UniSim Fired Process Heater Modeler

(referred to as UniSim FPH)

Getting Started Guide

Honeywell

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The information in this help file is subject to change over time. Honeywell may make changes to the requirements described. Future revisions will incorporate changes, including corrections of typographical errors and technical inaccuracies.

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1 Introduction

This Getting Started Guide forms part of the documentation supplied with each UniSim Heat Exchanger program:

- UniSim® Heat Exchangers User Guide
- Getting Started
- Program Reference Guide.

The UniSim® Heat Exchangers User Guide is supplied as a pdf document with the installation media. The Documentation media contains the UniSim® Heat Exchangers User Guide and all the other documents. The UniSim® Heat Exchangers User Guide is generic to all UniSim Heat Exchanger programs. The Getting Started and Reference Guide are specific to each UniSim Heat Exchanger program.

The Getting Started Guide assumes you have access to an installed copy of the UniSim Heat Exchanger program, and takes you through some example cases provided with the program, so you can get a feel for it capabilities. It also describes how you can run a set of QA sample cases, and compare the output files with sample results, to confirm that the operation of the program is as it should be.

More detailed examples, showing how you can use the program to solve typical problems, are provided in Appendices to the program Reference Guide.

1.1 Technical Support

Technical support is available by phone (1-403-509-1379 or 1-866-392-8748 toll free in North America), fax (1-403-216-2801).

E-mail support for customers with a current support contract for their product is available.

Honeywell	Email Address
Global	unisim.support@honeywell.com
North America	unisim.support@honeywell.com
Latin America	unisim.support.lar@honeywell.com
Europe, Middle East, Africa	unisim.support.emea@honeywell.com
Asia Pacific	unisim.support.ap@honeywell.com

On-line support can be accessed via http://www.honeywell.com/ps.

When contacting us via email or phone, please include in your message:

Your full name, company, phone and fax numbers.

The software version you are using (shown in the Help menu, About UniSim…).

A detailed description of the problem (attach a simulation case if possible).

2 Getting Started

Included with your **UniSim® Fired Process Heater Modeler** (*referred to as **UniSim® FPH***) software are a number of example input files that can acquaint you with the program. The cases are fully defined and ready to run. You can simply open the cases and run UniSim® FPH to see the type of output that can be calculated. This **Getting Started** will step you through one of these example cases, as a brief introduction to the UniSim® FPH architecture, input options and available output information.

A complete set of results for the sample input files is provided in a separate location for Quality Assurance purposes. See **Chapter 3 - UniSim® QA Examples**.

A set of tutorials showing you how to set up input files for (different) specific problems is included in **Chapter 7 - Examples**, of the Reference Guide.

Before examining and running the example input files, it is important to define the main types of calculations that UniSim® FPH can perform. These allow you to calculate the performance of the firebox and/or convection sections of a fired process heater. The examples in the Reference Guide will elaborate on this.

The two fundamental UniSim® FPH calculation modes are shown in the following table.

UniSim® FPH Calculation Modes	
Fixed (Performance Simulation)	This is for simulation or design checking. You input information about the firebox geometry, the fuel, the combustion air, the convection section geometry and the process fluids including the inlet condition of the process streams and UniSim® FPH calculates the heat transfer, temperature and pressure drop distributions in the heater and the stream outlet conditions.
Calculate (Burner Rate Mode)	This is a thermal rating option in which UniSim® FPH calculates the burner fuel flowrate required to achieve a specified heat load on the firebox process stream. You input the same information as for the **Simulation** option and in addition specify the outlet temperature of the firebox process fluid. (In **Rate** mode you must also provide an initial estimate of the fuel flowrate required for the duty). UniSim® FPH calculates the heat transfer, temperature and pressure drop distributions in the heater. UniSim® FPH then compares the calculated outlet temperature of the process stream in the firebox with that specified by you and iterates on the burner fuel flow rate until the calculated temperature matches the specified temperature. You can only use the **Rate** mode if you are modelling the firebox.

