

# Release Notes

## Plate-Fin/Cold Plate

---

INSTED Ver. 11.3



**TTC TECHNOLOGIES, INC.**

**May 06, 2020**

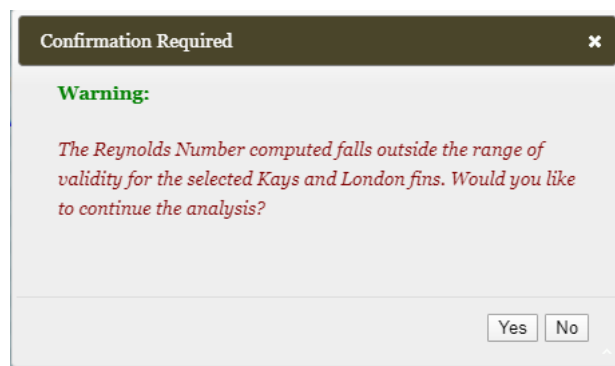
## Release Features

### INSTED Ver. 11.3

The latest version of INSTED (Ver. 11.3) includes the following enhancements. The modules affected are INSTED/Plate-Fin and INSTED/Cold Plate. Also, TTC's Math Calculator and Unit Conversion tools have now been added to the PC version of INSTED, which is available free-of-charge to licensed customers with an up-to-date annual maintenance contract with TTC.

#### *A Resolved Issue in the Plate-Fin Module*

- **Kays and London Fin Error:** In the previous version of the Plate-Fin module, there is a condition in which a run is halted when your data is outside the range of validity of the j/f data in Kays and London. In this case, the Reynolds number computed falls outside of the range of validity for the selected Kays and London fins. This issue leads to an error code "1" and a termination of the run. In the current version of the Plate-Fin module, the following warning message will now be displayed, in which you have the option of continuing with the simulation, even though the parameters are outside the range of Kays and London's original data, or you can terminate the run.



If "No" is selected in the dialog box (above), the run will be terminated. If "Yes" is selected, the calculation will continue, and an extrapolation will be used to calculate the j/f data beyond the data points of the Kays and London fins. Obviously, the you must pay particular attention to the analysis results you obtain by "forcing" a solution beyond the database.

#### *Enhancements to the Plate-Fin & Cold Plate Modules*

- The current version of Plate-Fin and Cold Plate modules provides a new option to enable you to specify "Fins Per Inch," or "FPI," instead of "Fin Pitch." In both the Plate-Fin and Cold Plate modules, a new "FPI" button has been added to the right of the input box for "Fin Pitch," as shown in the screen shot below.

III. Fin Properties:

Plate Spacing ( $h$ ):  m

Fin Thickness ( $t$ ):  m

Fin Pitch ( $p$ ):  m **FPI**

Fin Conductivity:  W/(m·K)

Fin Density:  kg/m<sup>3</sup>

After the “FPI” button has been clicked, a small dialog box (below) will be presented for the you to specify the FPI value.

FPI

Number of Fins per Inch (FPI):

Set Cancel

After the FPI value has been typed in, please click the “Set” button to close the window and allow the FPI value to be automatically converted to fin pitch.

Plate Spacing ( $h$ ):  m

Fin Thickness ( $t$ ):  m

Fin Pitch ( $p$ ):  m **FPI**

Fin Conductivity:  W/(m·K)

Fin Density:  kg/m<sup>3</sup>

If the fin pitch value has already been specified, the corresponding FPI value can be obtained by clicking the “FPI” button.

### *New XML File Format to Create User-Defined/Custom Data*

- In the previous version the Plate-Fin and Cold Plate modules, only an Excel file could be used to create user-defined (custom) data. In the current version, the data can now be created via an XML file. The XML format is based on pure plain text and can be easily read by both humans and the computer. As opposed to the Excel file approach, INSTED does not require any third-party “driver” (Microsoft for Excel) in order to interpret an XML file. This can prevent some issues that have otherwise been observed on some computer systems when the driver is accidentally uninstalled or does not work properly.
- To use an XML file to create user-defined thermophysical fluid data, in the “Custom Fluid Properties” page, choose “XML” in “Choose File Format.”

