
HYSYS[®] 3.2

Installation Guide



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Introduction

We are pleased to present you with the latest version of **HYSYS**-the product that is continually extending the boundaries of process engineering software. **HYSYS** is part of the **Aspen Engineering Suite (AES)**, a set of software tools designed to help manage process knowledge throughout the asset lifecycle. **HYSYS** is a major part of the **Simulation and Optimization** family of products that forms the foundation of **AES**.

The Aspen Engineering Suite (AES)

There is huge opportunity in successfully managing the process industry challenges through optimal **Process Asset Lifecycle Management (PaLM)** from Business Planning & Economic Analysis, to R&D and Conceptual Design, to Process Engineering, to Detailed Engineering, to Technology Transfer & Construction, and throughout to Operations.

Figure 1



AES is AspenTech's **Process Asset Lifecycle Management** solution that enables optimal and consistent decisions to be made through the use of consistent data and models. **AES** consists of integrated products, enabling the execution of various **PaLM** tasks throughout the enterprise:

- **AES Economic Evaluation** products combine engineering and business decisions for accurate project scope definition and cost evaluation, from conceptual project definition through detailed engineering.
- **AES Collaborative Engineering** products support integrated collaborative engineering to create a **Front End Engineering Design (FEED)** package and share process engineering expertise.

- **AES Physical Properties & Chemistries** products include physical property data, models, estimation and regression capabilities adapted for the Oil & Gas, Refining, Chemicals, and Pharmaceuticals industries.
- **AES Conceptual Engineering** products assist process engineers in creating, identifying and selecting best process designs for heat exchangers networks and separation trains.
- **AES Simulation and Optimization** products enable engineers to quickly identify optimal plant designs for steady state and dynamic simulation and optimization as well as for batch process and recipe development. These products enable to optimize plant designs, establish heat and material balances, support environmental and safety studies, and to carry out operability analysis.
- **AES Equipment Design and Rating** products support the design and rating of highly performing heat exchangers with minimum capital cost.

AES is an open environment that supports and promotes open industry standards such as CAPE-OPEN, OPC, ASME, CODAP, PD5500, DIN, JIS, TEMA.

HYSYS

HYSYS is a process simulation environment designed to serve many processing industries especially Oil & Gas and Refining. With HYSYS, you can create rigorous steady state and dynamic models for plant design, performance monitoring, troubleshooting, operational improvement, business planning and asset management. Through the completely interactive HYSYS interface, you can easily manipulate process variables and unit operation topology, as well as fully customize your simulation using its customization and extensibility capabilities.

The HYSYS environment has been developed with an overall vision of the ultimate process simulation solution in mind. This vision has led us to create a product that is interactive, intuitive, open, extensible and integrated with the products in the AES. HYSYS also has many add on options to extend it's capabilities into specific industries or into other aspects of PaLM.

The set of HYSYS related products and options:

HYSYS, an interactive and integrated modeling environment	
Product	Capabilities
HYSYS	<p>Steady State Process Simulation with HYSYS</p> <p>Provides the accuracy, speed, and efficiency required for process design activities. The level of detail and the integrated utilities available in HYSYS allow for skillful evaluation of design alternatives, with fast and efficient process simulation. A wide range of thermodynamics and unit operations together with standard links to Windows packages makes HYSYS the most complete steady state process simulation tool.</p>
HYSYS Dynamics Option	<p>Plant Operability, Design and Management with the HYSYS Dynamics option.</p> <p>The HYSYS option provides a dynamic simulation capability fully integrated with the HYSYS environment, a steady state model can be leveraged into a dynamic model which offers rigorous and high-fidelity results with a very fine level of equipment geometry and performance detail. Evaluate dynamic plant behaviour, controllability, start up and shut down scenarios from the same base model used in steady state process design. With a consistent look and feel, links to APC software, hydraulic applications, and other third-party applications, HYSYS provides a complete platform for dynamic process simulation.</p>
HYSYS Upstream Option	<p>The Upstream option enables HYSYS as a powerful design, operations and planning tool for the Upstream Oil and Gas industry.</p> <p>Complete with Black Oils and PVT Analysis, this option allows HYSYS to speak the thermodynamic language of the Upstream. Transition from Black Oil to a full compositional mode is possible when more accuracy is required. Together with Aspen Hydraulics, for well and flowline integration, HYSYS has become the only modeling environment to complete the entire upstream asset model from sandface to transmission.</p>
HYSYS Amines Option	<p>The Amines option is specifically designed for acid gas treating using amines, blended amines and physical solvents.</p> <p>The Amines option is based on the AMSIM technology developed by DBR Associates, a division of Schlumberger. The Amines option is a unique property package developed specifically for acid gas treating processes involving amines, blended amines and physical solvents. The Amines option utilizes the most up to date thermodynamics models and is validated against plant data.</p>

HYSYS, an interactive and integrated modeling environment

Product	Capabilities
HYSYS Crude Option	<p>The Crude option is used to accurately characterize crude oils from laboratory assay data.</p> <p>The HYSYS Crude Option gives the user the choice of 5 different assay laboratory analyses standards used in the Oil industry. Using the standard laboratory data input along with the most recent correlation methods, the HYSYS Crude option will determine the hypothetical components that make up the Oil and predict their thermophysical and transport properties.</p>
HYSYS OLI Interface	<p>An add-on option to HYSYS specifically designed for modeling aqueous systems.</p> <p>The HYSYS OLI Interface option is based on technology developed by OLI Systems Inc, experts in aqueous chemistry. The OLI thermodynamic models and engine are seamlessly integrated into HYSYS so that virtually any water based system can be accurately simulated in the HYSYS environment.</p>
Virtual Plant Simulator	<p>Operator Training Services with HYSYS Virtual Plant Simulator project services.</p> <p>HYSYS Virtual Plant Simulator services provides real-time simulated training exercises that train operations personnel and help develop their skills performing critical process operations. Increased process understanding and procedural familiarity for operations personnel can lead to increased plant safety and improved process performance. The Virtual Plant Simulator is powered by the same HYSYS models used by the Engineering and Process Control Departments but with DCS emulation, look, and feel. HYSYS extends the model's use into the Operations Departments.</p>
HYSYS Optimizer & Data Reconciliation	<p>Online and Offline Optimization with the Optimizer and Data Reconciliation Options in HYSYS.</p> <p>HYSYS provides tools for on or offline performance monitoring and optimization. These Options enables the optimization of plant efficiency and the management of production rate changes and upsets in order to handle process constraints and maximize operating profits. Using SQP Optimization techniques, constraint handling and data reconciliation with the HYSYS simulation providing the predictive capability this creates a powerful tool for operations improvement.</p>

Intuitive & Interactive Process Modeling

AspenTech believes that the role of process simulation is to improve your process understanding so that you can make the best process decisions. This solution has been, and continues to be, interactive simulation. This has not only proven to be the most efficient use of your simulation time, but by building the model interactively with immediate access to results you gain the most complete understanding of your simulation.

HYSYS uses the power of object oriented design, together with an event-driven graphical environment, to deliver a completely interactive simulation environment where:

- calculations begin automatically whenever you supply new information, and
- access to the information you need is not restricted.

At any time, even as calculations are proceeding, you can access information from any location in HYSYS. As new information becomes available, each location is always instantly updated with the most current information, whether specified by you or calculated by HYSYS.

Open & Extensible HYSYS Architecture

The Integrated Simulation Environment and our fully object oriented software design has paved the way for HYSYS to be fully Active X compliant, allowing for complete user customization. Through a completely transparent interface, OLE extensibility lets you:

- develop custom steady state and dynamic unit operations.
- specify proprietary reaction kinetic expressions.
- create specialized property packages.

With seamless integration, new modules appear and perform like standard operations, reaction expressions or property packages within HYSYS. The Automation features within HYSYS expose many of the internal objects to other Active X compliant software like Microsoft Excel, Visual Basic, and Visio. This functionality enables you to create custom applications that utilize HYSYS unique capabilities or link it to your own in-house applications.

By using industry standard Active X Automation and Extensibility, the custom simulation functionality is portable across AspenTech software updates. The open architecture allows you to extend your simulation functionality in response to your changing needs.

Integration with AES

HYSYS is now integrated with many products of the AES to enhance Process Asset Lifecycle Management. These include:

Aspen WebModels

HYSYS models can be authored and published over the intranet/ internet through integration with Aspen WebModels from within the HYSYS simulation environment. Aspen Webmodels is an excellent tool for distributing the power of simulation models to non expert users.

Aspen Enterprise Engineering

HYSYS can be run under the Aspen Enterprise Engineering platform, AEE. AEE is a Citrix based system for deploying the Aspen Engineering Suite within an organization. Using AEE, HYSYS is installed on a server through which users access the software. No local installations on user desktops are necessary

Aspen OnLine

HYSYS models can be connected to live plant information systems through Aspen OnLine. Aspen OnLine uses CIMIO to connect to numerous Plant Information and DCS Systems including Aspen's IP21. The ability to connect HYSYS simulation models to live plant data enables high value activities such as Performance Monitoring, Soft Sensors, Safety Surveillance and Optimization

Aspen Custom Modeler

Aspen Custom Modeler is the easy to use custom modeling environment for the Aspen Engineering Suite. Custom user models built in ACM can be exported to the HYSYS simulation environment and run in both Steady State and Dynamics. This addition gives HYSYS yet another means to customize and extend HYSYS simulation models to meet your specific simulation needs.

Aspen DMC+

Aspen's Advance Process Controller, DMC+, has been integrated with HYSYS Dynamics. This integration provides a unique tool to the world of advanced control. Configuring an Advanced Control mechanism typically requires step tests to be performed on the physical plant. These step tests take the plant off production until the APC model is configured. The advanced control algorithm can be tested and validated on a HYSYS model before costly step tests are performed on the plant.

HTFS

HYSYS users have a rigorous option for design of heat transfer equipment through the integration with the HTFS family of heat exchanger equipment products. TASC, for shell and tube exchangers, MUSE for multi-pass exchangers and ACOL, for air coolers are all accessible through the appropriate HYSYS unit operation. This gives the user a powerful tool when more rigor is required in modeling the heat transfer equipment without ever leaving the HYSYS environment.

Aspen Icarus

HYSYS simulation models can be exported to Aspen Icarus IPE or IPM for economic evaluation of process designs. Aspen Icarus performs unit operation and site wide costing of processing equipment and facilities.

Aspen Zyqad

HYSYS simulation models can be exported to Aspen Zyqad in order to streamline the front-end engineering work process. Using Zyqad throughout this process results in increased engineering efficiency, quality and reduced project cycle time.

Use of the Manuals

HYSYS Electronic Documentation

The HYSYS Documentation Suite includes all available documentation for the HYSYS family of products.

All HYSYS documentation is available in electronic format as part of the HYSYS Documentation Suite. The HYSYS Documentation CD-ROM is included with your HYSYS package. The content of each manual is described in the following table:

Manual	Description
Installation Guide	Introduces you to HYSYS, explains how to install HYSYS, and discusses style conventions used in the manuals. Sample steady state and dynamics cases are included to teach you how to navigate through HYSYS.
User Guide	Provides in-depth information on the HYSYS interface and architecture, and guides you through all aspects of HYSYS.
Simulation Basis	Contains all information relating to the available HYSYS fluid packages and components. This includes information on the Oil Manager, Hypotheticals, Reactions as well as a thermodynamics reference section.
Operations Guide	Contains information on building and running HYSYS simulations in steady state and dynamic mode. Unit operations and utilities are covered in depth.
Dynamic Modeling	Contains information on dynamic theory and controls theory.
Customization Guide	Details the many customization tools available in HYSYS. Information on enhancing the functionality of HYSYS by either using third-party tools to programmatically run HYSYS (Automation), or by the addition of user-defined Extensions is covered. Other topics include the current internally extensible tools available in HYSYS: the User Unit Operation and User Variables as well as comprehensive instruction on using the HYSYS View Editor.
Upstream Option Guide	Contains information on the Black Oil, Infochem Multiflash, Lumper, Delumper, PIPESIM Link and PIPESIM NET.
Tutorials & Applications	The Tutorials section provides step-by-step instructions for building industry-specific simulation examples. The Applications section contains more advanced example problems. Before you use this manual, you should have a good working knowledge of HYSYS (from the Tutorials). The Applications do not provide many of the basic instructions at the level of detail given in the Tutorials.

Contact your AspenTech agent for information on HYSYS training courses, or e-mail us at training@aspentech.com.

If you are new to HYSYS, you may want to begin by completing one or more of the HYSYS tutorials, which give step-by-step instructions for building a simulation case. If you have some HYSYS experience, but would still like to work through some more advanced sample problems, refer to the HYSYS Applications.

Since HYSYS is totally interactive, it provides virtually unlimited flexibility in solving any simulation problem. Keep in mind that the approach used in solving each example problem presented in the HYSYS documentation may only be one of the many possible methods.

