COSMIC Software

IDEA

Integrated Development Environment for COSMIC Software

C Compiler and Zap Debugger

Quick Start Guide

PC/Windows 98/NT/2000/XP

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IDEA Quick Start Guide

- Overview
- Running IDEA
- Managing a project
- Building a project
- Debugging a project

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Overview

Who is Cosmic Software?

Cosmic Software provides highly-optimized target support for FreeScale, ST MicroElectronics, Infineon, Hitachi, Nec, Zilog microprocessors/microcontroller, with others in development.

The product line includes complete ANSI/ISO C language cross compilers, macro assemblers, linkers, utilities, ZAP C and assembler source-level cross debuggers, and the IDEA integrated development environment. These products are prepackaged and ready-to-run on PC/ Windows and Linux and SUN SPARC/HP9000 UNIX workstations.

The compilers have been updated to Version 4 technology, which gives improved code optimization levels and improved language features for developers of embedded systems.

The ZAP debugger products are packaged to work off-the-shelf with popular debugging hardware configurations, such as low-cost evaluation boards or In-Circuit Emulators; the simulator versions of ZAP allows application code to be debugged entirely on a PC without access to target hardware, and can therefore simplify the development effort by providing for a “software debugging” phase before hardware/software integration.

The IDEA integrated development environment products provide a Windows-based graphical user interface (GUI) for building and managing projects. IDEA is fully integrated with all Cosmic tools, including compilers, assemblers, linkers, utilities, and ZAP debuggers.

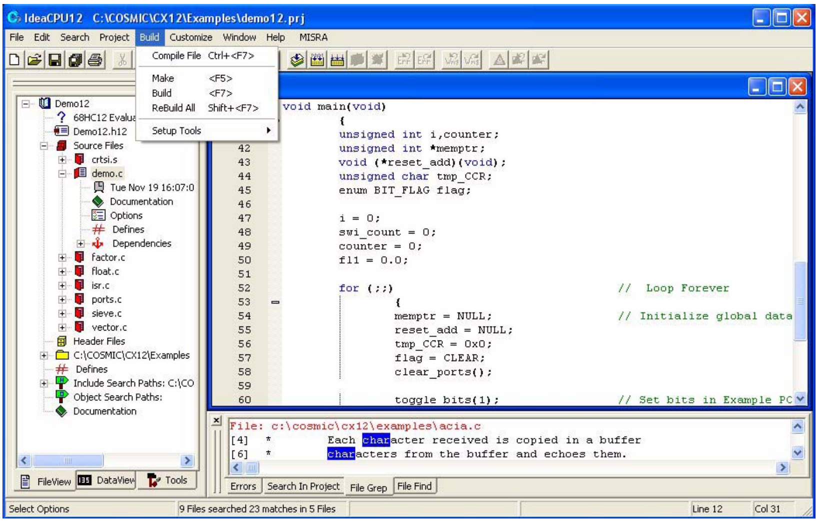
What is IDEA?

IDEA is an integrated development environment and editor for managing cross development projects using Cosmic tools. IDEA is supplied in a target specific version customized to the Cosmic tools you are using. For example, IDEA12 is designed for use with the Cosmic cross compiler and ZAP debugger for the FreeScale HC12/HCS12. In order to run IDEA you must have the matching cross compiler installed on your system; the ZAP debugger is optional.

With IDEA you can create and edit projects; compile, assemble and link C or assembler code; run an application Make or Build; and run a ZAP debugger session; all with a few simple mouse clicks in a user-friendly, graphical Windows interface.

Using IDEA

The IDEA GUI (graphical user interface) provides immediate access to all the tools you need to manage full projects.



```
void main(void)
        {
        unsigned int i,counter;
        unsigned int *memptr;
        void (*reset_add)(void);
        unsigned char tmp_CCR;
        enum BIT_FLAG flag;

        i = 0;
        swi_count = 0;
        counter = 0;
        fl1 = 0.0;

        for (;;)                                        //  Loop Forever
                {
                memptr = NULL;                          // Initialize global data
                reset_add = NULL;
                tmp_CCR = 0x0;
                flag = CLEAR;
                clear_ports();

                toggle bits(1);                         // Set bits in Example PC
```

```
File: c:\cosmic\cx12\examples\acia.c
[4]   *         Each character received is copied in a buffer
[6]   *         characters from the buffer and echoes them.
```

Figure 1: IDEA GUI

The **Project window** at the left provides a graphical, tree-structured view of your project. Using just the Project window, you can add or remove files from the project, set compiler options, configure build utilities, and much more.

The **File windows** at the right allow you to open project files for editing and compiling. IDEA provides color-coding of Comments, Preprocessor Keywords, C Keywords, and several other coding items so that you can easily edit source code files.

Running IDEA

Starting IDEA

From the Windows Start menu, select **Programs>Cosmic Tools>CX*xx***, where *xx* stands for the Cosmic Software compiler that you are using (for example, **Programs>Cosmic Tools>CX6812** if you are using the Cosmic HC12/HCS12 compiler).

The IDEA main window appears:

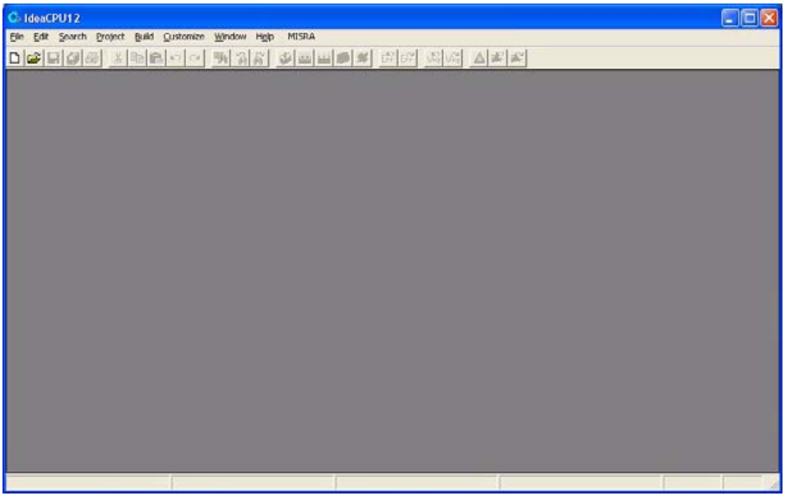
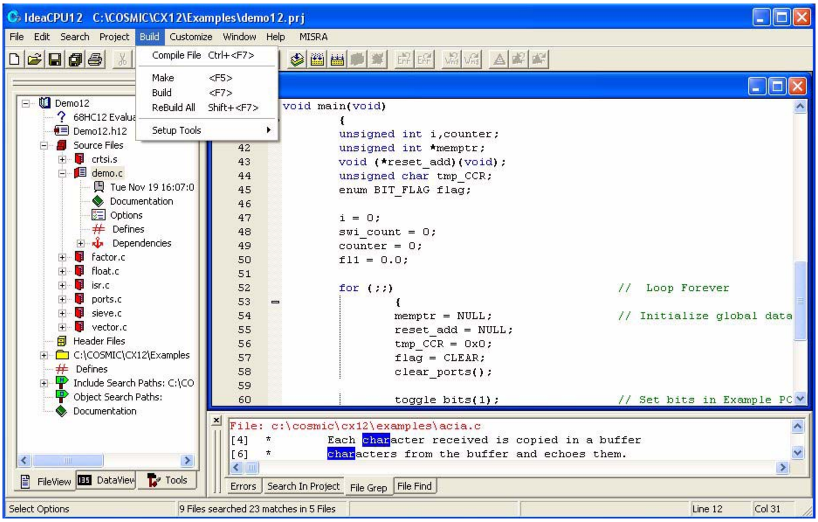


Figure 2: IDEA main window

After you open a project and some files within the project, the IDEA main window appears as in the following figure.



```
void main(void)
        {
        unsigned int i,counter;
        unsigned int *memptr;
        void (*reset_add)(void);
        unsigned char tmp_CCR;
        enum BIT_FLAG flag;

        i = 0;
        swi_count = 0;
        counter = 0;
        fl1 = 0.0;

        for (;;)                                    //  Loop Forever
                {
                memptr = NULL;                      // Initialize global data
                reset_add = NULL;
                tmp_CCR = 0x0;
                flag = CLEAR;
                clear_ports();

                toggle bits(1);                     // Set bits in Example PC
```

```
File: c:\cosmic\cx12\examples\acia.c
[4]   *         Each character received is copied in a buffer
[6]   *         characters from the buffer and echoes them.
```

```
Select Options    9 Files searched 23 matches in 5 Files    Line 12    Col 31
```

Figure 3: IDEA main window with Project and File windows open

The IDEA main window is the principal graphical user interface (GUI) for the program.