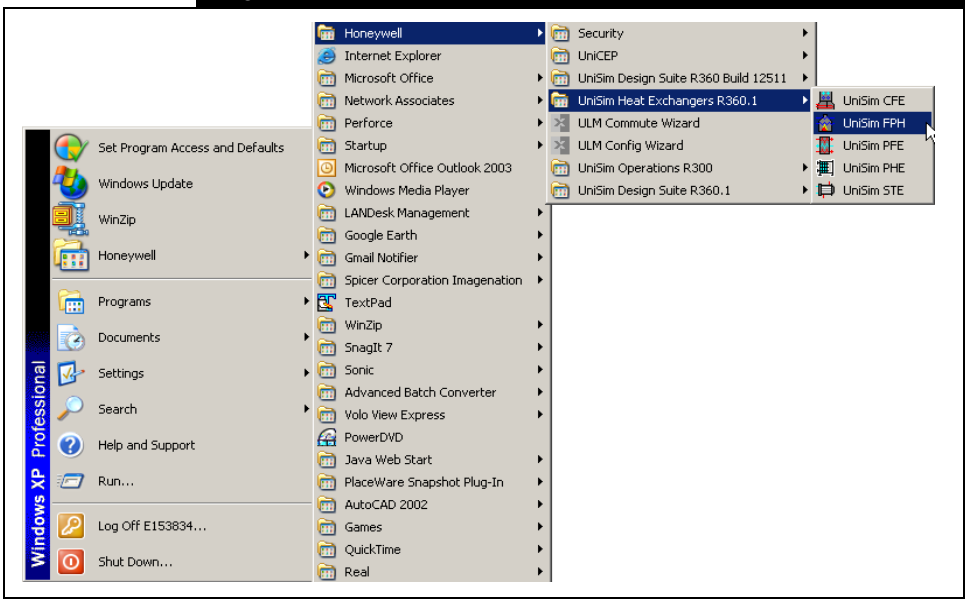
2.1 Example 1

In this first example we will take a brief look at how an existing dataset can be reviewed, run and the outputs accessed.

1. Start UniSim® FPH. This can be done several ways and will depend on exactly how you set up your desktop. However, the two main ways are:
   - Clicking the UniSim® FPH shortcut on the **Start** menu then **Programs**, **Honeywell**, **UniSim® Heat Exchangers Rxxx** and **UniSim FPH** menu. See **Figure 2.1**.

- Select UniSim FPH from within **Windows Explorer**.

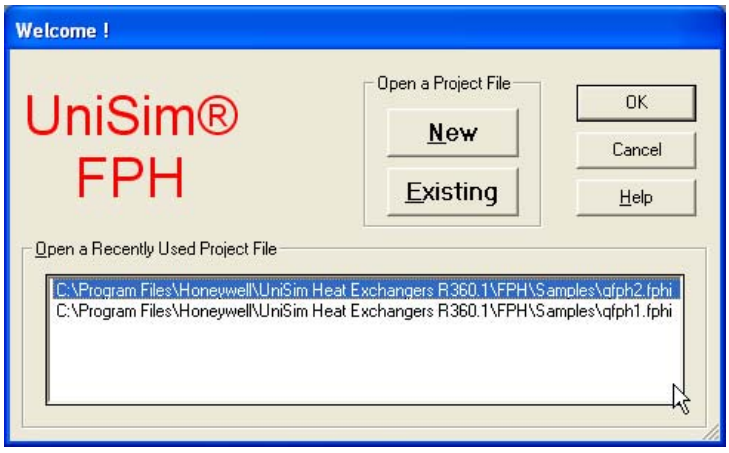
Figure 2.1



Once the splash screen has cleared you will see the main UniSim® FPH window and over the top of this is the **Welcome!** dialog. From this view you can select to create a **New** file or an **Existing** file. If you have used UniSim® FPH previously, the project file you have worked with will appear in the **Recently Used Project File** list, making it easy to get back to files you were recently working on.

