Document Version

3.1

PROCESSOR EXPERT FOR FREESCALE HC(S)08, RS08 & ColdFire V1

Freescale Semiconductor, Inc.

Processor Expert and Device Initialization

User Guide

PROCESSOR EXPERT AND DEVICE INITIALIZATION FOR FREESCALE HC(S)08, RS08 &
COLDFIRE V1 FAMILY
SOFTWARE DEVELOPMENT TOOLS FOR HC(S)08, RS08 & COLDFIRE V1 DESIGNERS

Processor Expert and Device Initialization User Guide

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Software Product Decription and Benefits

About the Product

SOFTWARE PRODUCT DESCRIPTION

This release package contains software tools to support development of applications for Freescale HC(S)08, RS08 & ColdFire V1 series of microcontrollers.

PROCESSOR EXPERT PLUG-IN is the Processor Expert™ environment integrated into the CodeWarrior IDE application.

DEVICE INITIALIZATION PLUG-IN is a powerful and easy to learn tool for generating a CPU peripheral initialization code in C or assembler.
(For ColdFire V1, the assembly initialization code generation is not available.)

COMPONENT WIZARD (OPTIONAL) is a tool for creating user components including examples and its on-line documentation.

BENEFITS

- Integrated development environment increases productivity and saves time and cost.
- Usage of the tool minimizes the time to learn the microcontroller.
- All tools have a user friendly time-saving graphical user interface.
- Processor Expert allows rapid prototyping of entire application.
- Processor Expert provides modular, reusable and fully tested functions.
- It’s easy to modify and port the existing implementations using Processor Expert.
- Processor Expert and Device Initialization support all on-chip peripherals and provide design-time settings verifications.
- Device Initialization generates fully commented CPU initialization code in assembler or C language.

Chapter

2

System Requirements, Installation Process Step-by-Step

Installation

SYSTEM REQUIREMENTS

Please refer to README.TXT file.

INSTALLATION STEP-BY-STEP

Please follow the CodeWarrior installation process (see CodeWarrior User Guide).

Chapter

3

CodeWarrior and Processor Expert Licensing Options

Licensing

CODEWARRIOR EDITIONS

Processor Expert plugin and Device Initialization plugin are distributed exclusively as a part of the CodeWarrior Development Studio. There are various CodeWarrior licensing options scaled from a simple free limited version to the fully equipped one.

Please visit the CodeWarrior home page http://www.freescale.com/codewarrior or contact your nearest Freescale distributor for details on availability and ordering.

Chapter

4

First-time Usage of the Processor Expert

Getting Started with Processor Expert

ABOUT THE TOOL

Processor Expert (PE) is an Integrated Development Environment (IDE) for design, implementation, verification, optimization of the embedded microcontroller applications. This high productivity development platform allows efficient use of microcontrollers and their peripherals, allows building of portable solutions, and saves development time and cost. For latest information about the Processor Expert and related tools for HC(S)08, RS08 & ColdFire V1 please visit the website http://www.processorexpert.com.

Processor Expert has a built-in knowledge (internal definitions) of the entire microcontrollers with all their integrated peripherals. Functional elements are encapsulated using the concept of configurable components (called Components) that provide methods and event subroutines. An intuitive and powerful graphical UI allows users to define the desired behavior of the system by using components with their settings and drag & drop selections. The IDE simplifies the utilization of the generated code within the application code.

Notice: For RS08 derivatives only the Peripheral Initialization Components are available.

TYPICAL DEVELOPMENT STEPS

This chapter describes a typical development process (step-by-step) and contains recommendations/tips for your first application:

1. **Create a new project, select and configure a CPU components**
   - Start the CodeWarrior
   - Click the button ‘Create New Project’. A ‘New project’ wizard appears.
   - Specify the name of the project and its location. Check the ‘C‘ language.
   - Select the CPU derivative and connection/target you would like to use.
   - Skip ‘Add Additional Files’ step.

- Select ‘Processor Expert’ in Rapid Application Development options.
- Don’t change settings in C/C++ options and PC-lint configuration steps.
- A new Processor Expert project is created and the target CPU component is displayed in the Processor Expert Project Panel (it is a tab in the project panel of CodeWarrior). Double-click on the CPU component icon to select it and open Component Inspector, which allows customizing the Component settings. The default settings of the CPU components are suitable for most applications.