For complete details on the components of the IDEA main window, refer to Chapter 4, "*IDEA User Interface*" in the IDEA User's Guide.

Getting Help

The **Help** drop-down menu provides help on the C language and on the C Library. You can also view IDEA version information.

Open the **Help** drop-down menu by clicking on **Help** in the Main menu. Alternatively, type **Alt+H**.

Starting a new project

To start a new project select **Project > New** from the Main menu.

The Project window appears with a new project opened.

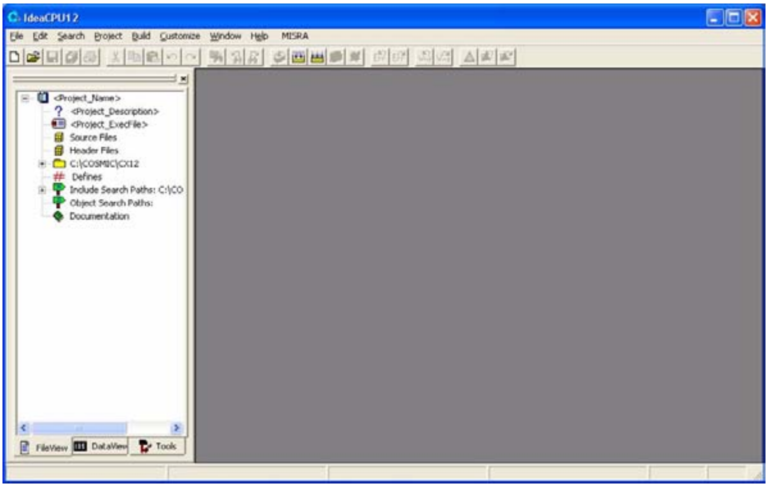


Figure 4: IDEA Project window with new project open

The Project window displays the various project components as icons in a tree-structured format, similar to Windows Explorer. Each icon in the project tree represents a project component.

Project Components

📖	Project Name
?	Project Description
▤	Project Target File Name
🗄	Project Source Files
📁	Project Directory
#	Project Defines
🪧	Project Include Paths
📗	Project Documentation

A ⊞ sign next to a component icon means that sub-components are hidden below the icon. Click on the ⊞ sign or double click on the icon to display the sub-components.

A ⊟ sign next to a component icon means that the first level of sub-components below the icon is displayed. Click on the ⊟ sign or double click on the icon to hide the sub-components.

For additional details on the Project window, refer to Chapter 4, "*IDEA User Interface*" in the IDEA User's Guide.

For details on project management, refer to Chapter 7, "*Managing an IDEA Project*" in the IDEA User's Guide.

Exiting IDEA

To exit IDEA, click on **Exit** in the **File** menu. Alternatively, type **Alt+F+X**.

If you have selected **Auto Save before C/asm** in the **Customize** drop-down menu (**Alt+C+A**), all changed files are saved prior to exiting. If you have not selected **Auto Save before C/asm**, a dialog box appears in turn for each changed file and lets you select whether to save the file or not.

Managing a Project

Opening the project

IDEA is supplied with an example project, **demo12.prj** for the Cosmic HC12/HCS12 compiler. You can use this example project to become familiar with the principles of managing an IDEA project.

If you opened a new project earlier, save it by clicking on **Project > Save** from the main menu. Close the project by selecting **Project > Close** from the Main menu.

To open the example project, select **Project->Load** in the Tool bar. In the dialog box that appears, select **demo12.prj** from the **Examples** folder. The Project window appears with the **demo12.prj** project opened.

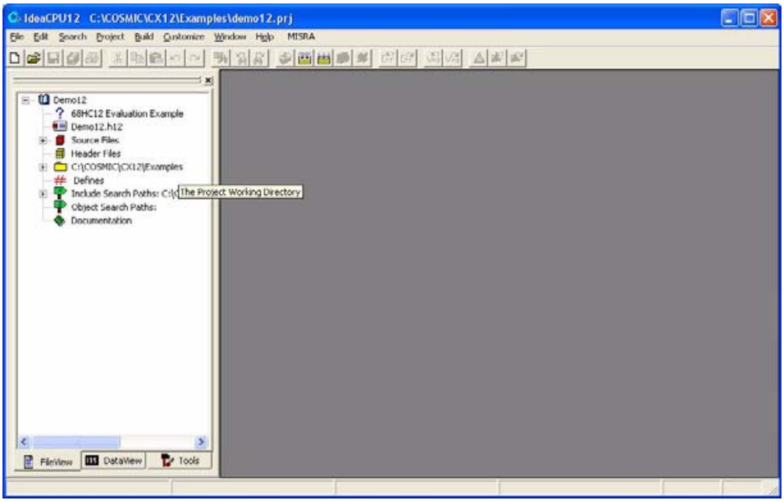

IdeaCPU12 C:\COSMIC\CX12\Examples\demo12.prj
File Edit Search Project Build Customize Window Help MISRA
Demo12
68HC12 Evaluation Example
Demo12.h12
Source Files
Header Files
C:\COSMIC\CX12\Examples
Defines
Include Search Paths: C:\
The Project Working Directory
Object Search Paths:
Documentation
FileView
DataView
Tools

Figure 5: Project pane with demo12.prj project opened

Naming the project

The **Project Name** component lets you specify a name for the project. It also represents the parent component for all project sub-components.

To specify a name for the project, click on the **Project Name** icon . A text cursor appears to the right of the icon. Click on the text cursor to open a text box and enter a project name.

Right click on the **Project Name** icon to view a menu of project commands. These commands are shown in the following table.

Add File	Adds a source file to the project.
Add Group	Adds a group of file to the project.
Save	Saves the project.
Save As	Saves the project with a new name.
Make	Checks source file up-to-date status and dependencies. Then selectively compiles or assembles any out-of-date files and runs the Linker. The icons in the **Project Source Files** folder are colored yellow.
Build	Performs a **Make** as described above and then runs any utilities selected in the **Builder Configuration** dialog box. To have the **Build** rebuild all files regardless of their up-to-date status, right click on the project name, select **Mark All**, and then run the Builder.
Mark All	Marks all project source files for recompile/assemble without changing the file time/date stamp. The icons in the **Project Source Files** folder are colored orange.
Touch All	Marks all project source files for recompile/assemble and updates all project source files with the current system date and time stamp. The icons in the **Project Source Files** folder are colored red.
Documentation	Adds a document file to the project.

Describing the project

The **Project Description** component lets you specify a short description for the project.

To specify a description for the project, click on the **Project Description** icon ?. A text cursor appears to the right of the icon. Click on the text cursor to open a text box and enter a short project description.

Naming the project target file

The **Project Target File Name** component lets you specify a target file name for the project (for example, **acia.h12**. This name is used as the root name for the linked executable.

To specify a project target file name, click on the **Project Target File Name** icon.

A text cursor appears to the right of the icon. Click on the text cursor to open a text box and enter a target file name. Be sure to include the target file name extension; for example, "**.h12**" for the Cosmic HC12/HCS12 compiler.

Right click on the **Project Target File Name** icon to view a menu containing target file commands. These commands are shown in the following table.

