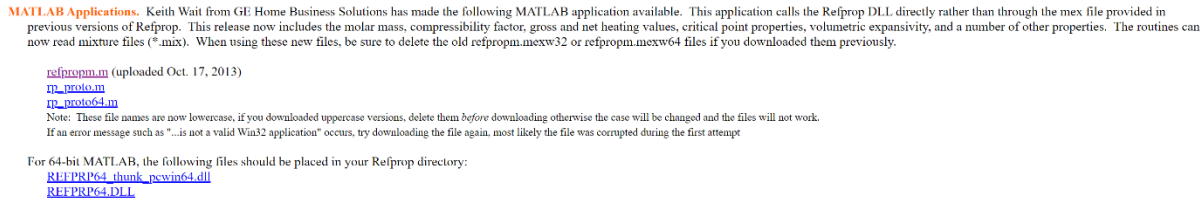
==========German version below==========

Anleitung Refprop in Matlab installieren:

1. Auf folgende Webseite zugreifen (https://trc.nist.gov/refprop/LINKING/Linking.htm#MatLabApplications)

2. Runterscrollen auf diesen Abschnitt:



MATLAB Applications. Keith Wait from GE Home Business Solutions has made the following MATLAB application available. This application calls the Refprop DLL directly rather than through the mex file provided in previous versions of Refprop. This release now includes the molar mass, compressibility factor, gross and net heating values, critical point properties, volumetric expansivity, and a number of other properties. The routines can now read mixture files (*.mix). When using these new files, be sure to delete the old refpropm.mexw32 or refpropm.mexw64 files if you downloaded them previously.

refpropm.m (uploaded Oct. 17, 2013)
rp_proto.m
rp_proto64.m
Note: These file names are now lowercase, if you downloaded uppercase versions, delete them *before* downloading otherwise the case will be changed and the files will not work.
If an error message such as "...is not a valid Win32 application" occurs, try downloading the file again, most likely the file was corrupted during the first attempt

For 64-bit MATLAB, the following files should be placed in your Refprop directory:
REFPRP64_thunk_pcwin64.dll
REFPRP64.DLL

   i. " REFPRP64_thunk_pcwin64.dll" & " REFPRP64.DLL" herunterladen und in dem Refprop Ordner speichern

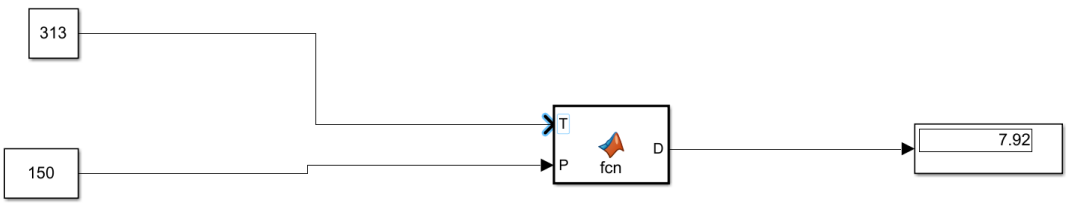
      ACHTUNG: evtl. sind hierfür Administratorrechte notwendig. Wie man diese aktiviert, ist auf folgender Webseite beschrieben (https://www.giga.de/tipp/windows-11-und-10-administrator-konto-aktivieren-so-geht-s/)

   ii. „refpropm.m" & " rp_proto.m" & " rp_proto64.m" herunterladen → Rechtsklick → Link/Ziel speichern unter → in „MATLAB Search Path" (Ordner, in dem normalerweise die Matlab-Modelle gespeichert werden) navigieren → MANUEL hinter den Namen der Datei noch „.m" schreiben! (siehe Bild) → speichern

3. Matlab öffnen → Refprop testen: bspw. Folgendes eingeben:
   i. D = refpropm('D','T',313,'P',150,'R1233zd(E)') und auf Run drücken → müsste die Dichte herausgeben
      i. Erklärung: refpropm (gesuchte Variable, gegebene Variable1, Wert Variable1, gegebene Variable2, Wert Variable2, Fluid)

   ii. [S Cp] = refpropm('SC','T',373.15,'Q',1,'water') → Falls man zwei Werte sucht

4. In Simulink auf Refprop zugreifen:




```
function D  = fcn(T,P)
D = zeros(1,1);
coder.extrinsic('refpropm')
D = refpropm('D','T',T,'P',P,'R1233zd(E)');
```