Viewing the Online Documentation

HYSYS online documentation is viewed using **Adobe Acrobat Reader®**, which is included on the Documentation CD. Install Acrobat Reader on your computer following the instructions on the CD insert card. Once installed, you can view the electronic documentation either directly from the CD, or you can copy the **Doc** folder (containing all the electronic documentation files) and the file named **Menu.pdf** to your hard drive before viewing the files. (Be certain to move these files together, otherwise all the links will not work properly.)

Manoeuvre through the online documentation using the bookmarks on the left of the screen, the navigation buttons in the toolbar or using the scroll bars on the side of the view. Bold blue text indicates an active link to a referenced section or view; click on the link and Acrobat Reader will jump to that particular section.

Selecting the Search Index

Ensure that your version of Acrobat Reader has the Search plug-in present. This plug-in allows you to add a search index to the search list.

For more information on the search tools available in Acrobat Reader, consult the help files provided with the program.

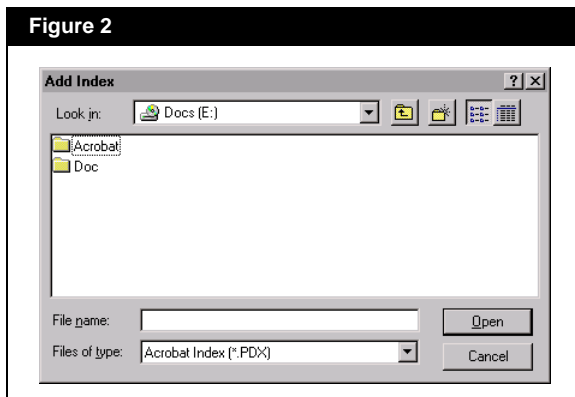
One of the advantages in using the HYSYS Documentation CD is the ability to do power searching using the Acrobat search tools. The Acrobat **Search** command allows you to perform full text searches of PDF documents that have been indexed using **Acrobat Catalog®**.

To attach the index file to Acrobat Reader 5.0.5, use the following procedure:

1. Open the Index Selection view by selecting **Edit-Search-Select Indexes** from the menu.
2. Click the **Add** button. The Add Index view appears.

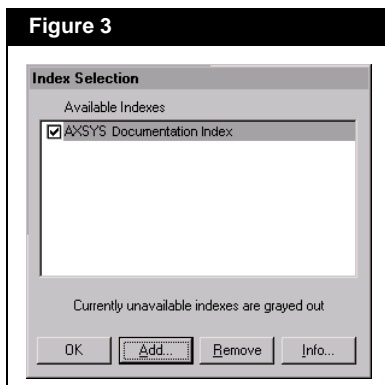
3. Ensure that the **Look in** field is currently set to your CD-ROM drive. There should be two folders visible from the root directory: Acrobat and Doc as shown below.

Figure 2



4. Open the **Doc** folder. Inside it you should find the **Index.pdx** file. Select it and click the **Open** button.
5. The Index Selection view shows the available indexes that can be attached. Select the index name and then click the **OK** button. You may now begin making use of the Acrobat **Search** command.

Figure 3



Using the Search Command

Wild card characters:

* and ?

Operators:

= exact match

~ contains

! does not contain

Boolean Operators:

NOT exclude

AND

Use quotes “ ” for a literal search.

The Acrobat **Search** command allows you to perform a search on PDF documents. You can search for a simple word or phrase, or you can expand your search by using wild-card characters and operators.

To search an index, first select the indexes to search and define a *search query*. A search query is an expression made up of text and other items to define the information you want to define. Next, select the documents to review from those returned by the search, and then view the occurrences of the search term within the document you selected.

To perform a full-text search do the following:

1. Choose **Edit-Search-Query** from the menu.
2. Type the text you want to search for in the Find Results Containing Text box.
3. Click **Search**. The Search view is hidden, and documents that match your search query are listed in the Search Results window in order of relevancy.
4. Double-click a document that seems likely to contain the relevant information, probably the first document in the list. The document opens on the first match for the text you typed.
5. Click the **Search Next** button or **Search Previous** button to go to other matches in the document. Or choose another document to view.

You can also use the Find tool (CTRL F). This is a less powerful method of searching but can still be useful. Other Acrobat Reader features include a zoom-in tool in the toolbar, which allows you to magnify the text you are reading. You can print pages or chapters of the online documentation using the **Print** command under the **File** menu.

Conventions Used in the Manuals

The following section lists a number of conventions used throughout the documentation.

Keywords for Mouse Actions

As you work through various procedures in the manuals, you will be given instructions on performing specific functions or commands. Instead of repeating certain phrases for mouse instructions, keywords are used to imply a longer instructional phrase:

Keyword	Action
Point	Move the mouse pointer to position it over an item. For example, point to an item to see its Fly-by information.
Click	Position the mouse pointer over the item, and rapidly press and release the left mouse button. For example, click the Close icon to close the current view.
Right-Click	Same as click, but use the right mouse button. For example, right-click an object to display the Object Inspection menu.
Double-Click	Position the mouse pointer over the item, then rapidly press and release the left mouse button twice. For example, double-click the HYSYS icon to launch the program.
Drag	Position the mouse pointer over the item, press and hold the left mouse button, move the mouse while the mouse button is down, and then release the mouse button. For example, you drag items in the PFD to position them.
Fly-by Information	Whenever you pass the mouse pointer over certain objects, such as toolbar icons and flowsheet objects, a small yellow box with text appears. It contains a brief description of the action that will occur if you click on that button or details relating to the object.

Selecting Items

Selecting refers to either picking a specific item from a list, or invoking a button command. There are three types of selecting in HYSYS:

Method	Description
Selecting a cell	Move the mouse to the location and left-click to select.
Selecting from a drop down menu or list	Move the focus location into the drop-down, and use the mouse pointer or keyboard arrows to highlight the selection, then press ENTER to select.
Multiple list selections	Click and drag the mouse over the items you want to select (provided they are all sequential in the list). Alternatively, you can highlight sequential items by selecting the first item in the list, holding down the SHIFT key and selecting the last item in the list. If the items are not sequential, select the first item with the left mouse button and then select additional items with the mouse while holding down the CTRL key.

A number of text formatting conventions are also used throughout the manuals:

Format	Example
When you are asked to access a menu command, the command is identified by bold lettering.	Select File-Save from the menu to save your case.
When you are asked to click a button, the button is identified by bold lettering.	Click the Close button to close the current view.
When you are asked to press a key or key combination to perform a certain function, keyboard commands are identified by words in bolded small capitals (small caps).	Press F1 to open the context sensitive help.
The name of a HYSYS view (also know as a property view) is indicated by initial capitalization.	The Session Preferences view appears.
The names of pages and tabs on various views are identified in bold lettering when an action is being performed on these pages or tabs. If there is no direct action on that particular page or tab, then it is NOT bolded.	Click Composition page on the Worksheet tab to see all the stream composition information.
The names of radio buttons, checkboxes and cells are identified by initial capitalization.	Click the Ignored checkbox to ignore this operation.
Material and energy stream names are identified by initial capitalization.	Double-click on the Column Feed stream to open its view.
Unit operation names are identified by initial capitalization.	Click on the Inlet Separator to highlight it.
When you are asked to provide keyboard input, it will be indicated by bold lettering accompanied by words such as 'type' or 'press'.	Type 100 in the cell to define the stream temperature, and press ENTER .

Bullets & Numbering

Bulleted and numbered lists are used extensively throughout the manuals. Numbered lists are used to break down a procedure into steps, for example:

1. Select the Name cell.
2. Type a name for the operation.
3. Press ENTER to accept the name.

Bulleted lists are used to identify alternative steps within a procedure, or for simply listing like objects. A sample procedure that utilizes bullets is:

1. Move to the Name cell by doing one of the following:
 - Select the Name cell.
 - Press ALT N.

Notice the two alternatives for completing Step 1 are indented to indicate their sequence in the overall procedure.

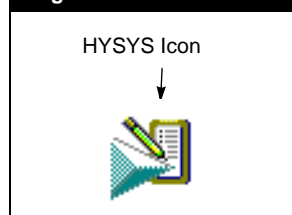
A bulleted list of like objects might describe the various groups on a particular view. For example, the Options page of the Simulation tab on the Session Preferences view has three groups, namely:

- General Options
- Errors
- Column Options

Callouts

A callout is a label and arrow that describes or identifies an object. An example callout describing a graphic is shown below.

Figure 4



Annotations

Annotation text appears in the outside page margin.

Text appearing in the outside margin of the page supplies you with additional or summary information about the adjacent graphic or paragraph. An example is shown to the left.

Shaded Text Boxes

A shaded text box provides you with important information regarding HYSYS behaviour, guidelines, or alerts. Examples include:

The resultant temperature of the mixed streams may be quite different than those of the feed streams, due to mixing effects.

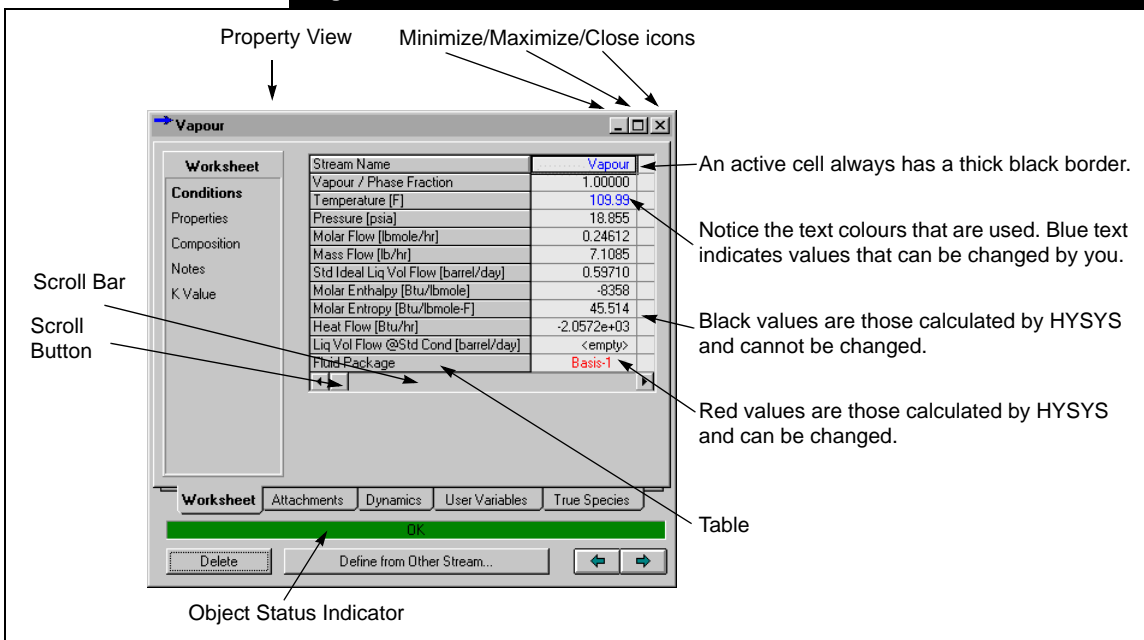
Before proceeding, you should read the introductory section which precedes the example problems in this manual.

The use of many of these conventions will become more apparent as you progress through the manuals.

Terminology

The following views show some of the HYSYS interface terminology:

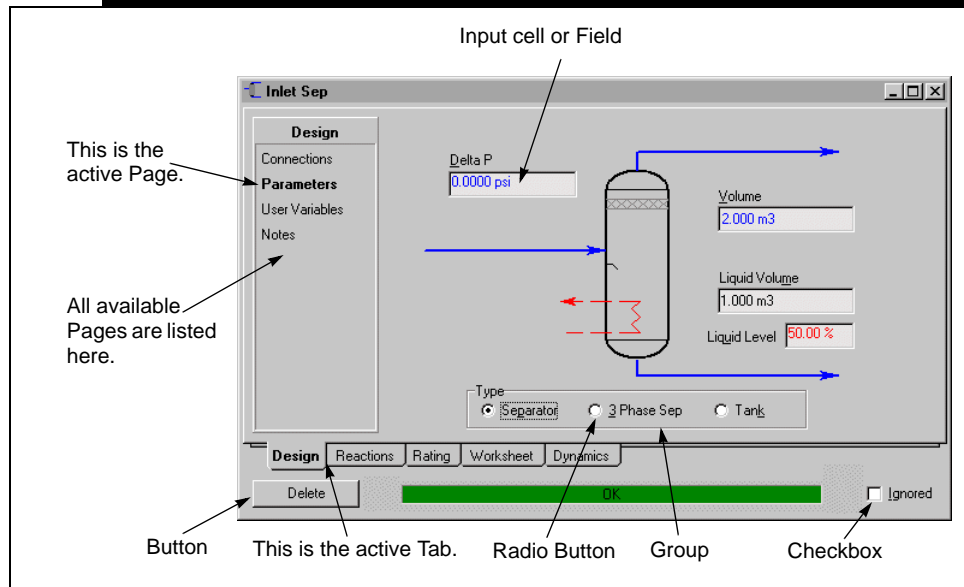
Figure 5



- **View.** Any “windowed” graphical representation found on the HYSYS Desktop. Examples include the property view for a stream (such as **Inlet Sep** shown in **Figure 6**) or unit operation, or an error message window. (View and Property View are interchangeable.)
- **Object Status Indicator.** Found at the bottom of each property view, it shows the calculation status of the associated object. The indicator displays a status message with an appropriately coloured background (red for a missing parameter, yellow for a warning message, and green for OK).
- **Scroll Bar.** Clicking inside the scroll bar allows you to access information which cannot be displayed in the current size of a menu or view. The scroll bar in the above view is horizontal.
- **Scroll Button.** Clicking and dragging the scroll button up/down or left/right allows you to access information which cannot be displayed in the current size of a menu or view.
- **Table.** A group of cells in tabular format, through which you can manoeuvre with the mouse or the keyboard arrow keys.

