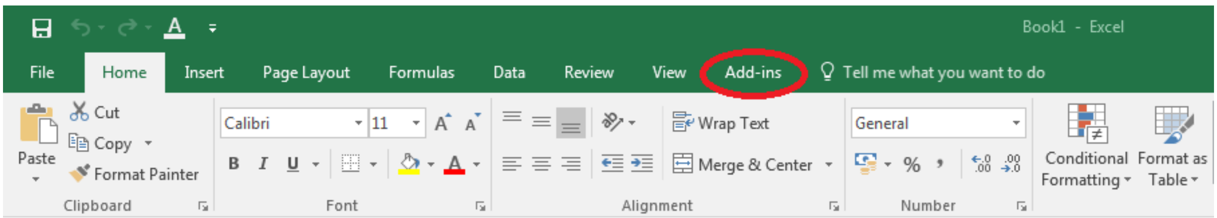


Figure 2.7: Menu item "Add-Ins"

In the upper menu region of Excel®, the FluidEXL*Graphics*Stud menu bar will appear as marked with the red circle in the next figure (Figure 2.8).

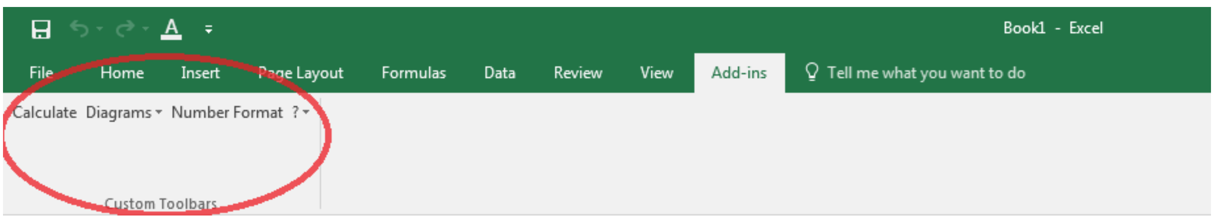


Figure 2.8: FluidEXL*Graphics*Stud menu bar

Installation of FluidEXL*Graphics*Stud in Excel® is now complete.

An example calculation of "LibNH3_Stud" DLL library property functions can be found in chapter 2.3.

2.3 Example calculation

Now we will calculate, step by step, the specific enthalpy *h* as a function of pressure *p*, temperature *t*, and vapor fraction *x*, using FluidEXL^{Graphics}. Please carry out the following steps:

- Start Excel®
- Enter a value for *p* in bar in a cell
  (Range of validity: *p* = 0.0609422 bar... 10000 bar)

  ⇒ e. g.: Enter the value 1 into cell A2
- Enter a value for *t* in °C in a cell
  (Range of validity: *t* = -77.65 °C ... 446.85 °C)

  ⇒ e. g.: Enter the value -30 into cell B2
- Enter a value for *x* in kg saturated steam/kg wet steam into a cell

  Since the wet steam region is calculated automatically by the subprograms, the following fixed details on the vapor fraction *x* are to be considered when the value for *x* is entered:

  Single-phase region

  If the state point to be calculated is located in the single-phase region (liquid or superheated steam) x = –1 must be entered as a pro-forma value.
  Here the backward functions will also result in x = –1.

  Wet-steam region

  When calculating wet steam, a value between 0 and 1 (x = 0 for boiling liquid, x = 1 for saturated steam) must be entered. In this case, the backward functions result in the appropriate value between 0 and 1 for *x*. It is adequate to enter either the given value for *t* and p = –1000, or the given value for *p* and t = –1000, plus the value for *x* between 0 and 1. When p and t and x are entered as given values, the program will consider *p* and *t* to be appropriate to represent the saturation-pressure curve. If it is not the case the calculation for the property of the chosen function to be calculated results in –1000.

  (NH3 saturation line: t_t = -77.65 °C ... t_c = 132.36 °C
  p_t = 0.0609422 bar ... p_c = 113.6114 bar)

  ⇒ e. g. Enter the value -1 into cell C2
- Click the cell in which the enthalpy *h* in kJ/kg is to be displayed.

  ⇒ e. g. Click the cell D2
- Click "Calculate" in the menu bar of FluidEXL^{Graphics}.
  Now the "Insert Function" window appears (see Figure 2.14).

