BR&E ProMax® 1.2 (Build 1.2.12198.0) Release Notes
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Bryan Research & Engineering, Inc.

Welcome to the release of ProMax 1.2 (build 1.2.12198.0). ProMax has been in research and development for several years and we hope you will greatly benefit from this extensive work and major investment. We would like to thank those of you who have provided comments and bug reports for the beta versions of ProMax. If you need assistance or would like to report a problem in ProMax, please contact our technical support group at support@bre.com.

Build 1.2.12198.0 of ProMax is a maintenance upgrade of earlier ProMax 1.x releases. A list of the significant changes relative to earlier releases is presented near the end of these release notes. The upgrade is available in both a Windows Installer Service binary patch file (msp) and a CDROM distribution. The binary patch file is primarily intended for Internet downloads and application.

ProMax combines the capabilities of our previous PROSIM® and TSWEET® programs into a single program while adding major improvements to allow application in other processes that have not been a focus for BR&E in the past. ProMax is the largest single step BR&E has ever made in a single release of our software. ProMax is not merely a Microsoft® Windows® version of PROSIM and TSWEET. Rather it is a totally new and redesigned product providing major engineering and computer science innovations over the previous software without sacrificing ease of use. ProMax will be enhanced even further in future releases to add more capabilities. The capabilities of the current release are summarized later in this document.

ProMax utilizes either Microsoft Visio® 2002 or Microsoft Visio 2003 as its drawing package. All flowsheets are drawn using Visio. You must have a legal copy of either Microsoft Visio 2002/2003 Professional or Standard to use ProMax through its GUI. **This particular version of ProMax is not compatible with other releases of Visio, including any future releases**. The version of Visio installed on your computer can be found by using the Help->About menu item in Visio. Additionally, Visio requires a patch from Microsoft to use successfully with ProMax. See Obtaining the Required Visio Patch section for more details.

ProMax will run only on Windows NT4 (Professional or Server), Windows 2000 (Professional or Server), Windows XP (Professional or Home), or Windows Server 2003 operating systems. **ProMax is not compatible with Windows 95, Windows 98, or Windows Me which are not designed upon the NT kernel**. There are no plans on supporting any of the Windows 9x compatible operating systems with ProMax. We suggest you migrate to Windows XP Professional if you are still using one of the Windows 9x platforms.

When ProMax is loaded by Visio, Visio will issue a warning concerning the presence of macros. This warning is provided by Microsoft Office applications to warn you of the possible presence of viruses that may be present within the macros. Microsoft has created a strategy where the macros are digitally signed by their author so you are assured of their integrity. Digital signatures require a trusted third party to verify the authenticity of the signature and its data. Not all macros are signed. The author of unsigned macros is unknown and usually should be

considered suspect. All BR&E documents pertaining to Visio or other Microsoft Office applications are digitally signed. This digital signature can be verified by inspecting the certificate displayed in the warning message. You must allow all BR&E signed macros to execute or you will prevent ProMax from functioning. We recommend that you add BR&E to your trusted list of macros to prevent the warning from continually appearing (this is required when using Visio 2003).

Obtaining the Required Visio Patch or Service Pack

During ProMax development in mid 2003, BR&E discovered a problem in Microsoft Visio that can cause corruption in files saved in ProMax or Visio due to loss of digital certificate signatures. While this problem was discovered during the initial beta test period for Visio 2003, we were unable to determine the exact cause of the problem with Microsoft at that time and consequently a solution was not obtainable. Early in 2004, we discovered the fundamental cause of the problem and were able to work with Microsoft to develop a Visio patch to solve this issue.

The digital certificate problem is present in both Visio 2002 and Visio 2003. Unfortunately, it may be more severe in Visio 2002 because the problem is present without warning to the user. With the release of Microsoft Office 2003 products, Microsoft set the default macro security level in documents to high. This causes any document with a missing digital certificate to fail on load. However, in Visio 2002, the default macro security level is medium which does not cause failure on load. Files saved with Visio 2002 will likely fail if the user upgrades to Visio 2003 if the digital signature has been silently lost unless the security level is changed.

You can determine if the minimum patch level is met by inspecting the full build available from the Help->About menu item in Visio. For Visio 2003, the build number must be 11.4301.6360 or greater. For Visio 2002, the problem was initially fixed in build 10.0.5228 (May 10, 2004). However, the Visio 2002 fix introduced an additional problem in Visio that was later fixed in build 10.0.6002 (December 4, 2004). When the ProMax betas were distributed, the only hotfix that was available was the 10.0.5228 build. Therefore, if you obtained the Visio 2002 hotfix for use with the ProMax betas, you will have build 10.0.5228 of Visio 2002. If you are running under Windows NT4/SP6a, you must use the 10.0.6002 build of Visio 2002. BR&E recommends that you obtain the 10.0.6002 hotfix when using Visio 2002 regardless of operating system.

For Visio 2003 users, the patch has been rolled into Service Pack 1 for Visio 2003 which may be downloaded from the Microsoft Office website at http://office.microsoft.com/en-us/officeupdate/default.aspx. However, for Visio 2002 users, the method to obtain the fix is through a Visio patch or hotfix. As of this writing the patch has not been rolled into a Visio 2002 Service Pack. Due to copyright restrictions, the patch must be obtained directly from Microsoft. You can obtain the patch for Visio 2002 (10.0.6002) by following the instructions in the Microsoft Knowledge Base article 890668 available at http://support.microsoft.com/?id=890668. Note that you must apply Visio 2002 Service Pack 2 before installing this patch. Due to the severity of this problem and the potential for data loss, ProMax will issue a warning each time you start the application if this patch is not installed.

There should be no cost involved with obtaining the patch. Please contact our customer support if you have questions or problems with the above requirement.

Microsoft Windows NT 4.0 Support to be Discontinued

BR&E does not intend to support Microsoft Windows NT 4.0 starting with ProMax 2.0 expected to be released next year. BR&E will support NT 4.0 in all 1.x releases of ProMax. We expect that version 2.0 of ProMax will be the next major release of the program. Microsoft dropped its support for NT 4.0 a few years ago and no longer supports it in newer application versions, including Visio 2003 and Office 2003. The current tools used to develop ProMax do not even run in Windows NT 4.0 and have not run in NT 4.0 for several years. Consequently, BR&E believes the efforts required to ensure NT 4.0 compatibility could be better used in other areas of product development that would be beneficial to all customers. If this change will significantly hinder your company, please contact BR&E immediately to discuss alternatives.