- **Input Cell/Field.** A location inside a view where information is supplied and/or displayed. Examples include stream names, temperatures, etc. In some cases, an Input Cell/Field has an associated drop-down.

Figure 6



- **Tab.** In views with multiple pages of information, such as property views and Workbooks, the pages are accessed by tabs at the bottom of the view. In the figure above, **Design**, **Reactions**, **Rating**, **Worksheet** and **Dynamics** are the tabs.
- **Page.** Most tabs have associated page views. These are listed in the column on the left side of the view. Above they are **Connections**, **Parameters**, **User Variables** and **Notes**.
- **Button.** Invokes a command when clicked. Buttons do NOT have any pictures on them. An example is the **Delete** button in the above view.
- **Icon.** Invokes a command when clicked. Icons have pictures on them (whereas Buttons do not). An example is the Minimize/Maximize icons in the above view.
- **Drop-Down List.** A list of available options for a certain input cell, indicated by the arrow at the end of an input cell.
- **Checkbox.** Items or settings which are either On or Off. Placing a checkmark in a checkbox will turn the function On. Removing the checkmark turns it Off. The **Ignored** checkbox in the above view has no checkmark and is therefore Off.
- **Unit Field.** Provides a drop-down list of units which are applicable for the parameter type of the current input cell.



HYSYS Icon

- **Group.** An organizational border within a page that groups related functions together.
- **Radio Button.** A set of options, of which only one can be active at a time. Radio buttons are always found in groups of at least two.
- **Close icon.** The **X** icon in the upper right corner of a view, used to close the view.
- **Minimize/Maximize icons.** In the upper right corner of a view, allows you to iconize (minimize) the current view, or expand a view to its full size.
- **Icon.** A minimized view. Double-clicking on an icon opens the view. The HYSYS icon is shown to the left. When you double-click, it opens HYSYS.

Now you're ready to get started!

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Online Technical Support Center

AspenTech customers with a valid license and software maintenance agreement can register to access the Online Technical Support Center at <http://support.aspentech.com>.

The support Web site allows you to:

- Access current product documentation
- Search for tech tips/solutions/frequently asked questions (FAQs)
- Search for and download application examples
- Search for and download service packs and product updates
- Submit and track technical issues
- Search for and review known limitations
- Send suggestions

Registered users can also subscribe to our Technical Support e-Bulletins. These e-Bulletins are used to alert users to important technical support information such as:

- Technical advisories
- Product updates
- Service Pack announcements
- Product release announcements

Contacting Technical Support

Technical support is available by phone, fax, and e-mail for customers with a current support contract for their product. For the most up-to-date phone listings, please see the Online Technical Support Center at <http://support.aspentech.com>.

When contacting us via e-mail, 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...).
- The serial number of your security key, if you have an installation, security, or network issue.
- A detailed description of the problem (attach a simulation case if possible).

We also have toll-free lines that you can use. When you call, please have the same information available.

Support Center Hours

Support Centers	Operating Hours
North America	8:00 - 20:00 Eastern Time
South America	9:00 - 17:00 Local time
Asia and Pacific Region	9:00 - 17:30 Local time
Europe, Middle East, and Africa (EMEA)	8:30 - 18:00 Central Europe time

Support Center Phone Numbers

Support Centers	Phone Numbers																																
North America	+1 888 996 7100 (Toll-free from U.S., Canada, Mexico) +1 281 584 4357 (From outside U.S., Canada, Mexico) +52 55 5536 2809 (Mexico Support Center)																																
South America	+54 11 4590 2254 (Argentina Support Center) +55 11 5012 0321 (Brazil Support Center) +0800 333 0125 (Toll-free to U.S. from Argentina) +000 814 550 4084 (Toll-free to U.S. from Brazil) +0800 100 2410 (Toll-free to U.S. from Venezuela)																																
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Europe, Middle East, and Africa (EMEA)	<div> +32 2 701 95 55 If you are calling from one of the countries listed below, you can dial your in-country toll-free number: </div> <table> <tr> <th>Country</th><th>Toll-free Number</th></tr> <tr> <td>Austria</td><td>0800-111-900</td></tr> <tr> <td>Belgium</td><td>0800-40-687</td></tr> <tr> <td>Denmark</td><td>8088-3652</td></tr> <tr> <td>Finland</td><td>0-800-1-19127</td></tr> <tr> <td>France</td><td>0805-11-0054</td></tr> <tr> <td>Germany</td><td>0800-101-0068</td></tr> <tr> <td>Ireland</td><td>1-800-930-024</td></tr> <tr> <td>Italy</td><td>800-905-826</td></tr> <tr> <td>Netherlands</td><td>0800-023-2511</td></tr> <tr> <td>Norway</td><td>800-13817</td></tr> <tr> <td>South Africa</td><td>0800-996-852</td></tr> <tr> <td>Spain</td><td>900-951846</td></tr> <tr> <td>Sweden</td><td>0200-895-284</td></tr> <tr> <td>Switzerland</td><td>0800-111-470</td></tr> <tr> <td>UK</td><td>0800-376-7903</td></tr> </table>	Country	Toll-free Number	Austria	0800-111-900	Belgium	0800-40-687	Denmark	8088-3652	Finland	0-800-1-19127	France	0805-11-0054	Germany	0800-101-0068	Ireland	1-800-930-024	Italy	800-905-826	Netherlands	0800-023-2511	Norway	800-13817	South Africa	0800-996-852	Spain	900-951846	Sweden	0200-895-284	Switzerland	0800-111-470	UK	0800-376-7903
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E-mail Addresses

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South America	Lasupport@aspentech.com
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Asia and Pacific Region	esupport@aspentech.com

Training Contact

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Sweden	0200-895-284
Switzerland	0800-111-470
UK	0800-376-7903

South Africa

Telephone: + 27-11-258-8780

Fax: + 27-11-258-8558

E-mail: susan.brown@aspentech.com

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Telephone: + 81-3-3262-1743

Fax: + 81-3-3262-1744

E-mail: atjtraining@aspentech.com

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1 Installing HYSYS

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1.1 Basic Requirements

System Component	Requirements
Operating System	Microsoft Windows 2000/XP Microsoft Internet Explorer version 5.0 or higher.
Processor Speed	Pentium II 400 MHz, recommended PIII 700 MHz or better.
RAM requirements	Minimum 128 MB RAM, recommended 256 MB. Total Memory (RAM + Virtual Memory) minimum 300 MB, recommended greater than 300 MB
Disk Space	Minimum 200 MB of free disk space.
Serial Port	The green security dongle is used with the standalone version of HYSYS and can only be attached to a serial communications port of the computer running the application (do not plug in a serial mouse behind the security dongle).
Parallel/USB Ports	SLM dongles are Sentinel SuperPro - Computer ID dongles, manufactured by Rainbow Technologies. The Computer ID dongle is installed on the parallel port (printer port) of your computer. An arrow indicates which end should be plugged to the computer. This is the new dongle that is used for both Standalone and Network versions of HYSYS.
Monitor/Video	Minimum usable: SVGA (800 x 600). Recommended: SVGA (1024 x 768).
Mouse	Required. Note that a mouse cannot be plugged into the back of the green serial port dongle used with the "standalone" version of HYSYS.

1.2 Licensing Information

You need a license file and hardware security key to run HYSYS. Refer to the [SLM Installation and Reference Guide](#) for detailed information on licensing.

1.3 Upgrading from Older Versions of HYSYS

HYSYS 2.2.2 & Older

If you are using a standalone copy of HYSYS, your green serial port key will continue to work with your old version of HYSYS; it will also work with all SLM versions of HYSYS (v2.4 and on) so long as you have properly installed your license file.

Network copies of HYSYS 2.2.2 will not function with your new SLM network key and license server. Only copies of HYSYS version 2.4 and newer will operate with the SLM licensing system.

The old network key can not be installed on the same computer as the new SLM network key. Please uninstall your old network key and key server software (procedure varies, consult the Get Started manual from the older HYSYS version for details) before installing the SLM license server.

HYSYS 2.4 & Newer Versions

These versions of HYSYS already use the SLM licensing system. You may need to install a new license file (if so, one will be supplied). Otherwise, install the HYSYS software and continue using the existing licenses.

If you are using commutable licenses, please ensure that there are *no* commuted HYSYS licenses on your computer *before* proceeding with the upgrade.*

* For more information, contact your AspenTech sales agent.

1.4 Installing HYSYS

The following instructions are written assuming installation on Windows 2000/XP.

1. Shut down all other programs on the computer before starting the installation process.
2. Insert the HYSYS software CD in the CD drive of your computer.

For computers which have the CD-ROM Autorun feature enabled, steps #3 and #4 will be automatically performed.

3. From the **Start** menu, select **Run**.
4. In the Run view, type: **d:\setup.exe** and click on the **OK** button (where d: is your CD drive).
5. The following installation screen appears.

Figure 1.1



6. Click on the **Install Products** link.

7. On the Products view, select **HYSYS**. The Installation Wizard may take a few moments to load. The Welcome view appears.
8. Read the information and click the **Next** button. The Customer Information view appears.

Enter your name and company information in the fields.

Select one of the radio buttons to determine whether HYSYS should be available to anyone else who logs on to your machine, or if it should be available only to you when you log on to your machine.

9. Click **Next**. The Destination Folder view appears.

This view displays the default location on where the HYSYS program is going to be placed on your machine.

C:\Program Files\Hyprotech\HYSYS 3.2\

To change the location of the program, click the **Change** button, enter or select the new location for the HYSYS program in the **Folder Name** field on the Change Current Destination Folder view, and click the **OK** button.

10. Click **Next**. The Setup Type view appears.

There are two setup types for installing HYSYS. Select the setup type you want by clicking the appropriate radio button:

- **Complete**. Installs the entire HYSYS program, including the example files, extension SDK, Sizing, and SLM Client Tools.
- **Custom**. Open the Custom Setup view and allows you to select which options/features you want to install with the HYSYS program.

11. Click **Next**. The Ready to Install the Program view appears.
12. Review your settings here: click **Back** to change your settings, or click **Install** to continue. HYSYS will then begin installing files to your computer.
13. In the Installing HYSYS view, you can see the progress of the installation. Once installation is done, the Installshield Wizard Complete view appears.
14. Read the information on this view and click the **Finish** button.

If you experience any difficulties, refer to [Chapter 10 - Troubleshooting SLM Problems](#) in the [SLM Installation and Reference Guide](#).

It is recommended that you restart your computer.

1.4.1 HYSYS Installation to an Application Server

Installing HYSYS onto a server follows exactly the same process as outlined in the previous section. Simply choose a network drive instead of the local drive when on the Select Components view. Then each of the client workstations must be set up as detailed below. To prevent accidental modification or deletion of files, it is recommended that HYSYS users be allowed read-only access to the HYSYS software. Each HYSYS user should then configure an individual preferences file and store that file on their local hard disk (or write-enabled network drive).

To set up each of the client workstations:

1. Ensure that the workstation has all of the required components for running HYSYS using the SLM (see section [Technical Support](#) for information on how to contact AspenTech for help); you can install missing components by running the files found on the Software CD in the **OS Upgrades** folder.
2. Copy the **strgxi2.dll** from the computer where HYSYS was installed; this file must be on every client workstation for them to work properly. You may want to copy the entire Hyprotech common files folder (C:\Program Files\Common Files\Hyprotech\) including all of its sub-folders onto each workstation as this will ensure that each user also has access to the SLM troubleshooting tools.
3. Register the **strgxi2.dll**; i.e., use the DOS command line or select **Run** from the Windows **Start** button.

```
regsvr32 "C:\Program Files\Common
Files\Hyprotech\Shared\strgxi2.dll"
```

Regsvr32.exe is installed in the HYSYS root directory.

4. Create a working directory for HYSYS on the workstation (i.e., C:\Program Files\Hyprotech\HYSYS\). In this directory, create the sub-directories CASES, PAKS, and USER.
5. Create a shortcut to HYSYS.exe (on the desktop or in the Start menu). In the shortcut Properties, set the Start In directory to the working directory you created in the previous step.

It is recommended that all components on C:\Program Files\Common Files\Hyprotech are installed and registered. You should register all DLL and OCX.

