Bartels AutoEngineer®
Installation Guide

The Bartels AutoEngineer® - Installation Guide describes the **Bartels AutoEngineer** configurations and system requirements and provides detailed **Bartels AutoEngineer** installation instructions for all supported hardware and software platforms.

Bartels AutoEngineer Installation Guide
Published by: Bartels System GmbH, Erding
Last printing: November 2013

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Bartels AutoEngineer (BAE) is a fully integrated EDA software system with powerful CAE/CAD/CAM program modules for circuit design, PCB (printed circuit board) layout and IC/ASIC design. The system is based on the famous **Bartels AutoEngineer** which has been incorporated in most leading PCB layout systems throughout the world, setting new industrial standards of autorouting success and dramatically reducing the requirement for manual routing.

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**

All BAE software configurations are provided with the same user interfaces and support different languages (English, German, etc.). **Bartels AutoEngineer** features binary-compatible design data management on different host platforms, i.e., BAE design data can be transferred "as-is" between all supported hardware and/or operating system platforms (Windows, Linux/Unix, DOS, etc.).

1.1   Bartels AutoEngineer Professional

Bartels AutoEngineer Professional is the basic BAE software configuration described in this manual. **BAE Professional** is available for PCs with Windows, Linux or DOS operating systems. The following components are included with the **BAE Professional** software:

- **Schematic Editor** with hierarchical circuit design support
- Forward/Backward Annotation
- PCB Layout system including **Layout Editor**, **Autoplacement**, automatic copper fill, **Bartels AutoEngineer**, **Bartels Autorouter®**
- **CAM Processor** and **CAM View** with Gerber viewer
- integrated, object-oriented database system (DDB, Design DataBase)
- in-built **Neural Rule System**
- **Bartels User Language Compiler**, **User Language** programs with source code
- utility programs for database management, foreign net list and design data import, etc.
- extensive part libraries for SCM and PCB layout
- design data examples
- Documentation (Bartels AutoEngineer User Manual, Bartels User Language Programmer's Guide)

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** (**BAE Demo**, fully-featured except for data output) are available free of charge for test and evaluation purposes.

1.2   Bartels AutoEngineer Light

Bartels AutoEngineer Light is available for PCs with Windows, Linux or DOS operating systems. **BAE Light** is a shareware price-level BAE configuration for educational purposes and/or semi-professional users. **BAE Light** provides full **BAE Professional** functionality, however, with the following restrictions:

- PCB layout size limited to 180mm*120mm
- max. 2 signal layers for manual routing and Autorouter
- no power layer support
- layouts from **BAE Professional**, **BAE Economy** and **BAE HighEnd** only loadable if **BAE Light** restrictions are not violated

1.3   Bartels AutoEngineer Economy

Bartels AutoEngineer Economy (formerly known as **Bartels AutoEngineer Educate/Entry**) is available for PCs with Windows, Linux or DOS operating systems. **BAE Economy** is a low-price BAE configuration for educational purposes and/or small business users. **BAE Economy** has full **BAE Professional** functionality, however, with the following limitations:

- PCB layout size limited to 350mm*200mm
- max. 4 signal layers simultaneously routable by **Autorouter** (however, like in **BAE Professional**, 100 signal layers for manual routing and support for 12 power layers in both manual routing and **Autorouter**)
- layouts from **BAE Professional** and **BAE HighEnd** only loadable if **BAE Economy** restrictions are not violated

1.4   Bartels AutoEngineer HighEnd

Bartels AutoEngineer HighEnd is available on workstations as well as on Windows and Linux PC platforms. **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
- place layout parts according to schematic plan
- selective layout short-circuit display
- extremely fast Mincon airline calculation
- DRC with multi-processor system support
- layer stack setup according to trace impedance
- layer-specific clearance paramaters for DRC and copper fill functions
- internal data structures optimized 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
- CAM output to suppress unconnected inner layer pads

BAE HighEnd is data-compatible to **BAE Professional** in both directions; requested data transformations are automatically applied during element load procedures.