Warnings and Warranty

The user assumes full responsibility for the results and application obtained from the use of ProMax. No implied warranty of merchantability, no implied warranty of fitness for any purpose, and no implied warranty arising by usage of trade, course of dealing, or course of performance is given by BR&E or shall arise from ProMax.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

ProMax is protected by copyright law and international treaties. Unauthorized reproduction, distribution, or reverse engineering of this program, or any portion of it, may result in severe civil and criminal penalties and will be prosecuted to the maximum extent possible under law.

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Installation of ProMax 1.2

ProMax uses Windows Installer Service 2.0 (WIS) technology for installation. The installer supports standard as well as administrative installs using a file server. In this release, a security device is not required to perform the installation. However, you must have a valid BR&E security device present to run ProMax. To install ProMax on a workstation, you must either be an administrator, or you must have elevated installation privileges set through either an IntelliMirror® approach or a group policy setting. Although not absolutely required, BR&E recommends that Microsoft Visio be installed and functioning prior to installing ProMax.

You should insure your system meets the minimum software requirements before installing. **ProMax will not run properly on systems that do not meet the minimum software requirements.** For Windows NT4, Service Pack 6a, Internet Explorer 5.5, and Microsoft Data

Access Components (MDAC) 2.5/SP2 or greater are required. For your convenience, MDAC 2.8 has been included on the CDROM if you require an update. You may obtain this and other versions of MDAC in addition to other required operating system updates at http://www.microsoft.com/downloads. For Windows 2000, Service Pack 3 or greater is required with Service Pack 4 being recommended. For Windows XP, Service Pack 2 is recommended but not required. BR&E recommends that you keep your system up to date with current service packs and major patches to ensure compatibility now and in the future.

When performing the install, you should select to install the SafeNet Sentinel LDK Run-Time Environment (RTE). In previous versions, the security device driver was required only if a key was physically attached to the system running ProMax. Currently, the RTE is required to provide communication with the license manager in network environments as well. SafeNet recommends that the RTE installation be performed *without* the security device attached to the system.

If you are using a network based security device, the Sentinel LDK RTE must be installed on the system that will host the key and serve as the network License Manager (LM). You may select any system in your network for this service that is accessible by the workstations that will run ProMax with a static IP address or hostname resolvable by DNS. The RTE software is available with the DVD distribution in a folder named "Sentinel Key". Both GUI and command line versions of the installer are present. There is also a BR&E vendor specific version of the command line installer that is required if the license manager will host software keys for detachable licenses. This version will install BR&E vendor specific libraries that are required for use with software keys. Please see the document "ProMax Security Key Information" on the ProMax DVD or the ProMax help for more information on this topic.

Unless the Sentinel License Manager is available through IP broadcast, the RTE will require configuration to specify the address or DNS name of the system with the network key. This configuration must be made on each system that will run ProMax. This configuration is made through a web based console that configures the RTE. The web application is called the Sentinel Admin Control Center (ACC).   The configuration is performed using http protocol on port 1947. To access the configuration section, open your web browser and navigate to the location http://localhost:1947. Click Configuration under Options followed by the Access to Remote License Managers tab. On that page, use the Specify Search Parameters to enter either the IP address or the hostname of the system with the network key. Multiple locations may be specified by placing entries on separate lines. This will be required if separate systems are used to host Sentinel protected applications from different vendors, or if you host ProMax keys on more than one license manager. Separate host systems are not required with different applications as any number of keys can be attached to a single host. However, you may distribute Sentinel keys to separate hosts as you desire. By default, only local administration of the Sentinel LDK RTE is permitted. This can be changed on the Basic Settings tab. For more information concerning the Sentinel Admin Control Center, select the help links on the appropriate page.

As indicated earlier, this release of ProMax is available in two formats, a binary patch file and a CDROM distribution. Both the binary patch file and the CDROM distribution allow for

upgrading earlier ProMax 1.x versions, with the binary patch file primarily intended for use with Internet downloads. All new installations and beta release upgrades must be made using the CDROM distribution.

Performing an Initial Installation from CDROM

This procedure must be followed to install ProMax on a system that currently does not have the program installed, or to upgrade a system that contains one of the beta releases of ProMax. During the installation process, ProMax 1.2 will uninstall prior beta versions (prior to 1.0) that may be installed. Note that project files created with the beta versions will not be readable using this final release and must either be converted by you or sent to support@bre.com for conversion. BR&E strongly recommends that you discard all beta media to minimize technical support issues and accidental installations of beta versions. BR&E will no longer support any of the beta releases now that the official release is available, except for conversion issues from the beta to the official release.

To install the program, insert the CD into your system. The system should auto-run the CD and allow you to start the installation program. If needed, you may start the installation program by running the SETUP.EXE program on the CD.

To perform an administrative install, you must run SETUP.EXE with the /a command line option. Note that an administrative install is used for placing ProMax on a file server for distribution using IntelliMirror or other alternative approaches. The administrative install does not actually install the application on the server. Do not confuse an administrative install with the administrator account or elevated privilege requirement for installing on a single workstation.

Upgrading ProMax Using the Binary Patch

The simplest method to upgrade ProMax is through the InstallShield Update Service capability in ProMax using a log-in account with the required privileges. Using this approach, all of the details of downloading and applying the patch are automatically handled. Simply log into an account with elevated installation privileges and use the InstallShield Update Manager on the ProMax start menu in Windows, or the Help->ProMax menu item in ProMax itself to obtain and apply the patch.

If desired or if you do not use the InstallShield Update Service, you may download and apply the patch manually. The upgrade is distributed as a single compressed WinZip executable file containing the standard binary patch file (MSP) for the Windows Installer Service. If you extract the MSP patch file from the download executable file, do not attempt to apply the patch by simply double clicking the MSP file in Windows Explorer. You must manually run the Windows Installer program (msiexec) supplying the appropriate command line switches for proper patching to occur. In general, we recommend you apply the patch using the downloaded executable file directly without extracting the MSP file as the proper command line switches are automatically inserted for you. Improper command line switch usage will result in incorrect patching.