If it is necessary to move the common files to another machine, copy C:\Program Files\Common Files\Hyprotech\ to the drive you want to move the common files.

COMThermo

For COMThermo, the following keys must be created in the registry:

- HKLM\Software\Hypotech\COMThermo\DatabasePath - contains the path to COMThermo\Databases.
- HKLM\Software\Hypotech\COMThermo\ModelsPath - contains path to COMThermo\Models.
- HKLM\Software\Hypotech\COMThermo\Version - contains version number of COMThermo (version number can be found in any of the COMThermo DLLs and is used by the applications to display the COMThermo version information in the Help About box).

BaSYS

If you have BaSYS installed, you have to register all OCX and DLL.

XML

If you have XML, you have to register the XMLRead.dll, however this dll is optional.

MSXML4

The MSXML4.msi is available on the software CD. If you already have the XML parser installed on your computer you don't have to install the MSXML4.msi file.

If you install MSXML4.msi then you have to register the [INSTALLDIR]hyphys.dll.

System DLLs [fortran runtime]

The following are DLLs that are required especially for COMThermo:

- Msfrt40.dll
- Dformd.dll
- Dfortt.dll

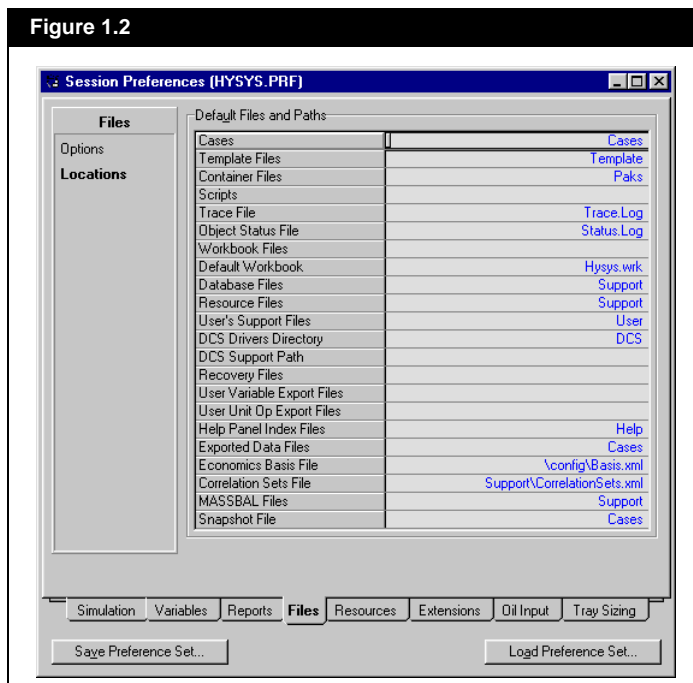
There are a number of other system DLLs that may be installed, however it is difficult to get a list of the DLLs as they are in merge modules.

1.4.2 Setting HYSYS File Location Preferences

To set your HYSYS file location preferences:

1. Start HYSYS.
2. From the **Tools** menu, select **Preferences**. The Session Preferences view appears.
3. On the Files tab, select **Locations**.
4. Configure the **Default Files and Paths** as shown below. These are suggestions only and some modification may be required.

Figure 1.2



5. Click the **Save Preference Set** button, and save it to the HYSYS working directory on the local disk.

2 Getting Started

2.1 Starting HYSYS.....	2
2.2 Steady State Case.....	7
2.3 Dynamics Case	22

The **Getting Started** section gives a quick introduction to HYSYS by recalling a saved case and illustrating how to navigate through HYSYS.

2.1 Starting HYSYS

To start HYSYS:

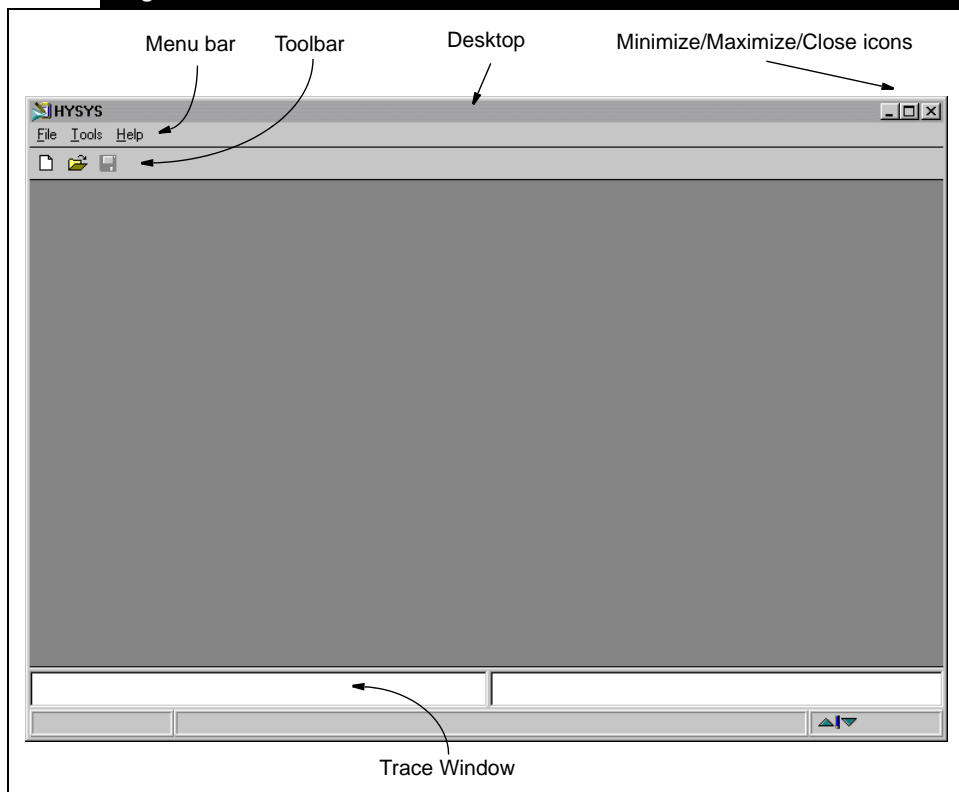
1. Click on the **Start** menu in Windows.
2. From the **Programs** menu, select **Hyprotech** then **HYSYS 3.2**.
3. Select **HYSYS**. HYSYS begins to load.



HYSYS Icon

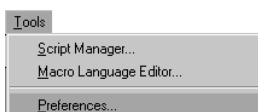
Now you are ready to begin working with HYSYS. The HYSYS Desktop is the first thing you will see:

Figure 2.1



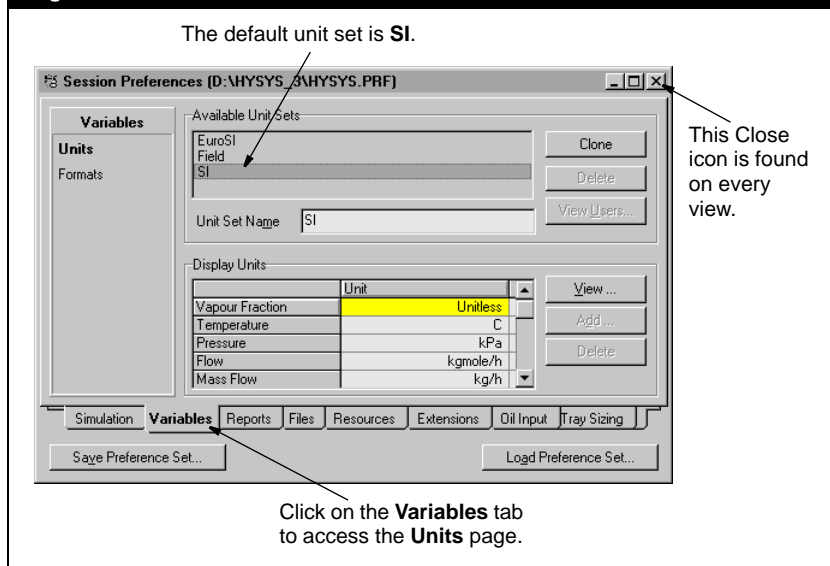
This view has been resized; your Desktop view should appear larger than this when initially opened. To re-size the view, click and drag the outside border. To make the view full size, click the Maximize icon in the upper right corner.

Before opening the pre-built Getting Started case, you should choose the HYSYS unit set used for displaying information. You can check your current unit set by accessing the Session Preferences from the menu bar:



1. From the **Tools** menu, select **Preferences**. The Session Preferences view appears.
2. Click on the **Variables** tab. The **Units** page should be open by default. The Current Unit Set is shown highlighted in the list of Available Unit Sets. The HYSYS default is SI; however the Getting Started example has been developed in Field units.

Figure 2.2



3. Click on **Field** to make it the current unit set.
4. Click the **Close** icon to close the Session Preferences view.

Recalling the Simulation Case from Memory

Included with your HYSYS package are a number of pre-built simulation cases located in the Samples subdirectory of the HYSYS root directory. One of these cases is named **gstst-ss.hsc** and is the example used here. To load the case:

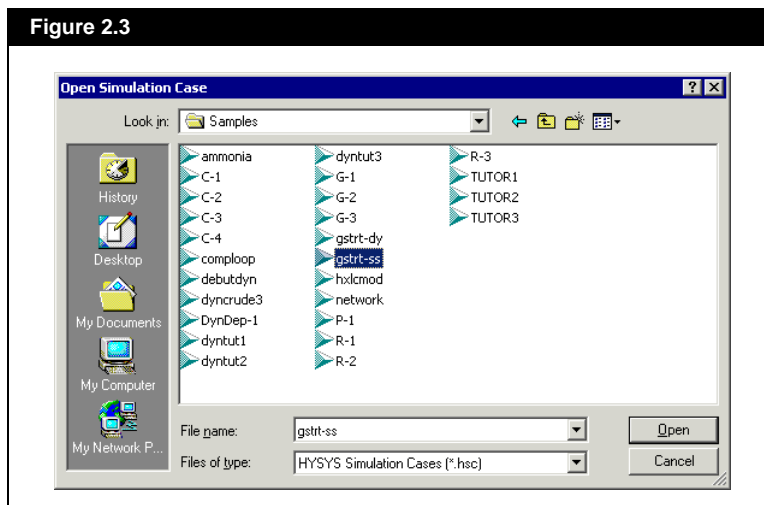


Open Case icon

1. Do **one** of the following:
 - Click the **Open Case** icon on the toolbar.
 - From the **File** menu, select **Open** then **Case**.
 - Press **CTRL O**.

The Open Simulation Case view appears.

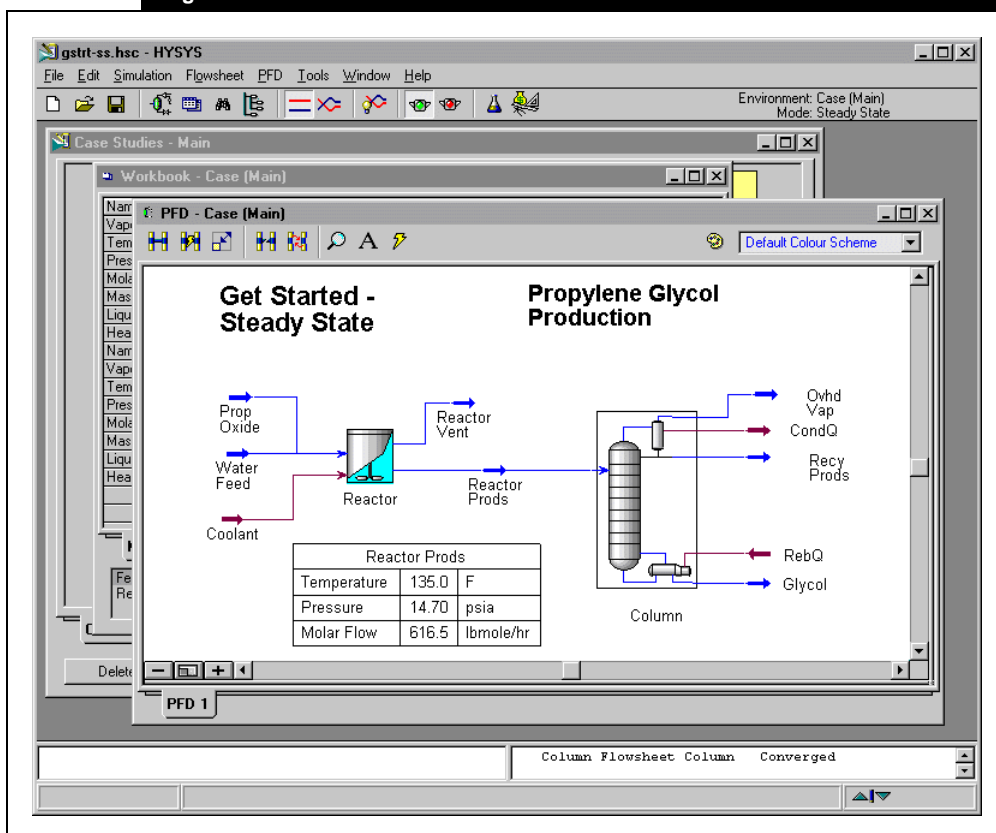
Figure 2.3



2. Open the **Samples** subdirectory and scroll through the list of files until **gstst-ss.hsc** is visible.

- Click on **gstprt-ss.hsc**, then click the **Open** button. The pre-built simulation case appears on your Desktop.