**Custom Fluid Properties:**

Existing custom fluid data:

Choose a data for details: -- Please Select -- Details (Excel) Details (XML) Delete

Upload a new custom fluid data:

Choose File Format: XML

Choose a File to Upload: Choose File No file chosen

Upload XML File ?

Download template file: [single phase](#), [two phase](#) ?

The template files for the XML format can be downloaded to create custom fluid data for both single-phase and two-phase fluids. A sample single-phase template file is shown below. Instructions are given in the comment block at the beginning of the file. You can modify the template file to fill-in your own custom thermophysical fluid properties data, save the changes of the file, and then use “Choose File” / “Upload XML File” buttons to upload the file to INSTED. If no error is found, the new created data can be viewed in “Choose a data for details” Select box and the data will become available in various INSTED modules. Note that, currently, all the data used to define the thermophysical fluid properties in the XML format must be specified in SI units.

```
<CustomFluid xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <!-- Note Type 1 Indicates Single Phase Fluid
  The values must be in the following units
    Temperature - [K]
    Density - [kg/m^3]
    Specific Heat - [J/(kg.K)]
    Viscosity - [kg/(m.s)]
    Thermal Conductivity - [W/(m.K)]
    Enthalpy - [J/kg]
    Surface Tension - [N/m]
  Enthalpy and surface tension values are optional -->
  <Type>1</Type>
  <Name>Air (288-378)</Name>
  <Points>10</Points>
  <SinglePhase>
    <Temperature>
      <Value>288.16000366</Value>
      <Value>298.16000366</Value>
      <Value>308.16000366</Value>
      <Value>318.16000366</Value>
      <Value>328.16000366</Value>
      <Value>338.16000366</Value>
      <Value>348.16000366</Value>
      <Value>358.16000366</Value>
      <Value>368.16000366</Value>
      <Value>378.16000366</Value>
    </Temperature>
    <Density>
      <Value>1.2165999413</Value>
      <Value>1.1699999571</Value>
      <Value>1.1341999769</Value>
      <Value>1.1009999514</Value>
      <Value>1.0677000284</Value>
      <Value>1.03489995</Value>
      <Value>1.0017000437</Value>
      <Value>0.97517997026</Value>
      <Value>0.95033997297</Value>
      <Value>0.9255999228</Value>
    </Density>
  </SinglePhase>
</CustomFluid>
```

```

<SpecificHeat>
<Value>1006.7000122</Value>
<Value>1007</Value>
<Value>1007.0999756</Value>
<Value>1007.7000122</Value>
<Value>1008.0999756</Value>
<Value>1008.5</Value>
<Value>1008.9000244</Value>
<Value>1009.7999878</Value>
<Value>1010.7999878</Value>
<Value>1011.7999878</Value>
</SpecificHeat>
<Viscosity>
<Value>1.7868000214E-05</Value>
<Value>1.8368000383E-05</Value>
<Value>1.8844999431E-05</Value>
<Value>1.9316999897E-05</Value>
<Value>1.9789000362E-05</Value>
<Value>2.0253599359E-05</Value>
<Value>2.0725599825E-05</Value>
<Value>2.1170399123E-05</Value>
<Value>2.1608400857E-05</Value>
<Value>2.2046400773E-05</Value>
</Viscosity>
<Conductivity>
<Value>0.025352999568</Value>
<Value>0.026153000072</Value>
<Value>0.026534000412</Value>
<Value>0.026903999969</Value>
<Value>0.027643999085</Value>
<Value>0.028384000063</Value>
<Value>0.029112000018</Value>
<Value>0.030680000234</Value>
<Value>0.03136799857</Value>
<Value>0.032127998769</Value>
</Conductivity>
<Enthalpy>
<Value>228600</Value>
<Value>228900</Value>
<Value>229300</Value>
<Value>229600</Value>
<Value>229900</Value>
<Value>230200</Value>
<Value>230500</Value>
<Value>230800</Value>
<Value>0</Value>
<Value>0</Value>
</Enthalpy>
<SurfaceTension>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
<Value>0</Value>
</SurfaceTension>
</SinglePhase>
</CustomFluid>

```

- To use an XML file to define a custom multiple-rating data in the “Multiple Rating” task of the Plate-Fin or Cold Plate module, check the box “Use user-defined multiple rating data,” and choose “XML” in “Choose File Format.”