Inspect Object	Runs the **Object Inspector** utility (***cobj***) on the target file.
Show Debug	Runs the **Debug Info Examiner** utility (*cprd*) and opens the project debug file in read-only mode.
Produce Hex Records	Runs the **Hex Converter** utility (*chex*), which translates executable images produced by the *clnk* linker to one of several hexadecimal interchange formats.
Produce Absolute Listings	Runs the **Absolute Lister** utility (*clabs*) to generate absolute listings.
Produce IEEE Output	Runs the **IEEE695 Converter** utility (*cv695*) to generate IEEE695 debug format.

Produce ELF Output	Runs the **ELF/DWARF Converter** utility (*cvd-warf*) to generate ELF/Dwarf debug format.
Debug File	Runs the selected ZAP debugger and loads the linked executable.
Delete	Deletes the project target file. A pop-up dialog box asks you to confirm the deletion

Managing project source files

The **Project Source Files** component lets you specify the C and Assembly language source files to be included in the project.

Right click on the **Project Source Files** icon to view a menu containing source file management commands. These commands are shown in the following table.

Add File	Adds a source file to the project.
Add Group	Adds a group of files to the project.
Touch All	Updates all project source files with the current system date and time stamp and marks them for recompile/assemble when a **Make** or **Build** is executed. The icons in the **Project Source Files** folder are colored red.
Mark All	Marks all project source files for recompile/assemble when **Make** or **Build** is executed. This option does not change the time-date stamp of the files. The icons in the **Project Source Files** folder are colored orange.

Adding source files to the project

You can add source files to the project using the **Add File** command:

- To add a source file using the **Add File** command, right click on the **Project Source Files** icon, select **Add File**, and select the file to add from the **Add File** dialog box.

You can select more than one source file at a time using standard Windows conventions for selecting and grouping files.

Working with individual source files

Each source file included in the project is listed next to a **Source File** icon . The **Source File** icon lets you view the source file and its attributes.

Right click on the **Source File** icon to view a menu containing source file commands. These commands are shown in the following table.

Load (read only)	Opens the source file in read-only mode.
Open	Opens the source file for editing.
Remove	Removes the source file from the project.
Mark	Marks the source file for rebuilding. The **Source File** icon is colored orange.
Touch	Updates the source file with the current system date and time stamp and marks it for rebuilding. The **Source File** icon is colored red and the **Source File Time Stamp** icon is updated with the new date and time.
Compile	Compiles or assembles the source file. The source file icon is colored yellow if the **Compile** is successful.
Options	Opens the **Compiler** (or **Assembler**) **Options for Source File** dialog box, where you can specify options for the source file.
Defines	Opens the **#defines** dialog box, where you can specify compiler define options for the source file.
Documentation	Adds a document file for the source file.

Each icon in the source file tree represents a source file component. The source file components are described in the following table.

	Source File Time Stamp
	Source File Documentation

	Source File Options
#	Source File Defines
	Source File Dependencies
	Source File Functions. Appears only if **Project Analysis** option is selected in **Options** sub-menu.
	Source File Variables. Appears only if **Project Analysis** option is selected in **Options** sub-menu.

Source File Time Stamp

The **Source File Time Stamp** component and icon shows the day, date, and time that the file was last saved or "touched".

Source File Documentation

The **Source File Documentation** component shows all documents that are associated with the source file.

Right click on the **Documentation** icon and select **Add Doc** to associate a documentation file with the source file.

The **Document** component lets you view, edit, or remove a document associated with a source file. The appearance of the **Document** icon varies, depending on the type of document.

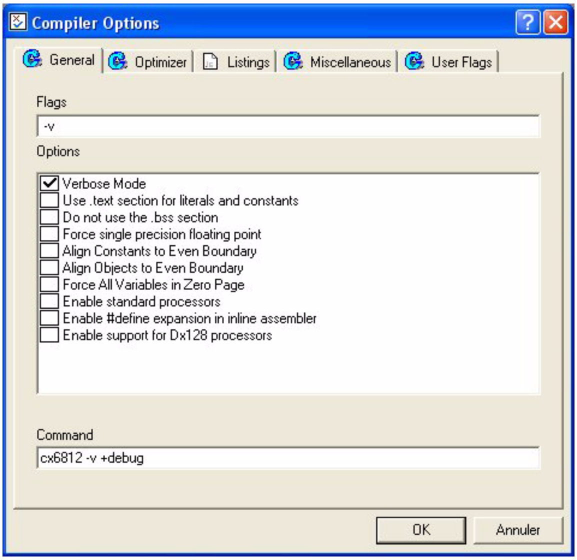
Right-click on the **Document** icon to view a menu containing documentation file commands. The documentation file commands are described in the following table.

Load (read only)	Opens the document in read-only mode.
Open	Opens the document for editing using the appropriate Windows-registered application.
Remove	Removes the document from the project.

Source File Options

The **Source File Options** component lets you specify compiler or assembler options for the source file. These options override the default project compiler or assembler options.

Right-click on the **Source File Options** icon to open the **Compiler** (or **Assembler**) **Options for Source File** dialog box.



Flags
-v

Options
- [✓] Verbose Mode
- [ ] Use .text section for literals and constants
- [ ] Do not use the .bss section
- [ ] Force single precision floating point
- [ ] Align Constants to Even Boundary
- [ ] Align Objects to Even Boundary
- [ ] Force All Variables in Zero Page
- [ ] Enable standard processors
- [ ] Enable #define expansion in inline assembler
- [ ] Enable support for Dx128 processors

Command
```
cx6812 -v +debug
```

Figure 6: Compiler Options for Source File dialog box

The **Compiler** (**Assembler**) **Options** dialog box has five tabs:

- **General options**
- **Optimizer options**
- **Listings options**
- **Miscellaneous options**
- **User Flags**

Choose a tab and select the desired options. Selected options are displayed in bold and unselected options are greyed out. To select an option simply click on the option description. To deselect an option click on the option again.

The source file compiler or assembler options will override the default project compiler or assembler options.

Refer to “Setting default compiler options” on page 25 or “Setting default assembler options” on page 27 for details.

Source File Defines

The **Source File Defines** component lets you specify compiler #define options for a source file.

Right-click on the **Source File Defines** icon # to open the **#defines** dialog box and specify up to twenty user-defined preprocessor symbols.

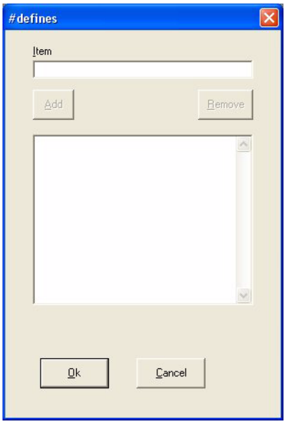


Figure 7: Source File #defines dialog box

To add a symbol to the list, enter the symbol in the **Item** field and click on **Add**. To remove a symbol from the list, select the symbol and click on **Remove**.

You can also add project #defines to the source file #define list by clicking on **Add Project Defines**.

Refer to “Specifying Project Defines” on page 22 for details.

After you add #defines, they appear as individual sub-components in the **Defines** list, each one after a **Define** icon . The define symbol is shown to the right of the icon. In addition, the day, date, and time that the #defines were last updated is shown next to the **Source File Defines** icon.

Source File Dependencies

The **Source File Dependencies** component and icon let you view the files that are named in the source file #includes.

The **File** icon shows a file that is named in the source file #includes. If the file name is enclosed in brackets, it is a system include file and is not typically modified in each project.

If the file name is enclosed in quotes, it is a user include file and can be modified. Right-click on the **File** icon to display a menu include file commands. The include file commands are described in the following table.

Load (read only)	Opens the file in read-only mode.
Open	Opens the file for editing.
Touch	Updates the file with the current system date and time and marks it for rebuilding.

Source File Functions

The **Source File Functions** component and icon let you view the functions in the source file. The **Function** icon shows a function in the source file and lists all of the variables local to that function. Right-click on the **Function** icon to open the source file at the function.

Source File Variables

The **Source File Variables** component and icon let you view the variables that are local to the source file.