1.5   Bartels AutoEngineer IC Design

BAE HighEnd can be upgraded to a fully featured ASIC design system. **Bartels AutoEngineer IC Design (BAEICD)** 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** and **IC DRC** (Design Rule Check). GDS-II and CIF standard interfaces are provided for converting foreign data and/or producing CAM output (mask data, bonding data, etc.). The **BAEICD** CAM tools include a module for displaying CIF data in order to perform visual CAM output checks. Net list data is usually transferred by the BAE **Packager** after defining the circuitry with **BAE Schematics**, which provides features for hierarchical circuit design. Alternative solutions for importing foreign/third-party netlist data/formats can be provided on request.

1.6   Bartels AutoEngineer FabView

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 layout design changes to BAE project files are deactivated.

2   System Requirements

The C programming language is used for the implementation of the **Bartels AutoEngineer** software to ensure easy portability. The software is available with identical user interfaces on different hardware and operating system platforms. Design data created with **Bartels AutoEngineer** is binary-compatible on all supported platforms, i.e., there are no software-imposed restrictions for accessing and transferring BAE data in heterogeneous networks connecting different operating systems on workstations and PCs.

2.1   Processor and Operating System

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.

BAE Light, **BAE Economy** and **BAE Professional** versions are available for Linux (Kernel 2.0.x and above), Windows 8.1, Windows 8, Windows 7, Windows Vista, 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 8.1, Windows 8, Windows 7, Windows Vista, 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.

Under Windows and Motif, the BAE software can be operated with pulldown menus instead of the BAE standard sidemenu user interface.

Table 1: BAE Hardware and Operating System Platforms

Hardware Platform	Operating System (Graphic Interface)	BAE HighEnd IC Design	BAE Professional Economy Light	BAE Schematics FabView	Notes
Intel/AMD X86	Windows 8.1 Windows 8 Windows 7 Windows Vista Windows XP Windows 2000 Windows NT 4.0 Windows NT 3.51 Windows ME Windows 98 Windows 95	x	x	x	
	Linux Kernel 2.0.x (Motif)	x	x	x	
	Solaris/OpenSolaris	x	x	x	
	MS-DOS Windows DOS Box OS/2 DOS Full Screen		x	x	DPMI

Bartels AutoEngineer DOS software uses the **Phar Lap 386|DOS Extender** which supports DOS Protected Mode Interface Specification (DPMI, Version 1.0), eXtended Memory Specification (XMS, usually provided by installing the HIMEM.SYS driver for accessing memory beyond 1 Mb), Virtual Control Program Interface (VCPI, supporting LIM-compatible 386 EMS emulators such as Microsoft EMM386, Quarterdeck QEMM-386, Qualitas 386MAX), Virtual Disk facilities (VDISK) and the INT 15h method of extended memory allocation. I.e., BAE DOS software can be run from operating system MS-DOS (Version 3.1 or later), and BAE can be started via DPMI from operating system IBM OS/2 (Version 2.0 and/or Version 3.0 Warp; to be started in a DOS Full Screen session) or from Microsoft Windows 3.x/95/98/NT (to be run as DOS-Box in Enhanced Mode).

2.2   Main Memory (RAM)

A minimum of 16 Mbytes RAM is required for DOS systems (32 Mbytes RAM recommended). A minimum of 32 and/or 64 Mbytes RAM is required for Windows and Linux systems.

2.3   Hard Disk Drive

Some 40 Mbytes of hard disk space are required for installing the BAE software. Note also that additional disk space is required for user-specific libraries and design files to be created when working with the **AutoEngineer**.

2.4   Video Adapter, Monitor

A VGA or higher resolution monitor and a mouse or a corresponding pointing device are required on any BAE platform.

A video adapter and/or graphic card supporting at least 16 colors at reasonable resolutions is required for operating the BAE software. The BAE Windows versions can be operated using the graphic device driver installed with the operating system. The BAE DOS versions require the installation of a BAE-specific graphic device driver, i.e., a video adapter supported by one of the BAE DOS graphic device drivers is required for the BAE DOS software. See table 4 for a list of the graphic device drivers supplied with the BAE DOS software.

The monitor must correspond with the installed graphic card and vice versa. Due to ergonomic considerations, the display should have a size of at least 15 inches with a screen resolution of at least 800*600 pixels. A color display is strongly recommended since **Bartels AutoEngineer** requires at least 4 color planes with up to 16 different colors for graphical output.

2.5   Pointing Device, Mouse

Bartels AutoEngineer requires a mouse with three or at least two buttons. A compatible trackball and/or touchpad pointing device can be used instead of a mouse.