For standalone installations, simply follow these instructions to install the patch:

1) Download the patch using the InstallShield Update Service or contact BR&E for instructions on how to obtain the patch.
2) Log in using an account with elevated privileges.
3) Execute the patch file to apply the patch on the system.

To patch an administrative installation used to distribute the application in a network environment, the steps are:

1) Download the patch using the InstallShield Update Service or contact BR&E for instructions on how to obtain the patch.
2) Extract the MSP patch file to a temporary folder from the self extracting ZIP file.
3) Log in using an account with sufficient privileges to modify the administrative share and to force redeployment of the application.
4) Patch the administrative share using the command:
   msiexec /a [Path to Administrative Image]\ProMax.msi /p [Path to MSP Binary Patch]
5) Force a redeployment of the ProMax application using Active Directory or other approach used to redeploy the application.

Upgrading ProMax Using the CDROM Distribution

The upgrade of ProMax may be accomplished using a ProMax CDROM as well as a binary patch. Since the patch process is typically much faster to perform, the CDROM will only be distributed to customers upon request. To upgrade a standalone installation, simply run the Setup.exe program on the CDROM using an account with local administrator privileges. If you wish to use the MSI file directly, you must issue the case-sensitive command:

   msiexec /i [path to CDROM]\ProMax.msi REINSTALL=ALL REINSTALLMODE=vomus

You cannot simply double click the MSI file in Windows Explorer because the command line options above will not be present. The Setup.exe program internally determines the current installation state and starts the msiexec process using the proper command line arguments.

Upgrade Process Restores Default Options.xml Behavior – User Changes Backed Up

If you have made custom changes to the Options.xml file, the custom changes will be saved in a file in the same folder as Options.xml with a number appended to the file name. Each subsequent update will also backup this file and increase the number appended to the name. The Options.xml file on the system will be replaced by the Options.xml file from the update package. To obtain your previous behavior defined in Options.xml, you will need to manually migrate these user defined changes into the Options.xml file on your system from the backup copy.

Incomplete or Missing Features

1. ProMax does not include the ability to model the Claus sulfur process as in TSWEET or the earlier SPED program. This capability is present in ProMax 2.0, and users requiring this feature are encouraged to upgrade immediately.

2. Rating of gasketed, plate-frame heat exchangers is not available in ProMax (brazed aluminum, plate-fin/compact exchangers are available). This feature has also been included in ProMax 2.0, and users requiring this capability are encouraged to upgrade immediately.

New Features in ProMax as Compared to PROSIM and TSWEET

1. The ProMax GUI is built around the Microsoft Visio package. Therefore, it inherits many of the benefits of this package (e.g., shape sizing, transformation, placement, text annotations, etc.). While some of these capabilities may not be fully available in this initial release, more capabilities with Visio will be exploited in the future.

2. ProMax contains an OLE automation interface to allow program extension and macro writing. The details of this automation interface will be documented in the future. However, the methods and properties are available and are used significantly internally in ProMax. The OLE automation interface is available in Visio's Visual Basic for Applications and through other standard approaches such as Microsoft Excel. Our technical support staff will assist you if you have a special need that requires this capability.

3. ProMax will generate reports into either Microsoft Excel spreadsheet files (.XLS) or rich text format documents (RTF) that can be read by Microsoft Word and other RTF readers capable of processing RTF version 1.7 files (for those who do not have Microsoft Word or an application capable of reading RTF version 1.7 files, a free Microsoft Word viewer may be downloaded from Microsoft). ProMax allows you to generate reports for any number of selected items.

4. ProMax is basically a stream based process simulator rather than a block based process simulator as are PROSIM and TSWEET. ProMax includes both process (PStream) and energy (QStream) streams. Energy streams must be attached to heat exchangers and power units such as pumps and compressors for those units to execute. The stream based approach allows ProMax to execute in both the upstream and downstream directions without complicating specifications. The stream approach allows specifications to be made in streams other than just inlet streams. This change in philosophy may require some adjustment for those accustomed to PROSIM and TSWEET.

5. ProMax is based upon a multiple flowsheet approach. Each flowsheet is assigned an environment which defines the components present and the thermodynamic options in effect. The same environment can be used in any number of flowsheets, but only one environment may be used on any given flowsheet. Each page within a Visio drawing

represents a single flowsheet. Material and energy may cross from one flowsheet to another. A project contains one or more flowsheets and is stored in a single file with a PMX file extension along with the Visio drawing and other OLE embedded objects. Although most projects will contain a single flowsheet, the multiple flowsheet approach provides these benefits:

  a. A complex process can be split across multiple pages in Visio for easier viewing. This is possible since material and energy are allowed to cross the flowsheet boundary.
  b. Different units within a facility may be assigned to different flowsheets so that different thermodynamic packages may be used on each unit.

6. ProMax contains many new thermodynamic and physical property capabilities not present in either PROSIM or TSWEET. These include the following:

  a. ProMax contains approximately 1500 pure components. PROSIM and TSWEET contain approximately 130 and 50 pure components, respectively.
  b. ProMax contains Gibbs Excess (activity coefficient) models for liquid phase thermodynamic property calculation. These models include Margules, Van Laar, Scatchard-Hamer, NRTL, Wilson (VLE only), TK Wilson (VLE/LLE/VLLE), Regular Solution, UNIQUAC, Dortmund UNIFAC, and UNIFAC. Further, the Chien-Null approach is available to provide a consistent framework for binary model selection. The user is allowed to specify components modeled using Henry's law for these property packages. Additionally, binary interaction estimation is available from azeotropic or infinite dilution activity coefficient data, or UNIFAC type models.
  c. ProMax contains additional equation of state (EOS) approaches not found in PROSIM. These include BWRS and Lee-Kesler. Further, an SRK-Polar and Peng-Robinson-Polar model have been included which is based on proprietary Huron-Vidal type mixing rules. The polar models (SRK or PR) should be used for any gas processing application involving methanol.
  d. ProMax contains other specialized packages for water/steam (NBS Steam Tables) and common heat transfer fluids such as DOWTHERM®.
  e. ProMax allows you to specify binary interaction parameters for most thermodynamic models in the program. Due to the nature and complexity of the electrolytic models, you may not specify parameters for these models.