Figure 2.4



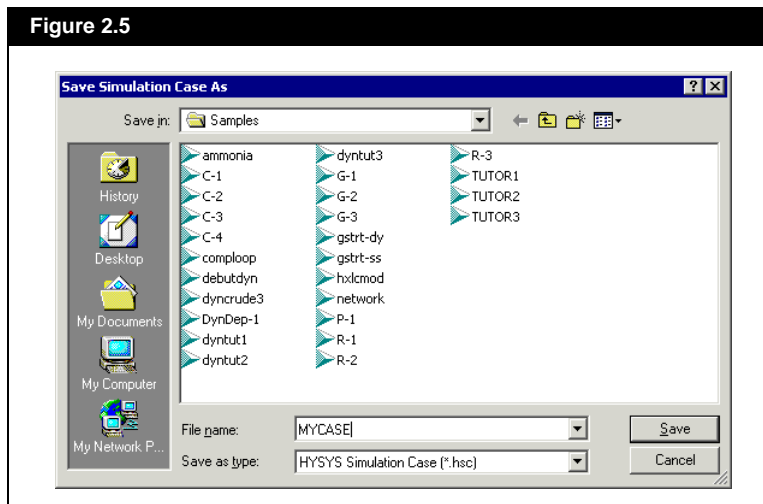
Saving the Case Under a New Name

Before working with this case, you should save it using a new name to ensure that the original file remains intact.

- Do **one** of the following:
 - From the **File** menu, select **Save As**.
 - Press **CTRL SHIFT S**.

The Save Simulation Case As view appears.

2. Type a new name, for example **MYCASE**, in the **File name** field. Note that you do not have to enter the **.HSC** extension; HYSYS will add it automatically.

Figure 2.5

3. Click the **Save** button, and HYSYS saves your case with the new name.

2.2 Steady State Case

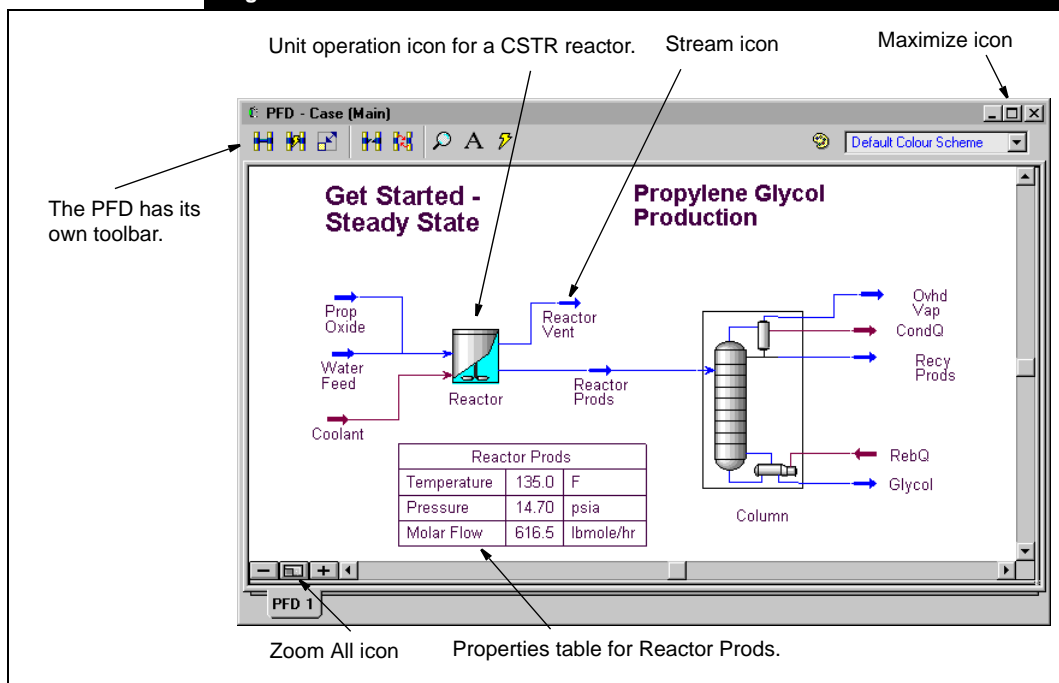


The Steady State - Dynamic toggle on the toolbar indicates that you are currently in Steady State mode.

This steady state simulation models the production of propylene glycol. Using a continuously-stirred-tank reactor (CSTR), propylene oxide and water are reacted at atmospheric pressure. The reaction is exothermic, so a coolant is circulated to the reactor to maintain its temperature. The reactor effluent, consisting of propylene glycol and unreacted feed, is fed to a distillation column. In the column, 99.5 mol% glycol is produced from the bottoms, while unreacted propylene oxide and water are recovered overhead.

Three windows, or views, are currently displayed on the HYSYS Desktop. Each view is identified by its title at the top of the view. The current active view is the PFD, which is a graphical representation of the process flowsheet.

Figure 2.6



The PFD shows:

- The streams and unit operations, represented by symbols (called icons), in the flowsheet.
- The connectivity amongst the streams and unit operations.
- A property table for the Reactor Prods stream.

If you want, you can re-size the PFD view to make it more readable.

1. Do one of the following:
 - Click and drag the outside border to the new size.
 - Click the Maximize icon in the upper right corner of the view.
2. Click the Zoom All icon to zoom-in on all items in the PFD, filling the resized view.

Prop Oxide	
75.00	F
14.70	psia
163.8	lbmole/hr

Stream Fly-By

You can display summary information for a particular object (stream or operation) simply by placing the cursor over the object's icon. For example, position the cursor over the icon for stream Prop Oxide. A fly-by view appears at the cursor tip, showing the stream temperature, pressure and molar flow.

Accessing Stream Information from the PFD

For detailed information on the information in this section, see [Chapter 3 - Streams](#) in the **Operations Guide**.

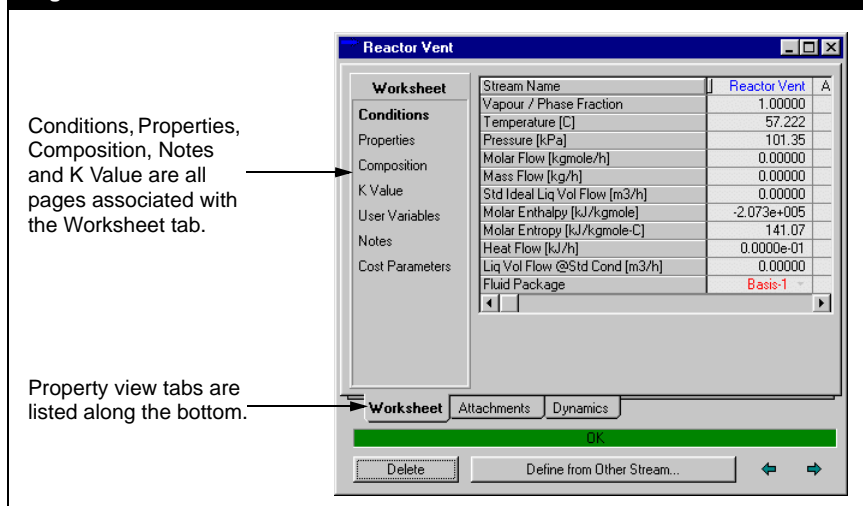
Every stream and operation (object) contained in a HYSYS simulation has its own property view, which contains multiple tabs and related pages of information or properties describing the object. You can access the property view for a stream directly from the PFD by simply double-clicking on the stream icon.



Reactor Vent Icon

For example, to see the property view for one of the streams entering the reactor, double-click on the Reactor Vent icon on the PFD. The property view for the Reactor Vent appears as shown in the figure below.

Figure 2.7



When an object's property view is initially opened, it displays the first page on the first tab of the view. For the Reactor Vent property view, the first tab is the Worksheet tab; its first page is the Conditions page. Tabs are listed along the bottom of an object's view. Each tab has associated pages that are listed in the column on the left side of the view. Change the page or tab by clicking on the page or tab.

Conditions Page

The Conditions page of the Worksheet tab gives the basic conditions of the stream: the vapour fraction, temperature, pressure, material flows and heat flow (enthalpy).

Properties Page

The Properties page of the Worksheet tab displays all the Transport Properties for each stream phase. You can manipulate the properties displayed on this page for an individual stream. The properties from the Conditions page are not available for this page.

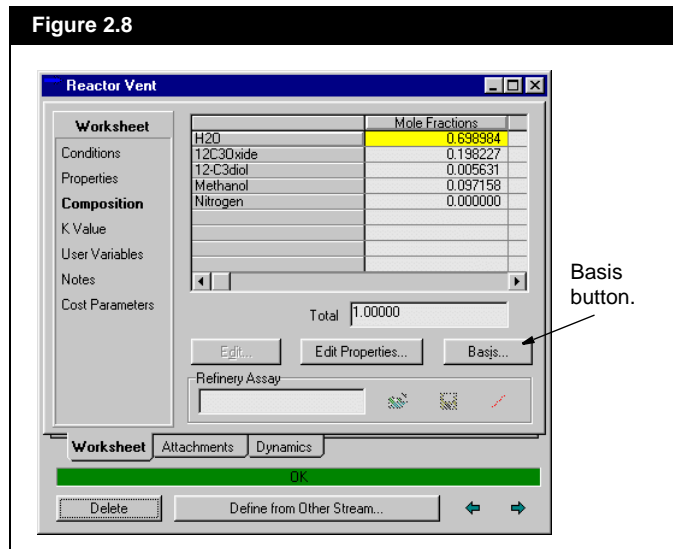
You can manipulate the Property page for all streams, by using the Correlation Manager.

Refer to [Section 11.18 - Correlation Manager](#) in the **User Guide** for more information about the Correlation Manager.

Composition Page

The Composition page of the Worksheet tab displays the material composition of the stream. In this case, five components are displayed along with the liquid volume flow for each component. You can display the composition on another basis, such as mass or molar fraction, by clicking the Basis button.

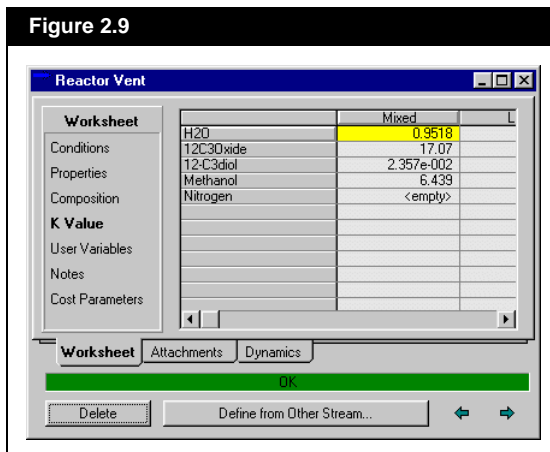
Figure 2.8



K Value Page

The K Value page of the Worksheet tab displays the K values or distribution coefficients for each component in the stream.

Figure 2.9



Electrolytes Page

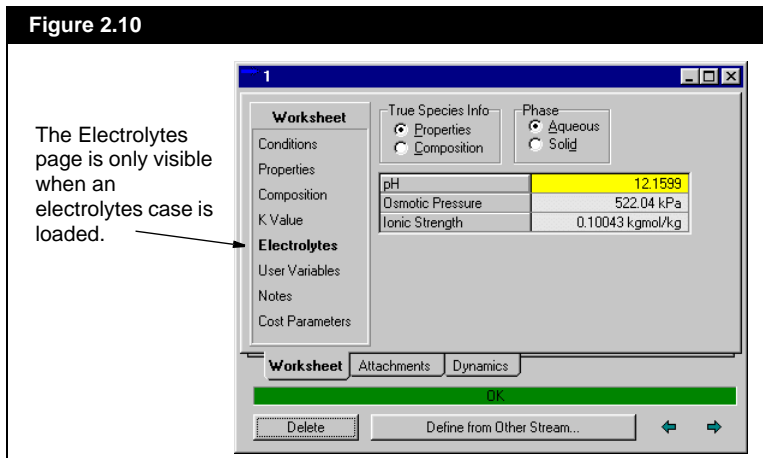
In this case, there are *no* electrolytes being used, so an Electrolytes page does *not* exist. Shown below is *only* an example of the Electrolytes page.

The Electrolytes page is only available if the stream is in an electrolyte system.

Refer to [Section 1.2.4 - Adding Electrolyte Components](#) in the **Simulation Basis** manual for more information about electrolytes.

The Electrolytes page of the Worksheet tab displays true species phase properties and compositions of an electrolyte stream.

