



# **Bartels AutoEngineer®**

## **Version 5.4**

### **Release Notes**

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This document contains information about the new features introduced with Bartels AutoEngineer Version 5.4. Forward compatibility from earlier versions to Bartels AutoEngineer Version 5.4 is ensured, but not backward compatibility.

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**Bartels AutoEngineer Version 5.4 Release Notes**

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# Contents

<b>1</b>	<b>General .....</b>	<b>5</b>
1.1	Bartels AutoEngineer Product Line.....	5
1.2	System Requirements.....	6
1.3	Documentation.....	6
1.4	Installing on Windows and DOS Platforms.....	7
1.5	Installing on Linux and UNIX Platforms.....	10
1.6	Parameter Setup and Program Start.....	13
1.7	User Interface and General Functions.....	16
1.8	Symbol and Part Libraries.....	16
<b>2</b>	<b>Schematic Editor .....</b>	<b>17</b>
2.1	General.....	17
2.2	Symbols, Labels.....	17
2.3	Connections.....	18
2.4	Text, Attributes.....	18
2.5	Group Functions.....	19
<b>3</b>	<b>Packager.....</b>	<b>20</b>
3.1	Parameter Settings.....	20
3.2	Error Handling.....	20
3.3	Bus Net Attributes.....	20
3.4	Layout Library.....	20
3.5	Logical Library Definition Update.....	20
3.6	ERC (Electrical Rule Check).....	21
<b>4</b>	<b>Layout Editor.....</b>	<b>22</b>
4.1	General.....	22
4.2	Display, Design Rule Check.....	23
4.3	Parts, Placement.....	24
4.4	Traces, Routing.....	24
4.5	Graphic, Copper Areas.....	24
4.6	Text, Drill.....	25
4.7	Group Functions.....	25
4.8	Automatic Copper Fill.....	26
<b>5</b>	<b>Autorouter .....</b>	<b>27</b>
5.1	Autorouter Algorithms.....	27
<b>6</b>	<b>CAM Processor .....</b>	<b>28</b>
6.1	General.....	28
6.2	Gerber Output.....	28
6.3	Drilling Data Output.....	28
<b>7</b>	<b>CAM View .....</b>	<b>29</b>
7.1	General.....	29
<b>8</b>	<b>Neural Rule System.....</b>	<b>30</b>
8.1	General.....	30
8.2	SCM Rules.....	30
8.3	Layout Rules.....	30
<b>9</b>	<b>Utilities.....</b>	<b>31</b>
9.1	COPYDDB.....	31
9.2	LOGLIB.....	31
<b>10</b>	<b>Bartels User Language.....</b>	<b>32</b>
10.1	General.....	32
10.2	User Language Compiler.....	32
10.3	User Language Interpreter.....	32
10.4	Index Variable Types.....	33
10.5	System Functions.....	34
10.6	BAE User Language Programs.....	35

## **Tables**

<b>Table 1: BAE Software License Files .....</b>	<b>8</b>
<b>Table 2: BAE Graphic Device Drivers.....</b>	<b>9</b>
<b>Table 3: BAE System File Environment Variables .....</b>	<b>15</b>

# 1 General

## 1.1 Bartels AutoEngineer Product Line

The following Bartels AutoEngineer software configurations are available:

- Bartels AutoEngineer Schematics
- Bartels AutoEngineer Light
- Bartels AutoEngineer Economy
- Bartels AutoEngineer Professional
- Bartels AutoEngineer HighEnd
- Bartels AutoEngineer IC Design
- Bartels AutoEngineer FabView

Bartels AutoEngineer Professional is the standard BAE software configuration. BAE Professional is available for PCs with Windows, Linux, or DOS operating systems. BAE Schematics, the schematic editor of BAE Professional is *freely available* and can be operated in stand-alone mode. Demo software configurations of BAE Professional (fully-featured except for data output) are available free of charge for test and evaluation purposes.

Bartels AutoEngineer Light is a shareware price-level BAE configuration for educational purposes and/or semi-professional users, available for PCs with Windows, Linux or DOS operating systems. BAE Light has full BAE Professional functionality, however, limited to a maximum PCB layout size of 180mm \* 120mm and a maximum of two signal layers for manual routing and Autorouter.

BAE Economy is a low-price BAE configuration for educational purposes and/or small business users, available for PCs with Windows, Linux or DOS operating systems. BAE Economy has full BAE Professional functionality, however, limited to a maximum PCB layout size of 350mm \* 200mm and a maximum of four signal layers to be simultaneously routed by the Autorouter.

Bartels AutoEngineer HighEnd is available for workstations and for PC systems (Windows 95/98/ME/NT/2000/XP, Linux). BAE HighEnd utilizes special operating system characteristics (multi-tasking, multi-windowing, virtual memory management, etc.) to implement advanced features and functions such as HighSpeed kernel, in-built messaging system to support advanced communication between different BAE modules, in-built multi-tasking to support multiple project views, global net highlight, cross-probing, selective layout short-circuit display, extremely fast Mincon airline calculation, optimized data structures for high Autorouter performance, advanced Neural Rule System features, rule-driven Neural Autorouter, nettype-specific routing area definitions, net-specific maximum via count settings, net-specific maximum connection length settings, etc.

BAE HighEnd is optionally available with Bartels AutoEngineer IC Design (BAEICD). BAE IC Design is a complete CAD/CAM system for the physical design of integrated circuits (gate arrays, standard cells, custom ICs and/or ASICs). BAEICD consists of a series of system components such as IC Mask Editor, IC Autoplacement, IC Autorouter, IC DRC (Design Rule Check) and GDS-II and CIF standard interfaces.

Bartels AutoEngineer FabView is a low-cost PCB layout viewer with manufacturing data output functions. BAE FabView is intended for PCB manufacturing departments and service providers who only have to produce manufacturing data and print/plot outputs but don't have to edit layouts. BAE FabView can be used together with BAE Professional and/or BAE HighEnd. BAE FabView provides the same functionality, however, the functions for saving design changes to BAE project files are deactivated.

## 1.2 System Requirements

### General System Requirements

A VGA or higher resolution monitor with a screen resolution of at least 800\*600 pixels and a mouse or a corresponding pointing device are required on any BAE platform.

Up to 40 Mbytes hard disk space are required for installing the BAE software.

### Operating System

BAE Light, BAE Economy and BAE Professional versions are available for Linux (Kernel 2.0.x and above), Windows XP, Windows 2000, Windows NT 4.0, Windows NT 3.51, Windows ME (Millenium Edition), Windows 98, Windows 95 and MS-DOS.

BAE HighEnd and BAE IC Design systems are available for Hewlett-Packard 9000/7xx workstations with OSF/Motif and/or X11 and for PCs with Linux (Kernel 2.0.x and above), Windows XP, Windows 2000, Windows NT 4.0, Windows NT 3.51, Windows ME (Millenium Edition), Windows 98, and Windows 95 operating systems.

BAE Schematics and BAE FabView systems are available for all of the afore-mentioned platforms.

### PC System Requirements

PC systems should be equipped with a Pentium (80586, 80686) or at least a 80486DX processor. Any compatible processor such as AMD-K6 or AMD-K7 (Athlon) will also do.

A minimum of 8 Mbytes RAM is required for DOS systems (16 Mbytes RAM recommended). A minimum of 32 Mbytes RAM is required for Windows 95/98/ME/NT/2000/XP and Linux systems (64 Mbytes RAM or more recommended).