7. The Electrolytic NRTL and Kent-Eisenberg models of TSWEET have been completely redesigned and developed. BR&E has expended 3-4 years of effort in developing the electrolytic models for amine sweetening in which we have analyzed everything from the electrolytic and reactivity nature of these mixtures to hydrocarbon solubility. The complexity of the electrolytic model in ProMax far surpasses that of TSWEET. We expect much better VLE matches over a broader range of conditions in ProMax than we experienced with TSWEET. There are three basic models available: The ELR (extended long range), NRTL (ELR + short range NRTL), and Kent-Eisenberg models. For most systems, BR&E recommends the ELR approach. The NRTL is applicable to very high loadings. For low to moderate loadings, ELR and NRTL will yield virtually identical results. However, NRTL is computationally much more expensive to evaluate. For each of these electrolytic packages, you may select either SRK or Peng-Robinson for the vapor

and non-aqueous liquid phase. TSWEET only provides an SRK approach. The changes in electrolytic modeling remove the requirement for a constant heat of reaction specification as present in TSWEET. In ProMax, a thermodynamic based approach is used to determine the heat of reaction.

8. By combining both the PROSIM and TSWEET approaches into a single application, many of the restrictions present in TSWEET are eliminated by ProMax. Further, many of the advanced specifications and other options available only in PROSIM in the past are now also available for use in TSWEET type applications in ProMax. Liquid hydrocarbon streams may be present in any location within a TSWEET type process in ProMax. TSWEET only allows liquid hydrocarbon streams to enter an absorber and leave an absorber. No other processing is possible. ProMax removes this restriction and will also predict VLLE in TSWEET type processes within any operation. TSWEET will only handle VLE and LLE within an absorber.

9. Refinement has been made to SRK Polar and Peng-Robinson Polar property packages. The impact of this refinement is most evident on aqueous methanol-hydrocarbon systems at very high methanol to water molar ratios. Early beta versions of ProMax (as well as PROSIM) improperly predicted the phase equilibria of these systems.

10. ProMax offers four types of distillation column algorithms: Equilibrium, Polar Liquid, TSWEET Kinetics, and TSWEET Alternate Stripper. Equilibrium is used for general distillation calculations including hydrocarbon systems. Polar Liquid may be used when the column contains methanol or physical solvents such as DEPG to expedite convergence. Equilibrium may also be used for methanol systems provided convergence is obtained. TSWEET Kinetics must be used in the absorber when modeling amine sweetening processes to properly handle the selective absorption of CO_2 in ethanolamine solutions due to kinetic limitations. TSWEET Kinetics requires a residence time specification to be made either directly or through geometric specifications. If no residence time is specified, the stage is assumed to be at equilibrium and a warning is issued. This will lead to erroneous values in cases involving selective CO_2 absorption. TSWEET Kinetics is also used for strippers, though convergence is sometimes more difficult than TSWEET Alternate Stripper. TSWEET Alternate Stripper is a simplified model that should only be used when the TSWEET Kinetics model will not converge. See the ProMax online help for more information on this selection.

11. In addition to Murphree efficiencies, ProMax allows thermal efficiencies to be specified on a stage resulting in vapor and liquid streams that are not in thermal equilibrium.

12. You may now model all columns, including amine absorbers and regenerators, in ProMax using either real or ideal stages. In TSWEET, columns are always calculated using ideal stage models. However, absorbers are specified using the residence time of a real stage and TSWEET multiplies this time by three to obtain the residence time of an ideal stage for its internal kinetic model calculations. When modeling an absorber in ProMax using real stages, the residence time is the residence time of the real stage. When modeling an absorber in ProMax using ideal stages, the residence time is again the residence time of a

real stage with a time scale factor available to scale the real stage residence time to an ideal stage based residence time for the kinetic model. No automatic 3:1 scaling is performed in ProMax on the residence time value. In ProMax the residence time used by the TSWEET kinetic model on a tray is the product of the residence time (either from direct input or geometry calculations) and the scale factor for that tray. The sum of these products is equal to the total liquid residence time of the tower. In order to match the temperature profile of columns modeled using real stages modeled with Murphree efficiencies, especially in systems with high heat release such as amine absorbers and glycol dehydration absorbers with large quantities of water in the inlet, you will likely need to specify thermal efficiencies as well as Murphree efficiencies. BR&E is currently researching methods to quantitatively estimate the thermal efficiencies. We will provide more information on this when available.

13. More complex tray geometry-residence time calculations are available in ProMax including application to multi-pass trays.

14. ProMax offers two enthalpy models within distillation columns: Boston-Britt and Composition Dependent. The Composition Dependent model is computationally more expensive, but may aid in column convergence for amine regenerators. The Boston-Britt model is recommended for general hydrocarbon columns and amine absorbers.

15. The approach used to model multisided heat exchangers in ProMax has changed relative to PROSIM. An icon representing a multisided exchanger is now present for use. Energy streams may be attached to this icon to transfer energy to and from other heat exchangers on the same or different flowsheets. Unlike PROSIM, which required the user to manually calculate the energy balance in the exchanger, ProMax forces the exchanger to be in energy balance, in effect setting the duty of one of the sides. If the user desires to set inlet and outlet conditions for all the sides, a solver type calculator will be required to obtain the desired operating conditions on one of the streams in multisided heat exchangers.

16. The distillation tower in ProMax contains many new specifications and is capable of handling more complex flow schemes without recycles. Recovery and purity specifications have been enhanced to allow more than a single component to enter into the specification. Most process stream properties (e.g., viscosity) are available as column specifications. Further, VLLE columns are also available in ProMax.

17. ProMax provides an Options.xml file for configuring the startup condition of the application. This file is an XML file and, therefore, obeys all the rules of XML, including case sensitivity. (The definition of the XML standard is available at http://www.w3.org/XML.) If you modify the Options.xml file, you must ensure that you maintain the well formed nature of the document. ProMax will provide you a syntax error if the document does not adhere to XML standards or the data within the document are incorrect. The Options.xml file also defines the content of the unit sets available in ProMax. You may add more unit sets if desired or you may modify the existing unit sets.

We strongly recommend that you do not modify the SI unit set because its contents are defined by the *Bureau International des Poids et Mesures* (see http://www.bipm.fr). The Options.xml file is an extension to the PROSIM.CFG and TSWEET.CFG files of the past.