Figure 2.10



This page contains two radio buttons for phase selection:

- Aqueous
- Solid

There are two radio buttons corresponding to each phase selection:

- Properties
- Composition

The following are the combination views for the selection of the radio buttons under Phase and True Species Info groups.

Phase	True Species Info	Display
Aqueous	Properties	Aqueous phase related properties like pH value, Osmotic Pressure and Ionic Strength.
	Composition	The concentrations calculated on ionic basis. The real ionic species from the aqueous phase are also shown.
Solid	Properties	Scale tendency* value for each solid in the lists. User can choose to include or exclude the solid component in the list for the stream thermo flash by checking the Include checkbox.
	Composition	Concentrations that are the same as in the traditional stream phase view. But the solid component list indicates if the solid component is a precipitate or a hydrate.

* It is a measure of the tendency of a solid species forming at the specified stream conditions. Solids with a scale tendency index greater than one will form if the solid formation is governed by equilibrium (as opposed to kinetics) and if there are no other solids with a common cation or anion portion which also has a scaling tendency greater than one. If more than one solid exists with a common ion and scaling tendency greater than one, then at least one will form. You can use scaling tendencies to learn more about which solid can safely be deleted from the model.

User Variables Page

The User Variables page of the Worksheet tab allows you to write and attach code as a User Variable to extend the functionality of your stream.



Close icon

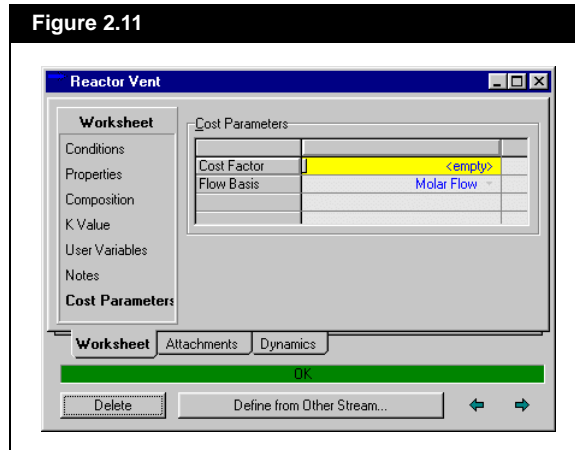
Once you have finished examining the stream properties, close the view using the Close icon in the upper right corner of the view. The next time you open the property view, it will open to the last page that you accessed before closing the view.

Cost Parameters Page

For more information regarding cost parameters refer to the **Sizing** manual.

You can enter a cost factor value for the stream in the Cost Parameters page of the Worksheet tab. You can also choose the flow basis associated with the cost factor from the Flow Basis drop-down list.

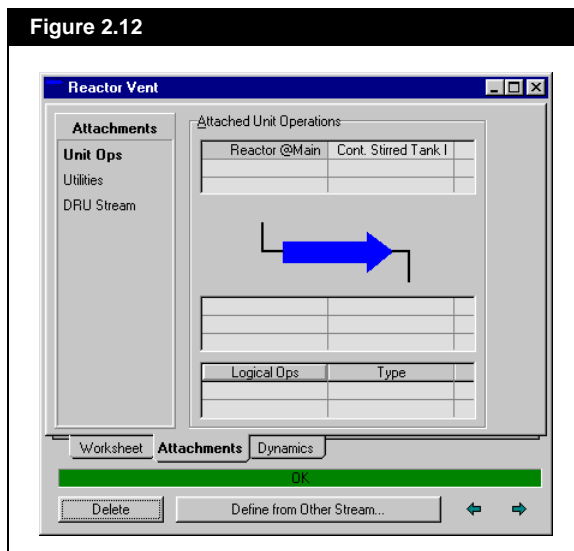
Figure 2.11



The remaining property view tabs and their associated pages are explained below.

Attachments Tab

Figure 2.12

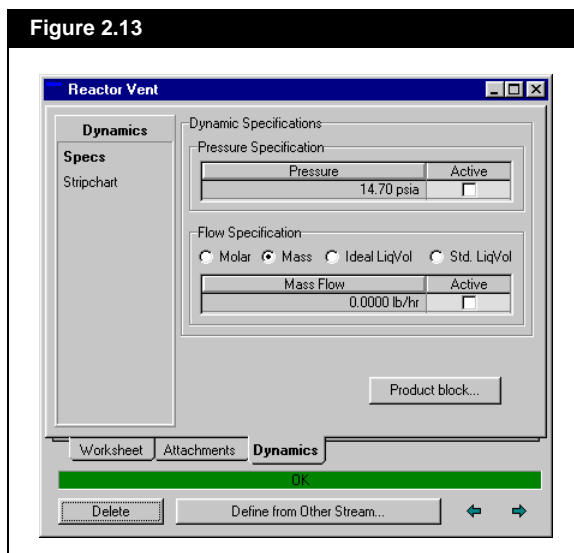


The Attachments tab consists of the following pages:

- **Unit Ops Page.** Lists the unit operation(s) to which the stream is attached.
- **Utilities Page.** Allows you to create and attach utilities to the stream.
- **DRU Stream Page.** Allows you to add a transfer stream.

Dynamics Tab

Figure 2.13



The Dynamics tab consists of the following pages:

- **Specs Page.** Applicable only in Dynamics mode. You activate dynamic specifications on this page.
- **Stripchart Page.** Provides an automatic way to create a strip chart for monitoring stream variables while running in Dynamics mode.



Workbook icon

Using the Workbook to Change a Stream Temperature

Click the **Workbook** icon on the HYSYS toolbar to change the current view to the Workbook.

Figure 2.14

Name	Prop Oxide	Water Feed	Reactor Vent	Reactor Prods
Vapour Fraction	0.0000	0.0000	1.0000	0.0000
Temperature [F]	75.00	75.00	135.0	135.0
Pressure [psia]	14.70	14.70	14.70	14.70
Molar Flow [lbmole/hr]	163.8	600.0	0.0000	616.5
Mass Flow [lb/hr]	9269	1.081e+004	0.0000	2.008e+004
Liquid Volume Flow [barrel/day]	760.9	741.6	0.0000	1357
Heat Flow [Btu/hr]	-8.994e+006	-7.351e+007	0.0000	-8.730e+007
Name	Dvhd Vap	Recy Prods	Glycol	New
Vapour Fraction	1.0000	0.0000	0.0000	
Temperature [F]	160.9	160.9	367.3	
Pressure [psia]	14.70	14.70	14.70	
Molar Flow [lbmole/hr]	4.721e-007	468.4	148.0	
Mass Flow [lb/hr]	2.075e-005	8856	1.122e+004	
Liquid Volume Flow [barrel/day]	1.667e-006	618.4	738.7	
Heat Flow [Btu/hr]	-2.899e-002	-5.596e+007	-2.914e+007	

The temperature of Reactor Prods is currently 135°F.

Lists the unit operations to which the stream is attached.

The Workbook view displays tabular information pertaining to the streams and unit operations in the simulation. You can also add, delete or modify streams and unit operations in the Workbook. The first tab of the Workbook, Material Streams, displays for each stream the same information that is available on the Conditions page of the stream property view. You can view the streams that are not currently visible by re-sizing the view, or by clicking repeatedly on the vertical scroll arrow.

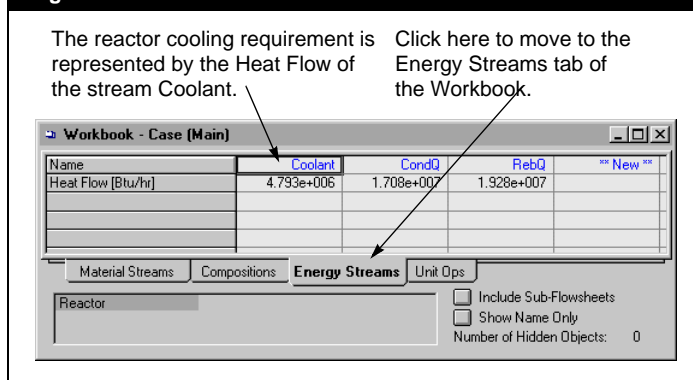
The remaining Workbook tabs include:

- **Compositions.** Displays the composition of each material stream.
- **Energy Streams.** Displays the name and heat flow of each energy stream.
- **Unit Ops.** Lists summary information for all unit operations.

Suppose you want to investigate the amount of cooling required to maintain the reactor at certain temperatures. The reactor is currently operating at 135°F, which is the temperature of the product Reactor Prods (as shown in the previous figure).

To see the cooling requirement to achieve this temperature, move to the **Energy Streams** tab in the Workbook.

Figure 2.15



The cooling duty required to maintain the specified reactor temperature is 4.8 MMBtu/hr, the Heat Flow of the energy stream Coolant. Check the cooling requirement for outlet temperatures of 100°F. The reactor temperature is set by the specification on the outlet stream Reactor Prods.

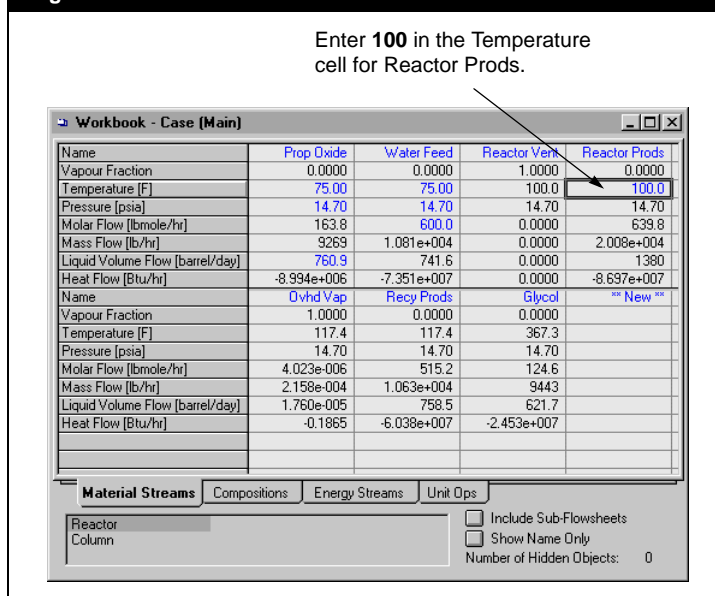
Workbook values shown in blue are user-specified. Values in black are calculated by HYSYS.

To specify the new separator temperature:

1. Return to the **Material Streams** tab in the Workbook by clicking on the tab.
2. Select the temperature cell for the Reactor Prods stream.

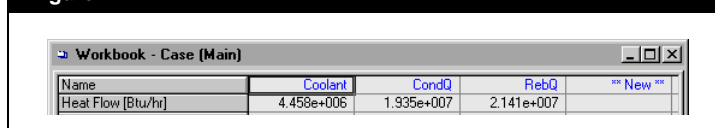
3. Type **100**, the press ENTER. HYSYS will automatically re-calculate the Flowsheet based on the new temperature.

Figure 2.16



4. Return to the **Energy Streams** tab to see the re-calculated cooling requirement.

Figure 2.17



You might expect the cooling requirement to increase as the reactor temperature is lowered. However, the reaction has two attributes that dominate the reactor's heat balance:

1. The reaction produces heat proportional to the amount of reaction occurring.
2. Less reaction occurs at 100°F than at 135°F.

So by lowering the reactor temperature, less reaction is taking place and less heat is produced by the reaction. Therefore, less cooling is required.

The temperature change has decreased the required cooling duty to **4.4 MMBTU/hr**.

Suppose you want to examine the cooling duty at a number of other temperatures. Instead of repeating the above procedure for each new temperature, the HYSYS Case Study feature will automatically make changes and tabulate the results for you.

Using the Case Study

The third view open on your Desktop is the Case Studies view. To access this view:

1. From the **Window** menu, select **Case Studies -Main**.

The three views that are currently open on the Desktop are listed at the bottom of the menu. A checkmark indicates the view that currently has focus. In this case, it is the Workbook view.