The BAE software is usually provided on CD-ROM, i.e., a CD-ROM drive is required to install the software.

A hardlock key is used to protect BAE Economy, BAE Professional and BAE Fabview Windows and DOS versions against software piracy. I.e., a printer port (LPT1, LPT2, or LPT3) is required to run these BAE versions under DOS and/or Windows.

On Linux systems, either a printer port (for the hardlock key) or an Ethernet card is required for checking the software authorization of BAE Economy, BAE Professional, BAE HighEnd and BAE FabView.

## 1.3 Documentation

Both the [Bartels AutoEngineer User Manual](#) and the [Bartels User Language Programmer's Guide](#) have been completely revised and are provided in HTML and PDF format (in the baedoc directory of the BAE CD-ROM).

## 1.4 Installing on Windows and DOS Platforms

### Preparing for Update Installations

The BAE library and User Language directory contents are replaced when performing update installations. Thus it is strongly recommended to backup any user-specific data from these directories before installing the BAE update, and to restore the required data afterwards.

The bsetup.dat file from the BAE programs directory is always re-installed when performing BAE Update Installations. Thus it is not necessary to run the time-consuming batch for compiling the BAE User Language programs provided with the BAE software. However, user-specific BAE parameter settings stored with the existing bsetup.dat file will get lost and must be restored after successfully installing the BAE software using the **bsetup** utility program (or the Setup function available from the BAE main menu of the Windows/Motif versions). Customer-specific User Language programs developed and compiled under the previously installed BAE version must also be re-compiled after performing the BAE Update Installation.

The bae.ini file with user-specific parameter settings, key assignments and menu definitions is not overwritten when performing update installations. The bae54.ini file is provided for documentation purposes. bae54.ini contains all new parameter definitions and can be appended to bae.ini if required.

### Running the Windows 95/98/ME/NT/2000/XP Install Program

Under Windows 95/98/ME/NT/2000/XP, the BAE setup program for installing BAE Demo, BAE Schematics BAE Light, BAE Economy, BAE Professional, BAE HighEnd, BAE IC Design and/or BAE FabView should start automatically after inserting the BAE CD-ROM to the CD-ROM drive. If this doesn't happen, simply start the setupen.exe program from the CD-ROM using the Run function from the Windows Start menu. Please follow the instructions of the setup program.

The setup ends with the BAE software configuration. Please select the BAE configuration which is authorised for your machine (BAE Demo, BAE Schematics, BAE Light, BAE Economy, BAE Professional, BAE HighEnd, BAE IC Design oder BAE FabView; see also [table 1](#)).

### Running the MS-DOS Install Program

For installing BAE Schematics, BAE Economy, BAE Professional, BAE HighEnd or BAE FabView under MS-DOS, the CD-ROM must be inserted to the CD-ROM drive, and the drive and directory must be set accordingly. E.g., to install the BAE software from CD-ROM drive D, insert the BAE CD-ROM to CD-ROM drive D, and enter the following commands to the DOS prompt:

```
> D: <CR>
> install <CR>
```

Once the install program has been started, the instructions issued on the screen should be followed carefully. First you will be asked for the BAE user interface language (e.g., English, German, etc.) and for the operating system host platform (DOS, Windows NT, etc.).

The install program provides different modes for performing either new Installation or Update installations. The Update install mode is strongly recommended when just updating from earlier BAE Versions; this will prevent the install program from overwriting special BAE system and setup files ending on .dat, .def, and .fnt (otherwise, user-defined color tables, aperture tables, fonts, layer definitions, library access path settings, and menu setups stored with these files might get lost!).

After selecting the install mode, you will be prompted to specify the destination directories for installing the programs, the libraries, the User Language source files, and the examples and test jobs. You can exclude certain destination directories by deleting the corresponding path names. Thus more experienced BAE users can e.g., suppress the installation of the BAE example jobs, or re-install certain parts of the BAE software later. For security reasons, the install parameter settings will be verified with user query before starting the installation process. The destination directories will be created automatically on request. The install program automatically copies the BAE software files to the selected destination directories on the hard disk.

At the end of the install process, the install program asks for the licensed BAE software configuration in order to install the correct software authorization file (see [below](#)). When installing the DOS version, the user will also be asked to select the graphic device driver to be installed (see [below](#)).

### Installing the Software Security Module

The BAE PC software for Windows and DOS (except for BAE Demo, BAE Light and BAE Schematics) is protected by a hardlock key (dangle) which must be plugged onto one of the parallel ports (LPT1, LPT2, or LPT3) of your PC. Switch off your computer before mounting the hardlock key shipped with the software, or otherwise the dangle might be damaged by high voltage! If you have connected a peripheral device such as a laser printer to the hardlock key, then you must *always switch on the peripheral device before switching on your computer* to avoid hardlock key check problems.

The BAE PC software provides the license files according to the available software configurations as shown in the table below. You will be asked to select the BAE software configuration (and thus the appropriate license file) when installing the BAE software. Make sure to select the BAE software configuration to be installed and/or authorized on your computer.

**Table 1: BAE Software License Files**

Software Configuration	License File Name	Note
BAE Demo	demo.cfg	SCM and Layout; no Hardlock Key, no (CAM) output
BAE Schematics	schema.cfg	SCM only; no HardlockKey
BAE Light	see note	SCM and Layout; no Hardlock Key, customer-specific CFG file is provided on purchase
BAE Economy	economy.cfg	SCM and Layout
BAE Professional	autoeng.cfg	SCM and Layout
BAE HighEnd	highend.cfg	SCM and Layout
BAE Layout	layout.cfg	Layout only; required/provided only for updating from BAE Versions older than BAE V4.6
BAE IC Design	icdesign.cfg	SCM, Layout and IC Design
BAE FabView	fabview.cfg	CAM/manufacturing data output; save to DDB file deactivated

The router.cfg license file matching the BAE software configuration authorized on your computer must be available in the BAE programs directory. I.e., to install the correct license file you can also copy the desired CFG file to router.cfg within the BAE programs directory instead of selecting the valid BAE configuration during BAE software installation

BAE Demo software is intended for evaluation purposes only. BAE Demo cannot produce any CAM or User Language output, and it will mask Layout board elements in order to prevent from processing with productive software configurations afterwards. I.e., the BAE user version are not able to read Demo jobs, however, we are able to convert these jobs.



## Selecting the BAE DOS Graphic Device Driver

With the Windows versions of the BAE software there is no BAE graphic device driver installation required since BAE Windows software runs under the graphic interface of the corresponding operating system.

The DOS versions of the BAE software are shipped with a series of graphic device drivers. During installation you will be asked to select an appropriate BAE graphic device driver. Table 2 provides the list of graphic device drivers supplied with the DOS PC software of the Bartels AutoEngineer. Please select the graphic device driver matching the video adapter and/or graphic card installed with your computer. It is recommended to install the standard VGA driver VGA480, if you are not sure about which driver to select since VGA480 is assumed to run on almost any PC system, and you can always select a different driver (e.g., with higher resolution) later (see below).