The **Variable** icon shows a variable declared with the source file.

NOTE

__Functions__ and __Variables__ appear in the Project window only if __Project Analysis__ is selected from the __Options__ menu.

Specifying the project directory

The **Project Directory** component is used to set the working directory for the project. This is typically where the source code files for the project are located.

Right-click on the **Project Directory** icon to open the **Set Working Directory** dialog box and set the path to the source files.

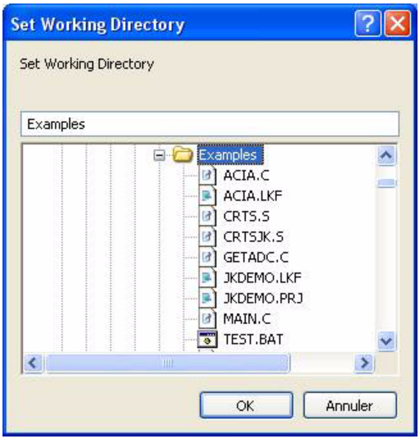


Figure 8: Path Editor dialog box

The **Folder** icon shows folders in the project directory. The **File** icon shows files in the project directory.

Right-click on the **File** icon to display a menu with file commands. The file commands are described in the following table.

Load (read only)	Opens the file in read-only mode.
Open	Opens the file for editing.
Touch	Updates the file with the current system date and time and marks it for rebuilding.

Specifying Project Defines

The **Project Defines** component lets you specify #define options for the project.

Right-click on the **Project Defines** icon # to open the #defines dialog box and specify up to twenty preprocessor symbols.

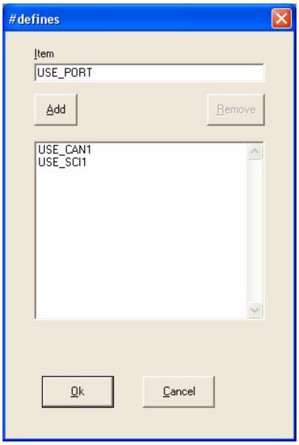


Figure 9: Project #defines dialog box

To add a symbol to the list, enter the symbol in the **Item** field and click on **Add**. To remove a symbol, select it and click on **Remove**.

Symbols defined as project #defines can be imported into source file #defines. Refer to “Source File Defines” on page 19 for details.

After you add project #defines, they appear as individual sub-components in the **Defines** list, each one after a **Define** icon DEFINE.

The define symbol is shown to the right of the icon. In addition, the day, date, and time that the project #defines were last updated is shown next to the **Project Defines** icon.

Specifying project include paths

The **Project Include Paths** component lets you specify include paths for the compiler (**-i** > option).

Right-click on the **Project Include Paths** icon to open the **Include Path Editor** dialog box then click on the **Select** button and specify up to twenty include paths for the project.

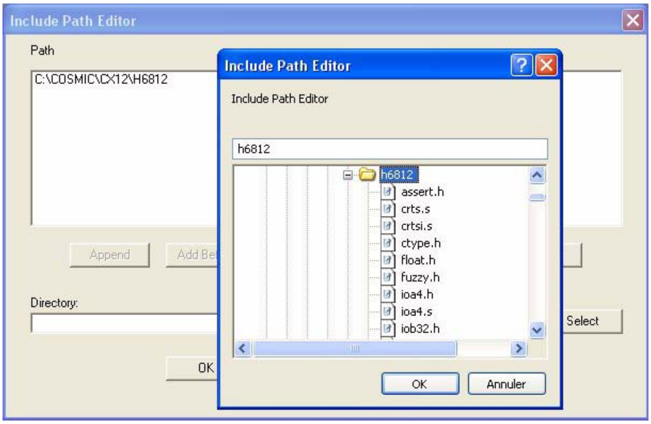


Figure 10: Include Path Editor

You can specify paths in any desired order. The paths are searched from top to bottom by the compiler.

You can use the **Drives** and **Directory** fields to specify the include path. Click on **Append** to add the path to the bottom of the list in the **Path** field.

To position the new path before or after the selected path, select an include path in the **Path** field and click on **Add Before** or **Add After**.

After you add include paths, they appear in order next to the **Project Include Paths** icon and as components in the **Project Include Paths** list, each one after a **Folder** icon.

Include path folders and files

The **Include Path Folder** icon shows folders for include file paths in the project directory. The **Folder** icon shows folders in an include file path.

The **File** icon shows files in an include file path. Right-click on the **File** icon to display a menu with the following commands:

Load (read only)	Opens the file in read-only mode.
Open	Opens the file for editing.
Touch	Updates the file with the current system date and time and marks it for rebuilding.

Configuring project tools

The **Project Tools** tab lets you set project default options for:

- **Compiler**
- **Assembler**
- **Linker**
- **Builder**
- **Debugger**

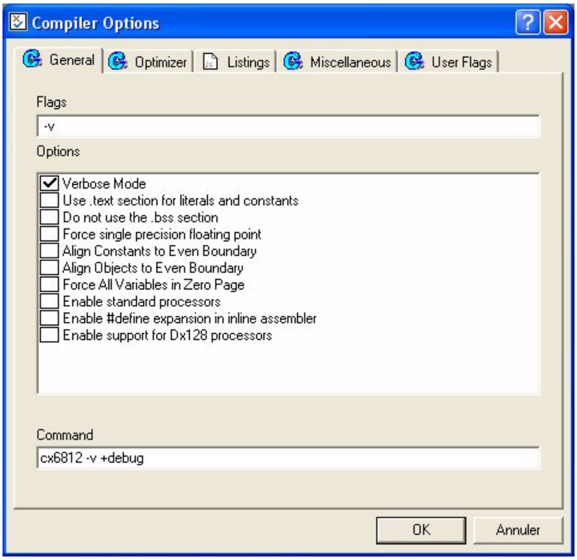
The **Builder** component lets you configure build utilities for the project, including:

- **Object Inspector (*cobj*)**
- **Hex Converter (*chex*)**
- **Debug Info Examiner (*cprd*)**
- **Absolute Lister (*clabs*)**
- **IEEE-695 Converter (*cv695*)**
- **ELF/Dwarf Converter (*cvdwarf*)**

Setting default compiler options

The **Compiler** component lets you set the default compiler options that are used to compile all C code (**.c**) files in a project.

Right click on the **Compiler** icon to open the **Compiler Options** dialog box. You can also double-click on the **Compiler** icon to display the **Compiler Options** icon and then right-click on the **Compiler Options** icon to open the **Compiler Options** dialog box.



Flags: -v

Options:

- [✓] Verbose Mode
- [ ] Use .text section for literals and constants
- [ ] Do not use the .bss section
- [ ] Force single precision floating point
- [ ] Align Constants to Even Boundary
- [ ] Align Objects to Even Boundary
- [ ] Force All Variables in Zero Page
- [ ] Enable standard processors
- [ ] Enable #define expansion in inline assembler
- [ ] Enable support for Dx128 processors

Command: cx6812 -v +debug

Figure 11: Compiler Options dialog box

The **Compiler Options** dialog box has five tabs:

- **General options**
- **Optimizer options**
- **Listings options**
- **Miscellaneous options**
- **User Flags**

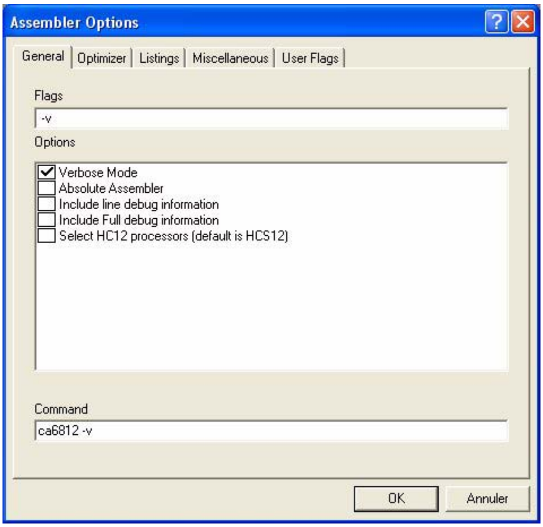
Choose a tab and select the desired options. Selected options are displayed in bold and unselected options are greyed out. To select an option, simply click on the option description. To deselect an option, click on the option again.