2. The Case Studies view appears as shown in the figure below.

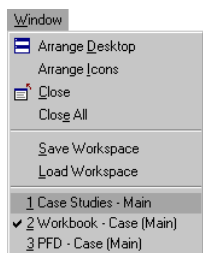
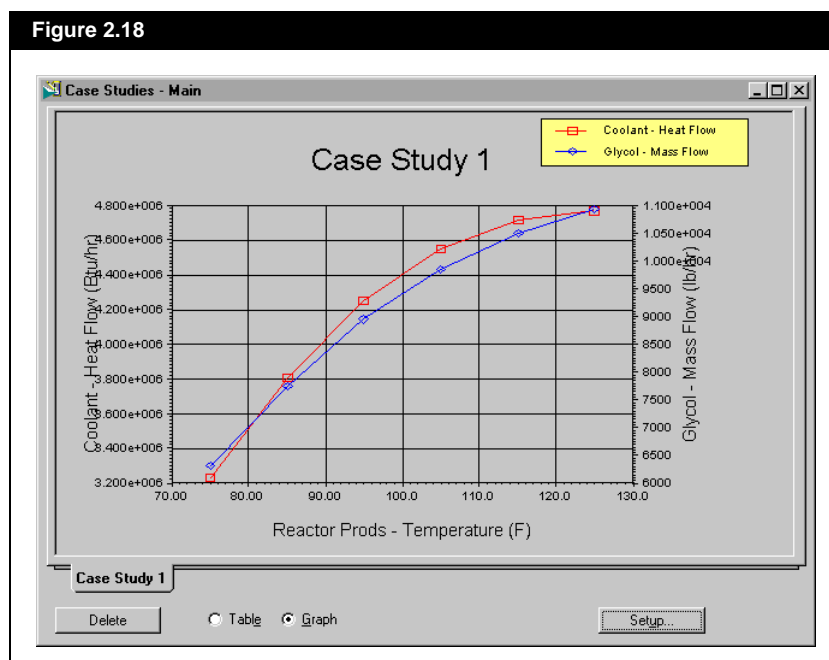


Figure 2.18



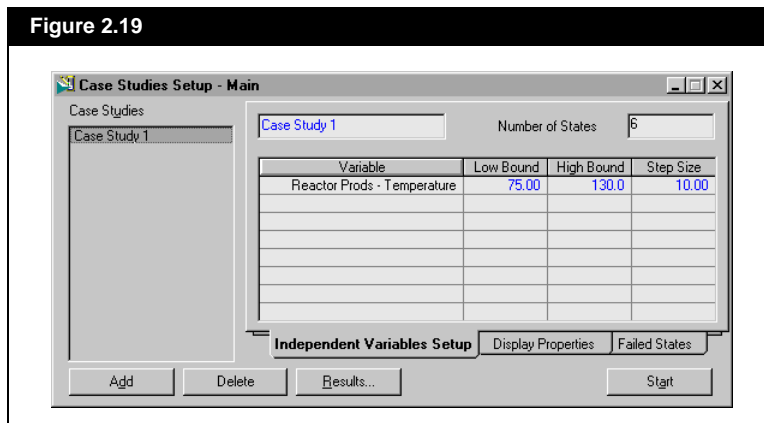
The Case Studies view shows a plot of the separator cooling duty and the Glycol stream molar flow rate (dependent variables) versus the separator temperature (independent variable).

Case Study 1 has been configured to calculate and plot values over an independent Temperature range of 75°F to 130°F with an increment of 10°F. You may actually want to observe the results over a wider range.

To change the bounds of the independent variable for the case study:

1. Click the **Setup** button on the Case Studies view. The Case Studies Setup view appears.

Figure 2.19



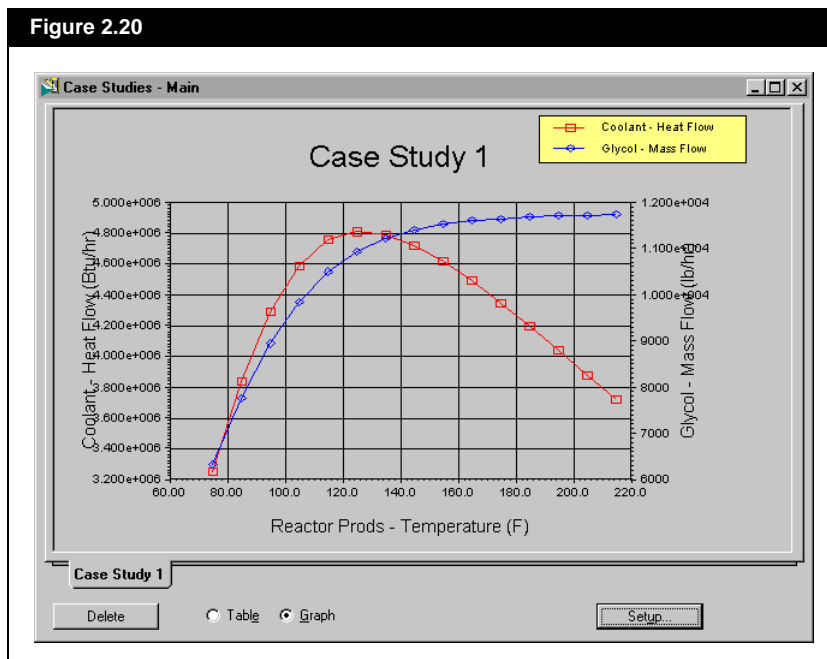
Leave the **Low Bound** at its value of 75°F, and the **Step Size** as 10°F.

2. Change the **High Bound** value to 215°F
3. Click the **Start** button.
4. Click the **Results** button.

HYSYS begins calculations immediately, solving the Flowsheet at each temperature and plotting the results on the Case Studies view. When the Flowsheet has been solved at the final temperature of 215°F, calculations will stop automatically.

The final Case Studies view is shown in the following figure.

Figure 2.20



The Case Study shows that the cooling requirement increases to its maximum value at approximately 125°F and then decreases, while the glycol production rate increases over the entire temperature range.

You have now completed your first HYSYS steady state simulation! You can save your case by doing **one** of the following:

- Click on the **Save** icon on the toolbar.
- From the **File** menu, select **Save**.
- Press **CTRL S**.



Save icon

You are now free to explore this case on your own. If you want, you can continue on with the Dynamics Case in the next section, or quit HYSYS by doing **one** of the following:

- From the **File** menu, select **Exit**.
- Click the **Close** icon in the right corner of the HYSYS desktop.

This case has been set up to run without any modifications from the dynamic assistant. However everything will still work if the changes are made.

The dynamic assistant can be toggled on/off in the preferences found under the Tools menu.



Open Case icon

If you have made any changes to your case since the last time it was saved, HYSYS will prompt you to save before exiting.

2.3 Dynamics Case

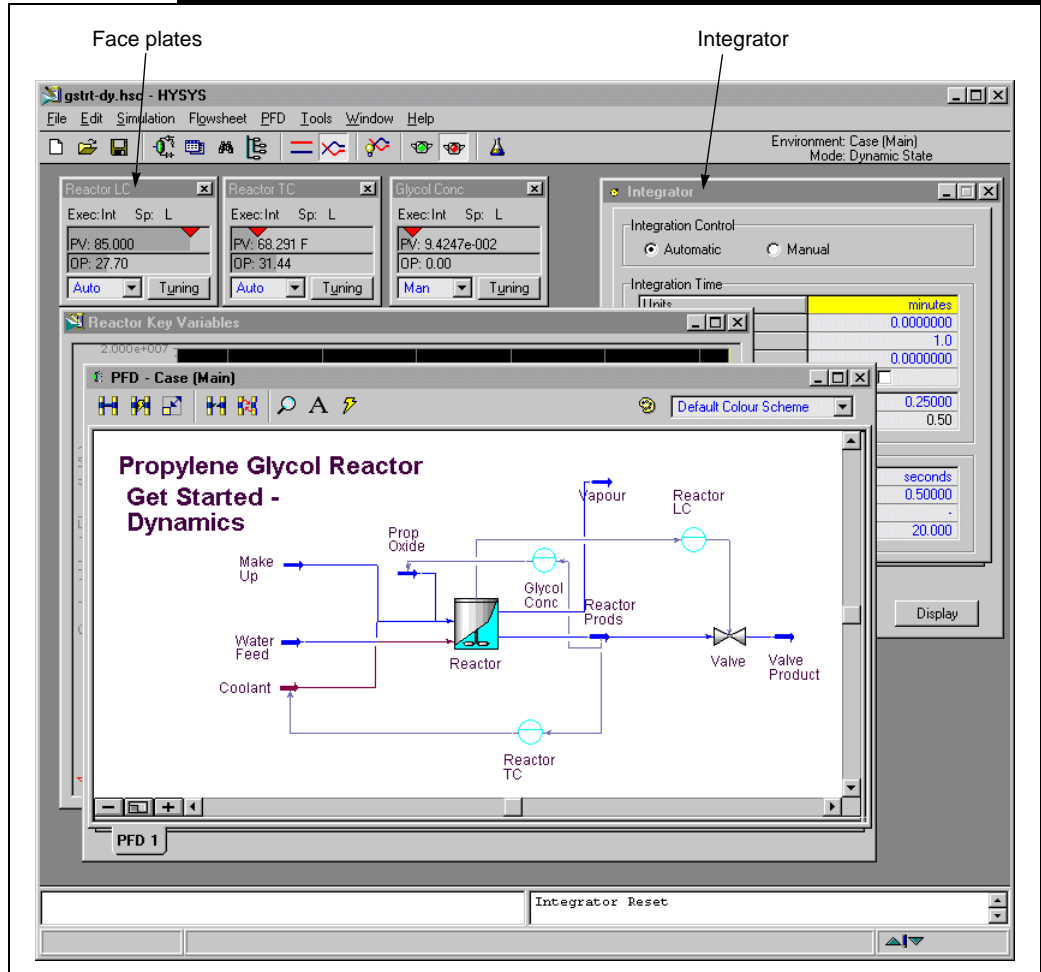
The previous steady state section of this example continues with the addition of a reactor control scheme in dynamics mode. To open the case:

1. Do **one** of the following:
 - Click the **Open Case** icon on the toolbar.
 - From the **File** menu, select **Open** then **Case**.
 - Click **CTRL O**.

The Open Simulation Case view appears.

2. Open the **Samples** directory. Scroll through the list of files until **gstrt-dy.hsc** is visible.
3. Click on **gstrt-dy.hsc**, then click **Open**. The pre-built simulation case opens on the Desktop.

Figure 2.21



As with the steady state case, you should save this case under a new name before making any changes.

4. Do one of the following:
 - From the **File** menu, select **Save As**.
 - Press **CTRL SHIFT S**.

The Save Simulation Case As view appears.

5. Type a new name, for example **MYCASE2**, in the **File Name** field.

You do not have to enter the .hsc extension; HYSYS will add it automatically.

6. Click the **Save** icon, and HYSYS saves the simulation case under its new name.



If the PFD is not open, you can open it by clicking the PFD icon on the toolbar.

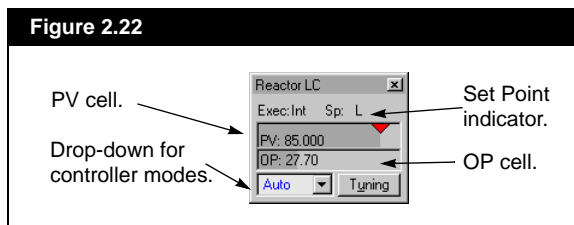
This case is a dynamic model of the propylene glycol reactor from the steady state portion of the example. The PFD shows the control scheme for the reactor, which includes the following three controllers:

Controller	Action
Reactor LC	Controls the liquid level in the reactor by manipulating the reactor outlet flow.
Reactor TC	Maintains the reactor temperature by manipulating the coolant flow.
Glycol Conc	Controls the concentration of propylene glycol in the reactor outlet stream by manipulating the flow of the propylene oxide feed.

The face plates for these three controllers are open along the top of the Desktop. The face plates components are listed in the following table:

Face Plate Field	Description
PV Cell	The PV cell shows the current value of the Process Variable, or <i>controlled</i> variable. For example, the PV for the Reactor LC is the percent liquid level in the reactor. The current Set Point for the Process Variable is indicated by the red pointer on the top of the PV cell.
OP Cell	The OP cell displays the current value of the controller Output as a percentage.
Controller Mode Drop-Down	Provides a drop-down list of the available controller modes. Currently, two of the controllers are in Automatic mode and the third is in Manual mode.

The face plate for the **Reactor LC** (level controller) is shown below:



You can also start and stop dynamic calculations using the Integrator toggle icons in the toolbar.



The green icon (left) starts the integrator. The red icon stops it.

In addition to the PFD and controllers, two other views appear on the desktop. They are:

- The Integrator, which lets you to start and stop dynamic calculations.
- The Reactor Key Variables view that is currently behind the PFD. To display this view, click on its title bar. The view is a customized HYSYS Strip Chart, on which the values of selected key variables will be plotted during dynamic calculations.

In Dynamics mode, HYSYS performs flowsheet calculations with each time step. Currently, the Step Size is 0.5 seconds, so HYSYS will perform flowsheet calculations for every 0.5 seconds of real plant time.

In this example, the CSTR reactor will be set up from an empty condition using the following procedure:

1. Fill the vessel with water until the level set point is reached, at which time the Reactor LC controller will open the outlet control valve to maintain the level.
2. Slowly introduce propylene oxide into the reactor while observing:
 - The Reactor TC controller maintaining the reactor temperature.
 - The concentration of propylene glycol in the product stream.
3. Switch the Glycol Conc controller to automatic mode to maintain the product concentration at a specified set point.

Starting Dynamic Calculations



Dynamics mode icon

Switch to dynamics mode by clicking the Dynamics mode icon on the toolbar. HYSYS will indicate that the Dynamics Assistant has identified items that need attention, click **No**.