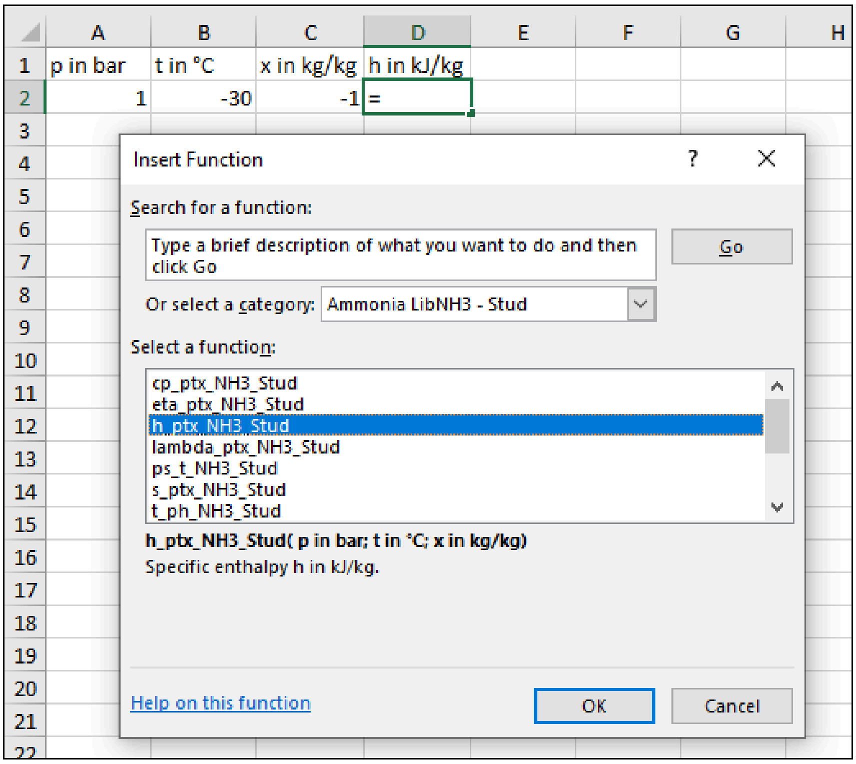


Figure 2.14: Selecting library and function

- Search and click the "Ammonia LibNH3" library in the upper list box next to "Or select a category:".
- Search and click the "h_ptx_NH3" function in the lower list box under "Select a function:".

  Here it is possible to get more information on range of validity, measuring units, error responses, etc. by clicking the "Help on this function" button.
- Click "OK".
  The window shown in Figure 2.15 appears.

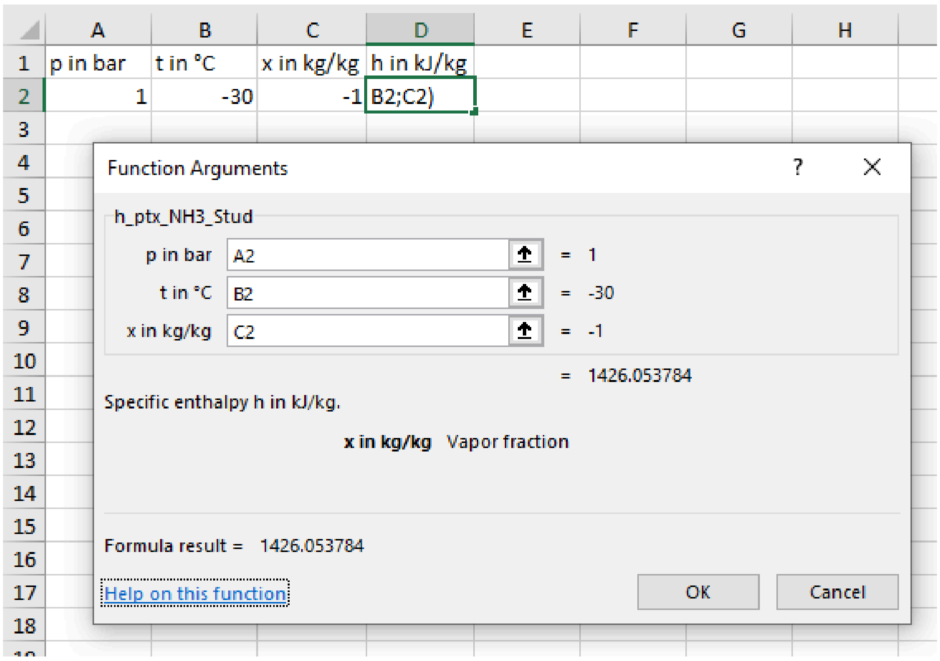


Figure 2.15: Entering the given values for the property calculation

- The Cursor is now situated on the line next to "p in bar". You can now enter the value for *p* either by clicking the cell with the value for *p*, by entering the name of the cell with the value for *p*, or by entering the value for *p* directly.

  ⇒ e. g.: Click on the cell A2

- Situate the cursor next to "t in °C" and enter the value for *t* by clicking the cell with the value for *t*, by entering the name of the cell with the value for *t*, or by entering the value for *t* directly.

  ⇒ e. g.: Type B2 into the window next to "t in °C"

- Situate the cursor next to "x in kg/kg" and enter the value for *x* by clicking the cell with the value for *x*, by entering the name of the cell with the value for *x*, or by entering the value for *x* directly.

  ⇒ e. g.: Click on the cell C2

- Click the "OK" button.

The result for *h* in kJ/kg appears in the chosen cell.

⇒ The result of this example must be h = 1426.053784 kJ/kg.

The calculation of *h* = f(*p*,*t*,*x*) has been carried out. You can now arbitrarily change the values for *p*, *t*, or *x* in the appropriate cells. The specific enthalpy is recalculated and updated every time you change the data. This shows that the Excel® data flow and the DLL calculations are working together successfully.

Now, we will calculate the specific entropy s = f(*p*,*t*,*x*) from the same values of *p*, *t* and *x*:

- Click the cell in which the enthalpy *s* in kJ/(kg K) is to be displayed.

  ⇒ e. g. Click the cell E2

- Click "Calculate" in the menu bar of FluidEXL*Graphics*.
  Now the "Insert Function" window appears .

- In the drop-down menu in the middle, next to "Or select a category:" the library "Ammonia LibNH3" is marked because this library was already called when we previously calculated the enthalpy.

- Choose and click the "s_ptx_NH3" function below.

- Click "OK"
  The input menu of the s_ptx_NH3 function appears.