18. ProMax allows you to enter and view values in any units that are compatible with a property. A drop down list is provided for most properties containing the common units used for that property. However, you may enter strings that are not present in the list for ProMax to parse. The names and abbreviations of the units are based on the values provided by NIST (see NIST Special Publication 811 http://www.physics.nist.gov/Document/sp811.pdf). Further, ProMax will work in gauge rather than absolute pressures if desired. The local atmospheric pressure may be specified by the user independently of the standard pressure when gauge pressure is employed.

19. ProMax has the ability to export and import individual values to and from Microsoft Excel. This allows the Excel Solver and other macros in Excel to control the execution of ProMax. You can expect further refinement of this capability in the future. To accomplish this task, you must OLE embed an Excel workbook in your ProMax project. The workbook will be saved within the ProMax PMX file.

20. ProMax includes advanced Solver and Specifier calculators that replace the convergence or controller blocks present in PROSIM and TSWEET. The solver is used whenever an iterative solution is required to find the root of an objective function (just as the PROSIM and TSWEET blocks), and the specifier is used whenever a direct specification is to be made based on other values available in ProMax, replacing the reference stream properties in PROSIM and TSWEET with a far more flexible and powerful capability. For example, PROSIM and TSWEET only allow the use of reference pressures and temperatures in certain blocks. The ProMax specifier is much more general. A user supplied function is provided for the solver or specifier to evaluate. For the solver, the objective function is written so that it evaluates to zero at convergence (remember this is an iterative solution solving $f(x) = 0$ for the root (or zero) x). For the specifier, the function value is the desired specification of the property. Usually, the objective or specifying function is made using either JScript or VBScript. JScript and VBScript are simple scripting programming languages built into the operating system that will be intuitive to use except in the most complex scenarios. Most of the functions used in a solver or specifier will involve simple algebraic expressions. If desired, the solver or specifier can use the calculation engine of an OLE embedded Excel workbook. An example application of the solver is the calculation of a temperature (or other variable) to achieve a certain approach temperature or UA value in a heat exchanger. An example application of a specifier is setting a pressure of a stream relative to the pressure of another stream.

21. Approach temperature and UA specifications in ProMax must always be done through a Solver type calculator. While initially this may seem somewhat cumbersome, the approach is much more flexible than the approach in PROSIM. Even though they appear

to be direct specifications in PROSIM, approach and UA specifications are actually iterative calculations (just as in ProMax). In the PROSIM approach you have no control over the variable selected to solve the problem. In ProMax you define the objective function and consequently select the calculated variable (x). TSWEET provides no specification of approach temperature or UA in a heat exchanger.

22. The Advanced parameters of the Recycle Block include a component by component weighting setting. With Electrolytic models, the reactive components are weighted to 1000 while all other components are weighted at 1.0. This weighting is intended to alleviate problems with the recycle not recognizing small changes in lean CO_2 and H_2S loading which could affect acid gas pickup in the absorber.   It is recommended that you not decrease this weighting for reactive components. Increasing the weighting may result in more recycle iterations.

23. ProMax properly handles liquid reference conditions in addition to those at 60°F (e.g., 15°C). PROSIM and TSWEET did not contain or estimate reference liquid densities at temperatures other than 60°F. Additionally, ProMax does not require the same reference temperature for the gas and liquid phases.

24. ProMax is written to use a separate thread for project execution. This allows you to inspect values in ProMax while the project is being solved. If you attempt to modify a value during project solution, the solver will abort.

25. Unlike its predecessors, ProMax will save all distillation column and other unit operation data into the PMX project file allowing the program to start at the point where it left off after a project load.

26. ProMax exploits the capabilities of multimonitor systems.

27. Most objects (e.g., flowsheets, blocks, process and energy streams, environments, oils, calculators) in ProMax allow the user to supply notes to aid in understanding the simulation. These notes are entered into a rich text control that permits OLE embedded objects and other formatting capabilities if desired. The copious use of notes in the calculators is highly recommended by BR&E since their purpose in a particular scheme can occasionally be confusing.

28. An ActiveX control for displaying stream and block results on the PFD is available. Two types of this control exist in ProMax. The first is for attachment to a single process stream (Callout). The second allows the display of properties from more than one stream or block at a time (Property Table). Both allow significant customization in their layout and presentation. These items are found in the ProMax Stream stencil.

29. In order to saturate a stream with a liquid (e.g., water), a saturator operation has been provided. In PROSIM and TSWEET, the relative saturation is entered along with the composition of an inlet stream. The new saturator operation provides more flexible

specification without having to alter user supplied dry compositions due to the addition of the saturant.

30. The makeup philosophy in ProMax has changed relative to PROSIM and TSWEET. Makeup calculations are no longer performed in a recycle operation. Rather, a special unit is provided to perform these calculations. This removes many of the flow restrictions that are present in TSWEET pertaining to lean amine connectivity to an absorber. The makeup operation is the location at which you specify the concentration of amine in the circuit as opposed to the absorber in TSWEET. The makeup operation is necessary to maintain the desired composition and flow of a stream and maintain a unit that remains in material balance.

31. The absorber in ProMax will allow multiple non-amine feeds where in TSWEET only a single non-amine feed is allowed. Further, TSWEET imposes the restriction that the lean amine must enter the top of the absorber, preventing water washes or other schemes from being modeled in the same tower. Again, this restriction is not present in ProMax.

32. The regenerator in TSWEET only allows a single amine feed preventing many alternative heat recovery schemes from being modeled. In ProMax, the regenerator is modeled using a more general approach similar to what is present in PROSIM, which allows for any number of feeds. Since the more general tower is provided, more general specifications for regenerators are also available similar to what is in PROSIM.

33. The PROSIM Test type blocks are no longer blocks in ProMax, but rather analysis objects that are owned by a process stream or a stage of a distillation column. You may add any number of analysis objects to a stream or stage. The analysis objects include phase envelope, fuel properties, vapor pressure calculation, solids and hydrate calculation, line sizing, and amine analysis.

34. In ProMax the compressor block allows multiple speed based compressor curves to be incorporated. In PROSIM only a compressor curve for a single rotation speed is permitted.

35. Oil blending, allowing multiple curve based oils to be blended into a single curve oil has been added. A smaller number of oil cut components will usually be required when blending oils as opposed to using multiple curves.