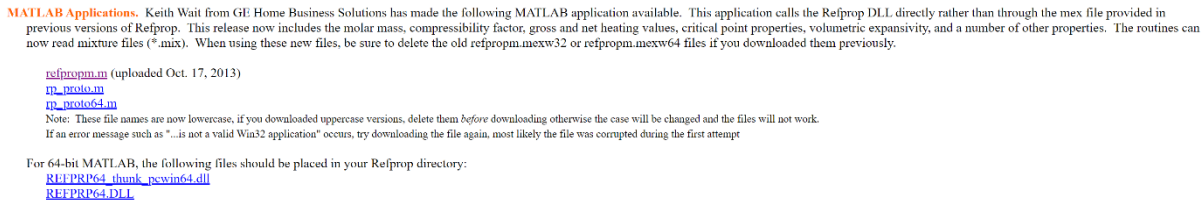
5. Variablen & Einheiten: siehe auch (https://trc.nist.gov/refprop/LINKING/refpropm.m)
    i. A Speed of sound [m/s]
    ii. B Volumetric expansivity (beta) [1/K]
    iii. C Cp [J/(kg K)]
    iv. D Density [kg/m^3]
    v. F Fugacity [kPa] (returned as an array)
    vi. G Gross heating value [J/kg]
    vii. H Enthalpy [J/kg]
    viii. I Surface tension [N/m]
    ix. J Isenthalpic Joule-Thompson coeff [K/kPa]
    x. K Ratio of specific heats (Cp/Cv) [-]
    xi. L Thermal conductivity [W/(m K)]
    xii. M Molar mass [g/mol]
    xiii. N Net heating value [J/kg]
    xiv. O Cv [J/(kg K)]
    xv. P Pressure [kPa]
    xvi. Q Quality (vapor fraction) (kg/kg)
    xvii. S Entropy [J/(kg K)]
    xviii. T Temperature [K]
    xix. U Internal energy [J/kg]
    xx. V Dynamic viscosity [Pa*s]
    xxi. X Liquid phase & gas phase comp.(mass frac.)
    xxii. Y Heat of Vaporization [J/kg]
    xxiii. Z Compressibility factor
    xxiv. $ Kinematic viscosity [cm^2/s]
    xxv. % Thermal diffusivity [cm^2/s]
    xxvi. ^ Prandtl number [-]
    xxvii.) Adiabatic bulk modulus [kPa]
    xxviii. | Isothermal bulk modulus [kPa]
    xxix. = Isothermal compressibility [1/kPa]
    xxx. ~ Cstar [-]
    xxxi. ` Throat mass flux [kg/(m^2 s)]
    xxxii. + Liquid density of equilibrium phase
    xxxiii. - Vapor density of equilibrium phase

==========**English version below**==========

How to install Refprop in Matlab:

1. access the following web page (https://trc.nist.gov/refprop/LINKING/Linking.htm#MatLabApplications).

2. scroll down to this section:


MATLAB Applications. Keith Wait from GE Home Business Solutions has made the following MATLAB application available. This application calls the Refprop DLL directly rather than through the mex file provided in previous versions of Refprop. This release now includes the molar mass, compressibility factor, gross and net heating values, critical point properties, volumetric expansivity, and a number of other properties. The routines can now read mixture files (*.mix). When using these new files, be sure to delete the old refpropm.mexw32 or refpropm.mexw64 files if you downloaded them previously.

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For 64-bit MATLAB, the following files should be placed in your Refprop directory:
REFPRP64_thunk_pcwin64.dll
REFPRP64.DLL

i. Download " REFPRP64_thunk_pcwin64.dll" & " REFPRP64.DLL" and save it in the Refprop folder.

ATTENTION: you may need administrator rights for this. How to activate them is described on the following website (https://www.javatpoint.com/how-to-login-as-administrator-in-windows-10).

ii. download "refpropm.m" & " rp_proto.m" & " rp_proto64.m" → right click → link/save target as → navigate to "MATLAB Search Path" (folder where normally the Matlab models are saved) → MANUEL write ".m" behind the name of the file! (see picture) → save

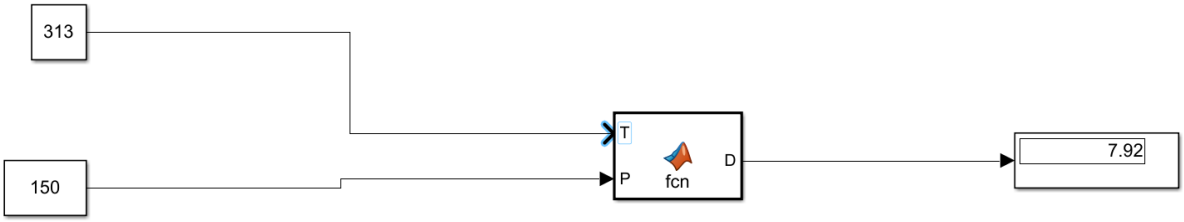
3. open Matlab test Refprop: enter the following:

i. D = refpropm('D','T',313,'P',150,'R1233zd(E)') → and press Run should return the density

→ Explanation: refpropm (searched variable, given variable1, value variable1, given variable2, value variable2, fluid).

ii. [S Cp] = refpropm('SC','T',373.15,'Q',1,'water') → If looking for two values.

4. access refprop in Simulink:




```
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D = zeros(1,1);
coder.extrinsic('refpropm')
D = refpropm('D','T',T,'P',P,'R1233zd(E)');
```

5. Variables & units: see also (https://trc.nist.gov/refprop/LINKING/refpropm.m)

i. A Speed of sound [m/s]
ii. B Volumetric expansivity (beta) [1/K]
iii. C Cp [J/(kg K)]
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