- The Cursor is now situated on the line next to "p in bar". You can now enter the value for *p* either by clicking the cell with the value for *p*, by entering the name of the cell with the value for *p*, or by entering the value for *p* directly.

- Situate the cursor next to "t in °C" and enter the value for *t* by clicking the cell with the value for *t*, by entering the name of the cell with the value for *t*, or by entering the value for *t* directly.

- Situate the cursor next to "x in kg/kg" and enter the value for *x* by clicking the cell with the value for *x*, by entering the name of the cell with the value for *x*, or by entering the value for *x* directly.

- Click "OK"

  The result for *s* in kJ/kg K appears in the chosen cell.

⇒ The result of this example must be s = 6.160660302 kJ/(kg K).

The calculation of s = f(p,t,x) has thus been carried out. You can now arbitrarily change the values for p, t, or x in the appropriate cells. The specific enthalpy is recalculated and updated every time you change the data. This shows that the Excel® data flow and the DLL calculations are working together successfully.

Note:

If the calculation results in –1000, this indicates that the values entered are located outside the range of validity of LibNH3. More detailed information on each function and its range of validity is available in Chapter 3.

For further property functions calculable in FluidEXL*Graphics*, see the function table in Chapter 1.

Number Formats

When using FluidEXL*Graphics* you have the option of choosing special number formats in advance.
Changes can be made as follows:

- Click the cell or select and click on the cells you wish to format.
  (In empty cells the new format will be applied once a value has been entered.)
- Click "Number Format" in the FluidEXL*Graphics* menu bar.
- Select the desired number format in the dialog box which appears:

  "STD – Standard": Insignificant zeros behind the decimal point are not shown.

  "FIX – Fixed Number of Digits": All set decimal places are shown, including insignificant zeros.

  "SCI – Scientific Format": Numbers are always shown in the exponential form with the set number of decimal places.
- Set the "Number of decimal places" by entering the number into the appropriate window.
- Confirm this by clicking the "OK" button.

As an example, the table below shows the three formats for the number 1.230 adjusted for three decimal places:

STD	1.23
FIX	1.230
SCI	1.230E+00

This formatting can also be applied to cells which have already been calculated.

2.4 Removing FluidEXL^{Graphics}Stud

In order to unregister the FluidEXL^{Graphics}Stud Add-In in Excel® carry out the following commands:

- Click the “File” button in the upper left corner of Excel®
- Click on the "Options" button in the menu which appears