**Table 2: BAE Graphic Device Drivers**

Graphic Driver	Type	Resolution	Chip Set/Manufacturer
CCD480.DEV	PGA	640x 480	IGC (Cad Card)
EGA350.DEV	EGA	640x 350	Standard
EGA480EW.DEV	EEGA	640x 480	EGA Wonder
EGA480GE.DEV	EEGA	640x 480	Genoa, ATI
EGA600EW.DEV	EEGA	800x 600	EGA Wonder
EGA600GE.DEV	EEGA	800x 600	Genoa, ATI
EGA600PA.DEV	EEGA	800x 600	Paradise
QPC1024.DEV	-	1280x1024	Datapath QPDM
QPDM768.DEV	VGA	1024x 768	AMD QPDM
QPDM1024.DEV	VGA	1280x1024	AMD QPDM
VGA480.DEV	VGA	640x 480	Tseng ET3000 / ET4000
VGA600.DEV	VGA	800x 600	Tseng ET3000 / ET4000
VGA768.DEV	VGA	1024x 768	Tseng ET3000
TSENG768.DEV	VGA	1024x 768	Tseng ET4000
VESA600.DEV	VESA	800x 600	various
VESA768.DEV	VESA	1024x 768	various
MACH768.DEV	-	1024x 768	ATI Mach 64
MACH1024.DEV	-	1280x1024	ATI Mach 64
MACH1200.DEV	-	1600x1200	ATI Mach 64
MGA600.DEV	-	800x 600	Matrox Millenium/Mystique
MGA768.DEV	-	1024x 768	Matrox Millenium/Mystique
MGA1024.DEV	-	1280x1024	Matrox Millenium/Mystique
MGA1200.DEV	-	1600x1200	Matrox Millenium/Mystique
TIGA.DEV	TI	variable	Texas TMS34010 / TMS34020

The graphic driver .dev file matching the video adapter and/or graphic card of your computer must be copied to the bae.dev file in the BAE programs directory. This is achieved either by selecting the correct driver during BAE software installation or by manually copying the desired .dev file in the BAE programs directory to bae.dev.

### Setting up the DOS Environment

It is strongly recommended to add the BAE programs directory path to the PATH environment variable. Load the autoexec.bat file to your text editor and check whether autoexec.bat contains a PATH statement or not. If there is already a PATH statement defined in autoexec.bat, then just add the following program path link to the PATH statement (assume BAE programs directory c:\bae):

```
;c:\bae
```

If there is no PATH statement defined in autoexec.bat, then insert the following PATH statement (assume BAE programs directory c:\bae):

```
PATH=c:\bae
```

You can also insert the following command at the end of the autoexec.bat file in order to include the BAE programs directory path name with the PATH variable:

```
PATH c:\bae;%path%
```

The config.sys file must contain the statements

```
BUFFERS=<b>  
FILES=<f>
```

where the number <b> of buffers should be at least 30, and the number <f> of files should be at least 20.

Note that you must reboot your computer if you made any changes to the config.sys or autoexec.bat. Otherwise you might not be able to start BAE.

## 1.5 Installing on Linux and UNIX Platforms

### Preparing for Update Installations

The BAE library and User Language directory contents are replaced when performing update installations. Thus it is strongly recommended to backup any user-specific data from these directories before installing the BAE update, and to restore the required data afterwards. The same backup and restore process should be applied to BAE programs directory files with extensions .dat (except for bsetup.dat; see next paragraph), .def, and .fnt when just updating from earlier BAE versions since these files can contain user-defined color tables, layer definitions, Gerber aperture tables, and character fonts which will be overwritten during update installations. The router.cfg file must also be saved and restored when updating from authorized BAE versions.

The bsetup.dat file from the BAE programs directory will always be re-installed when performing BAE Update Installations. Thus it is not necessary to run the time-consuming batch for compiling the BAE User Language programs provided with the BAE software. However, user-specific BAE parameter settings stored with the existing bsetup.dat file will get lost and must be restored after successfully installing the BAE software using the **bsetup** utility program (or the Setup function available from the BAE main menu of the Windows/Motif versions). Customer-specific User Language programs developed and compiled under the previously installed BAE version must also be re-compiled after performing the BAE Update Installation.

## Linux Installation

The baelinux directory on the BAE CD-ROM contains the baelinux.tgz and baelinus.tgz TGZ archive files with different BAE builds for operating BAE Demo, BAE Light, BAE Economy and BAE Professional under Linux. Each of these TGZ files contains the directories bin (programs and setup files), baelib (symbol and part libraries), baeulc (User Language source files), and baejobs (examples and test jobs). The BAE software is supposed to run on all common Linux system with Kernel 2.0.x (S.u.S.E. 6.0 or later, RedHat, etc.). The TGZ files baelinhe.tgz and baelinhs.tgz contain the binaries for BAE HighEnd. An additional file named baeeng.tgz including the English BAE user interface setup is also provided.

We strongly recommend that you have a look into the readme file from the baelinux directory of the BAE CD-ROM before installing the BAE Linux software. The readme file contains a list of the provided BAE Linux archive files and latest information and important instructions for installing the BAE Linux software.

baelinus.tgz must be installed on Linux systems without Motif. baelinus.tgz contains a *statically* linked BAE version including all system and Motif libraries (libc6/glibc, lesstif/Motif1.2) required to run BAE on any Linux Kernel 2.0.x distribution.

It is recommended to use the more efficient *dynamically* linked BAE version from baelinux.tgz (linked to libc6/glibc and Motif2.0) on Linux systems where Motif is already installed. The statically linked version from baelinus.tgz can always be used on Linux systems which fail to run the dynamically linked version.

To install the BAE Linux software, simply mount the CD-ROM drive with the BAE-CD-ROM (e.g., under /cdrom), change to the directory where you want to install the BAE software, and unpack the appropriate archive file (e.g., baelinux.tgz) using the tar command as in

```
> tar -xzf /cdrom/baelinux.tgz <CR>
```

The -z option is used to filter the TGZ file through the gzip utility. If your tar command does not support the -z option, simply use gzip and tar as in

```
> gzip -dv /cdrom/baelinux.tgz <CR>
> tar -xfv /cdrom/baelinux.tar <CR>
```

To install the dynamically linked BAE HighEnd version, simply extract the baelinhe.tgz file *after* installing baelinux.tgz. To install the statically linked BAE HighEnd version, simply install baelinhs.tgz *after* installing baelinus.tgz.

A configuration file is provided with productive BAE Linux versions. This configuration file (router.cfg) must be saved to the BAE program directory (bin, see above). To activate BAE Demo, the demo.cfg configuration file must be copied to router.cfg, to activate BAE Schematics, schema.cfg must be copied to router.cfg (see also [Table 1](#)).

BAE is pre-configured with a German user interface. The English user interface can be activated by extracting the baeeng.tgz archive file from the CD-ROM baelinux directory to the destination directory.

## UNIX Installation

The BAE HighEnd archive files for UNIX workstation are provided in specific BAE-CD-ROM directories such as baehp for the HP version. These archive files contain the directories bin (programs and setup files), baelib (symbol and part libraries), baeulc (User Language source files), and baejobs (examples and test jobs). An additional file named baeeng.tgz including the English BAE user interface setup is also provided.

The BAE HighEnd archive files for HP workstations are provided in the baehp directory on the BAE CD-ROM. Please see the readme file in the baehp directory for latest information and instructions on how to install the BAE HP software.

To install the HP software, simply mount the CD-ROM drive with the BAE-CD-ROM (e.g., under /cdrom), change to the directory where you intend to install the BAE software, and unpack the baehp.tgz archive using the tar command as in

```
> tar -xzf /cdrom/baehp.tgz <CR>
```

This installs the BAE HighEnd software with OSF/Motif interface. To activate the BAE HP software for X11, the baehpx11.tgz file from the baehp directory on the CD-ROM must be installed in the destination directory after installing baehp.tgz.

