Introduction to Flash Programming of Renesas MCUs

Description: The purpose of this lab it to explorer programming Flash MCUs by means of application re-programming and Renesas Flash Development Toolkits (FDT) software.

Objectives

1. Give exposure to the Renesas Simple Flash API for the M16C Family of devices.
2. Program a devices using FDT “Basic”.
3. Create a new FDT Workspace project in order to read internal flash memory.

Lab Materials:

Please verify you have the following materials at your lab station.

- Complete M16C/29 RSK Board
- E8a Emulator
- 5 Volt Regulated Power Supply
- HEW + NC30WA Ver 5.44
- FDT Ver 4.01

Skill Level : New to Renesas tools and MCUs

Time to Complete Lab: 30 minutes

Lab Sections

1	Modify a Simple Flash Re-writing Program	Time to complete task: 10 minutes
2	Program the Application Using FDT “Basic”	Time to complete task: 8 minutes
3	Upload Internal Flash Memory Using FDT	Time to complete task: 8 minutes
4	Device Programming Using HEW	Time to complete task: 4 minutes

1 Modify a Simple Flash Re-writing Program

Overview:

For this section, you will modify an existing application to program your name into the "Data Flash" area during run-time.

Procedural Steps

1. **Start** the Renesas High-Performance Embedded Workshop (HEW) using the shortcut on the desktop.
2. In the "Welcome!" screen, **select** "Browse to another project workspace" and **click** the OK button.
3. **Browse** to and **select** the following HEW Workspace (*.hws) file:
   `C:\WorkSpace\200_Flash_Lab\M16C_29_Flash_API.hws`

> The Renesas "Flash API" is a set of simple function calls that will allow you to easily create code to reprogram your MCU's internal flash memory. Since the Flash architectures of the M16C, R8C and M32C are so similar, we were able to create common ',c' files that are configured by a '.h' file.

4. Within HEW, in the file tree list on the left, **double click** the file "**`Flash_API_M16C.h`**" under the "**C header file**" folder in order to open that file in the editor.
5. To configure the Flash_API.h file for the MCU we will be using for this lab, simply **remove** the 'C' comment markers (//) from the front of the lines listed below.

Line 79: (For selecting the MCU we are using)

```
#define M16C_29 1
```

Line 61: (For selecting the programming mode to use)

```
#define EW_MODE 1
```

6. We also need to tell the API how fast our application is running so that timing may be adjusted. **Remove** the 'C' comment markers (//) from the front of the lines **Set** the *define* in `Flash_API.h` 20000000 (ie, 20MHz)

Line 39: (This is the run-time speed of our MCU)

```
#define BCLK_FREQUENCY 20000000
```

> You actually don't have to worry about saving this file after your edits are complete. HEW will automatically save the file the next time you build.

7. Within HEW, in the file tree list on the left, **double click** the file "**`main.c`**" under the "**C Source file**" folder in order to open it in the editor.
8. In the file `main.c`, **modify** the text between the quotes on **line 78** to be your full name and also **modify** the number on **line 79** to reflect the number of characters in your name include plus an extra byte for the NULL character that is added by the compiler.

> If your name is an **odd number of letters**, please add an extra character to make it an even number of characters. This is because the M16C MCUs must program 16-bits at a time.

9. **Build** the project within HEW by selecting the menu item: [menu] Build >> Build
10. **Minimize** the HEW environment, we will come back to it later.

2 Program the Application Using FDT "Basic"

Overview:

To program a binary file (.mot) into a device, Renesas offers two types of interfaces to its Flash Development Toolkit (FDT) software. In this section, you will work with the simpler of the two versions.

Procedural Steps:

1. **Connect** your E8a emulator to your target board via the 14-pin connector and also to your PC via USB plug.
   NOTE that the power supply is not needed yet.
2. **Start** the Renesas Flash Development Toolkit "Basic" version by selecting the following from the Windows start menu:
   Start > Programs > Renesas Flash Development Toolkit 4.01 > Flash Development Toolkit 4.01 Basic
3. In the main window, **select** [menu] 'Options' > 'New Settings…'
4. In the "Filter" box **enter** "290" which is the partial part number of the device on your board.
5. You should now be able to easy **select** the target device "M30290FC" (the 128KB Flash version) and **click** the "Next" button.
6. **Select** your "Select Port" setting to be "E8a" and **click** the "Next" button.
7. (No changes for this screen) **Click** the "Next" button.
8. (No changes for this screen) **Click** the "Finish" button.
9. In the main application window, **check** the box labeled "User / Data Area"
10. **Click** the button (on the far right) that has an arrow head label [▸] and select "**Browse…**"
11. **Browse** to and select the following file, then click **Open**:
    `C:\WorkSpace\200_Flash_Lab\Debug\M16C_29_Flash_API.mot`
12. **Click** the "Program Flash" button.
13. **Check** the "Power Supply" box, then **select** "5.0 V", then **click** the OK button.
14. **Click** the OK button in the "Select USB Device" Windows that appears.

> If prompted to update emulator firmware, click **OK**.

> If an ID Checkbox appears, enter "FF" in each box then press **OK**.

15. After the programming has completed, **verify** that the text "Image successfully written to device" is displayed in the progress text area.
16. **Click** the Disconnect button.
17. **Click** the Exit button (top right)
18. **Remove** the 14-pin connection between the E8a and the target board.

> Your downloaded application CANNOT run while the E8 debugger is connected to it. This because the RESET line is asserted by the E8 when it is left idle. This is done as a safety precaution to prevent your application from running pre-maturely.