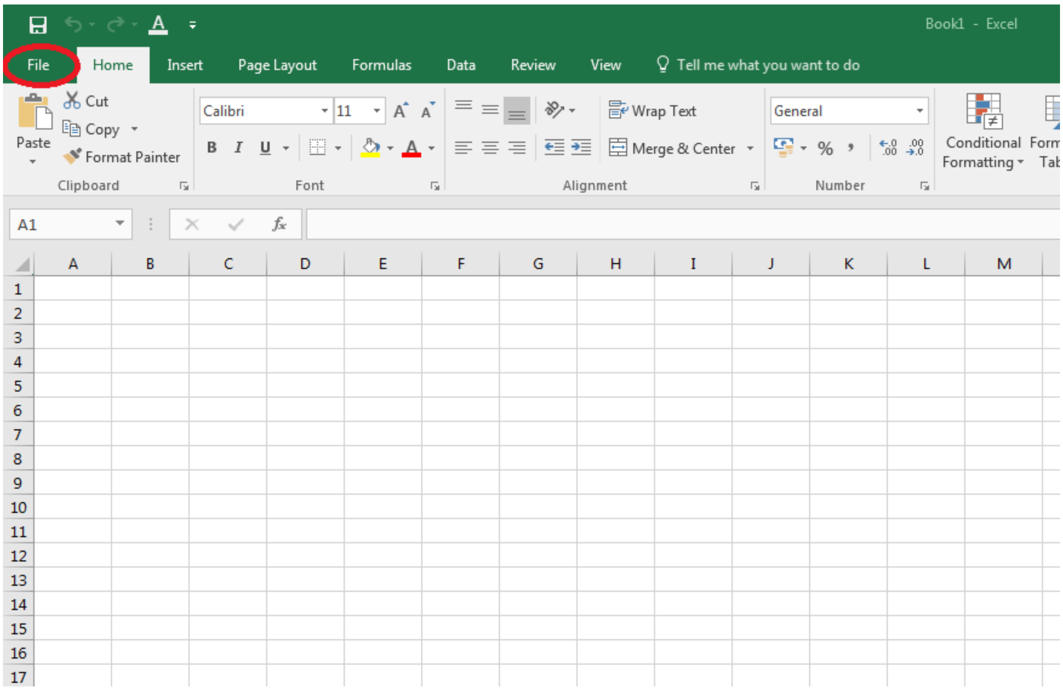


Figure 2.18: Unregistering FluidEXL^{Graphics}Stud as Add-In in Excel®

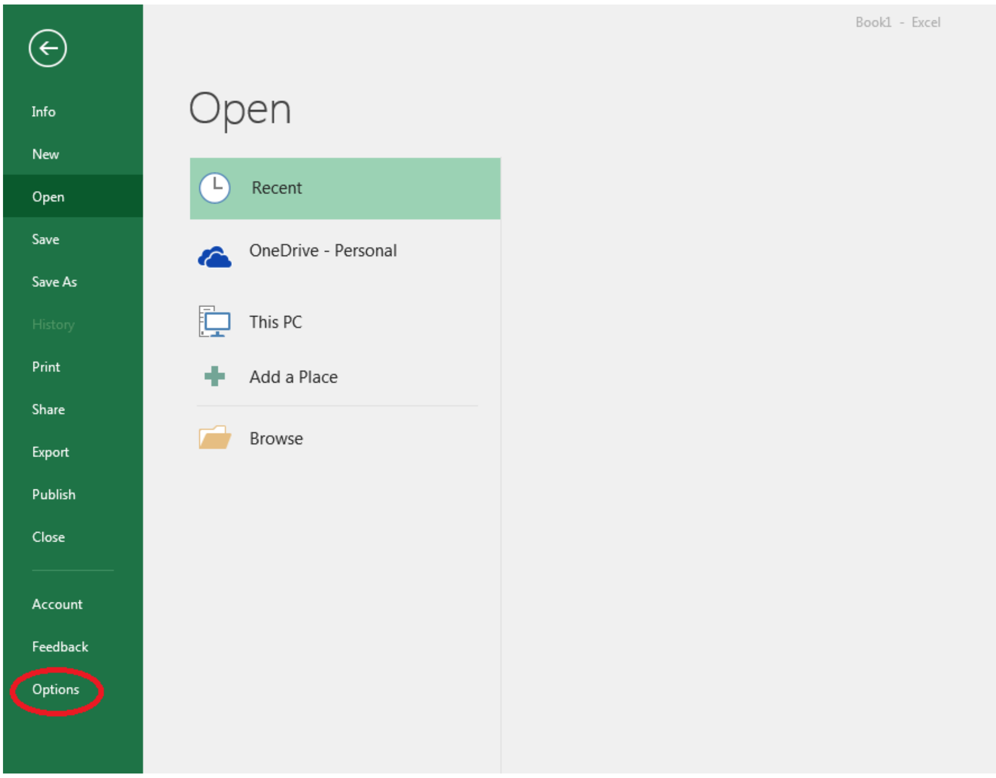


Figure 2.19 Unregistering FluidEXL^{Graphics}Stud as Add-In in Excel®

- Click on "Add-Ins" in the next menu (Figure 2.19)

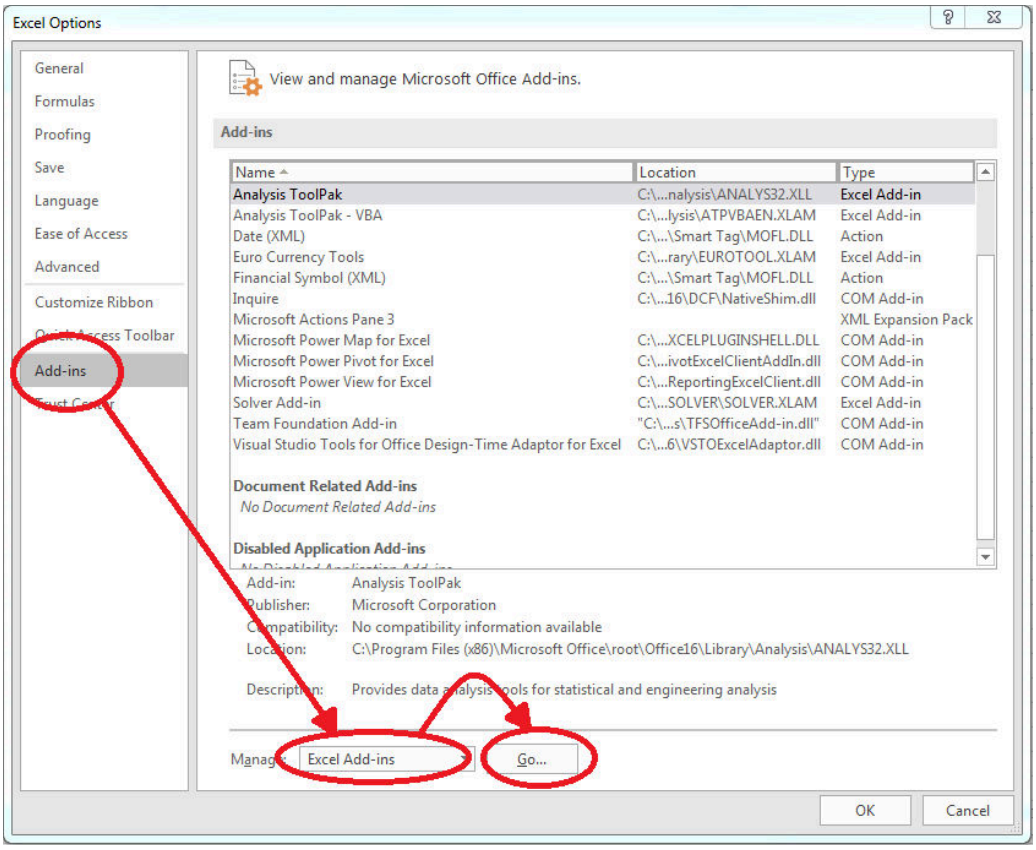


Figure 2.20: Dialog window "Add-Ins"

- If it is not shown in the list automatically, chose and click "Excel Add-ins" next to "Manage:" in the lower area of the menu
- Afterwards click the "Go…" button
- Remove the checkmark in front of

  "FluidEXL Graphics Stud"

  in the window which now appears. Click the "OK" button to confirm your entry.