A configuration file is provided with productive BAE UNIX versions. This configuration file (router.cfg) must be saved to the BAE program directory (bin, see above) To activate BAE Demo, the demo.cfg configuration file must be copied to router.cfg, to activate BAE Schematics, schema.cfg must be copied to router.cfg (see also [Table 1](#)).

BAE is pre-configured with a German user interface. The English user interface can be activated by extracting the baeeng.tgz archive file from the CD-ROM baelinux directory to the destination directory after installing the UNIX software.

## Setting up the Linux/UNIX Environment

The access rights must be set properly (i.e., execute for the programs, read access to the libraries, read/write access to the job files, all rights for the system administrator, special rights for the library manager, etc.). The user must have read access to the BAE program directory files ending on .cfg (for authorization check) and read/write access to the files with extensions .dat and .fnt. The user must also have write access in the working directory to enable temporary file creation.

The Linux/UNIX shell environment variable PATH must point to the BAE programs directory to allow for BAE program call from any other directory. The PATH variable can be set automatically through shell profile execution (shell script .profile, .login, .bashrc, or .cshrc, according to UNIX derivative, respectively).

## 1.6 Parameter Setup and Program Start

### BAE System Parameter

The BAE software versions for Windows and Motif provide an interactive program for modifying the BAE system parameters. Under DOS, however, the **bsetup** utility must be applied as described herein.

With the BAE software, a setup definitions file template named stdset.def is supplied, which will be installed to the BAE programs directory. This file contains the following commands for setting the BAE library access paths:

```
SCMDEFLIBRARY("<libdir>\stdsym");  
LAYDEFLIBRARY("<libdir>\laylib");
```

where <libdir> is the path name of the BAE library directory. If the library e.g., has been installed to the directory c:\baelib under DOS or Windows then you should replace <libdir> with this path name in order to provide correct access to the BAE symbol libraries. If the library e.g., has been installed to the directory /usr/bae/lib under Linux or Unix, then you should insert the following commands to the setup definitions file for providing correct access to the supplied BAE symbol libraries:

```
SCMDEFLIBRARY(/usr/bae/lib/stdsym);  
LAYDEFLIBRARY(/usr/bae/lib/laylib);
```

The setup definitions file can be transferred to the BAE setup file bsetup.dat using the following **bsetup** program call (assuming stdset.def to be the name of the setup definitions file, and the BAE programs directory to be the working directory):

```
> bsetup stdset <CR>
```

The **bsetup** utility program is also used for defining important system parameters such as the documentary layer definitions and the menu setup. The documentary layer definitions and assignments have major impact on how manufacturing data is generated. Thus it is strongly recommended to get familiar with the features of the **bsetup** utility program before using BAE for the design of real layouts. See [Bartels AutoEngineer User Manual - Chapter 7.2](#) for details on how to use **bsetup**.

### User Language Programs, Menu Assignments, Key Bindings

The BAE software installs many pre-compiled User Language programs to the bsetup.dat file of the BAE programs directory. The corresponding source files are also provided in the User Language directory (baeulc). See [Bartels User Language Programmer's Guide - Chapter 4](#) for a complete listing and short descriptions of the BAE User Language programs.

Some of the installed User Language programs define implicit User Language program calls for activating a modified BAE user interface with many additional functions. You can add even more functions, or you can modify and/or reset the predefined menu assignments and key bindings. For more details see [section 11.5](#) of these Release Note.

Usually, it is *not* necessary to (re-)compile the User Language programs delivered with the BAE software, since the compiled programs will be installed to the bsetup.dat file of the BAE programs directory. Nevertheless, the User Language directory provides several batch files for automatically compiling all BAE User Language programs. The CPLSLL (ComPiLe with Static Link Library) batch file is recommended for compilation. The compile batch can be started in the User Language directory (baeulc) by entering

```
> cplsll <CR>
```

to an MS-DOS-Prompt (with the PATH variable pointing to the BAE programs directory!) or with the

```
> cplsll.bat <CR>
```

command from a Linux or UNIX shell. The compilation process might last some time according to the power of your computer.

**BAE Program Start and DDB File Access**

Use the following command to start the Bartels AutoEngineer from a DOS prompt or a Linux and/or UNIX command shell:

```
> bae <CR>
```

Design file access can be simplified by starting and/or running BAE from the design and/or project files directory.

Under Windows, the Bartels AutoEngineer can also be started by selecting the bae.exe file using the Run function from the Windows Start menu. Windows also allows for application startup by double-clicking the application from within the Windows Explorer, and it is also possible to define an initial working directory for the application to start in. A shortcut to bae.exe can be placed on the desktop or the Windows Start menu to provide an even more convenient method of starting up the Bartels AutoEngineer.

When installing the BAE software under Windows 95/98/ME/NT/2000/XP, a BAE program group with shortcuts for starting the BAE main menu (BAE Main Menu) and the BAE program modules (BAE Setup, Schematic Editor, Packager, Layout Editor, Autorouter, CAM Processor, CAM View) and for accessing the Bartels AutoEngineer User Manual (BAE User Manual) is added to the Windows start menu.

The BAE DDB File option for creating a new BAE DDB file named New BAE DDB File is included with the New function from the Windows 95/98/ME/NT/2000/XP Desktop and Windows Explorer context menus to be activated through the right mouse button. The BAE DDB file context menus provide the BAE Schematic and BAE Layout options for loading the selected BAE file to the Schematic Editor and/or the Layout Editor. Double-clicking a BAE DDB file automatically loads the DDB file's standard layout element to the Layout Editor. The system suggests to create a new layout element if the DDB file does not yet contain a layout element with default name.

Please consult your operating system documentation for more information on how to configure applications for startup.

**File Access Environment Variables**

Environment variable references in file name specifications are automatically substituted. This allows for definitions such as \$BAELIB for the symbol library directory and combined specifications such as \$BAELIB/laylib or \$BAELIB/\$STDLIB to be used for path and file name specifications in functions such as Select Library from the Settings/Parameter menu. The environment variables are not evaluated until they are actually referred for file access. Thus they will be stored with design files to be transferred to different computers where they can refer to machine-dependent path specifications defined through corresponding environment variables. Environment variable references are preceded with a dollar sign (\$) and must be either entirely lower-case or entirely upper-case. The ~ character refers to the \$HOME variable. Undefined environment variable references are substituted with empty strings.

**System File Access Environment Variables**

The environment variables listed in table 3 are evaluated for advanced configuration of BAE system file access in network installations.

**Table 3: BAE System File Environment Variables**

Environment Variable	System FileDefault Name	Contents
BAE_CFG	router.cfg	BAE Configuration/License File
BAE_BSETUP	bsetup.dat	BAE System Parameters
BAE_ULCLIB	bsetup.dat	BAE User Language Programs
BAE_RULELIB	brules.dat	BAE Rules Database
BAE_LANG	language.dat	BAE Menu String Tables (language-specific)
BAE_FONTLIB	ged.fnt	BAE Graphic Character Fonts
BAE_SCMLIB	scm.dat	SCM Color Tables
BAE_GEDLIB	ged.dat	PCB Layout Color Tables
BAE_CEDLIB	ced.dat	IC Layout Color Tables
BAE_CAMLIB	cam.dat	CAM Gerber Aperture Tables
BAE_DCOLLIB	bae.col	BAE Display Color Table
BAE_PCOLLIB	baep.col	BAE Printer Color Table
BAE_WINLIB	baewin.dat baexwin.dat	BAE Windows Position File
BAE_CLIPB	baeclipb.dat	BAE Clipboard File

Environment variables must specify complete paths to the corresponding system files. This feature can be used in definitions such as

```
set BAE_WINLIB=d:\bae\user1.dat
```

where access to a machine-specific Windows positions file in network installations with central BAE programs directory is established.