2.6   CD-ROM Drive

The **Bartels AutoEngineer** is delivered on CD-ROM, i.e., a CD-ROM drive is required for installing the software. On request, the BAE software can also be provided on different media or through Internet and/or Email.

2.7   Special PC System Requirements

On DOS systems, a printer port (LPT1, LPT2 or LPT3) for the BAE hardlock key is required for checking the software authorization of **BAE Economy**, **BAE Professional**, and **BAE FabView**.

On Windows systems, a USB interface or a printer port for the BAE hardlock key is required for checking the software authorization of **BAE Economy**, **BAE Professional**, **BAE HighEnd** and **BAE FabView**.

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

2.8   CAM Interfaces

Plotter, Printer

The BAE **CAM Processor** provides plot data in HP-GL, HP-Laser or Postscript format. I.e., a HP7475A (or compatible) pen plotter, a HP LaserJet laser printer or a Postscript-capable output device can be used. HP-Laser output is automatically scaled to A4 format, i.e., HP-Laser output is intended for control purposes only. A hardware interface (e.g., COM2) can be utilized for directing the plot data to the output device. The output data can also be directed to files on the hard disk, which then can be sent to the output device using operating system commands or even emulator programs for supporting other output devices such as matrix printers, raster plotters, ink jet printers, etc.

With the Windows versions of the BAE PC software there is also a generic print/plot output function implemented. I.e., *any* print/plot output feature supported by the current Windows operating system configuration is also supported with the BAE Windows software.

Photo Plotter

Photo plot data is provided in Gerber format. Either a plot file can be generated or a hardware interface can be used for sending the plot data directly to the photo plotter.

Drilling Machine

Drill data is provided in Sieb&Meier or Excellon format. Either an ASCII drill data file can be generated, or a hardware interface can be used for sending the drill data directly to the drilling machine.

Insertion Data

Insertion data is provided in generic format. Either an ASCII insertion data file can be generated or a hardware interface can be used for sending the insertion data directly to the insertion machine.

Others

Almost any output interface needed for production and/or manufacturing (e.g., part lists, milling data, etc.) can be implemented with **Bartels User Language**. **User Language** also provides functions for storing design data and most powerful tools for the programming of ASCII file interpreters. I.e., **User Language** can be used for importing foreign data to the **Bartels AutoEngineer** such as net lists, artworks, library symbol definitions, placement data, part attributes, drawing data, routing data, etc.

3   Documentation

The `baedoc` directory of the BAE CD-ROM contains the complete **Bartels AutoEngineer** documentation including the Bartels AutoEngineer User Manual and the Bartels User Language Programmer's Guide in HTML and PDF format.

Part Library Documentation

PDF files displaying all graphic symbols of the officially released BAE libraries are provided in the `pdflib` directory of the BAE-CD-ROM. The `baelib` directory of the BAE-CD-ROM contains HTML files with comprehensive library contents tables and reference lists for the BAE symbol and part libraries.

4   Installation Guide

4.1   System Files

The BAE software contains some system files for storing user-specific setup and parameter data. These are the files from the BAE programs directory which end on `.vdb`, `.dat`, `.col` and/or `.fnt`. These setup files contain user-specific menu setups, color tables, layer definitions, Gerber aperture tables, character fonts, library access paths, etc. The setup files are overwritten when performing a new installation of the BAE software, i.e., when updating from an older version. It is recommended to save these files before starting a new installation or to select the update install mode when installing to PC platforms (see below).

Table 2 lists all system and setup files of the **Bartels AutoEngineer**, showing the BAE program module access modes (R=read, W=write).