36. ProMax offers improved and expanded help over either PROSIM or TSWEET. In ProMax context (F1 type) help in addition to "What's this" (Shift-F1 type) help is available.

Features Added, Completed or Changed Since Beta 3/3a Release

ProMax has undergone several additions and modifications since the Beta 3 and 3a releases. In fact, those using the Beta 3/3a releases could consider this a major upgrade to those versions.

Not only have several problems been resolved in the interim period, but the following significant changes have also been made:

1. Heat exchanger rating has been improved and completed for air coolers, shell and tube, double pipe, and compact exchangers. The ability to export and import heat exchanger rating data from one exchanger to another through an export file (using the extension .hexr) is now available.

2. ProMax adds vertical three phase separators and horizontal three phase separator types including interface control without boot, weir, and bucket and weir to the available types for sizing. The calculation philosophy has also been refined so that ProMax will calculate the minimum size separator required to meet holdup, surge, vapor-liquid separation, and liquid-liquid separation requirements. Additional length or height may be added to the unit (with a corresponding increased holdup and surge) without adversely affecting the design results. However, if the diameter is increased, the ProMax mechanical calculations of wall thickness and maximum allowable working pressure will no longer apply. These parameters are based on stress calculations that are a function of diameter.

3. Distillation sizing calculations have been expanded over the previous beta releases of ProMax as well as PROSIM and TSWEET. In particular, ProMax allows a mixture of trays and packing within a single column. Packing includes random packing and Sulzer$^{®}$ structured packing. Sulzer structure packing performance is calculated using methodologies from Sulzer. As an advanced feature, a user defined packing type is also available.

4. Convergence of the distillation column has been improved especially in the area of amine treating. The enthalpy models option available in earlier versions of the program has been moved from the Process Data tab to the Convergence tab and more options have been added. In addition to the enthalpy option, the user may choose to use non-ideal K's on the inner convergence loop, recalculate K's at each step rather than use Boston Sullivan shortcut methods, or limit changes in the K's from step to step if necessary.

5. Significant improvements to the pipe segment have been made. In this release, the pipe segment has been replaced by a Pipeline block which contains a user defined amount of internal pipe segments and fittings. You should think of the Pipeline as a container of pipe segments from earlier programs with the addition of the fittings. This change allows you frequently to combine multiple segments present in earlier versions into a single Pipeline. Additionally, the Pipeline will now solve with pressure and temperature specifications made on opposite ends of the Pipeline.

6. Material of construction properties from the 2004 edition of the ASME Boiler and Pressure Vessel Code have been added to ProMax.

7. Problems with using ProMax in a Windows Terminal Services environment have been resolved. BR&E has tested ProMax in a Windows 2000 and Windows 2003 Terminal Services environment. Using ProMax in this scenario requires a network security key.

8. ProMax contains an auto-update and messaging system that allows for patches and other updates from the BR&E website to be applied to ProMax when available. Additionally, BR&E can deliver to you important messages concerning the program using this process. This technology is based on a modification of the InstallShield® AutoUpdate Service and requires an active Internet connection to function. Any updates that are available will not be installed without your approval. We anticipate this service to be used primarily to deliver patches that address bugs in the program. Administrative or elevated installation privileges will be required to apply an update; however, messages can be received without these privileges. Messages that are issued by BR&E concerning ProMax using this functionality can be hidden from appearing in the future by using the Update Manager application installed with ProMax. This feature may be disabled entirely by unselecting the feature in the installation program. If desired, you may remove the feature after ProMax is installed using the Control Panel/Add Remove Programs applet by selecting the ProMax Change button.

9. ProMax no longer defaults to SRK as its property package. You must explicitly specify the property package in ProMax. This ensures that the SRK property package is not used in a process for which it is not applicable.

10. Analysis objects may now be assigned to a stage within a distillation column in addition to a process stream.

11. Error and warning messages displayed by the program have been enhanced. Further, the user interface used to display these messages has been improved.

12. The hydrate/freeze quick check available in PROSIM is now implemented in ProMax. ProMax will perform this quick check to determine if a stream (or internal stream of a tower or heat exchanger) is below or within the user supplied threshold of forming these species.

13. ProMax offers an alternative A4 page size version of the project template in a file named Project-A4.vst with sizes in millimeters rather than inches. The original Project.vst file is now Project-A.vst and creates projects based on A (letter) size paper. Selection of the template for default project creation is made in Options.xml.

Items Corrected or Added in Maintenance Upgrade 1.1.5115.0
(Released 25 April 2005)

1. A problem in the SRK and Peng-Robinson EOS (Polar and Standard) caused incorrect predictions of solubilities in DEPG. While the polar versions of these models provided better results, the results were still not fully correct. The SRK Polar and Peng-Robinson Polar packages are no longer required unless some other component is present to require

their use. **To realize these changes in a case which involves DEPG that was saved with the previous version of ProMax, you should execute the menu command ProMax->Execute->Clear All Calculated Data after loading the file to force a complete recalculation of the case.**

2. Aqueous amine-hydrocarbon mutual solubility has not been addressed in this update. This issue will be the focus of a subsequent update.

3. Separator sizing calculations for horizontal separators and vertical separators without mist eliminators would estimate a vapor-liquid K velocity when a user specified liquid droplet diameter was provided that was too small resulting in separators larger than required.

4. Specific parameters that should always be reported in absolute pressures (e.g., atmospheric pressure) were previously reported in gauge pressures if the project setting used gauge pressures.

5. Mass enthalpy is now included in the default stream phase property listings because of its importance in property propagation.

6. Several problems related to overspecification of pumps have been corrected.

7. Some polar components were not properly being ignored in a dry phase envelope.

8. Several improvements in predicting shell side heat transfer coefficients in the HEX rating package have been made. Application of the F-correction factor to LMTD is now more consistent.

9. Several problems in the oil characterization package have been addressed.

10. If a single oil was recharacterized or if a property of an oil cut in a curve oil was modified, ProMax would not properly clear out enough information for the change to force recalculation of all dependent values.

11. Problems in specification of distillation column pressure have been resolved. Additionally, the pressure drop can now be specified if a single pressure specification has been made in the column.