2. Press the ***Existing*** button, to select an **Existing** file.

Figure 2.2

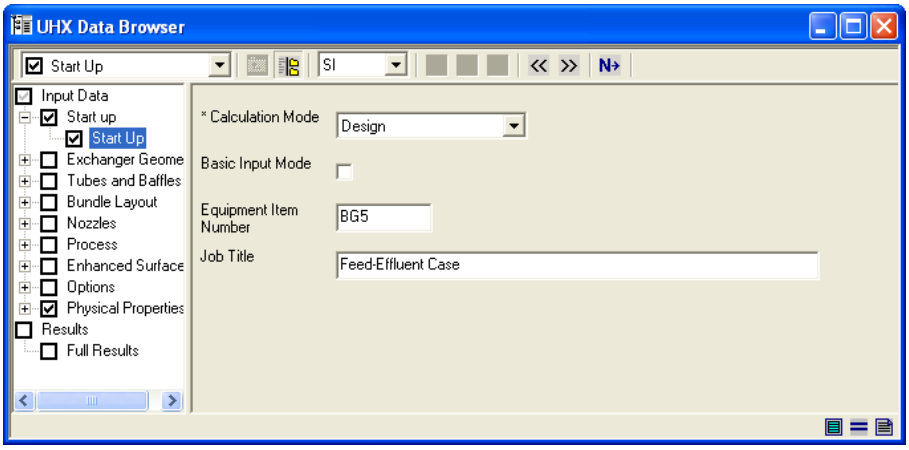


3. You are presented with an **Open File** screen. To open the file for this Get Started, go to the

C:\Program Files\Honeywell\UniSim Heat Exchangers Rxxx\FPH\Samples

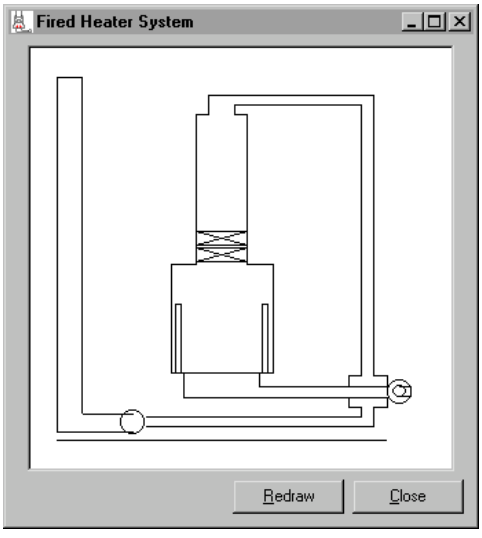
(This is the default directory, the exact location may be different if you changed the UniSim® FPH destination directory during installation.) See **Figure 2.3** for the **Open File** view.

Figure 2.3



4. For this example you should select the file **QFPH1.FPHI**. You will know when the file has been loaded, because the **Fired Heater System** diagram will appear within the **UniSim® FPH** program window. See **Figure 2.4**.

Figure 2.4



Tip -

If you cannot remember where a file is located, there is a Find File utility to help you. Select Find File from the File Menu or use the keyboard shortcut by pressing <CTRL>+<F>.

Open Button

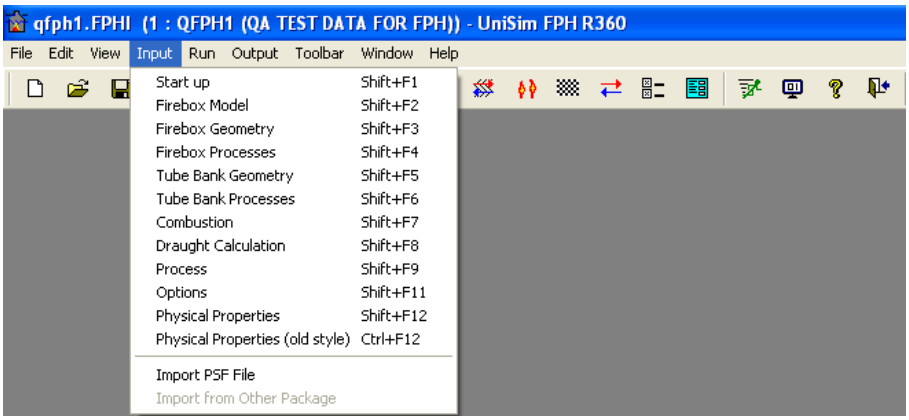
Once UniSim® FPH has started you can open other files by selecting **Open** from the **File** menu. To use the **Welcome** screen again, select **Start Project** from the **View** menu. However, in either case you can only have one project active at any one time. For most common activities there are shortcuts. So to open a file you can either click on the ***Open*** button or use the keyboard shortcut by pressing **<CTRL> + <O>**.

Now look a bit closer at the project file you have opened.

1. Click on **Input** in the menu bar.

Figure 2.5 shows the **Input** menu, which gives access to all of the input data. The menu itself is divided into the different types of data you need to describe the fired heater and the conditions under which it will operate. These include different aspects of geometry, process conditions and physical properties.