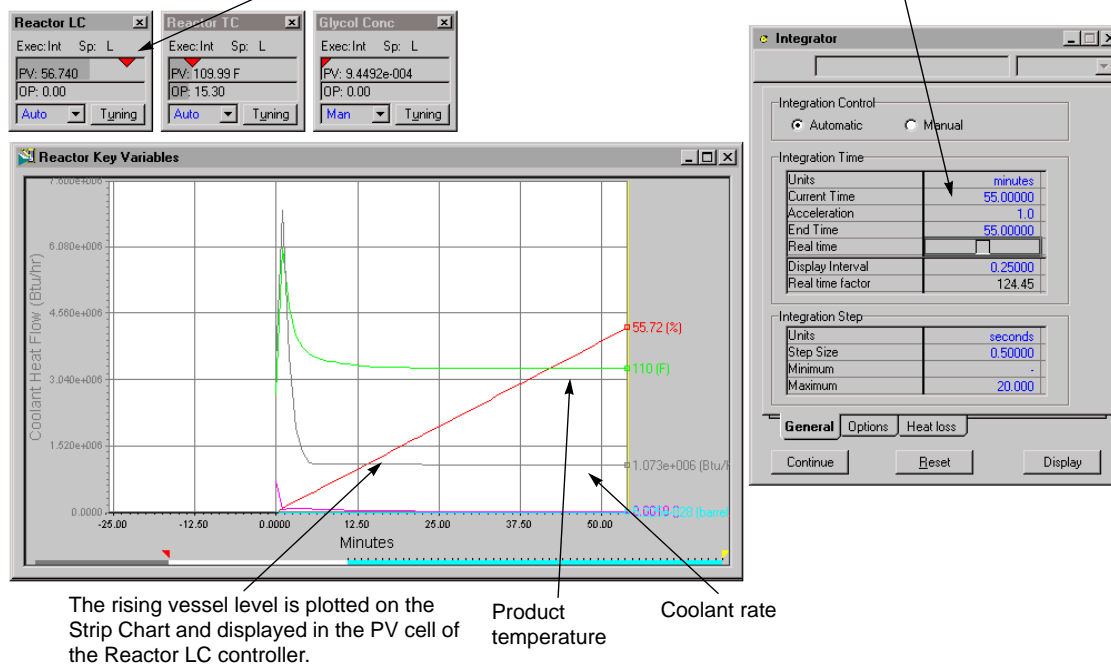
Ensure that the Reactor Key Variables view is visible by clicking on its title bar. To begin, click the **Start** button on the Integrator. HYSYS will again indicate that the Dynamics Assistant has identified items that need attention, click **No**.

The reactor will begin to fill and the values of the process variables will immediately be displayed on the controllers and plotted on the strip chart. When the Current Time reaches about 55 minutes, click the **Stop** button.

Figure 2.23

To check the current level set point, place the cursor over the Set Point Indicator. When the cursor changes to a double-headed arrow, left-click and hold.

The Current Time displays the real plant time.



Notice that the reactor level rises linearly as the vessel fills to its set point of 85%.

If you want to reset dynamic calculations, click the Reset button on the Integrator. Then click the Start button to restart the calculations from zero. HYSYS will ask for confirmation before resetting the values.

Click the **Continue** button on the Integrator. As the reactor level approaches its set point, the Reactor LC controller will open the outlet valve to maintain the level. When the current time reaches approximately 125 minutes, click **Stop** and view the results.

Adding a Process Disturbance

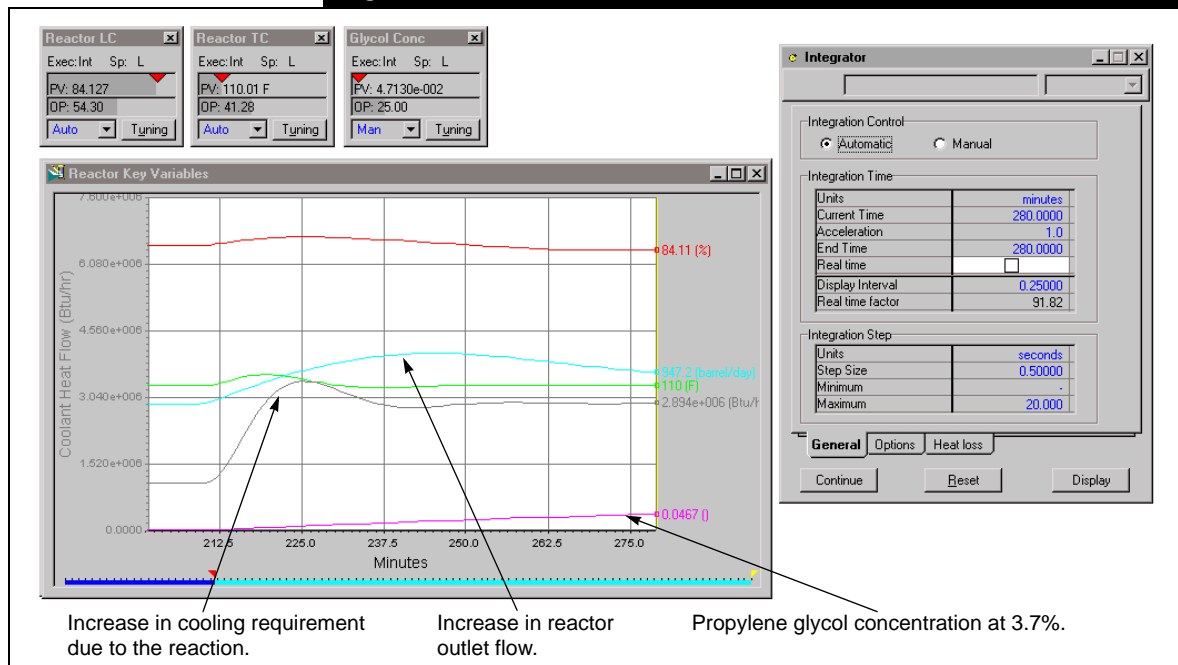
Click the **Continue** button of the Integrator. When the reactor level and product volume flows reach a steady state value, at about 200 minutes, click **Stop**. To add the disturbance, introduce some propylene oxide into the reactor by doing the following:

1. Double-click on the OP cell on the Glycol Conc controller face plate.
2. Type **25**, then press **ENTER**. The control valve for the propylene oxide feed will open 25%.
3. Note the Current Time displayed on the Integrator.
4. Start the Integrator again.
5. After the Current Time has increased by about 70 minutes, stop the Integrator.

As a result of the disturbance:

- The reactor temperature increases due to the exothermic reaction. The reactor coolant will increase in flow to maintain the reactor temperature at 110°F.
- The outlet flow increases to maintain the reactor level because of the increased feed.
- The propylene glycol begins to appear in the product stream.

Figure 2.24

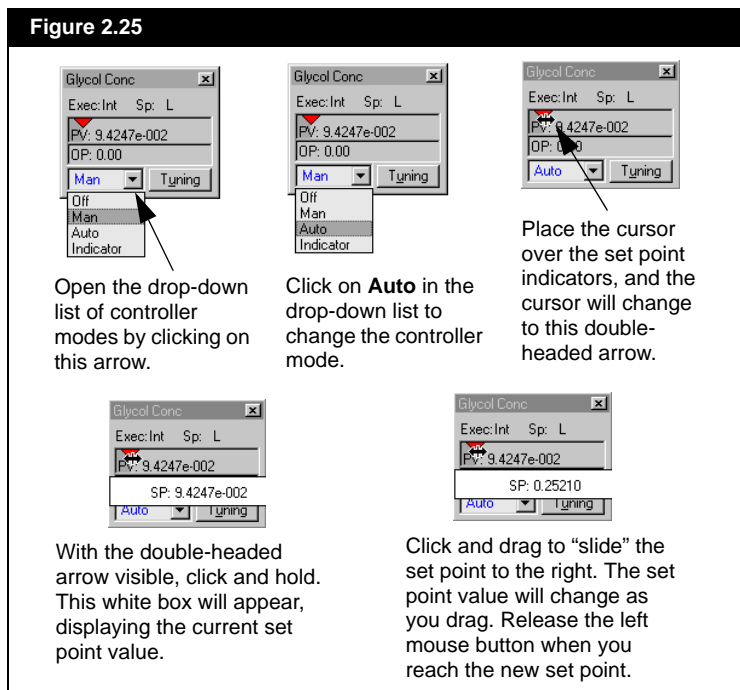


If you want, start the Integrator again and try entering other values for the OP, such as 40 or 50%, and watch the response.

The next step is to switch the composition controller Glycol Conc to automatic mode and let it maintain a concentration set point. Use a set point of 0.25 mole fraction propylene glycol. Before changing the set point, stop the Integrator again.

To change the set point follow the procedure outlined below:

Figure 2.25



Alternatively, you can enter an exact set point by typing the value in the PV cell, then pressing the **ENTER** key.

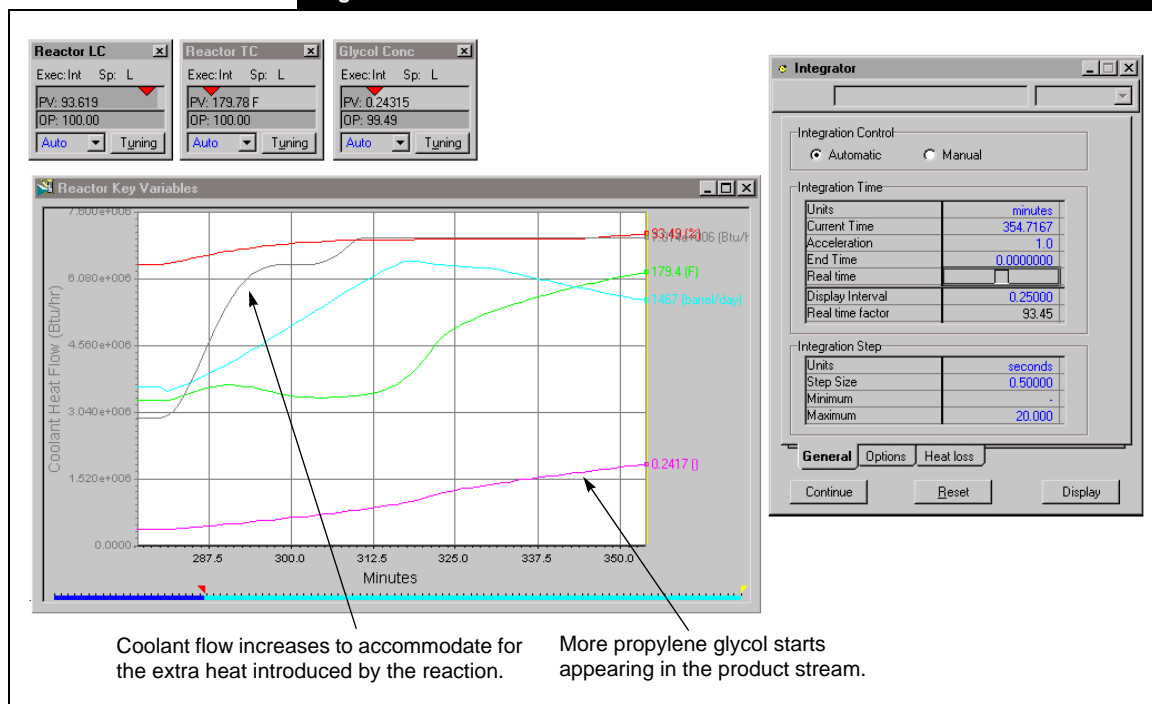
If you want at any time to reset dynamic calculations and begin filling the vessel again:

1. Click the **Reset** button.
2. Return the Glycol Conc controller to **Manual** mode.
3. Enter a value of **0** in the OP cell of the Glycol Conc controller.
4. Click the **Start** button.

After you have entered the new set point, start the Integrator again. The system will react to the new set point as follows:

- The flow of propylene oxide feed increases because the composition controller wants to raise the concentration of glycol in the product stream.
- The reactor level rises as a result of the higher feed rate; the product flow therefore increases to maintain the level set point.
- The reactor temperature rises because more exothermic reaction is taking place, and the coolant flow increases to compensate for this temperature change.

Figure 2.26



Feel free to experiment by changing either of the other set points and watch the response. When you are finished, stop the Integrator.

You have now completed your first dynamic simulation using HYSYS! Before moving on, you can save your case by doing one of the following:



Save icon

- Click the **Save** icon on the HYSYS toolbar.
- From the **File** menu, select **Save**.
- Press **CTRL S**.

If you want, you can quit HYSYS by doing **one** of the following:

- From the **File** menu, select **Exit**.
- Press **ALT F4**.
- Click the **Close** icon in the right corner of the HYSYS desktop.

If you have made any changes to your case since the last time it was saved, HYSYS will prompt you to save before exiting.

This concludes the Getting Started example. You are encouraged to proceed to the HYSYS Tutorials & Applications manual. The Tutorial problems provide a more in-depth look at HYSYS by guiding you step-by-step through a number of example simulations. Both steady state and dynamic tutorials are available.