12. More help content has been made available in the online help files.

13. The requirement for recycle blocks to be present in some thermosiphon reboiler circuits has been eliminated in this release. Work is ongoing to allow more rigorous modeling without recycles of additional schemes that will be available in a future release of ProMax. See the "Reboiler Options" example in the Miscellaneous folder for some examples.

14. An "Unexpected end of file" error that occurs when opening projects if Adobe Acrobat (full version, not reader) is installed has been corrected.

15. Problems handling the F5 key have been resolved.

16. The installation program now creates a TZ environment variable if not present to prevent ProMax from corrupting the security device for PROSIM and TSWEET outside of the U.S. Central time zone.

17. All known issues causing program crashes have been corrected.

18. When an error occurs due to an improper user specification, the value of the specification was not always being restored to the value before the specification change.

19. Several problems relating to exporting and importing values with Excel have been resolved.

20. The most recent versions of the Aladdin HASP device driver and License Manager have been included on the CDROM distribution.

21. A parametric study utility is shipped with the CDROM distribution of this release. This self-contained utility, called "ProMax Scenario Tester.xla", is a Microsoft Excel Add-In that may be loaded and run in any instance of Excel to manipulate ProMax user inputs. This utility and accompanying help document can be found in the Extras folder of the CDROM distribution. For those obtaining the patch via Internet, you may download the scenario utility and documentation from http://www.bre.com/support/download.asp. This utility is available with limited support at this time. A more integrated version of the utility will be available in a future ProMax release.

Items Corrected or Added in Maintenance Upgrade 1.2.5273.0

1. ProMax now includes provisions to allow end-user selection of color presentation to aid users with color vision deficiencies. BR&E has created style definitions containing default colors for all equipment types and statuses for normal vision users as well as for protanopes (red-deficient), deuteranopes (green-deficient), and tritanopes (blue-deficient). To select an alternative vision presentation, modify Settings.xml as described in the program help to select the proper vision type. Settings.xml is a user specific configuration file used with ProMax that is not shared by other users of the same computer. Drawings created with a specific vision selection will appear in the vision selection of the destination user when transferred between users. If desired, the individual color selections within each vision type for each kind of equipment and status in Settings.xml may also be modified to enhance visibility of certain aspects of the application.

2. Problems with internal ProMax Solver and Specifier calculators on non-English operating systems that use a comma for decimal separators have been resolved. Note that the code

or algebraic statement for Solvers and Specifiers must always be written in programming language syntax where the decimal separator is a period. Further, issues using the ProMax Solver in Excel when the decimal and thousands separators are set to some other value than the system separators has been resolved. Note that Excel has a bug in handling this issue and use of the Excel Solver outside of ProMax will still fail with these settings invoked. Microsoft indicates they will attempt to fix this bug in a later version of Excel.

3. ProMax now provides a separate phase property and composition basis for normal temperature and pressure (NTP) conditions (0°C/1 atm). Normal condition values contain the proper label and units (e.g., Nm^3/d). Normal condition values can be displayed and used with English unit sets; however, the normal condition values are always at the fixed NTP state, regardless of the specified reference state. Values for standard condition values are always at the specified reference conditions of the project. Consequently, the standard and normal values may be equal if the project reference conditions are set to NTP. When using NTP as a reference state, you should change the reference temperature to 0°C so that the ideal gas heating values reflect these conditions. Additionally, you will likely want to remove the standard condition properties from being displayed since they will be equal to the NTP values and may lead to confusion if present. To prevent having to configure each project individually, the Options.xml file may be configured so that NTP conditions are selected by default and that only normal volumes are displayed rather than standard volumes. Please contact BR&E support if you need assistance creating a specific Options.xml setting.

4. The Freeze analysis has been extended to include the low and middle temperatures on the hydrate or solids (i.e., ice and dry ice) phase boundary with the system. Depending on system composition and pressure, multiple temperatures are possible separating the hydrate or solid regions from the non-hydrate or non-solid regions. Currently ProMax will solve systems containing up to three formation points. When only a single temperature is present, temperatures below that temperature result in hydrate or solid phase formation. However, when three temperatures are present, hydrate or solid phase formation only between the mid and high temperature and below the low temperature of the three reported values. Between the mid and low temperature is a hydrate or solid phase free region. The algorithm requires the high temperature value for computation of the low temperature value and the values of the high and low temperature values for computation of the middle value. In the past, only the highest of the temperatures were reported by the Freeze analysis. The separate values were only computed using a Phase Envelope analysis, and we recommend the use this analysis to provide a graphical representation of the behavior. In addition to the low and middle temperatures, the coexisting phases present at hydrate or solid formation are also reported in this release of ProMax. Note that ProMax does not consider hydrate-solid phase equilibrium in its analysis.

5. Several issues with exporting and importing with Excel have been resolved.

6. The Divider block now allows the specification of pressure drop and temperature change relative to the inlet for the bulk and extracted outlet streams. This now eliminates the requirement of Specifiers to maintain outlet conditions relative to inlet.

7. A new Rich Approach column specification has been added to provide similar capabilities to the Percent Equilibrium Loading calculation in TSWEET. Unlike most column specifications that allow you to specify a target value for the column to obtain at convergence, the Rich Approach is a calculated specification that does not have a specifiable target value. Consequently, the Rich Approach specification cannot be marked as Active or Estimated. As with any inactive column specification, the value is calculated and displayed in the specifications dialog when the column is solved by ProMax. In addition to the TSWEET capabilities, the Rich Approach specification allows the user to select the stage, feed and component to use as a basis for computation. The computation can also be based on maximum loading or excess solvent flow rate. TSWEET always used the lean amine feed and the bottom stage of the absorber as the calculation basis. Early versions of TSWEET reported the percentage of maximum loading, while later versions reported the excess amine rate based on the most restrictive of H_2S or CO_2. To compute the fraction of equilibrium loading for both H_2S and CO_2 in an absorber, two Rich Approach specifications must be added, one for H_2S and another for CO_2.

8. Similar to the Rich Approach specification, a new Lean Approach specification has been created. The Lean Approach specification is also a calculated specification that has no specifiable target value. The Lean Approach specification is used to compute how close to equilibrium a specified component in a column internal stream or phase leaving a stage in a distillation column stage is relative to the internal stream entering the same stage. An application example for the Lean Approach specification would be determining how close to equilibrium water content the vapor leaving the top stage of a glycol dehydration absorber is relative to water entering in the lean glycol. Note the Lean Approach is not limited to placement at the top or bottom of the column.