Figure 2.5

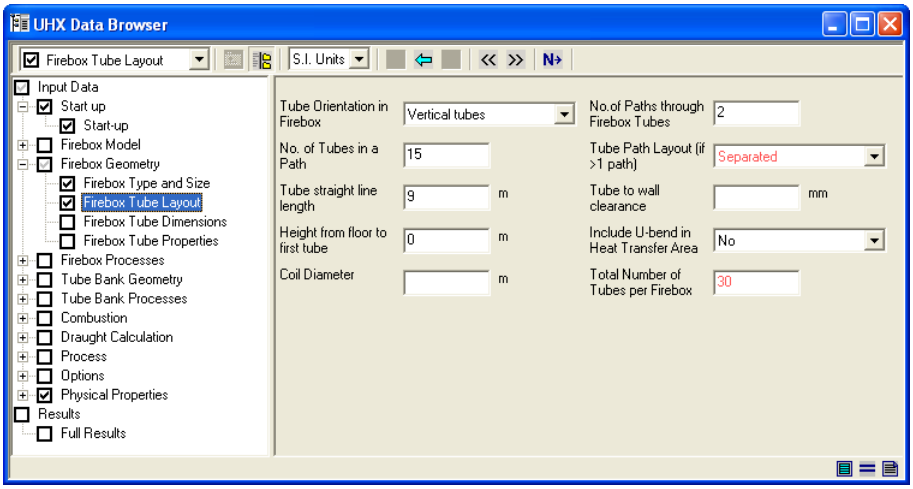


2. Select the **Firebox Geometry** input form and click on the **Firebox Tube Layout** tab (see **Figure 2.6**). This view allows the layout, tube orientation and arrangement, of the firebox tubes to be set.

This screen is typical of most screens in that the data is entered either in a text box, or via a drop-down menu. The drop-down menu presents the list of possible inputs, which you may select.

Note - You may see minor differences in the screens in your version of UniSim® FPH, compared with the figures in this manual.

Figure 2.6



Tip -

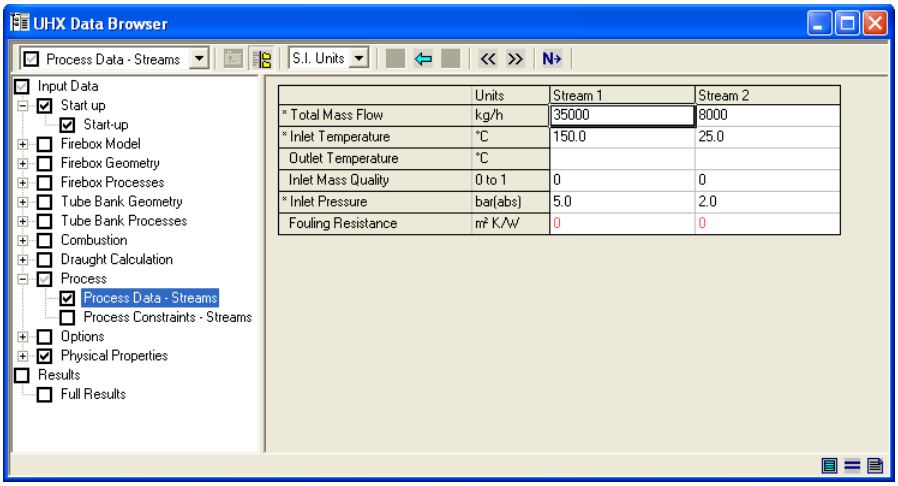
If at any point you are not sure what input you want or something is not clear, you can press <F1> and get context sensitive help. If you select the Tube Straight Line Length and press <F1>, you can see a description of this parameter. This help also contains links to diagrams and related topics that you can use by clicking with the mouse on any of the highlighted text. For example at the bottom of the help there is a list of links to diagrams which illustrate the concept of tube straight line length as used in UniSim® FPH. Click on the link Straight Line Lengths for Vertical Tubes. A new help page pops up showing you how the tube straight line length can be defined for vertical tubes.

Process Button

3. Now look at process data by selecting **Process** from the **Input** menu or by clicking on the ***Process*** button. See **Figure 2.7**.

This shows another form of input screen where the input items are arranged in the form of a spreadsheet. If the data do not fit the screen, a scrollbar allows you to access the other input items. The spreadsheet

Figure 2.7



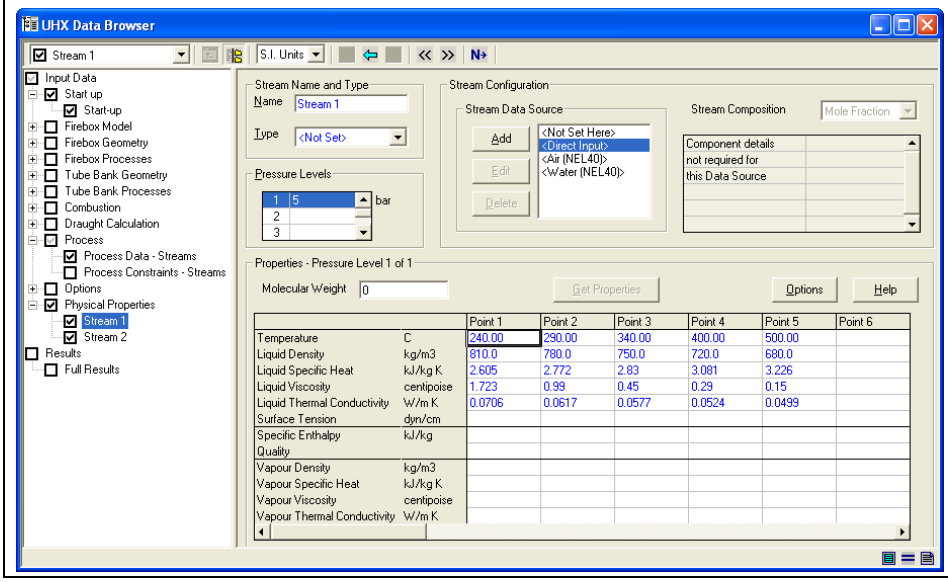
view is used when data are required several times, in this case for the two streams in the heater.