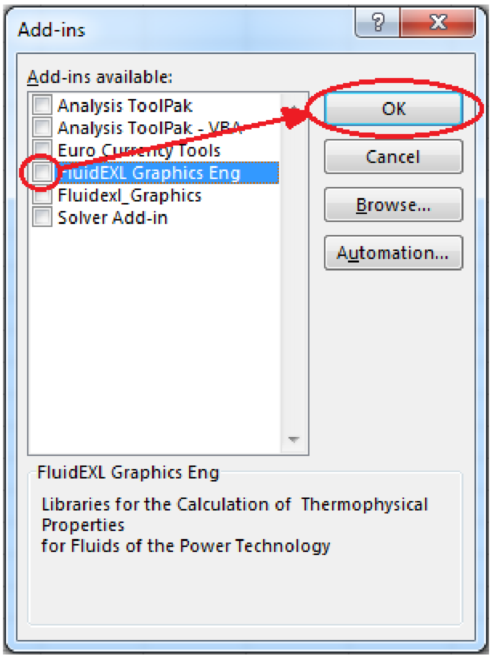


Figure 2.20: Dialog window "Add-Ins"

In order to remove FluidEXL*Graphics*Stud from Windows and the hard drive, click "Start" in the Windows task bar, select "Settings" and click "Control Panel."

Now, double click on "Add or Remove Programs."

In the list box of the "Add or Remove Programs" window that appears, select

"FluidEXL Graphics Stud"

by clicking on it and then clicking the "Add/Remove…" button.

Click "Automatic" in the following dialog box and then the "Next >" button.

Click "Finish" in the "Perform Uninstall" window.

Answer the question of whether all shared components should be removed with "Yes to All."

Finally, close the "Add or Remove Programs" and "Control Panel" windows.

Now FluidEXL*Graphics*Stud has been completely removed from your computer.

KCE-ThermoFluidProperties
www.thermofluidprop.com

Hochschule Zittau/Görlitz
UNIVERSITY OF APPLIED SCIENCES

Property Libraries for Calculating Heat Cycles, Boilers, Turbines and Refrigerators

Water and Steam

Library LibIF97

- Industrial Formulation IAPWS-IF97 (Revision 2007)
- Supplementary Standards IAPWS-IF97-S01, -S03rev, -S04, and -S05
- IAPWS Revised Advisory Note No. 3 on Thermodynamic Derivatives (2008)

Library LibIF97_META

- Industrial Formulation IAPWS-IF97 (Revision 2007) for metastable steam

Humid Combustion Gas Mixtures

Library LibHuGas

Model: Ideal mixture of the real fluids:

CO_2 - Span, Wagner H_2O - IAPWS-95
O_2 - Schmidt, Wagner N_2 - Span et al.
Ar - Tegeler et al.

and of the ideal gases:
SO_2, CO, Ne
(Scientific Formulation of Bücker et al.)

Consideration of:
- Dissociation from VDI 4670
- Poynting effect

Humid Air

Library LibHuAir

Model: Ideal mixture of the real fluids:
- Dry air from Lemmon et al.
- Steam, water and ice from IAPWS-IF97 and IAPWS-06

Consideration of:
- Condensation and freezing of steam
- Dissociation from VDI 4670
- Poynting effect from ASHRAE RP-1485

Extremely Fast Property Calculations

Spline-Based Table Look-up Method (SBTL)

Library LibSBTL_IF97
Library LibSBTL_95
Library LibSBTL_HuAir

For steam, water, humid air, carbon dioxide and other fluids and mixtures according IAPWS Guideline 2015 for Computational Fluid Dynamics (CFD), real-time and non-stationary simulations

Carbon Dioxide Including Dry Ice

Library LibCO2

Formulation of Span and Wagner (1996)

Seawater

Library LibSeaWa

IAPWS Industrial Formulation 2013

Ice

Library LibICE

Ice from IAPWS-06, Melting and sublimation pressures from IAPWS-08, Water from IAPWS-IF97, Steam from IAPWS-95 and -IF97

Ideal Gas Mixtures

Library LibIdGasMix

Model: Ideal mixture of the ideal gases:

Ar	NO	He	Propylene
Ne	H_2O	F_2	Propane
N_2	SO_2	NH_3	Iso-Butane
O_2	H_2	Methane	n-Butane
CO	H_2S	Ethane	Benzene
CO_2	OH	Ethylene	Methanol
Air			

Consideration of:
- Dissociation from the VDI Guideline 4670

Library LibIDGAS

Model: Ideal gas mixture from VDI Guideline 4670

Consideration of:
- Dissociation from the VDI Guideline 4670

Humid Air

Library ASHRAE LibHuAirProp

Model: Virial equation from ASHRAE Report RP-1485 for real mixture of the real fluids:
- Dry air
- Steam

Consideration of:
- Enhancement of the partial saturation pressure of water vapor at elevated total pressures

www.ashrae.org/bookstore

Dry Air Including Liquid Air

Library LibRealAir

Formulation of Lemmon et al. (2000)

Refrigerants

Ammonia

Library LibNH3

Formulation of Tillner-Roth et al. (1993)

R134a

Library LibR134a

Formulation of Tillner-Roth and Baehr (1994)

Iso-Butane

Library LibButane_Iso

Formulation of Bücker and Wagner (2006)

n-Butane

Library LibButane_n

Formulation of Bücker and Wagner (2006)