2. **Find a component suitable for the desired function in the Component Selector (using the command `Processor Expert | View | Component selector`). Components are sorted by category in folders.**
   - Processor Expert project consists of building blocks called **Embedded Components** . Each component represents encapsulation of functionality of any on-chip peripheral, external peripheral, virtual peripheral or some software algorithm. *See section Supported components for more information on supported components and their functionality*.
   - Double-click on the component name in the Component Selector and the component will be added to your Project. Components of the current project are visible in the Processor Expert Project Panel.
3. **Configure the behavior of the component by setting its properties, and decide which methods and events will be contained in the generated component modules.**
   - **Component Inspector** shows Properties, Methods and Events of the selected component.
   - **Properties** define the component connection to the target CPU, settings of allocated peripherals, an initialization of the component and other run-time component options.
   - **Methods** are functions generated by the Processor Expert and intended to be utilized by the user. Methods are located in the generated code modules, which should not be changed by the user. Each component has got its own module with the same name.
   - **Events** are the functions templates, which are called from the component modules like an interrupt service routines. Events are generated into the event module (events.c) and should be implemented by the user.
4. **Repeat previous two steps to insert all components needed for the desired function.**
5. **If exclamation marks are displayed in Project Panel or Component inspector, the component settings are wrong or conflict with each other.**
   - Processor Expert provides powerful design-time verifications, which protects users from the run-time problems and bugs. Error messages are displayed in the third column of the Component Inspector or in the Error Window.

- **Peripherals settings:** Processor Expert verifies if the selected peripheral meet the Component requirements.
- **Peripheral allocation:** Processor Expert also provides a protection against usage of one peripheral by several components. If the peripheral is used by one component, its settings cannot be modified by any other component.
- **Timing:** The settings of all timed devices are checked. If no error is detected, it means that you can work with the given settings without problem in runtime. Generated modules are provided in such a way that they cannot influence each another - it means that, even if several components share one physical device, changes in the component settings using the values given (and checked) by the Processor Expert is possible in run-time without affecting any other component.

6. **Initiate code generation using the command `main menu | Processor Expert | Generate Code` and check the error window. If the code generation was successful (no errors), proceed with the next step.**

   - All the Component modules are generated during code generation process, and the event and main modules are updated (or created if does not exist). See *generated modules* in the folder *Generated code* of the *Files* tab in the CodeWarrior's project panel.
   - The code generation finishes successfully only if the project is set-up correctly.

7. **Utilize component methods by placing their calls into the user modules (the main module, event functions or other user modules). List of methods is available for each component in the Project Panel window. User written code should be only added into the main, event and user modules.**

   - The main function is located in the module with the name same as the project name and it is called immediately after initialization of the CPU and components.
   - Event handlers are located in the Events module (*events.c*).
   - Do not modify other generated component modules. These files are re-generated during every code generation, so any user changes would be lost. For information on advanced options allowing to disable overwriting of the component modules by PE, please see the Processor Expert help.

8. **Build the application and correct errors found by compiler.**

   - CodeWarior integrated development environment allows to build the application automatically. Use `command main menu | Project | Make` to compile your application. Build and make commands will invoke code generation if it is necessary.

9. **If you need to add another components to your project, go back and continue with step 2**

   - Component Inspector can hide the advanced settings of the component using the predefined view levels: basic, advanced and expert (see the `Component Inspector | Items Visibility` menu). Basic level is selected by default and you can get more options for the component by selecting a higher level.

- You can add also external user modules to your project. These are listed in CodeWarrior Project Panel in the ‘user modules’ folder of the ‘files’ tab. Use the commands `Project Panel | User Modules (popup menu)| Add User Module` or `Project Panel | User Modules (popup menu)| New User Module` (popup menu is opened using the right mouse button click on the appropriate object).