System files without environment variable definition are accessed from the BAE programs directory using the default system file name. The BAE\_PROGDIR environment variable allows for the specification of an alternative system file directory.

**Windows System Font Selection**

The ANSI\_FIXED\_FONT system font is used on default for displaying status line and dialog text in BAE Windows versions. Alternatively, SYSTEM\_FIXED\_FONT can be selected by assigning an arbitrary value to the BAE\_OLDFONT environment variable if ANSI\_FIXED\_FONT isn't suited for the configured screen/monitor resolution.

## 1.7 User Interface and General Functions

### Text Input

Most status/message line input prompts have been replaced by comfortable text input dialogs with cursor key support and operating system specific cut, copy and paste functions.

### DBB File Access Rights under Unix and Linux

The access rights for new DDB files under Unix and Linux will now be set according to the current umask settings. Previously, only read and write access rights were granted to the file owner.

## 1.8 Symbol and Part Libraries

The SCM symbol and layout part libraries have been completely revised. A series of new symbol and part definitions have been added to the SCM and layout libraries.

SCM symbol name and attribute texts have been centered to standardize the visual appearance of symbols with different symbol name lengths and attribute values.

The new Center Coords. documentary layer 10 has been introduced for layout part definitions. This layer is reserved for insertion pick point texts on part center points coordinates. Insertion pick point texts have been added to the Center Coords. documentary layers of the part definitions from the laylib.ddb and smd.ddb layout libraries.

PDF files displaying all graphic symbols of the officially released BAE libraries are provided in the pdfplib directory of the BAE-CD-ROM.

A series of useful library management User Language programs for library management (library check, automatic symbol edit, automatic generation of library documentation, etc.) are installed with the BAE software. See [Bartels User Language Programmer's Guide - Chapter 4](#) for a complete listing of the User Language programs provided with the BAE software.



## 2 Schematic Editor

### 2.1 General

#### Size Specifications

Input value dialogs have been added for size specifications such as text heights to allow for the editing of existing values.

#### User Language Programs

A series of new SCM functions and features such as

- Advanced dialog for symbol attribute value assignments (**ATTRSET**)
- text class assignments for display and plot text visibility control (**SCMTEXT**)
- symbol edit batch functions for automatic standard and/or commentary text placement to symbol origin (**SYMEDBAT**)

have been implemented with User Language programs.

### 2.2 Symbols, Labels

#### Symbol Macro Selection

The symbol macro name query of the Add Symbol function has been replaced by a dialog with a symbol macro name input field and listboxes for optional project file symbol macro selection, library file symbol macro selection and library directory file selection. Additionally, the Other Library button is provided for selecting symbol macros from any other DDB file.

#### Attribute Assignments

The attribute assignment dialog of the Assign Value(s) function has been re-implemented with advanced features through the **ATTRSET** User Language program.

A Browse button for selecting existing part macros and/or logical part definitions from the default layout library is displayed for the \$pname and \$rname attributes.

A Default button is provided for assigning default attribute values as defined on symbol level.

The bae.ini configuration file allows for the definition of attribute descriptions (e.g., (Part Package) for the \$pname attribute) to be displayed in the attribute input dialogs.

#### Name and Attribute Text Positions

The Keep Text Positions option has been added to the Settings function from the Settings menu. The Keep Text Positions default mode off causes the Move Symbol/Label function to reset any symbol name and attribute text positions, whilst the on mode preserves non-default symbol name and attribute text position settings.

## Net Attribute Assignments through Label Symbols

The Symbol Tagmode function has been changed to allow for the assignment of tag modes to label macros. The Standard Label option processes labels in the usual/default way. The new Net Attr. Label option transfers a synthetically generated label tag symbol into the schematic net list. The tag symbol name refers to the logical library definition of the label macro (name). The corresponding logical library definition is supposed to be virtual and can provide any number of newattr commands for defining net attributes which will be assigned to the label net by the Packager. This feature is useful for assigning net attributes such as net types and/or DRC blocks to a series of nets without having to place numerous attribute symbols. The new Set Label Macros function (see below) can be applied to prepare older SCM plans for this new feature.

## 2.3 Connections

### Signal Routing

The functions for automatically re-routing connections when moving symbols and/or groups have been improved.

A new option for activating and/or deactivating signal routing for symbols and/or groups has been added to the Settings dialog from the Settings menu.

## 2.4 Text, Attributes

### Text Visibility Control Text Classes

The Text Class function with the Text Assignment, Symbol Mask and Sheet Mask options has been added to the Other Functions submenu from the Text menu. Text Class can be used to assign text classes for display and/or plot visibility control. The Text Assignment option activates a dialog box for assigning text classes to mouse selectable texts. The Symbol Mask option can be used on schematic plan level to fade-out texts of a specific text class from mouse-selectable symbols. The Sheet Mask option can be used to fade-out all schematic plan level texts of a specific text class. Each text can be assigned to different text classes. A text is faded-out if one its assigned text classes is faded-out. Texts without text class assignment are always visible.

A total of up to 31 different text classes are supported. Text class names can be optionally specified in the bae.ini file. The system assigns default text class names such as Class 1, Class 2 etc. if no text class names are defined in bae.ini.

Text classes can be used to increase the legibility of schematic plans by fading out less significant (symbol) attributes.

The Combine Rotations function from the Rule Attachment submenu of the Settings menu assigns class 31 to texts which are defined for nonzero symbol rotation angles. This causes Sheet Mask to fade-out rotation texts whilst editing combined symbols.

### Special Texts for Element Data Display

The \$pltfname (element file path name), \$pltfname (element file name) and \$pltpname (element plan name) texts can be placed to display the project file path name, the project file name (without directory path) and the element name of the currently loaded top level element.

The \$plsttime (element save time), \$pltsdatede (element save date, German notation) and \$pltsdateus (element save date, US English notation) texts can be placed to display the time and date the currently loaded top level element was last saved.

## **2.5 Group Functions**

### **Clipboard**

The Cut, Copy and Paste functions for saving and/or loading group elements to and/or from the clipboard have been added to the Edit menu. The data is saved in the BAE programs directory to a temporary file named hostnameclipb.dat (hostname is the network name of the host computer).

### **Multiple Group Definitions**

The Set Group Name function for assigning a group name to the currently selected group elements has been added to the Other Functions submenu of the Edit menu. The Group Name has been added to the Select and Deselect group functions to allow for group selections through group name specifications.

Unlike group selection status flags, group name assignments are saved with the project. I.e., group name assignments are permanent, allowing for grouped circuitry to be easily re-selected and/or re-processed in later sessions.

### **Group Selection by Symbol Name**

The Name option for selecting and/or deselecting SCM groups by symbol name has been added to the Select and Deselect functions from the Other Functions submenu of the Edit menu. The symbol name group selector can be specified by picking from the list of currently used symbols, or by symbol name pattern input.

### **Change Label Macros**

The Set Label Macros function for changing group-selected label macros has been added to the Other Functions submenu of the Edit menu. Set Label Macros changes only labels without implicit label macro assignment through label name.