Mixtures for Absorption Processes

Ammonia/Water Mixtures

Library LibAmWa

IAPWS Guideline 2001 of Tillner-Roth and Friend (1998)

Helmholtz energy equation for the mixing term

(also useable for calculating the Kalina Cycle)

Water/Lithium Bromide Mixtures

Library LibWaLi

Formulation of Kim and Infante Ferreira (2004)

Gibbs energy equation for the mixing term

Liquid Coolants

Liquid Secondary Refrigerants

Library LibSecRef

Liquid solutions of water with

$C_2H_6O_2$	Ethylene glycol
$C_3H_8O_2$	Propylene glycol
C_2H_5OH	Ethanol
CH_3OH	Methanol
$C_3H_8O_3$	Glycerol
K_2CO_3	Potassium carbonate
$CaCl_2$	Calcium chloride
$MgCl_2$	Magnesium chloride
NaCl	Sodium chloride
$C_2H_3KO_2$	Potassium acetate
$CHKO_2$	Potassium formate
LiCl	Lithium chloride
NH_3	Ammonia

Formulation of the International Institute of Refrigeration (IIR 2010)

Ethanol

Library LibC2H5OH

Formulation of
Schroeder et al. (2014)

Methanol

Library LibCH3OH

Formulation of
de Reuck and Craven (1993)

Propane

Library LibPropane

Formulation of
Lemmon et al. (2009)

Siloxanes as ORC Working Fluids

Octamethylcyclotetrasiloxane $C_8H_{24}O_4Si_4$ **Library LibD4**

Decamethylcyclopentasiloxane $C_{10}H_{30}O_5Si_5$ **Library LibD5**

Tetradecamethylhexasiloxane $C_{14}H_{42}O_5Si_6$ **Library LibMD4M**

Hexamethyldisiloxane $C_6H_{18}OSi_2$ **Library LibMM**

Formulation of Colonna et al. (2006)

Dodecamethylcyclohexasiloxane $C_{12}H_{36}O_6Si_6$ **Library LibD6**

Decamethyltetrasiloxane $C_{10}H_{30}O_3Si_4$ **Library LibMD2M**

Dodecamethylpentasiloxane $C_{12}H_{36}O_4Si_5$ **Library LibMD3M**

Octamethyltrisiloxane $C_8H_{24}O_2Si_3$ **Library LibMDM**

Formulation of Colonna et al. (2008)

Nitrogen and Oxygen

**Libraries
LibN2 and LibO2**

Formulations of Span et al. (2000)
and Schmidt and Wagner (1985)

Hydrogen

Library LibH2

Formulation of
Leachman et al. (2009)

Helium

Library LibHe

Formulation of
Arp et al. (1998)

Hydrocarbons

Decane $C_{10}H_{22}$ **Library LibC10H22**

Isopentane C_5H_{12} **Library LibC5H12_Iso**

Neopentane C_5H_{12} **Library LibC5H12_Neo**

Isohexane C_6H_{14} **Library LibC6H14**

Toluene C_7H_8 **Library LibC7H8**

Formulation of Lemmon and Span (2006)

Further Fluids

Carbon monoxide CO **Library LibCO**

Carbonyl sulfide COS **Library LibCOS**

Hydrogen sulfide H_2S **Library LibH2S**

Nitrous oxide N_2O **Library LibN2O**

Sulfur dioxide SO_2 **Library LibSO2**

Acetone C_3H_6O **Library LibC3H6O**

Formulation of Lemmon and Span (2006)

KCE
ThermoFluidProperties

For more information please contact:

KCE-ThermoFluidProperties UG & Co. KG
Prof. Dr. Hans-Joachim Kretzschmar
Wallotstr. 3
01307 Dresden, Germany

Internet: www.thermofluidprop.com
Email: info@thermofluidprop.com
Phone: +49-351-27597860
Mobile: +49-172-7914607
Fax: +49-3222-1095810

The following thermodynamic and transport properties can be calculated[a]:

Thermodynamic Properties

- Vapor pressure p_s
- Saturation temperature T_s
- Density ρ
- Specific volume v
- Enthalpy h
- Internal energy u
- Entropy s
- Exergy e
- Isobaric heat capacity c_p
- Isochoric heat capacity c_v
- Isentropic exponent κ
- Speed of sound w
- Surface tension σ

Transport Properties

- Dynamic viscosity η
- Kinematic viscosity ν
- Thermal conductivity λ
- Prandtl number Pr
- Thermal diffusivity a

Backward Functions

- $T, v, s\ (p,h)$
- $T, v, h\ (p,s)$
- $p, T, v\ (h,s)$
- $p, T\ (v,h)$
- $p, T\ (v,u)$

Thermodynamic Derivatives

- Partial derivatives used in process modeling can be calculated.

[a] Not all of these property functions are available in all property libraries.