Use user-defined multiple rating data?  
 Upload multiple rating data:  
 Choose File Format: XML  
 Choose a File to Upload: Choose File No file chosen  
 Upload XML File  
 Download template file

An XML template file can also be downloaded from the link that is provided in the dialog box (above). A sample template file for the Plate-Fin Multiple Rating task is shown below. Follow the instructions in the file to modify the file with your own data, and then use the “Choose File” / “Upload XML File” buttons to upload the file to INSTED.

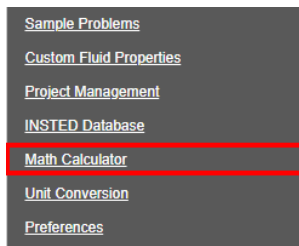
```

<PlateFinMultiRateCustomXMLData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <!-- Instruction Start
  Using the following type values for the corresponding parameters
  1 Hot Flow Flowrate [kg/s]
  2 Cold Flow Flowrate [kg/s]
  3 Hot Flow Inlet Temperature [K]
  4 Cold Flow Inlet Temperature [K]
  5 Hot Flow Inlet Quality
  6 Cold Flow Inlet Quality
  7 Plate Length [m]
  8 Plate Width [m]
  9 Plate Thickness [m]
  10 Hot Flow Plate Spacing [m]
  11 Cold Flow Plate Spacing [m]
  12 Hot Flow Fin Pitch [m]
  13 Cold Flow Fin Pitch [m]
  14 Hot Flow Fin Thickness [m]
  15 Cold Flow Fin Thickness [m]
  16 Hot Flow Fin Offset Pitch [m]
  17 Cold Flow Fin Offset Pitch [m]
  18 Hot Flow Fin Type
  19 Cold Flow Fin Type
  20 Hot Flow Fin Profile
  21 Cold Flow Fin Profile
  22 Hot Flow Fin Pitch Top [m] (trapezoidal)
  23 Hot Flow Fin Pitch Bottom [m] (trapezoidal)
  24 Cold Flow Fin Pitch Top [m] (trapezoidal)
  25 Cold Flow Fin Pitch Bottom [m] (trapezoidal)
  26 Hot Flow Fin Wavelength [m] (herringbone)
  27 Cold Flow Fin Wavelength [m] (herringbone)
  28 Hot Flow Fin Wave Amplitude [m] (herringbone)
  29 Cold Flow Fin Wave Amplitude [m] (herringbone)
  30 Plate Conductivity [W/(m.K)]
  31 Hot Flow Fin Conductivity [W/(m.K)]
  32 Cold Flow Fin Conductivity [W/(m.K)]
  Instruction End -->
  <NumSteps>3</NumSteps>
  <Parameters>
    <Parameter>
      <Type>1</Type>
      <Values>
        <Value>25.4</Value>
        <Value>26.4</Value>
        <Value>27.4</Value>
      </Values>
    </Parameter>
    <Parameter>
      <Type>2</Type>
      <Values>
        <Value>25.4</Value>
        <Value>26.4</Value>
        <Value>27.4</Value>
      </Values>
    </Parameter>
    <Parameter>
      <Type>10</Type>
      <Values>
        <Value>0.012</Value>
        <Value>0.024</Value>
        <Value>0.03</Value>
      </Values>
    </Parameter>
    <Parameter>
      <Type>13</Type>
      <Values>
        <Value>0.002</Value>
        <Value>0.005</Value>
        <Value>0.005</Value>
      </Values>
    </Parameter>
  </Parameters>
</PlateFinMultiRateCustomXMLData>

```

### *The TTC Math Calculator Tool has been Integrated Into INSTED*

TTC Math Calculator is an advanced mathematical tool, which is specially designed to aid engineering analysis. The tool can be accessed by clicking the “Math Calculator” button on INSTED’s main menu panel.