The default compiler options can be overridden by setting compiler options for the individual source files. Refer to “Source File Options” on page 18 for details.

Setting default assembler options

The **Assembler** component lets you set the default assembler options that are used to assemble all assembly language (**.s**) files in a project.

Right click on the **Assembler** icon Asm to open the **Assembler Options** dialog box. You can also double-click on the **Assembler** icon to display the **Assembler Options** icon and then right-click on the **Assembler Options** icon to open the **Assembler Options** dialog box.



Flags: -v

Options:
- [✓] Verbose Mode
- [ ] Absolute Assembler
- [ ] Include line debug information
- [ ] Include Full debug information
- [ ] Select HC12 processors (default is HCS12)

Command: ca6812 -v

Figure 12: Assembler Options dialog box

The **Assembler Options** dialog box five tabs:

- **General options**
- **Optimizer options**
- **Listings options**
- **Miscellaneous options**
- **User Flags**

Choose a tab and select the desired options. Selected options are displayed in bold and unselected options are greyed out. To select an option, simply click on the option description. To deselect an option, click on the option again.

The default assembler options can be overridden by setting assembler options for the individual source files. Refer to “Source File Options” on page 18 for details.

Setting default linker options

The **Linker** component lets you set the default ***clnk*** **utility** options that are used to link all files in a project. You can also specify a linker command file and edit the file.

Right click on the **Linker** icon to view a menu containing linker commands. The linker commands are described in the following Table.

Options	Opens the **Link Configuration** dialog box.
Edit Command File	Opens the project link command file for editing.
Change Command File	Opens the **Select Linker Command File** dialog box.

You can also double-click on the **Linker** icon to display the **Linker Options** icon and the **Linker Command File** icon .

Setting the linker configuration

Select **Options** from the **Project Linker** menu (or right-click on the **Linker Options** icon) to open the **Link Configuration** dialog box.

The **Link Configuration** dialog box lets you specify:

- **Linker options**
- **Libraries path option**
- **Reporting mode option**
- **Memory banking option**

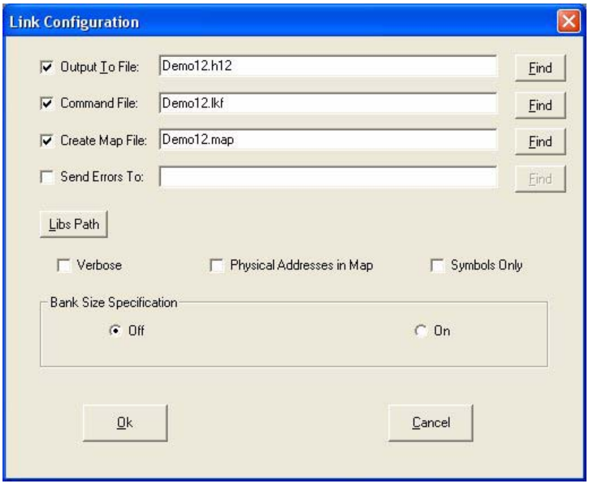

Link Configuration
[✓] Output To File: Demo12.h12
[✓] Command File: Demo12.lkf
[✓] Create Map File: Demo12.map
[ ] Send Errors To:
Find
Libs Path
[ ] Verbose
[ ] Physical Addresses in Map
[ ] Symbols Only
Bank Size Specification
[✓ Off] On
Ok
Cancel

Figure 13: Link Configuration dialog box

Specifying linker options

The Link Configuration dialog box lets you specify ***clnk*** **utility** options. These options are described in the following Table.

Output file	(**-o** option): writes output to the specified file. This option is required and has no default value.
Command file (.lkf)	The linker command file. This option is required and has no default value.
Map file	(**-m** option): produces map information for the program being built to the specified file.
Error file	(**-e** option): logs errors in the text file specified instead of displaying the messages on the screen.

After you select any one of these files, you can click on the **Find** button to specify the file name and path.

Specifying the libraries path

Click on the **Libs Path** button to open the **Libraries Path Editor** then click on the **Select** button and set a path to the compiler library (**-l >** option).

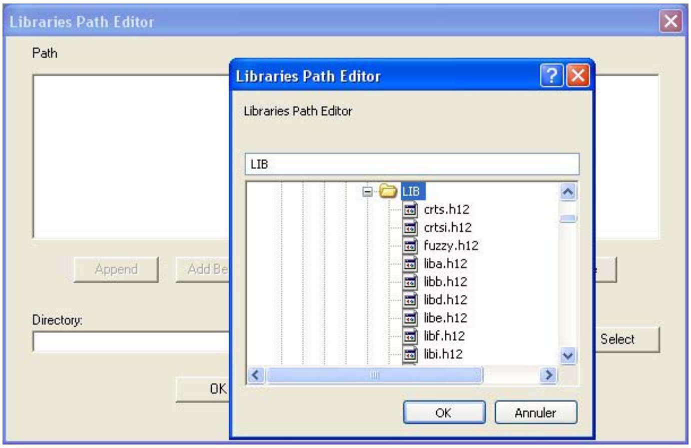


Figure 14: Libraries Path Editor

You can specify up to twenty library paths in any order. The paths are searched from top to bottom. After you add paths, they appear in order next to the **Libs Path** button.

Other linker options you can set are described in the following table.

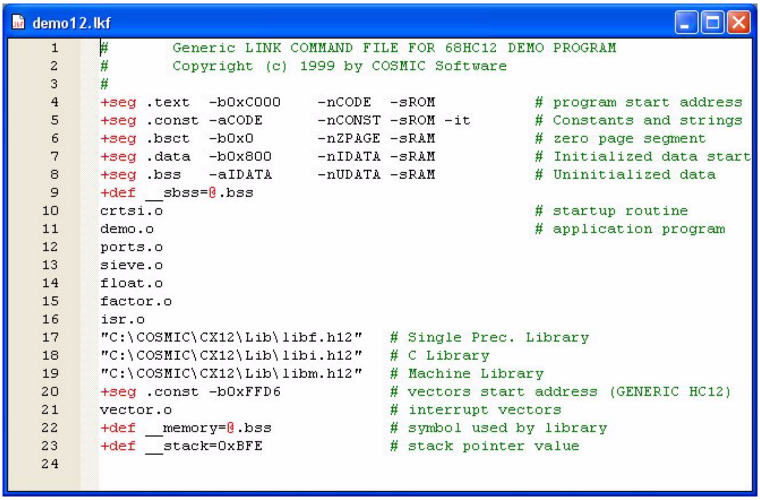
Verbose	(**-v** option): be verbose.
Symbols Only	(**-s** option): create an output file containing only an absolute symbol table, but still with an object file format.

Physical Addresses in Map	(**-p** option): display symbols with physical address instead of logical address in the map file.
Bank Size Specification	(**-bs** option): enter the **size** of the page to be used. The size is translated to the correct **-bs** option for the linker. For example the default page size for HC12/HCS12 paging is 0x4000 which translates to a **-bs14**. The default value for most processors is **0** (bank switching **disabled**).

Editing the linker command file

Before you can edit a linker command file, you must first check the **Command File** check box in the **Link Configuration** dialog box and then specify a linker command file name and path.