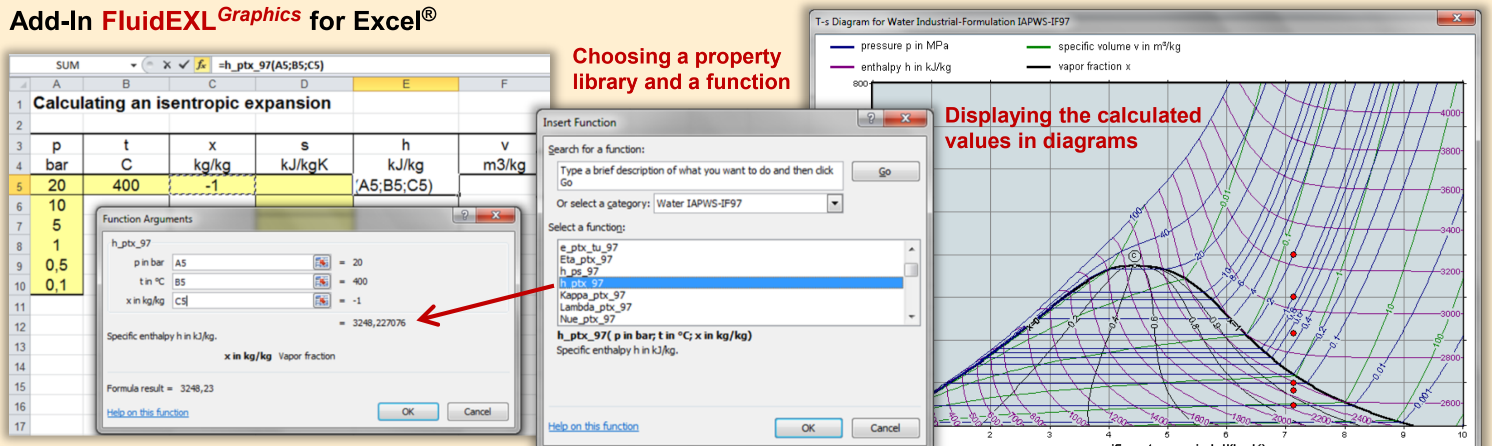
www.thermofluidprop.com

KCE-ThermoFluidProperties
www.thermofluidprop.com

Hochschule Zittau/Görlitz
UNIVERSITY OF APPLIED SCIENCES

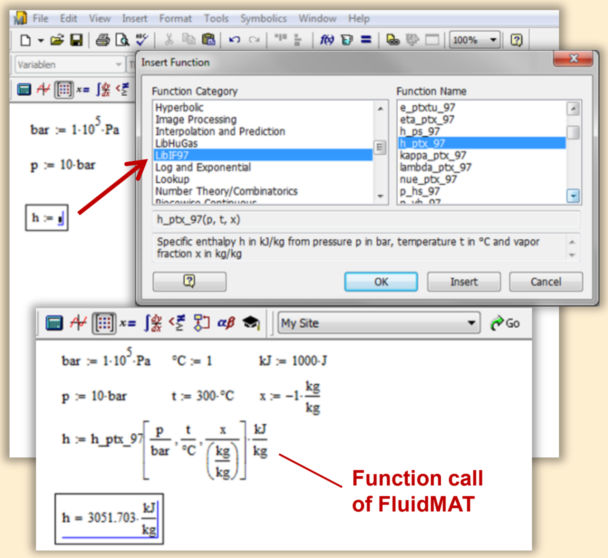
Property Software for Calculating Heat Cycles, Boilers, Turbines and Refrigerators

Add-In FluidEXL*Graphics* for Excel®



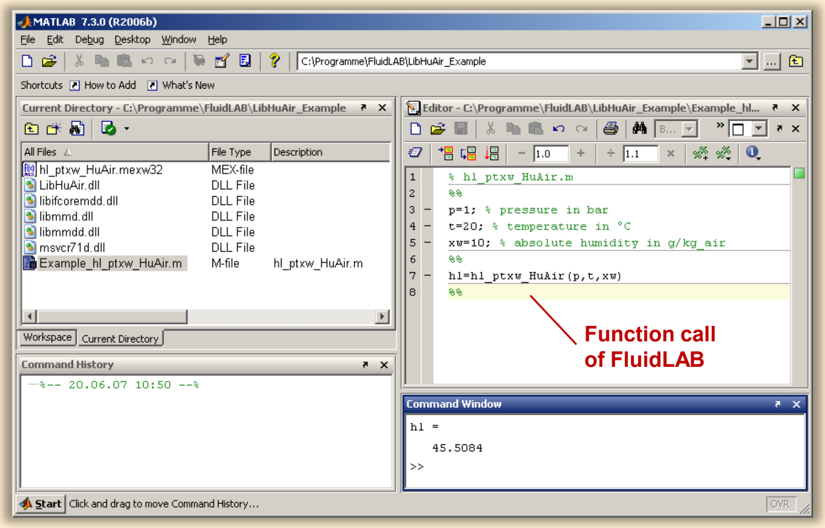
Add-On FluidMAT for Mathcad®
Add-On FluidPRIME for Mathcad Prime®

The property libraries can be used in Mathcad® and Mathcad Prime®.



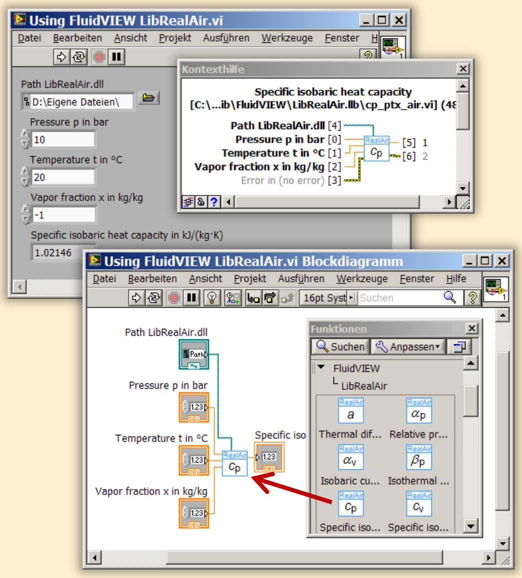
Add-On FluidLAB for MATLAB® and SIMULINK®

Using the Add-In FluidLAB the property functions can be called in MATLAB® and SIMULINK®.