9. A complete hydrocarbon solubility model has been added in Electrolytic ELR and Electrolytic Kent-Eisenberg property packages. Hydrocarbons show greater affinity to aqueous amine solutions than water. When available, parameters have been regressed to published VLE, LLE, and VLLE data. These are shown as DB in the Binary Interactions Tab in the Environment dialog. BR&E has developed a model to estimate interactions for systems where data are not available. Estimations for hypothetical amine interactions are also provided. These systems appear as Est (estimated) in the Binary interactions tab. Because of changes in the hydrocarbon solubility predictions, operations that depend on electrolytic environments are forced to be recalculated when loaded into version 1.2 of ProMax.

10. Improvements to the physical and transport properties for $NaOH$-H_2O solutions have been completed. These properties include liquid heat capacity, liquid thermal conductivity, liquid viscosity, and liquid density. When modeling $NaOH$-H_2O systems, BR&E recommends using COSTALD as the liquid molar volume model. For the most

accurate liquid viscosities, BR&E recommends selecting the BR&E ProMax Cubic Average Liquid Viscosity Class for the Light Liquid and Heavy Liquid Mixture Viscosity through a custom property package selection in the Environment. Note the custom property package should be initialized using the Electrolytic ELR package before customizing the viscosity properties. A Caustic Treating directory in the examples folder has been provided to serve as examples.

11. When using electrolytic models, methyl, ethyl, the various isomers of propyl, and the various isomers of butyl mercaptan now are modeled as dissociating compounds. These changes result in more complete absorption of mercaptan when contacted with strong base solvents such as sodium hydroxide. Because of changes in mercaptan predictions, operations that depend on electrolytic environments are forced to be recalculated when loaded into version 1.2 of ProMax.

12. Amine-water VLE has been improved for TEA, DEA, DGA, DIPA, MEA. Slight changes have been made to MDEA water systems. These changes result in higher amounts of amine in the overhead of absorbers and corresponding higher values in the Makeup block relative to previous ProMax versions. Heat capacity predictions of binary amine-water systems have also been improved.

13. The heat of absorption in water-DGA-CO_2 systems has been improved.

14. New data for hydrocarbon-mercaptan and hydrocarbon-sulfide systems have been incorporated into ProMax which should result in better VLE estimates for LPG systems containing these sulfur compounds.

15. The heat exchanger block now provides additional information when a temperature cross occurs. Although a temperature cross is an infeasible engineering condition, rating or approach Solvers may venture into that region during the course of iteration, or as is often likely, may start out in an ill-conditioned region. By returning a value in all cases, the mathematical requirements of the Solver are met, and it continues to operate, recovering to a more feasible region. Appropriate warnings and approximate solution flags are issued.

16. The Chien-Null Gibbs Excess Model (activity coefficient model) has been extended to allow Raoult's Law to be employed as the basis for selected binary component pairs.

17. The Callout and Property Table can now display data contained within Analysis objects. Additionally stream phase properties for the individual phases can also be displayed in the Callout.

18. A procedure for refining the temperature profiles of trayed amine columns using real stages with required thermal and Murphree efficiencies has been developed and is discussed in the Help. Since the procedure utilizes thermal efficiencies, the vapor and liquid leaving a stage will not be the same temperature. Examples have been added which illustrate this approach. The user is strongly cautioned that several steps must be

completed for proper modeling of columns using efficiencies, and that interpretation of results from these simulations can be quite complex. While the procedure outlined in the help can serve as a starting point for refining temperature profiles in columns using real trays, you must ensure that all steps are observed or considered when implementing the procedure. In general, BR&E recommends that the ideal stage approach be used unless large temperature changes are present between adjacent trays in the tower. All initial design calculations should be based on the ideal stage model.

19. Problems in characterizing curve oils have been fixed. When light ends are present several changes have been made to how the oil cuts are calculated. Heavy cuts with a TBP above 1600 F were previously ignored and are now lumped into the highest boiling fraction. Changes have been made to the characterization of curve types other than TBP curves. **To realize these changes in a case which involves curve oils that was saved with the previous version of ProMax, you should execute the menu command ProMax->Oils and highlight the curve oil and click on Properties. Toggle the assay type to a different type and then back again to the original assay type. Click on OK->Close. This procedure should be repeated for each curve oil to be recalculated. Compositions such as recycle guesses and certain estimates will need to be adjusted for the newly generated cutpoints. The flowsheet will need to be resolved.**

Items Corrected or Added in Maintenance Upgrade 1.2.5342.0

1. An issue where the composition table of a phase in a stream would be inconsistent with specifications has been corrected.

2. Improvements have been made to the OLE Automation interfaces to prevent ProMax from crashing when not properly released by the user in the OLE Automation client.

3. More stability improvements made in the interface with Microsoft Excel.

4. Separator sizing could crash ProMax if only a single liquid outlet was connected to a three phase separator.

Items Corrected or Added in Maintenance Upgrade 1.2.8002.0

1. ProMax 1.x is compatible with new security devices issued in the device exchange of December 2007.

2. This update includes several changes made in ProMax 2.0 that make the program compatible with Microsoft Office 2007 and Microsoft Visio 2007, as well as Windows Vista.

Items Corrected or Added in Maintenance Upgrade 1.2.12198.0

1. The security model from the upcoming major release of ProMax, ProMax 4.0, has been incorporated into this build. The new security model offers many enhancements,

including detachable licenses for network licensees. The design also offers improved reliability and availability in networks, especially in environments with high simultaneous demand such as classrooms. This update is required to provide compatibility with the security device as used in ProMax 4.0. Without this upgrade, you will not be able to use the same security device with ProMax 4.0 and earlier releases of ProMax. To provide compatibility with all earlier releases, updates are being made available to versions of ProMax back to version 1.2. A PDF document entitled "ProMax Security Key Information" is being made available as part of the DVD distribution to assist you in installing and activating the security device. Initial use of keys requires activation with the new Licensing Wizard which is distributed with this update. Please see the document for more information.

2. The FlexNet Connect system by Flexera Software is being replaced by a BR&E internally developed utility called the BR&E Notification Manager in order to serve the requirements of ProMax better.

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