Select **Edit Command File** from the **Project Linker** menu (or right-click on the **Linker Command File** icon) to open the linker command file for editing.



```
#       Generic LINK COMMAND FILE FOR 68HC12 DEMO PROGRAM
#       Copyright (c) 1999 by COSMIC Software
#
+seg .text  -b0xC000    -nCODE  -sROM           # program start address
+seg .const -aCODE      -nCONST -sROM -it       # Constants and strings
+seg .bsct  -b0x0       -nZPAGE -sRAM           # zero page segment
+seg .data  -b0x800     -nIDATA -sRAM           # Initialized data start
+seg .bss   -aIDATA     -nUDATA -sRAM           # Uninitialized data
+def __sbss=@.bss
crtsi.o                                         # startup routine
demo.o                                          # application program
ports.o
sieve.o
float.o
factor.o
isr.o
"C:\COSMIC\CX12\Lib\libf.h12"   # Single Prec. Library
"C:\COSMIC\CX12\Lib\libi.h12"   # C Library
"C:\COSMIC\CX12\Lib\libm.h12"   # Machine Library
+seg .const -b0xFFD6            # vectors start address (GENERIC HC12)
vector.o                        # interrupt vectors
+def __memory=@.bss             # symbol used by library
+def __stack=0xBFE              # stack pointer value
```

Figure 15: Linker command file for demo12.prj

To edit the linker command file, you can make changes directly in the file using the options in the **Edit** menu. Type **Alt+E** to view the editing options. You can also right click to view a menu of editing options.

Changing the linker command file

Select **Change Command File** from the **Project Linker** menu to change the linker command file. The **Select Linker Command File** dialog box lets you specify a file name and path for the new linker command file.

After you select a new command file, the **Command File** check box is checked in the **Link Configuration** dialog box, and the linker command file name and path are displayed.

Specifying project builder utilities

The **Project Builder** component lets you specify utilities for building the project.

Right click on the **Project Builder** icon to open the **Builder Configuration** dialog box. You can also double-click on the **Project Builder** icon to display the **Builder Options** icon , and then right-click on the **Builder Options** icon to display the **Builder Configuration** dialog box.

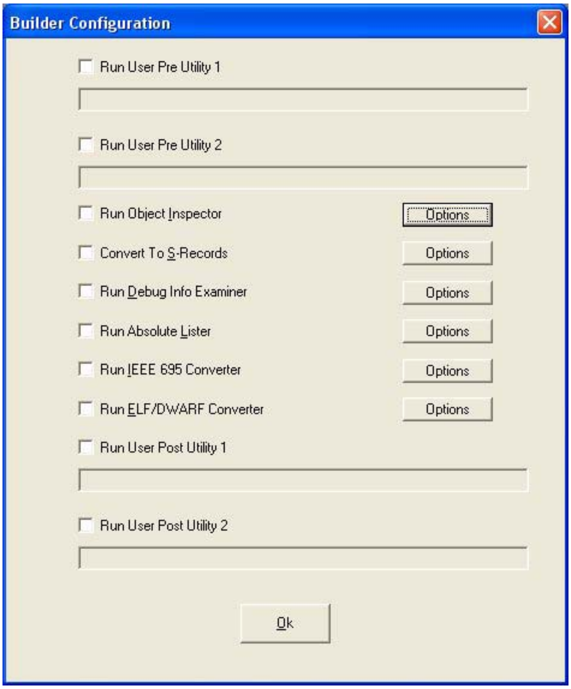


Figure 16: Builder Configuration dialog box

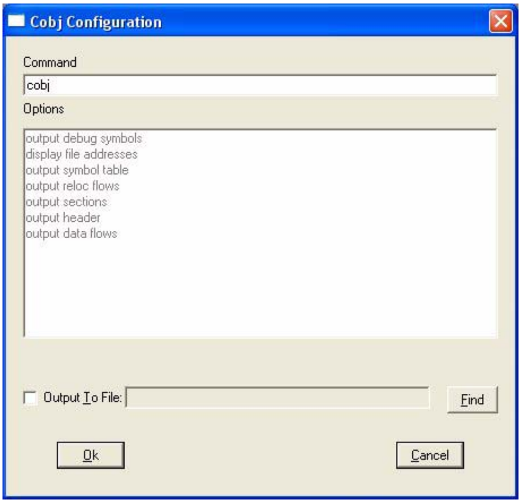
The **Builder Configuration** dialog box contains check boxes that let you specify which builder utilities to run. The builder utilities are described in the following table.

Run Object Inspector	Runs the ***cobj* utility** to examine object modules. If you select **Run Object Inspector** and then click on the **Options** button, the **Options** dialog box appears. Refer to "Configuring the Object Inspector utility" on page 35 for details.
Convert to S-Records	Runs the ***chex* utility** to translate object module format to hexadecimal format. If you select **Convert to S-Records** and then click on the **Options** button, the **CHEX Configuration** dialog box appears. Refer to "Configuring the Hex Converter utility" on page 36 for details.
Run Debug Info Examiner	Runs the ***cprd* utility** to print debugging information about functions and data objects. If you select **Run Debug Info Examiner** and then click on the **Options** button, the **CPRD Configuration** dialog box appears. Refer to "Configuring the Debug Info Examiner utility" on page 38 for details.
Run Absolute Lister	Runs the ***clabs* utility** to generate absolute listings. If you select **Run Absolute Lister** and then click on the **Options** button, the **CLABS Configuration** dialog box appears. Refer to "Configuring the Absolute Lister utility" on page 40 for details
Run IEEE 695 Converter	Runs the ***cv695* utility** to generate IEEE695 format. If you select **Run IEEE 695 Converter** and then click on the **Options** button, the **cv695 Configuration** dialog box appears. Refer to "Configuring the IEEE695 Converter utility" on page 42 for details.
Run ELF/Dwarf Converter	Runs the ***cvdwarf* utility** to generate ELF/Dwarf format. If you select **Run ELF/Dwarf Converter** and then click on the **Options** button, the **CVDWARF Configuration** dialog box appears. Refer to "Configuring the CVDWARF Converter utility" on page 44 for details.
Run User Utility 1	Runs the specified user utility. You can specify a path and filename for the utility.
Run User Utility 2	Runs the specified user utility. You can specify a path and filename for the utility.

Configuring the Object Inspector utility

The ***cobj* utility** lets you inspect relocatable object files or executable output by the assembler or linker. The ***cobj* utility** can be used to check the size and configuration of relocatable object files or to output information from their symbol tables.

Right click on the **Object Inspector** icon and select **Options** to open the **Options** dialog box. You can also double-click on the **Object Inspector** icon to display the **Options** icon and then right-click on it to display the **Options** dialog box.



Cobj Configuration

Command

cobj

Options

output debug symbols
display file addresses
output symbol table
output reloc flows
output sections
output header
output data flows

Figure 17: *cobj* utility Options dialog box

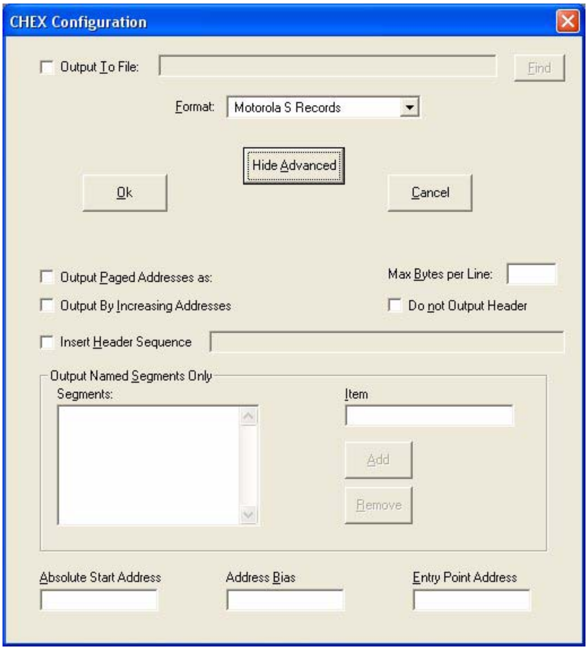
Selected options are displayed in bold and unselected options are greyed out. To select an option simply click on the option description and it is added to the command line. To deselect an option click on the option again.

You can also specify a path and file name to receive the **Object Inspector** output. This file may be in relocatable format or executable format.

Configuring the Hex Converter utility

The ***chex* utility** translates executable images produced by the ***clnk* utility** to one of several hexadecimal interchange formats.