Physical Properties Button

4. Finally, look briefly at the physical properties input by selecting **Physical Property Data** from the **Input** menu or by clicking on the ***Physical Properties*** button.

The initial screen in **Figure 2.8** shows the top level information about each stream.

Figure 2.8



Depending on the type of physical property data you are working with, you can either enter the property data for the stream directly or enter

data for components and allow UniSim® FPH to perform vapour liquid equilibrium and mixture calculations. All of the physical property data are managed through these screens.

Since this is an existing case all the necessary data has already been entered.

5. Run UniSim® FPH by doing **one** of the following:

Run Button

- Click on the ***Run*** button in the Toolbar.
- Select the **Run** menu and then **Calculate All**.
- Press **<F4>**.

UniSim® FPH now displays a status window that reports progress of the run.

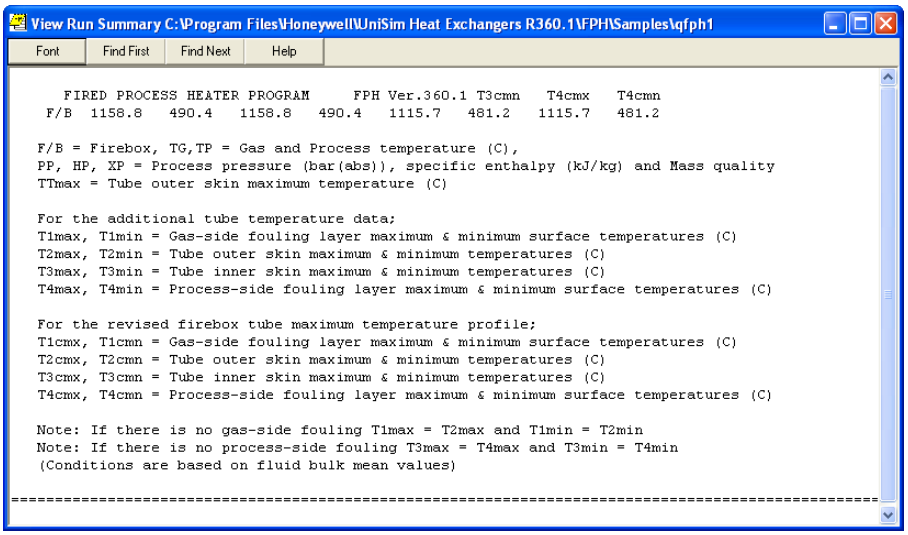
When the run completes there are three possible outcomes and corresponding outputs will be displayed.

- Successful run with no fatal errors and no warnings - a screen showing the **Results Summary** is displayed.
- Successful run with no fatal errors but with one or more warnings - the **Results Summary** is displayed together with the **Error / Message Log** which contains a description of the warnings that have occurred.
- Failed run due to fatal errors - the **Error / Message Log** is shown with a description of the errors that have occurred.

In this case you should just see the **Results Summary** which shows you the main process and performance data such as; the Thermal Efficiency of the firebox and convection section; the inlet and outlet process fluid and gas temperatures to each part of the heater; the inlet and outlet process fluid pressure and quality to each part of the heater, the tube maximum and minimum temperatures in each part of the system and the firebox tube temperature profile allowing for

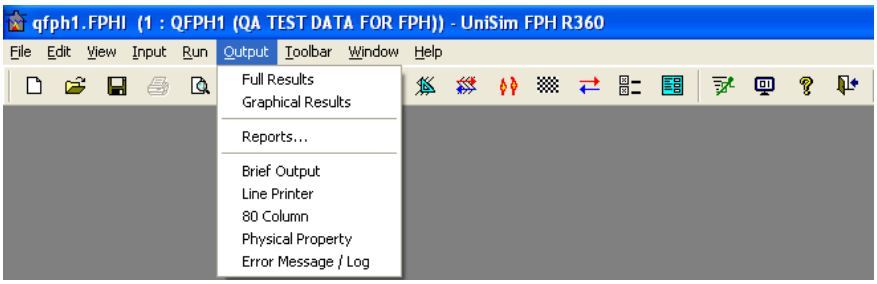
circumferential heat flux (as in API530). See **Figure 2.9**.