## 3 Packager

### 3.1 Parameter Settings

#### Parameter Memory

The Packager settings for the layout library name, the alternative layout library name and the layout element are saved with the project files and will be reloaded with future Packager runs. This allows for the Packager and back and Packager and Layout Schematic Editor functions to be applied to projects with non-default layout element names.

### 3.2 Error Handling

The Error Control function for controlling the Packager behaviour in case of missing layout parts and/or pins has been added to the Settings menu. The Standard option causes the Packager to abort with an error message on missing layout parts and/or pins. The Ignore miss. Pins option causes the Packager to issue missing layout part/pin warning messages without aborting the packaging process.

#### Warning

The Ignore miss. Pins option should be used carefully since it can create physically non-existing layout net list pins for missing logical pin definitions. For this reason, the Ignore miss. Pins Error Control setting is not saved with the project file, i.e., it has to be re-selected in subsequent Packager runs. It is strongly recommended to apply a layout net list consistency check using the **CHECKLNL** User Language program on layouts created with Ignore miss. Pins Error Control option.

### 3.3 Bus Net Attributes

The Packager has been updated so that net attributes assigned to busses through virtual symbols and/or tag symbols are now being propagated to all nets of the affected bus.

### 3.4 Layout Library

#### Alternative Library

The Alternate Library parameter for specifying a second layout library has been added to the Settings menu. The Packager searches the alternative library for logical part definitions and/or layout part macros which are neither in the project file nor in the standard layout library.

#### Automatic Project Layout Library Generation

The Packager copies referenced part macros from the standard and/or alternative layout library to the project file, thus enabling the generation of project specific layout libraries during packaging.

### 3.5 Logical Library Definition Update

The Update Mode parameter with the No Update and Definition Update options has been added to the Settings menu. No Update is the default setting for transferring only those logical part definitions from the library file(s) which are not yet in the project file. Definition Update forces the logical part definitions from the library file(s) to be copied to the project file, thus overwriting (updating) existing logical part definitions in the project file. Logical part definitions which only exist in the project file are not changed.

### **3.6 ERC (Electrical Rule Check)**

The Packager evaluates \$pintype pin attribute settings to perform electrical rule checks (ERC). It is recommended to assign fixed ERC pin types through the logical symbol/part definitions. The following pin type attribute value settings are currently supported:

- in (input)
- out (output)
- bidi (bi-directional pin)
- anl (analog signal pin)
- sup (power supply pin)

The ERC issues a warning message such as Net 'netname' has only inputs! if a net with one or more input pins has no (normal, bi-directional or power supply) output pin. A warning message such as Driver collision on net 'netname!' is issued if a normal output pin is connected to another output pin, a bi-directional pin or a power supply pin.

## 4 Layout Editor

### 4.1 General

#### Size Specifications

Input value dialogs have been added for size specifications such as trace widths and text heights to allow for the editing of existing values.

#### Net List Import

The ICAP Input function for importing packed net lists from Intusoft's ICAP/4 SCM/simulation tool (Version 8.2.10 / 1843 and above; Tango net list export) has been added to the Import/Export submenu of the File menu.

#### User Language Programs

A series of new Layout Editor functions and features such as

- ICAP net list import (**ICAPNET**, **GEDIO**)
- part insertion pick point query (**GEDPART**)
- part placement with automatic part selection and position suggestion (**GEDPART**)
- automatic placement of hierarchical part groups (**GEDPART**)
- angle measuring (**GEDDRAW**)
- copper fill keepout area generation (**GEDPOLY**)
- arbitrary scaling factor settings for EPS and PDF output (**LAYEPS**)

have been implemented with User Language programs.

## 4.2 Display, Design Rule Check

### Element Fixed Mode Query

The Query Element function from the View menu has been changed to indicate element fixed modes.

### Element Drill Class Query

The Query Element function from the View menu has been changed to display non-default drill class settings for pins and vias.

### Fine Grid

The 1/240 Inch and 1/480 Inch grid options have been added to the menus for setting the input and display grid.

### Polygon Display Patterns

The Change Colors function from the View menu has been changed to allow for layer-specific polygon display pattern assignments. The color selection facility provides a graphical selection bar with outline, filled area and dotted outline default display modes and 32 different polygon display patterns. Arrows are used between the color and pattern selection bars to indicate color and pattern selections.

The polygon display patterns are designed with offsets to ensure visual distinction of overlapping patterns and/or areas from different layers. Outline and pattern display modes with appropriate color assignments can be used to enhance the visibility of multi-layer structures and copper fill areas significantly.

Polygon display patterns are only applied on-screen. I.e., CAM output is not affected by these settings.

### Advanced DRC Parameter Settings (BAE HighEnd)

The Advanced DRC function from the BAE HighEnd Settings menu now provides a dialog for layer-specific minimum distance value settings.

### Netgroup-specific DRC (BAE HighEnd)

The BAE HighEnd version supports netgroup-specific clearance parameters. This allows for the definition of clearance parameters to be used when checking elements of specific netgroups such as high and low voltage circuit blocks against each other. Netgroups can be defined in the Schematic Editor by assigning \$nettype attribute values to nets. Nets without \$nettype attribute value assignment are considered to be of type std. DRC block assignments through specific rule definitions are required for net type combinations which are to be checked. The nettype.rul rule definition file from the baeulc directory contains an example which shows how to use an alternate DRC block for checking hv (high voltage) net type elements against other net types.

## 4.3 Parts, Placement

### Part Name Selection

The part name selection menu of the Add Part has been replaced by a comfortable dialog with a part name input field and scrollable listboxes for placed and unplaced parts, constructive parts and selected and unselected net list parts from the current part set. The name of the next unplaced part is loaded to the part name input field upon activation of the part name selection dialog. The Select Pattern, Deselect Pattern, Select All and Deselect All buttons can be used for direct part set manipulations.

### Via Selection

A dialog with three scrollable listboxes for selecting currently defined vias, project file padstacks and library file padstacks has been implemented for the via selection function.

### Insertion Pick Point Coordinate Query

The coordinates and rotation angles of part name texts on PHYSICAL documentary layers have been included to the report of the Place Data Query functions, thus allowing for part insertion pick point coordinate queries.

## 4.4 Traces, Routing

### Move Segment

The Adjust neighbours option has been added to the context menu of the Move Segment function from the Traces menu. Adjust neighbours considers intersection points between new and neighbouring segments and rearranges neighbouring segments accordingly. This feature is especially useful for moving diagonal segments at trace corners. The Move w.out neighb. option is applied if neighbouring segments cannot be rearranged.

## 4.5 Graphic, Copper Areas

### Angle Measuring

The Angle Measure option for generating angle measuring graphics has been added to the Drawing Utilities function from the Other Functions submenu of the Areas menu. Angle Measure prompts for a documentary layer and angle start, center and end points. The angle measuring circle segment graphic is then drawn clockwise from angle start to end point, and a measuring label text (angle value in degrees) is dropped for placement.

### Active Copper Areas on Part and Padstack Level

The Add Active Copper for placing active copper areas with "no net" attribute assignment is now available on part and padstack level. On padstack level, active copper area placement is restricted to power layers. These new features allow for the definition of power layer milling cutouts on part level.

### Net Name Selection

The net name selection menus of the polygon functions have been replaced by dialogs with scrollable net name selection list boxes. The system remembers the last selected net name and uses this name as default in subsequent net name queries.



## 4.6 Text, Drill

### Special Texts for Element Data Display

The \$pltfname (element file path name), \$pltfname (element file name) and \$pltpname (element plan name) texts can be placed to display the project file path name, the project file name (without directory path) and the element name of the currently loaded element.