Right click on the **Hex Converter** icon and select **Options** to open the **CHEX Configuration** dialog box. You can also double-click on the **Hex Converter** icon to display the **Options** icon and then right-click on it to display the **CHEX Configuration** dialog box.


CHEX Configuration

Output To File: [ ]

Format: Motorola S Records

Output Paged Addresses as: [ ]

Max Bytes per Line:

Output By Increasing Addresses [ ]

Do not Output Header [ ]

Insert Header Sequence [ ]

Output Named Segments Only

Segments:

Item

Absolute Start Address

Address Bias

Entry Point Address

Figure 18: CHEX Configuration dialog box

The following Table describes the formats and options that are available.

Motorola S Records format	(**-fm** option) - produces S1 and S2 records as needed.
Motorola S2 Records format	(**-f2** option) - produces S2 records only. This is the default.
Motorola S3 Records format	(**-f3** option) - produces S3 records only. This is the default.
Intel Hex format	(**-fi** option) - produces Intel Hex only.
Absolute Start Address	(**-a** option) - the output address of the first byte.
Address Bias	(**-b** option) - subtract from any address before output.
Max Bytes per line	(**-m** option) - maximum data bytes per line. The default is 32 bytes per line.
Do not Output Header	(**-h** option) - do not output header sequence if such sequence exists for the selected format.
Output Paged Addresses	(**-p** option) - output addresses of banked segment.
Output by Increasing Addresses	(**-s** option) - sort the output addresses in increasing order.
Output to File	(**-o** option) - the default is STDOUT.
Insert Header Sequence	(**+h** option) - insert header sequence if such sequence exists for the selected format.
Output named segments only	(**-n** option). Up to twenty different named segments can be specified. To add a named segment to the **Segments** field, enter the named segment in the **Item** field and click on the **Add** button. To remove a named segment from the **Segments** field, select the segment and click on the **Remove** button.

Configuring the Debug Info Examiner utility

The ***cprd*** **utility** extracts and prints information about functions and data objects from an object module or executable image that has been compiled with the **+debug** option.

Right click on the **Debug Info Examiner** icon and select **Options** to open the **CPRD Configuration** dialog box. You can also double-click on the **Debug Info Examiner** icon to display the **Options** icon and then right-click on it to display the **CPRD Configuration** dialog box.

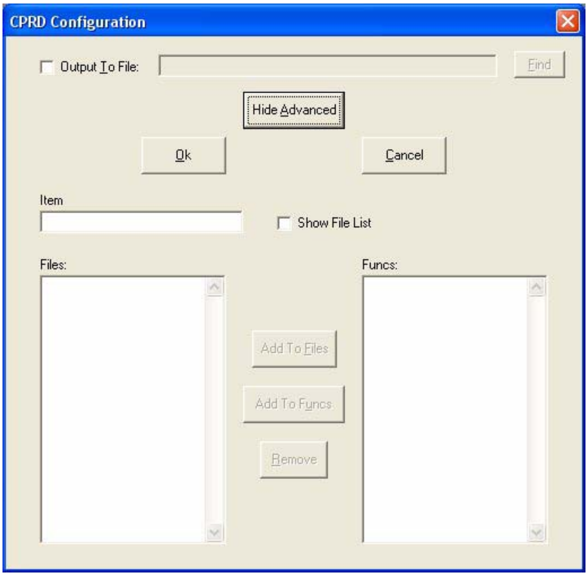


Figure 19: CPRD Configuration dialog box

The **CPRD Configuration** dialog box lets you build a list of files and functions for debugging purposes. Enter a file or function name in the **Item** field, and then click on **Add to Files** to add the item to the **Files** list or **Add to Funcs** to add the item to the **Functions** list.

If you check the **Show File List** check box, the **Item** field changes to a **File List** field, with a drop-down list of the files in the project directory. Select a file from the list and then click on the **Add to Files** button to add it to the **Files** list.

To remove an item from either list, select the item and then click on the **Remove** button.

Each file in the **Files** list is processed with the **-fl** option, which prints debugging information about the file. By default, the ***cprd*** utility prints debugging information on all C source files.

Each function in the **Functions** list is processed with the **-fc** option, which prints information only about the function. By default, the ***cprd*** utility prints debugging information on all functions in a file.

You can also specify a path and file name to receive the debugger output. This is equivalent to the ***cprd*** utility **-o** option. By default, the ***cprd*** utility writes debugging information to the terminal screen.

Configuring the Absolute Lister utility

The ***clabs* utility** processes relocatable C and Assembly listing files with the associated executable file to produce absolute listings with updated code and address values.

Right click on the **Absolute Lister** icon and select **Options** to open the **CLABS Configuration** dialog box. You can also double-click on the **Absolute Lister** icon to display the **Options** icon and then right-click on it to display the **CLABS Configuration** dialog box.

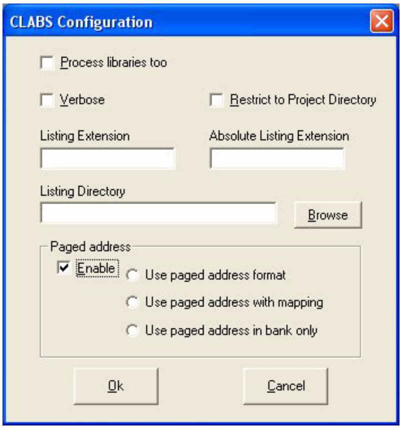


Figure 20: CLABS Configuration dialog box

The *clabs* utility options are described in the following table.

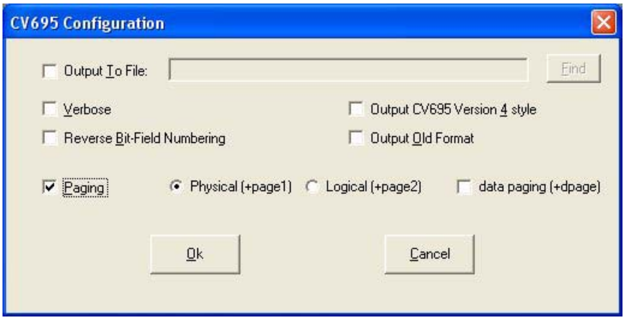
Process Libraries too	(**-a** option) - process also files located in libraries.
Verbose	(**-v** option) - the name of each module of the application is output to STDOUT.
Restrict to Project Directory	(**-l** option) - process files in the project directory only. The default is to process all files of the application.
Listing Extension	(**-r** option) - specify the input file extension. The default is "**.ls**".

Absolute Listing Extension	**(-s** option**) -** specify the output file extension. The default id "**.la**"
Paged Address	(**-p** option) - output addresses of banked segment.

Configuring the IEEE695 Converter utility

The ***cv695* utility** converts a file produced by the linker into IEEE695 format.

Right click on the **IEEE695 Converter** icon and select **Options** to open the **CV695 Configuration** dialog box. You can also double-click on the **IEEE695 Converter** icon to display the **Options** icon and then right-click on it to display the **CV695 Configuration** dialog box.


CV695 Configuration

☐ Output To File: Find

☐ Verbose ☐ Output CV695 Version 4 style

☐ Reverse Bit-Field Numbering ☐ Output Old Format

☑ Paging [✓ Physical (+page1)] Logical (+page2) ☐ data paging (+dpage)

Ok Cancel

Figure 21: CV695 Configuration dialog box

The *cv695* utility options are described in the following table.

Verbose	**(-v** option**) -** the ***cv695*** utility displays information about its activity.
Reverse Bit-Field Numbering	**(-rb** option**) -** reverses bitfield from left to right.
Paging	(**+page#** option) - this option is currently meaningful for the **HC12/HCS12** only. This option specifies the address format for bank-switched code. If you check the **Paging** check box, three options appear to the right: **Physical (+page1)** - the application is banked and the *cv695* utility outputs physical addresses. This is the default if **Paging** is checked. **Logical (+page2)** - the application is banked and the *cv695* utility outputs addresses in paged mode: `<page><offset_in_page>`. This is equivalent to the old **+paged** flag. **data paging (+dpage)** - the application uses data paging.
Output to File	(**-o** option) - you can specify a path and file name to receive the *cv695* utility output. By default, the *cv695* utility outputs to the file whose name is obtained from the input file by replacing the filename extension with "**.695**".