SUPPORTED COMPONENTS

Embedded Component is a component which can be used in Processor Expert. Embedded components encapsulate functionality of basic elements of embedded systems (like CPU core, CPU on-chip peripherals, standalone peripherals, virtual devices, and pure software algorithms) and provide the control of these devices via properties, methods, and events (like objects in Object Oriented Programming). Processor Expert generates modules for Freescale C Compiler from each component. Each generated module contains initialization of the component and peripheral and optimized code of methods, according to user settings of the component.

All components are listed in the Component Selector window. A component can be added to the project by clicking on the icon or the component name. It provides various ways of searching for component.

When you want to use components you need license that is provided along with the CodeWarrior. Please see the chapter Licensing for details on licensing information. In the demo mode (without any license) the restricted group of components generates code. For more information see documentation of the CodeWarrior.

ADDITIONAL COMPONENTS

Many additional components can be freely downloaded from the Downloads section of our website: **http://www.processorexpert.com** . These components are licensed under the *Software Beans* license.

IMPORTANT INFORMATION FOR BEGINNERS

You can find the following useful information in the documentation provided with the Processor Expert :

- **Tutorial Courses** – step-by-step procedure how to build a simple application in Processor

Expert.

```
Help | Processor Expert | Tutorial
```

- **Ready to use examples** can be opened using the button `Load Example` available in the startup screen.
- **Quick Start -** recommendations how to learn the Processor Expert quickly.

```
Help | Processor Expert | Quick start
```

- **List of Supported Components -** list of supported components with link to more detailed description.

```
Help | Processor Expert | Embedded Components
```

```
Processor Expert |View | Installed Components Overview
```

- **Processor Expert main help**

```
Help | Processor Expert | Processor Expert Help
```

For further information please see also the other documentation included in the CodeWarrior installation.

INFORMATION FOR ADVANCED USERS

- **Test projects** - With usage of these projects user can easily test functionality of Embedded components and internal peripherals. Each component has one test project located in `Projects\Test` projects subdirectory.
- **Component Wizard** is a tool for a user component construction. The usage of the tool requires a deep knowledge of Processor Expert principles and skills.

Chapter

5

First Steps With Device Initialization

Getting Started with Device Initialization

ABOUT THE TOOL

Device Initialization is a fast, easy and user-friendly way to configure and generate a CPU peripheral initialization code in assembly or C language. The tool is intended for users that do not require C drivers for high-level peripheral control provided by Processor Expert.

Notice: Device Initialization support for the ColdFire V1 derivatives is limited to C language output.

IMPORTANT INFORMATION FOR BEGINNERS

You can find the following important information in the documentation provided with the CodeWarrior Device Initialization Plug-in.

- **Tutorial Courses** – step-by-step procedure how to build a simple application in Processor Expert.

  ```
  Help | Processor Expert | Device Initialization Tutorial
  ```

- **Ready to use examples** can be opened using the button `Load Example` available in the startup screen.
- **Quick Start -** recommendations how to learn the Processor Expert quickly.

  ```
  Help | Processor Expert | Device Initialization Help
  ```

- **List of supported Peripheral Initialization Components and CPUs** – list of supported peripheral initialization components with detailed description of the component parameters.

Help | Device Initialization | List of all supported CPUs

Chapter

6

Support Services

Support

FREESCALE

To obtain an assistance with Processor Expert or any related product for Freescale HC(S)08, RS08 & ColdFire V1 family, please contact the Freescale Technical Support.

WWW

http://www.frescale.com/codewarrior

EMAILS

cw_support@freescale.com

Chapter

7

Main Contacts

Contacts

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Chapter

8

List of Revisions

Revisions

Version	Revision Date	Description - Summary of Changes
2.0	April, 2006	New layout and formatting. Language corrections.
2.1	October, 2006	Updated hardware requirements.
2.2	April, 2007	Added ColdFire V1 information.
2.3	July, 2007	Updated RS08 support information.
2.4	August, 2007	Minor changes.
2.5	October, 2007	Minor layout corrections.
2.6	April, 2008	Removed specific HW requirements.
2.7	April, 2008	Minor changes.
2.8	November, 2008	Minor changes.
2.9	April, 2009	Updated contacts and company references.
3.0	June, 2009	Beans are now Components.
3.1	Jan 13, 2010	Updated www links.