Table 2: BAE System Files

System File	Contents	BAE Program Module						
		SCM	GED	AR	NAR	CAM	CV	CED
		R=Read Access, R/W=Read/Write Access						
`bsetup.dat`	Menu Colors Library Paths Layer Definitions	R/- R/- -/-	R/- R/- R/-	R/- -/- R/-	R/- R/- R/-	R/- -/- R/-	R/- -/- R/-	R/- R/- R/-
`ulcprog.vdb`	BAE **User Language** Database	R/-	R/-	-/-	R/-	R/-	R/-	R/-
`ulchelp.vdb`	BAE **User Language** Help Texts	R/-	R/-	-/-	R/-	R/-	R/-	R/-
`brules.vdb`	BAE Rule Database	R/-	R/-	-/-	R/-	R/-	-/-	R/-
`bae.ini`	BAE Module Startup Parameter Settings	R/W	R/W	-/-	R/W	R/W	R/W	R/W
`baebase.ini`	BAE Module Startup Parameter Settings (company-specific)	R/W	R/W	-/-	R/W	R/W	R/W	R/W
`baeuser.ini`	BAE Module Startup Parameter Settings (user-specific)	R/W	R/W	-/-	R/W	R/W	R/W	R/W
`baehist.dat`	BAE Element Access History	R/W	R/W	-/-	R/W	R/W	R/W	R/W
`baemacro.dat`	BAE Macro Command Definitions	R/W	R/W	-/-	R/W	R/W	R/W	R/W
`scm.dat`	SCM Color Tables	R/W	-/-	-/-	-/-	-/-	-/-	-/-
`ged.dat`	PCB Layout Color Tables	-/-	R/W	R/W	R/W	R/W	R/W	-/-
`cam.dat`	CAM Gerber Aperture Tables	-/-	-/-	-/-	-/-	R/W	R/W	-/-
`ced.dat`	IC Design Color Tables	-/-	-/-	-/-	-/-	-/-	-/-	R/W
`ged.fnt`	BAE Graphic Character Fonts	R/-	R/-	R/-	R/-	R/-	R/-	R/-
`baewin.dat`	BAE Windows Position File	R/W	R/W	R/W	R/W	R/W	R/W	R/W
`baexwin.dat`	BAE X11/Xwindows Position File	R/W	R/W	R/W	R/W	R/W	R/W	R/W
`bae.col`	BAE Screen Color Table	R/-	R/-	R/-	R/-	R/-	R/-	R/-
`baescm.col`	**Schematic Editor** Screen Color Table	R/-	-/-	-/-	-/-	-/-	-/-	-/-
`baeged.col`	**Layout Editor** Screen Color Table	-/-	R/-	-/-	-/-	-/-	-/-	-/-
`baear.col`	**Autorouter** Screen Color Table	-/-	-/-	R/-	R/-	-/-	-/-	-/-
`baecam.col`	**CAM Processor** Screen Color Table	-/-	-/-	-/-	-/-	R/-	-/-	-/-
`baecv.col`	**CAM View** Screen Color Table	-/-	-/-	-/-	-/-	-/-	R/-	-/-
`baeced.col`	**Chip Editor** Screen Color Table	-/-	-/-	-/-	-/-	-/-	-/-	R/-
`baep.col`	BAE Printer Color Table	R/-	R/-	R/-	R/-	R/-	R/-	R/-
`language.vdb`	BAE Menu Items	R/-	R/-	R/-	R/-	R/-	R/-	R/-

The **BSETUP** utility program and/or the Setup function from the BAE main menu of the Windows/Motif versions are used for changing the system parameters in the `bsetup.dat` file. The **FONTCONV** utility program can be applied for transferring user-defined character fonts to the `ged.fnt` file. See Bartels AutoEngineer User Manual - Chapter 7 of this manual for a description of the utility programs provided with the **Bartels AutoEngineer**.

The `language.vdb` file contains the **Bartels AutoEngineer** menu and message texts. This file is delivered only with software configurations where the customer wants to run the BAE user interfaces with a language differing from the default German language (e.g., English).

4.2   Preparing for Update Installations

The BAE library and **User Language** directory contents are replaced when performing update installations. 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`, `.def`, `.fnt` and `.ini` 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 are overwritten during update installations.

BAE updates can be installed to new directories. You should then copy the BAE system files with the `.dat`, `.def`, `.fnt` and `.ini` extensions from the old BAE programs directory to the BAE programs directory of the new installation to transfer all user-specific system definitions such as color tables and Gerber aperture tables to the new BAE installation.

The BAE (update) installation procedures always (re-)install the BAE system files ending on `.vdb` to the BAE programs directory. These files contain version-dependent system data such as the compiled **User Language** programs of the BAE software (`ulcprog.vdb`) and the compiled rule definitions of the BAE software (`brules.vdb`). It is therefore not necessary to run the time-consuming batch for compiling the **User Language** sources provided with the BAE software or to compile the rule definition files deliverd with the BAE software. However, customer-specific **User Language** programs and rule definitions developed and compiled under the previously installed BAE version must be re-compiled after performing a BAE Update Installation.