### Direct Power Layer Connection Display

Drill holes with direct power layer connections are indicated through an X-shaped marker (matching the drill hole size) to distinguish such drill holes from drill holes without power layer connection.

## 4.7 Group Functions

### Clipboard

The Cut, Copy and Paste functions for saving and/or loading group elements to and/or from the clipboard have been added to the Edit menu. The data is saved in the BAE programs directory to a temporary file named hostnameclipb.dat (hostname is the network name of the host computer).

### Multiple Group Definitions

The Set Group Name function for assigning a group name to the currently selected group elements has been added to the Other Functions submenu of the Edit menu. The Group Name has been added to the Select and Deselect group functions to allow for group selections through group name specifications.

Unlike group selection status flags, group name assignments are saved with the project. I.e., group name assignments are permanent, allowing for grouped layout element to be easily re-selected and/or re-processed in later sessions.

### Group Selection by Part Name

The Name option for selecting and/or deselecting layout groups by part name has been added to the Select and Deselect functions from the Other Functions submenu of the Edit menu. The part name group selector can be specified by picking from the list of currently used parts, or by part name pattern input.

### Group Selection by Polygon Type

The Polygon Type option for selecting and/or deselecting polygon group elements by polygon type has been added to the Select and Deselect functions from the Other Functions submenu of the Edit menu.

### Group Selection by Net

The Net option for selecting and/or deselecting layout group elements by net has been added to the Select and Deselect functions from the Other Functions submenu of the Edit menu. The net group selector is picked from the list of currently defined nets. All elements connected to the selected net are selected and/or deselected. Parts with at least one pin connected to the net fulfill the selection criteria.

### Change Polygon Type

The Change Poly Types function for changing the polygon type of group-selected polygon elements has been added to the Other Functions submenu of the Edit menu. Polygon layer and net assignments are not affected by this function, and polygons with layer assignments incompatible to the new polygon type are not changed.

## 4.8 Automatic Copper Fill

### Copper Fill on Alternative Layers

Automatic copper fill has been significantly improved to allow for the generation of different fill area types even on layers different from the current fill area layer. The Add Cop.-Fill Area function creates standard fill areas with identical source and destination layers. The Alternate Layer option of the Set Polygon Type/Net function from the Other Functions submenu of the Areas menu allows for the assignment of non-default fill area parameters. Alternate Layer requires net name, source layer, destination layer and area type specifications for the area to be generated. For signal source layers, the clearance calculation mode must also be selected. The Standard clearance calculation mode considers general and net-specific DRC parameters. The No DRC Clearances calculation mode ignores the DRC parameters and considers only the minimum distance specified for copper fill (which can be zero).

These features allow for a series of new copper fill applications. Specific parameter settings and destination layer and area type specifications can be used to generate milling contours for prototype manufacturing, positive solder resist mask generation from negative layers, dielectric layer generation for hybrid circuits, etc.

### Fixed Active Copper Area Processing

The Clear single area and Clear all areas functions from the Copper Fill submenu have been changed to retain fixed copper areas matching the copper fill area signal level. Such copper areas can be placed onto pins to create pin-specific power plane connections which can be different from the connections generated by automatic copper fill (e.g., direct connections instead of heat-traps). The Fix Group function from the Edit menu can be used to fix group-selected polygons (use, e.g., Group Elements for area group selection).

### Automatic Isolated Area Selection

The Select Islands option has been added to the Settings dialog of the Copper Fill submenu from the Areas. With the Select Islands option, the automatic copper fill functions select isolated areas as they are created. Group-selected isolated areas can easily be recognized through group-highlight, and the user can subsequently decide whether to keep or delete these areas.

### Copper Fill Keepout Areas

The Standard and Only Copper Fill modes have been added to the Keep Out Area polygon type selection option provided with the Set Polygon Type/Net function from the Other Functions submenu of the Areas menu. Standard creates default keepout areas to be used for DRC, copper fill, Autoplacement and Autorouter, whilst Only Copper Fill creates keepout areas only relevant for automatic copper fill. Copper fill keepout areas can be used to, e.g., suppress heat-trap connections for specific pin without causing DRC errors.

### Hatching Angle

The Line Angle option has been added to the Settings dialog from the Copper Fill submenu of the Areas menu. Line Angle can be used to set the hatching angle for traces to be generated by the Hatch single area and Hatch all areas functions. A zero degree hatching angle setting might be useful to avoid problems when performing visual PCB checking automatically.

## **5 Autorouter**

### **5.1 Autorouter Algorithms**

#### **Distance Check**

Distance checks on fixed traces were carried out using wrong trace width values (trace diameter instead of trace radius). This could cause redundant/erroneous Trace out of border! messages for thick trace segments placed close to the board outline. This bug has been fixed.

#### **Short-Circuit Problems**

The Autorouter sometimes created short-circuits to nets with pins blocked by keepout or copper areas. This problem has been fixed.

## 6 CAM Processor

### 6.1 General

#### User Language Programs

A series of new CAM Processor functions and features such as

- Arbitrary scaling factor settings for EPS and PDF output (**LAYEPS**)

have been implemented with User Language programs.

### 6.2 Gerber Output

#### Extended Gerber Output

Pads with Area Mirror Display assignments for mirrored output were not processed when generating dynamic aperture tables for Extended Gerber output. This problem has been fixed.

### 6.3 Drilling Data Output

#### Sieb & Meyer Formats 1000/3000

The Sieb & Meyer 1000 and Sieb & Meyer 3000 output format options have been added to the Drill Data Output function from the Import/Export submenu of the File menu. These formats include the drill tool table with the drilling data output file, thus eliminating the need for transmitting the drill tool table in a separate file. The Sieb & Meyer 1000 drilling coordinates resolution/accuracy is 1/100 mm, whilst the Sieb & Meyer 3000 drilling coordinates resolution/accuracy is 1/1000 mm.

## **7 CAM View**

### **7.1 General**

#### **Interactive Zoom Window Selection**

CAM View now supports interactive zoom window selection whilst the left mouse button is pressed.

## 8 Neural Rule System

### 8.1 General

#### Rule Definitions

The brules.dat file installed to the BAE programs directory contains precompiled rule definitions. The source files for these rule definitions are also provided (User Language directory; file extension .rul), i.e., the rule definitions can be modified and recompiled with the **rulecomp** Rule System Compiler.

#### Project-specific Rule Database

Rules referenced throughout a project are now automatically copied from the global rule database file (brules.dat) to the project file. This allows for the transfer of project files with specific rule definitions to a different user and/or BAE installation without having to transfer and compile the referenced rule definitions in a separate step.

The **COPYDDB** utility program has been adapted accordingly - referenced rule definitions are automatically copied with each element.

### 8.2 SCM Rules

BAE Version 5.4 provides a series of new rules for the implementation of special SCM features (e.g., text class assignments). See **chapter 2** of this documentation for a description of these rules and their applications.

### 8.3 Layout Rules

BAE Version 5.4 provides a series of new rules for the implementation of special layout features (e.g., group name assignments to elements). See **chapter 4** of this documentation for a description of these rules and their applications.

## 9 Utilities

### 9.1 COPYDDB

The -rule option for copying rule definitions has been added to the **COPYDDB** utility program.