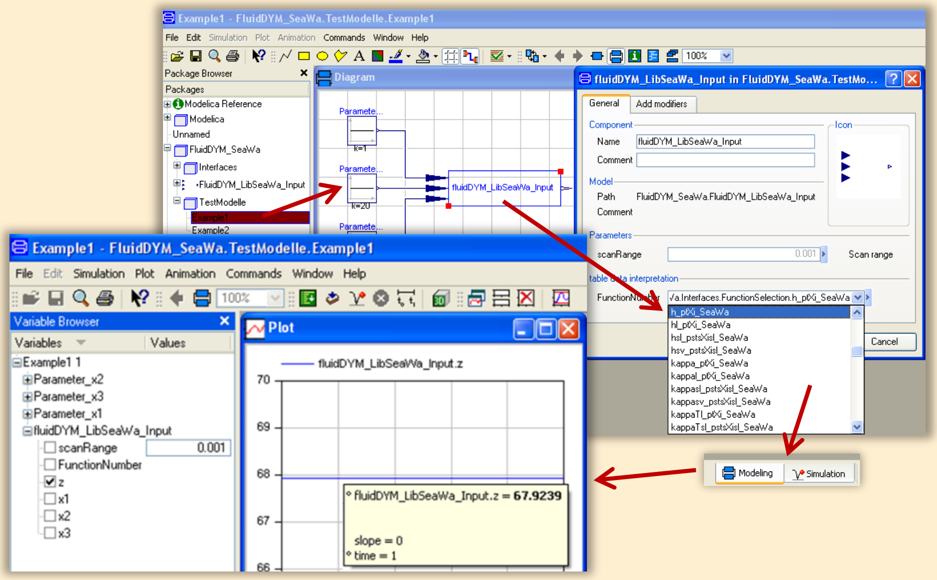
Add-On FluidVIEW for LabVIEW™

The property functions can be calculated in LabVIEW™.

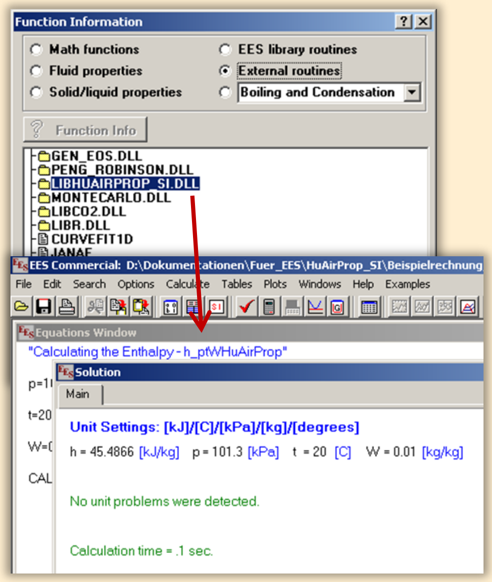


Add-On FluidDYM for DYMOLA® (Modelica) and SimulationX®

The property functions can be called in DYMOLA® and SimulationX®.

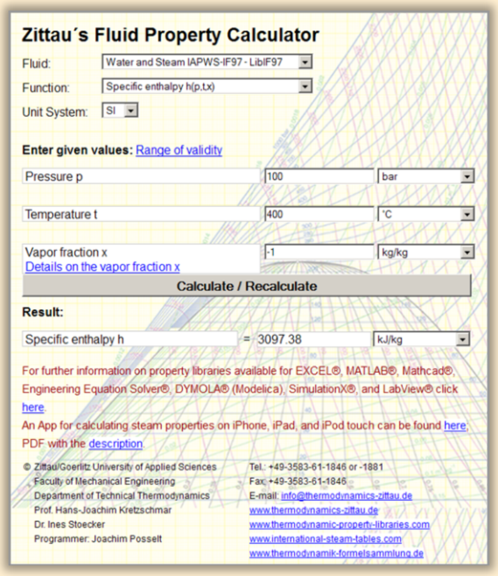


Add-On **FluidEES** for Engineering Equation Solver®



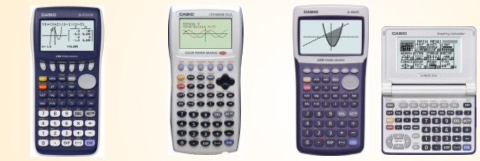
App International Steam Tables for iPhone, iPad, iPod touch, Android Smartphones and Tablets

Online Property Calculator at www.thermofluidprop.com



Property Software for Pocket Calculators

FluidCasio

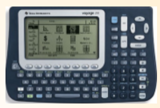


fx 9750 G II | CFX 9850 fx-GG20 | CFX 9860 G Graph 85 | ALGEBRA FX 2.0

FluidHP

HP 48 | HP 49

FluidTI



TI Voyage 200

TI Nspire CX CAS
TI Nspire CAS

TI 83
TI 84
TI 89

TI 92

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- Saturation temperature T_s
- Density ρ
- Specific volume v
- Enthalpy h
- Internal energy u
- Entropy s
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[a] Not all of these property functions are available in all property libraries.

www.thermofluidprop.com

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