4.3   Software Security Module and License Files

The BAE PC software for Windows, Linux, and DOS (except for **BAE Demo**, **BAE Light** and **BAE Schematics**) is protected by a hardlock key (dangle). You have the choice between a USB adapter for Windows and Linux or a parallel port adapter for Windows, Linux, or DOS. On Linux systems, it is also possible to use a pre-installed Ethernet card instead of a hardlock key for BAE software authorization checks.

The parellel port hardlock key must be plugged onto one of the parallel ports (LPT1, LPT2 or LPT3) of your PC. Switch off your computer before mounting the BAE parallel port module, or otherwise the hardlock key could be damaged by high voltage. If a peripheral device such as a laser printer is connected to the hardlock key, then you must *always switch on the peripheral device before switching on your computer* to avoid hardlock key check problems.

If your PC system has a free USB port then we recommend the USB adapter which can usually be operated more easily.

The BAE PC software provides the license files according to the available software configurations as shown in table 3. 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 3: 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 Hardlock Key
BAE Light	*see note*	SCM and Layout; no Hardlock Key, customer-specific CFG file `router.cfg` 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 Version 4.6**
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` in 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. **BAE Demo** masks Layout board elements 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.

4.4   Windows Installation

The **Bartels AutoEngineer** software for Windows is provided on CD-ROM. I.e., you will need a CD-ROM drive if you intend to install the software.

The installation of the BAE Windows software includes the installation of the BAE programs (directory `bae`), the BAE libraries (directory `baelib`), the BAE **User Language** sources (directory `baeulc`), the BAE test jobs and examples (directory `baejobs`) and the BAE online documentation (directory `baedoc`), respectively. Make sure there is enough disk space available for the installation. See chapter 2 of this documentation for information on BAE system requirements.

Running the BAE Windows Setup Program

Under Windows, 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** or **BAE FabView**; see also table 3).

Note

BAE usually closes files immediately after write procedures are completed. Depending on the type of the BAE save operation it may be necessary that BAE files are re-opened and closed subsequent to the save operations. This can lead to significant delays when saving elements in certain **Windows** configurations where automatic file indexing is activated. This problem can be fixed by excluding `.ddb` and `.lck` files from automatic indexing using the Indexing Options in the **Windows** Control Panel.

4.5   MS-DOS Installation

The **Bartels AutoEngineer** software for Windows and DOS is provided on CD-ROM. I.e., you will need a CD-ROM drive if you intend to install the software.

Four different directory path names can be chosen for installing the BAE programs (default directory path name `bae`), the BAE libraries (directory `baelib`), the BAE **User Language** sources (directory `baeulc`) and the BAE test jobs and examples (directory `baejobs`), respectively. Any of these directories not yet existing are automatically created with user verification. You can manually copy the BAE online documentation (format HTML and PDF; CD-ROM directory `baedoc`) to your hard disk if you wish to do so. Make sure there is enough disk space available for the installation. See chapter 2 of this documentation for information on BAE system requirements.

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: ⏎
> install ⏎
```

Once the install program has been started, the instructions issued on the screen should be followed carefully. First you are 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 are 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. 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 are verified with user query before starting the installation process. The destination directories are automatically created 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 and/or software authorization file (see table 3).

Graphic Device Driver

The DOS versions of the BAE software are shipped with a series of graphic device drivers. During the installation you are asked to select an appropriate BAE graphic device driver. Table 4 lists the DOS graphic device drivers supplied with the **Bartels AutoEngineer** software. Please select the graphic device driver matching the video adapter and/or graphic card installed with your computer. Or simply select standard VGA driver VGA480 if you are not sure about which driver to select. VGA480 is assumed to run on almost any PC system. The selected graphic driver file is copied to the **bae.dev** file in the BAE programs directory. You can manually copy a different driver (e.g., with higher resolution) even after running the BAE DOS installation.

Table 4: BAE Graphic Device Driver for MS-DOS

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

MS-DOS System Settings

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 to include the BAE programs directory path name with the `PATH` variable:

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

With the PC versions of the BAE software an environment variable called `BAETMP` can be defined for optionally specifying a BAE temporary directory to avoid problems with temporary file generation on network-based PC/MS-DOS systems. To specify the BAE temporary directory the following command must be added to the `autoexec.bat` file:

```
SET BAETMP=<dirpath>\
```

`<dirpath>` is the path name of the temporary directory (e.g., `d:\baetmp`; the backslash at the end of the path name is required).

The `config.sys` file must contain the following statements:

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

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.

The BAE DOS software works in Protected Mode, i.e., there is no 640 Kbytes barrier. **Bartels AutoEngineer** uses the **Phar Lap 386|DOS Extender**, which supports **DPMI**, **VCPI**, **EMM386**, **XMS/HIMEM**, **VDISK** and **INT 15h**. However, in special cases (e.g., with certain third party software configurations) it might be necessary to remove conflicting memory managers. It is possible to reconfigure the BAE programs, if you wish to restrict the way in which BAE uses memory; please contact us for more detailed information in case. With EMM386 installed under MS-DOS 6.x it is strongly recommended to add the NOVCPI switch (and the NOEMS) switch to the corresponding `config.sys` line since otherwise the performance for starting BAE graphic program modules will dramatically slow down.

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

4.6   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 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 systems 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 –xzvf /cdrom/baelinux/baelinux.tgz ⏎
```

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 ⏎
> tar -xfv /cdrom/baelinux.tar ⏎
```

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 3).

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.

Setting up the Linux 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 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 Linux derivative, respectively).

4.7   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 -xzvf /cdrom/baehp.tgz ⏎
```

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 3).

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 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 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).

5   Parameter Setup and Program Start

5.1   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.

The BAE software comes with a setup definitions file template named **stdset.def** which is 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");
```

<libdir> is the path name of the BAE library directory. If the library has been installed to, e.g., the directory **c:\baelib** under DOS or Windows then you should replace **<libdir>** with this path name to provide correct access to the BAE symbol libraries. If the library has been installed to, e.g., 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 ⏎
```

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. It is strongly recommended to become 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**.

5.2   User Language Programs, Menu Assignments, Key Bindings

The BAE software installs many pre-compiled **User Language** programs to the **ulcprog.vdb** file of the BAE programs directory. The corresponding source files are 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.

Usually, it is _not_ necessary to (re-)compile the **User Language** programs delivered with the BAE software, since the compiled programs are installed to the **ulcprog.vdb** 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 ⏎
```

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

```
> cplsll.bat ⏎
```

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

5.3 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 ⏎
```

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 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, 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 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.

5.4 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. The environment variables are 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 (`$`) and must be either entirely lower-case or entirely upper-case. The `~` character serves as an alias for the `$HOME` variable. Undefined environment variable references are substituted with empty strings.

5.5 System File Access Environment Variables

The environment variables listed in table 5 are evaluated for advanced configuration of BAE system file access in network installations.

Table 5: BAE System File Environment Variables

Environment Variable	System File Default Name	System File Contents
`BAE_CFG`	`router.cfg`	BAE Configuration/License File
`BAE_BSETUP`	`bsetup.dat`	BAE System Parameters
`BAE_INI`	`bae.ini`	BAE Initialization/Startup Parameters
`BAE_BASEINI`	`baebase.ini`	BAE Initialization/Startup Parameters (company-sepcific)
`BAE_PARLIB`	`baeparam.dat`	BAE Parameter Settings
`BAE_MACRO`	`baemacro.dat`	BAE Macro Commands
`BAE_HIST`	`baehist.dat`	BAE Command History
`BAE_ULCLIB`	`ulcprog.vdb`	BAE **User Language** Programs
`BAE_ULCHELP`	`ulchelp.vdb`	BAE **User Language** Help Texts
`BAE_RULELIB`	`brules.vdb`	BAE Rules Database
`BAE_LANG`	`language.vdb`	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_DRCLIB`	`drcparam.dat`	DRC Block Parameter Tables
`BAE_RUTLIB`	`rutparam.dat`	Autorouter Parameter
`BAE_CEDLIB`	`ced.dat`	IC Layout Color Tables
`BAE_CAMLIB`	`cam.dat`	CAM Gerber Aperture Tables
`BAE_CAMBLIB`	`cambatdb.dat`	CAM Batch Outpout Parameter
`BAE_EPSBLIB`	`epsbatdb.dat`	EPS/PDF Batch Output Parameter
`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.

5.6   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.