Figure 2.9



There are several different outputs that can be viewed from the **Output** menu (see **Figure 2.10**).

Figure 2.10



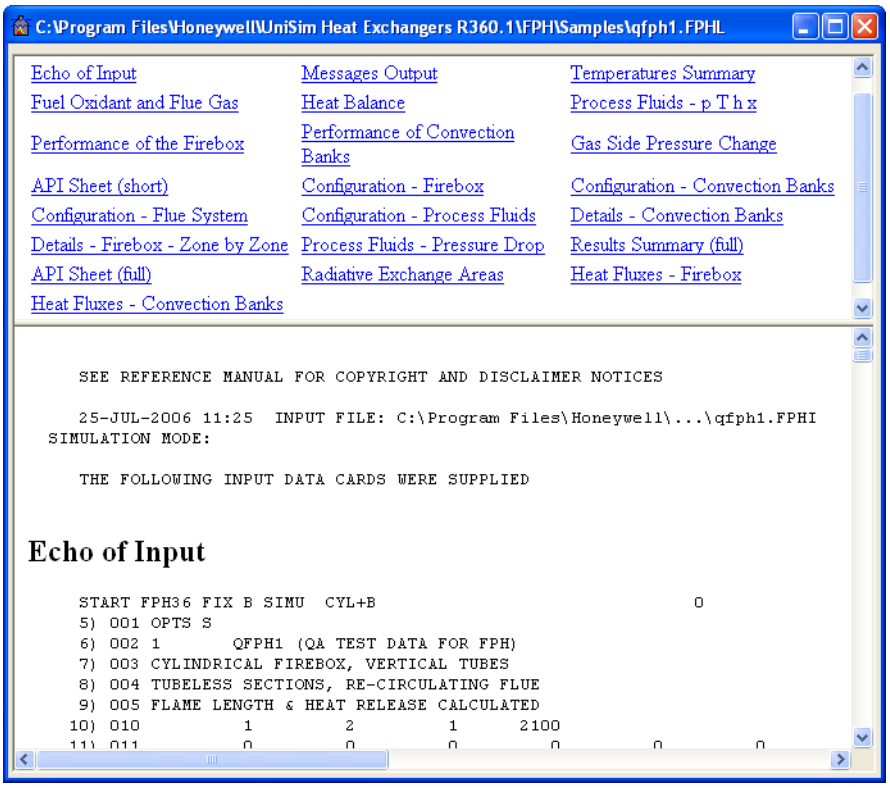
Notice from this menu the different types of output available. The **Brief Output** is the same as the **Results Summary**, and the **Error / Message Log** appears automatically if necessary when a run completes. We will look here at the different types of detailed output available through the **Results** option from the **Output** menu.

UniSim® FPH carries out very detailed calculations on many parts and aspects of a fired process heater system and therefore produces a large number of results. These results have been carefully categorised to give you the maximum choice in the type, content and quantity of the output you wish to view and subsequently include. A hard copy can be produced from the **Line Printer** output.

6. Select **Full Results** from the **Output** menu. UniSim® FPH generates all the necessary output files which contain these results. During this process a progress window will appear whilst the results are generated.

After the files have been generated, the main **UniSim® FPH Output** screen will appear. You can use check-boxes on the screen, available under the **Text** tab, to select which sections of the results you wish to view, and if necessary, decide on what to include in the **Line Printer** output for printing off. (see **Figure 2.11**).