### 9.2 LOGLIB

#### Logic Synthesis

The **LOGLIB** utility program supports the new architecture command for the definition of logical parts consisting of different arbitrarily connected SCM symbols and/or layout parts. This allows for the definition of schematic symbols consisting of different layout parts (e.g., 16-bit driver logic consisting of two physical 8-bit drivers) without having to apply hierarchical design.

## 10 Bartels User Language

### 10.1 General

This section describes general changes to the User Language specification. See [Bartels User Language Programmer's Guide - Chapter 2](#) for a detailed description of the User Language specification.

#### Internal User Language Version

The internal version of BAE Version 5.4 User Language has been changed. All User Language programs compiled under earlier BAE versions won't execute in the BAE Version 5.4 User Language interpreter environment (error message User Language program version incompatible!). This means that each User Language program compiled under earlier BAE Versions must be recompiled under BAE Version 5.4 in order to regain compatibility.

### 10.2 User Language Compiler

This section describes the news and changes introduced to the BAE User Language Compiler. See [Bartels User Language Programmer's Guide - Chapter 3](#) for detailed information on how to operate the User Language Compiler.

#### Optimizer

The Optimizer of the User Language Compiler has been updated to allow for the substitution of the loadv (Load variable) and loads (Load stack) machine instructions with the new and more efficient loadvd (Load variable destructive) and loadsd (Load stack destructive) machine instructions, respectively. The substitution takes place in assignment operations where the assigned variable on the left is part of the assignment expression on the right ( $n = 5 * n$ ,  $s += s + "ABC"$ , increment, decrement, etc.).

### 10.3 User Language Interpreter

This section describes the news and changes introduced to the User Language Interpreter. See [Bartels User Language Programmer's Guide - Chapter 3](#) for detailed information on how to operate the User Language Interpreter.

#### Machine Instruction Set

The loadvd (Load variable destructive) and loadsd (Load stack destructive) instructions have been added to the machine instruction set, and the Optimizer of the User Language-Compiler has been redesigned to substitute loadv (Load variable) and loads (Load stack) instructions with the more efficient loadvd and loadsd instructions if possible (see above).

The addstr (Add string) machine instruction for concatenating strings has been optimized. This optimization reduces the computing time used for concatenating long strings by roughly 50 percent. The performance of User Language programs which create long strings can be significantly increased (factor 10 to 20) by assembling long strings from short string concatenations instead of repeatedly concatenating short strings to long strings.



## 10.4 Index Variable Types

This section lists the new and changed User Language index variable type. See [Bartels User Language Programmer's Guide - Appendix B](#) for a detailed description of all index variable types.

### New Index Variable Types

The following new User Language index variable types have been implemented for BAE V5.4:

IP	Index Variable Type	Short Description
CAP	<a href="#">CL_ALTPLNAME</a>	Layout Net List Alternate Part Package
	<a href="#">CL_ATTRIBUTE</a>	Layout Net List Attribute
	<a href="#">CL_CNET</a>	Layout Net List
	<a href="#">CL_CPART</a>	Layout Net List Part Entry
	<a href="#">CL_CPIN</a>	Layout Net List Part Pin Entry

### Changed Index Variable Types

The int attribute VIS for net visibility queries has been added to the [L\\_CNET](#) index variable type.

The int attribute RULEOBJID for element-specific rule object queries has been added to the [I\\_FIGURE](#) index variable type.

## 10.5 System Functions

This section lists the new and changed User Language system functions. See [Bartels User Language Programmer's Guide - Appendix C](#) for a detailed description of all system functions.

### New System Functions

The following new User Language system functions have been implemented for BAE V5.4:

IP	System Function	Short Description
STD	<a href="#">bae_asksymname</a>	Interactive BAE library element query
	<a href="#">bae_dialadvcontrol</a>	Add advanced BAE dialog element
	<a href="#">bae_getpackdata</a>	Get BAE Packager data
	<a href="#">bae_menuitemhelp</a>	Display BAE menu item help
	<a href="#">bae_setplanfname</a>	Set BAE project file name
	<a href="#">launch</a>	Pass command to operating system without waiting for completion
	<a href="#">rulecompile</a>	Compile a rule definition
CAP	<a href="#">cap_findlayconpart</a>	Get layout connection list part index
	<a href="#">cap_findlaycontree</a>	Get layout connection list net name net index
	<a href="#">cap_getlaytreeidx</a>	Get layout connection list net number net index
	<a href="#">cap_layconload</a>	Load layout net list
SCM	<a href="#">scm_attachtextpos</a>	Attach text position to SCM element
	<a href="#">scm_checkjunctplot</a>	Get SCM junction point plot status
	<a href="#">scm_chkattrname</a>	SCM attribute name validation
	<a href="#">scm_gethpglparam</a>	SCM HPGL parameter query
GED	<a href="#">ged_askrefname</a>	Interactive GED reference name query
	<a href="#">ged_asktreeidx</a>	Interactive GED net query
	<a href="#">ged_attachtextpos</a>	Attach text position to layout element
CAM	<a href="#">cam_getdrlaccuracy</a>	Get CAM drill tool tolerance
	<a href="#">cam_setdrlaccuracy</a>	Set CAM drill tool tolerance

### Changed System Functions

The [system](#) function has been changed to wait for command completion in any operating system environment before returning to BAE.

A new parameter for specifying part processing mode flags (remove from screen, screen redraw) has been added to the [scm\\_setpartattrib](#) function.

The [ged\\_groupselect](#) provides new modes for selecting elements with or without connection to specified tree/net numbers and for selecting elements by polygon type.

## 10.6 BAE User Language Programs

BAE installs some 200 pre-compiled User Language programs to the bsetup.dat file of the BAE programs directory. Additionally, the User Language *source* files (more than 3.5 Mbytes; more than 120,000 lines) are installed to a special directory (baeulc). See [Bartels User Language Programmer's Guide - Chapter 4](#) for a complete listing and short descriptions of the BAE User Language programs.

### Include Files

The User Language include files already delivered with the previous BAE Version have been completely revised and extended by a series of new definitions and functions.

The following new User Language include files are provided with BAE Version 5.4:

IP	Include File	Short Description
ICD	<a href="#">ICD.ULH</a>	IC Design Utilities

The baewsresize and baewsshink functions for Schematic Editor, Layout Editor and Chip Editor workarea manipulation have been integrated to the [STD.ULH](#) include file. These functions replace the corresponding functions from [SCM.ULH](#) (scmwsresize and scmwsshink) and GED.ULH (gedwsresize and gedwsshink). All User Language programs have been changed to use the new workarea functions as required. GED.ULH has become redundant and was removed from the BAE software.

### New User Language Programs

The following new User Language programs are provided with BAE Version 5.4:

IP	Program Name	Short Description
SCM	<a href="#">ATTRSET</a>	SCM Symbol Attribut Assignment
GED	<a href="#">ICAPNET</a>	ICAP Logical Netlist Import
ICD	<a href="#">ICDPCR</a>	IC Design Report
CED	<a href="#">CED_MS</a>	Chip Editor Mouse Action
	<a href="#">CEDDISP</a>	Chip Editor Display Functions
	<a href="#">CEDGROUP</a>	Chip Editor Group Functions
	<a href="#">CEDMACL</a>	IC Design Macro Load
	<a href="#">CEDPART</a>	Chip Editor Macro and Placement Functions
	<a href="#">CEDPOLY</a>	Chip Editor Polygon Functions

### Changed User Language Programs

The User Language programs already delivered with the previous BAE Version have been completely revised and extended by many new features and functions. A series of significant improvements and enhancements have already been mentioned in the previous sections of these Release Notes.