Configuring the CVDWARF Converter utility

The ***cvdwarf* utility** converts a file produced by the linker into ELF/ Dwarf format.

Right click on the **CVDWARF Converter** icon and select **Options** to open the **CVDWARF Configuration** dialog box. You can also double-click on the **CVDWARF Converter** icon to display the **Options** icon and then right-click on it to display the **CVDWARF Configuration** dialog box.

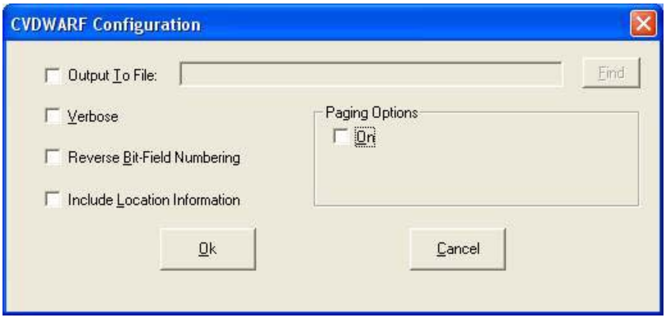


Figure 22: CVDWARF Configuration dialog box

The *cvdwarf* utility options are described in the following table:

Verbose	(**-v** option) **-** the ***cvdwarf*** utility displays information about its activity.
Paging	(**+page#** option) - this option is currently meaningful for the **HC12/HCS12** only. This option specifies the address format for bank-switched code. If you check the **Paging** check box, three options appear to the right: **Physical (+page1)** - the application is banked and the *cv695* utility outputs physical addresses. This is the default if **Paging** is checked. **Logical (+page2)** - the application is banked and the *cv695* utility outputs addresses in paged mode: `<page><offset_in_page>`. This is equivalent to the old **+paged** flag. **data paging (+dpage)** - the application uses data paging.
Reverse Bit-Field Numbering	(**-rb** option) **-** reverses bitfield from left to right.
Include location information	(**-loc** option) location lists are used in place of location expressions whenever the object whose location is being described can change location during its lifetime. THIS POSSIBILITY IS NOT SUPPORTED BY ALL DEBUGGERS.
Output to File	(**-o** option) - you can specify a path and file name to receive the *cvdwarf* utility output. By default, the *cvdwarf* utility outputs to the file whose name is obtained from the input file by replacing the filename extension with "**.elf**".

Specifying a project debugger

Right-click on the **Debugger** icon in the **Project>Tool** tab to open a dialog box that allows you to specify a debugger for the project.

After you select a debugger, the path and filename appears after the **Project Debugger** icon.

Once you have specified a debugger, you can double click on the **Debugger** icon to run the ZAP debugger with the project target file opened or select the debugger icon from the toolbar.

Specifying project documentation

The **Project Documentation** component shows all documents that are associated with the project.

Right click on the **Documentation** icon and select **Add Doc** to associate a documentation file with the project.

The **Document** icon lets you view, edit, or remove a document associated with the project. The appearance of the icon varies, depending on the type of document.

Right-click on the **Document** icon to view a menu containing documentation file commands. These commands are described in the following table.

Load (read only)	Opens the document in read-only mode.
Open	Opens the document for editing.
Remove	Removes the document from the project.

Building a Project

After a project is configured, you need to build the application. There are a three different ways to do this:

1) Right click on the **Project Name** icon in the Project window and select **Make** or **Build** from the pop-up menu.

2) Choose **Compile** (single, open file), **Make**, or **Build** from the **Project** pull-down menu.

3) Click on one of the following tools on the Tool bar:

	Compile tool - compiles (**.c** file) or assembles (**.s** file) an open project source file. Options are specified in the **Compiler** or **Assembler Options** dialog box.
	Build Project tool - checks source file up-to-date status and dependencies. Selectively compiles or assembles any out-of-date files and runs the Linker.
	Rebuild All tool - performs a Make by rebuilding all files regardless of their up-to-date statusand then runs any utilities selected in the **Builder Configuration** dialog box.

For additional details on the project building tools, refer to Chapter 4, "*IDEA User interface*" in the IDEA User's Guide.

For additional details on building an IDEA project, refer to Chapter 7, "*Building an IDEA Project*" in the IDEA User's Guide.

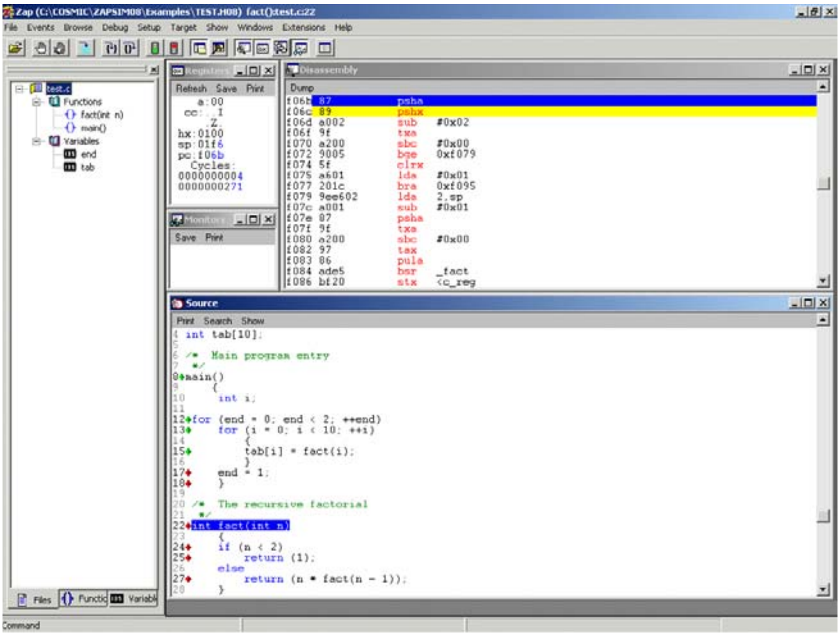
Debugging a project

IDEA lets you use a Cosmic ZAP debugger to debug your project.

You can open the ZAP Debugger by clicking on the **Debugger** tool in the Tool bar.

NOTE

Before you can use the ZAP debugger, you must first specify its location by right clicking on the ***Debugger*** *tool in the* ***Tool Browser*** *(select* ***Tools*** *from the Main menu to open the* ***Tool Browser****). This opens a dialog box that allows you to specify the debugger for the project.*



```
a:00
cc:..I
.Z.
hx:0100
sp:01f6
pc:f06b
Cycles:
0000000004
0000000271
```

```
f06b 87        psha
f06c 89        pshx
f06d a002      sub   #0x02
f06f 9f        txa
f070 a200      sbc   #0x00
f072 9005      bge   0xf079
f074 5f        clrx
f075 a601      lda   #0x01
f077 201c      bra   0xf095
f079 9ee602    lda   2,sp
f07c a001      sub   #0x01
f07e 87        psha
f07f 9f        txa
f080 a200      sbc   #0x00
f082 97        tax
f083 86        pula
f084 ade5      bsr   _fact
f086 bf20      stx   <c_reg
```

```
int tab[10];

/*  Main program entry
 */
main()
    {
    int i;

for (end = 0; end < 2; ++end)
    for (i = 0; i < 10; ++i)
        {
        tab[i] = fact(i);
        }
    end = 1;
    }

/*  The recursive factorial
 */
int fact(int n)
    {
    if (n < 2)
        return (1);
    else
        return (n * fact(n - 1));
    }
```

Figure 23: ZAP Debugger with project target file open

When you run the ZAP Debugger from within IDEA, the ZAP Debugger automatically opens the target file for the currently loaded project (for example, **acia.h12**.

For details on using the ZAP Debugger, refer to the ZAP User's Guide.