Figure 2.11

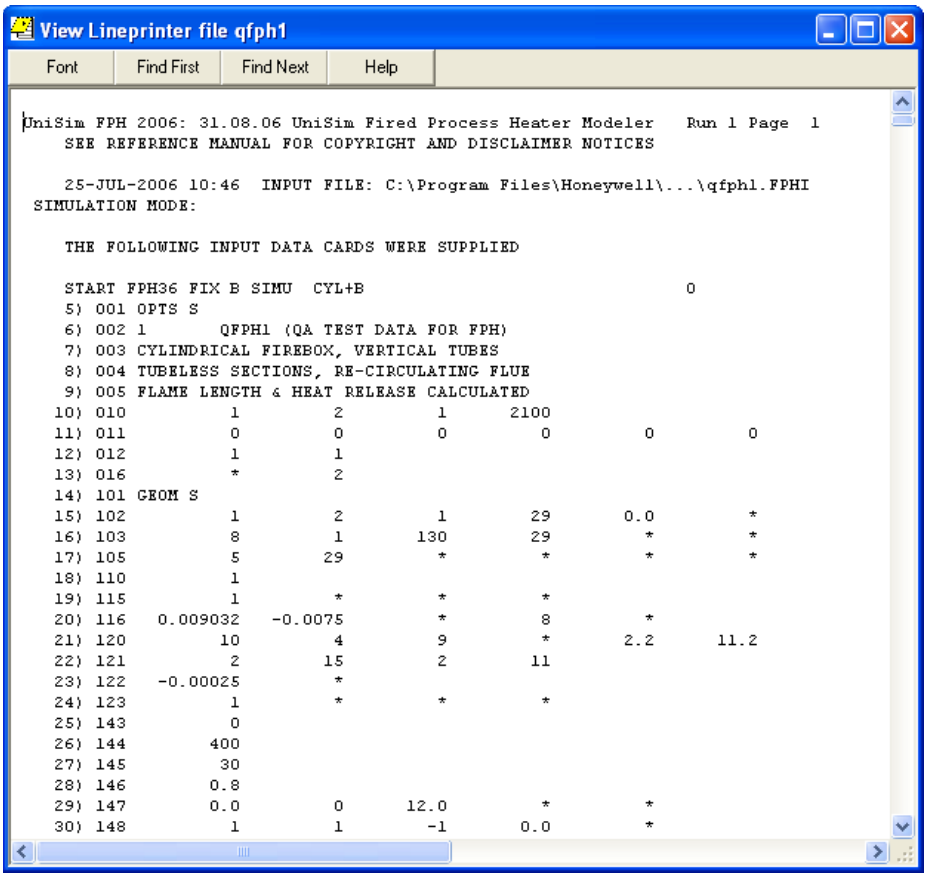


7. Select **Graphical Results** from the **Output** menu.

A window will appear detailing the progress made in generating a Line Printer file suitable for printing off as a hard copy of your results. On completion you will see the file automatically appear in a **View Line Printer** file QFPH1 window. If you look at this file, you will see that it contains all the output you have currently selected, in this case the

Concise output sheets, from the **Output** screen. See **Figure 2.12**.

Figure 2.12



We will now look at the graphical output available in UniSim® FPH.

8. Close down the **Line Printer** screen.
9. Select **Graphical Results** from the **Output** menu.

   The Graph selection screen will appear. See **Figure 2.13**.

   You may select which graphs and for which part of the heater system you want to see the graph cover. We will look at the temperature pinch chart for the **Full System**.

10. Click on **Temperature Pinch Chart** and then click the ***Full System*** button.

    A graph showing the process fluid and combustion gas temperature, throughout the heater system, will appear. See **Figure 2.14**.

11. Once you have looked at this graph, you can either print it off, using the ***Print*** button, or return to the **Graph** selection screen by clicking on the **Return** button.

Figure 2.13

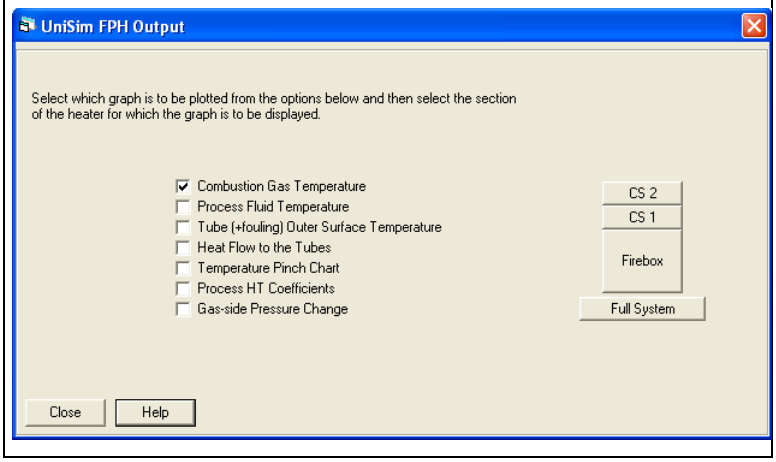
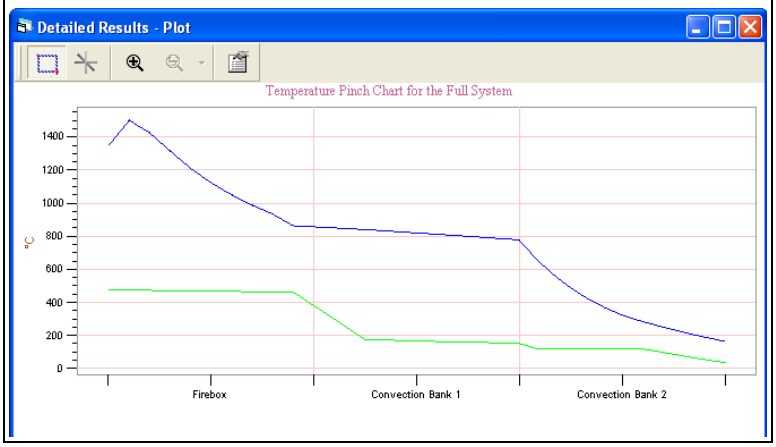