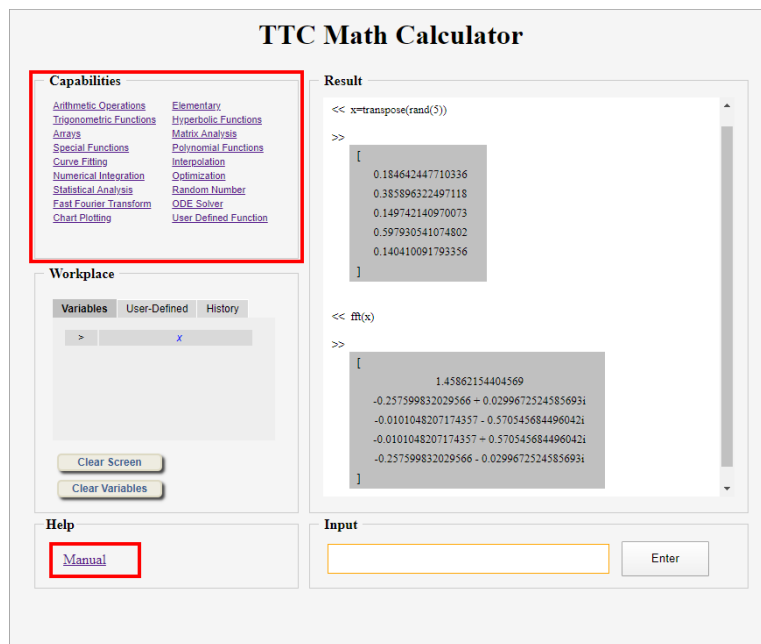


Its functionalities include:

- named variables support

- real / complex number support
- vectors / matrices support
- arithmetic operations for scalar, vector, and matrix
- trigonometric/hyperbolic functions
- arrays and matrix operations
- special functions
- curve-fitting and interpolation
- numerical integration
- statistical analysis
- fast Fourier transforms
- optimization
- ODE solver
- user-defined functions
- chart plotting.

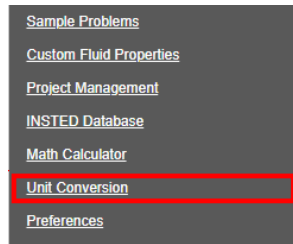
Below is a screenshot of the interface of the Math tool.



The TTC Math Calculator is easy-to-use. The math functions and syntax used are similar to those in MATLAB. Sample syntax/functions can be viewed under “Capabilities,” and detailed instructions on how to use the math tool can be found in User’s Manual which can be accessed by clicking the “Manual” button.

### *TTC’s Standalone Unit Conversion Tool has been Integrated Into INSTED*

The TTC Unit Conversion tool can also be accessed by clicking the “Unit Conversion” button on INSTED’s menu panel.



The Unit Conversion tool provides an all-in-one place for converting units of various kinds of quantities. Below is a screenshot of the tool's interface.

**TTC Unit Conversion Tool**

<p>Unit Category:</p> <div style="border: 1px solid #ccc; padding: 2px;"><ul style="list-style-type: none"><li>All</li><li>Dimension</li><li>Electricity</li><li>Energy</li><li>Fluid</li><li>IT</li><li>Kinetic</li><li>Light</li><li>Magnetism</li><li>Miscellaneous</li></ul></div>	<p>Unit Type:</p> <div style="border: 1px solid #ccc; padding: 2px;"><ul style="list-style-type: none"><li>Angle</li><li>Area</li><li>Length</li><li>Time</li><li>Volume</li></ul></div>
<p>From:</p> <div style="border: 1px solid #ccc; padding: 2px;">1.0</div>	<div style="border: 1px solid #ccc; padding: 2px;">meter [m]</div>
<p>To:</p> <div style="border: 1px solid #ccc; padding: 2px;">39.3700787</div>	<div style="border: 1px solid #ccc; padding: 2px;">inch [in]</div>
<div style="border: 1px solid #ccc; padding: 5px 20px; display: inline-block;">Convert</div>	