Figure 2.14



3 UniSim® QA Examples

A set of two sample UniSim® FPH cases, including both input and output files are provided with UniSim® FPH for Quality Assurance (**QA**) purposes. As a check that you have installed UniSim® FPH correctly, you should run the input files and compare your results files with those provided.

UniSim® FPH files have a file extension **.FPHx** (where **x** is an indicator of the type of file - input or one of the various outputs). A full listing is given in the **Help Text**.

On installation, the QA files are stored in a subdirectory **QADATA** of the directory containing the main UniSim® FPH folder. The two sample cases have file names **QFPH1 and QFPH2**, and files extensions **.QAx** instead of **.FPHx**. The different extensions are used to ensure that you don't accidentally overwrite the QA files when running UniSim® FPH.

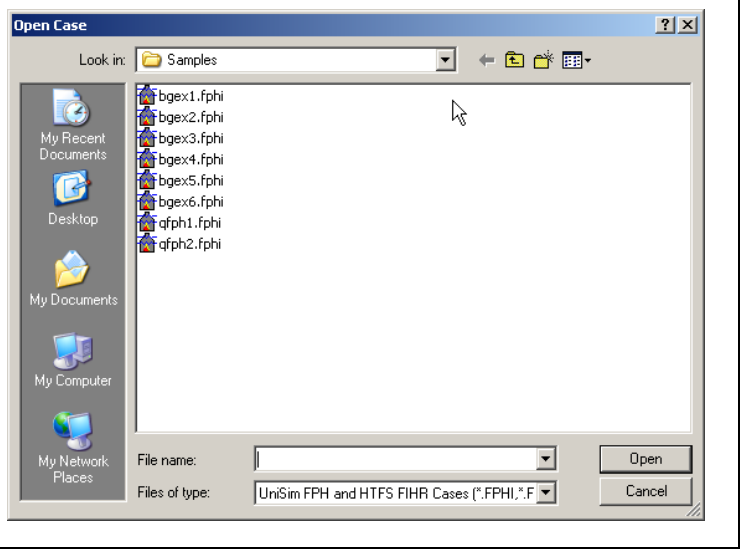
Copies of the two QA input files, with the standard input file extension **.FPHI** are put in the **My Documents\My UniSim Heat Exchanger Cases** directory by the installation procedure.

3.1 Creating Output for Comparison

Using the **QFPH1** example, a typical check on UniSim® FPH installation would be as follows:

1. Copy the **QFPH1.QAI** file from the **\UniSim FPH\QADATA** directory to some other directory for example **\My Documents\My UniSim Heat Exchanger Cases**.
2. Rename the file, and give it the extension **.FPHI** for example **MYTEST1.FPHI**.
3. Start UniSim® FPH, you will see the **Welcome** screen, click on ***Existing*** and select **MYTEST1.FPHI**
4. Run UniSim® FPH with this case.
5. Compare the results files from your run with the results files supplied with UniSim® FPH.
6. Checks may be repeated with the other QA files supplied.

Figure 3.1



3.2 Comparing Outputs

Your calculated results are files named **MYTEST1.FPHx**, in directory **\My Documents\My UniSim Heat Exchanger Cases** and these need to be compared with the supplied results files **QFPH1.QAx** in directory **\UniSim FPH\QADATA**.

Remember, the QADATA files supplied with UniSim® FPH have the extension **.QAx**.

The most important comparison is the **.FHV** file, but other files can be compared as well. The .FHV file is the **Results Summary** and is a relatively short file. You can do the comparison using a file difference utility, or by printing off the two files and looking for differences.

If the files are exactly identical, (except for the run time and input file name recorded in the output), the QA check is successful. If the files differ slightly, but only in the fourth or fifth significant figure of one or two variables, the QA check on this example is also successful. If there are more significant differences, consult Honeywell.