19. **Plug** in the power supply and **press** the RESET button on the board.
20. **Verify** that the LCD reads "done" on the top line, and the first 8 characters of your name on the bottom line. You have now successfully downloaded and ran your application.

3 Upload Internal Flash Memory Using FDT

Overview:

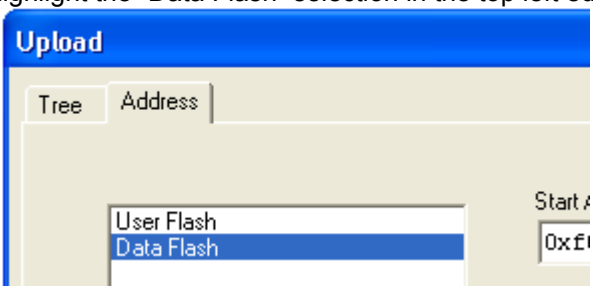
We now want to verify that our names were written to flash correctly. Since the FDT Basic interface does not have a mechanism to upload and view what is already in the Flash memory, we must use the full FDT interface.

Procedural Steps:

1. **Keep** the power plug attached to you target board.
2. **Connect** your E8a emulator to your target board via the 14-pin connector and also to your PC via USB plug.
3. **Start** the Renesas Flash Development Toolkit full version by selecting the following from the Windows start menu:
   Start > Programs > Renesas Flash Development Toolkit 4.01 > Flash Development Toolkit 4.01
4. In the "Welcome!" screen, **select** "Create a new workspace" and click OK.
5. In the edit box for "Workspace Name", **enter** the text "Flash_Lab".
6. In the edit box for "Project Name", **enter** the text "Flash_Lab".
7. You can leave the edit box for "Directory" just the way it is.
8. **Click** OK
9. In the "Filter" box **enter** "290" which is the partial part number of the device on your board.
10. You should now be able to easy **select** the target device "M30290FC" and click the "Next" button.
11. **Select** your "Select Port" setting to be **E8a** and click the "Next" button.
12. (No changes for this screen) **Click** the "Next" button.
13. (No changes for this screen) **Click** the "Finish" button.

> Now that our FDT project workspace is created, we could use it to manage more complicated flashing programming procedures like merging files, creating checksums or automated scripted programming for manufacturing.

14. In the FDT main screen, **select** [menu] Device > Connect to Device.
15. Just **click** the OK button since our power supply is still attached to our target board and we don't need to supply power from the E8a.
16. **Click** the OK button in the "Select USB Device" Windows that appears.
17. In the FDT main screen, **select** [menu] Device > Upload Image
18. In the Upload window, **click** to highlight the "Data Flash" selection in the top left edit box as shown below.



19. **Click** the Upload button at the bottom of the window.
20. The contents of the Data Flash area should now be displayed. **Verify** that you name was successfully written into flash at address "0000F000".
21. **Click** the Disconnect button.
22. **Close** the FDT application and **select** "No" in the "Would you like to save?" window that will appear.

4 Device Programming Using HEW

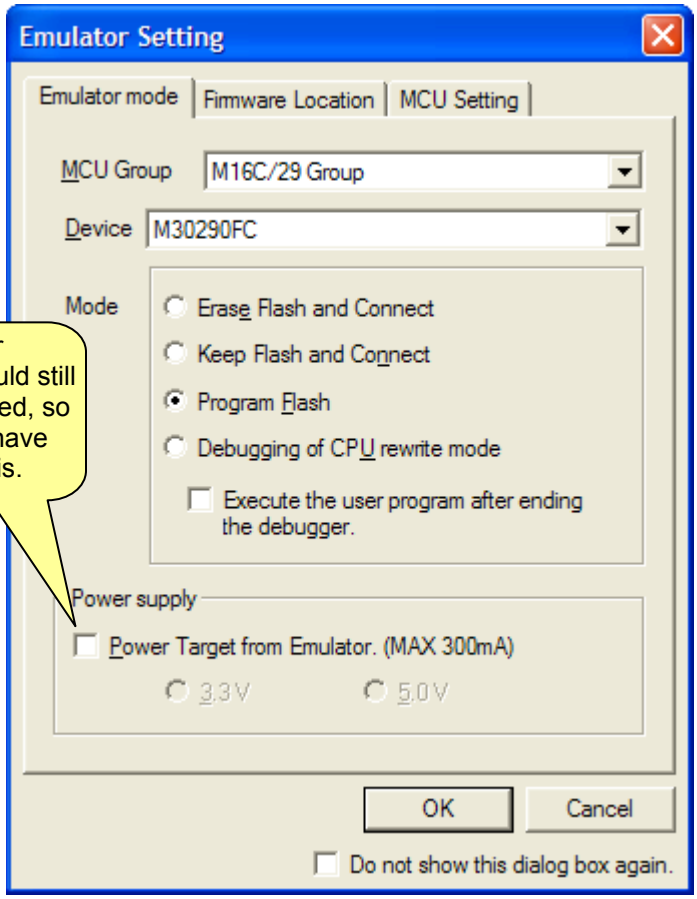
Overview:

It is also possible to program your flash MCU device using the HEW environment.

Procedural Steps:

1. **Switch** you attention back to HEW.
2. In the main.c file, **change** text that is currently your name to something different so we can prove we programmed something new.
3. **Build** the project within HEW by selecting the menu item: [menu] Build >> Build
4. **Change** the current session from "DefaultSession" to "E8a_Programming" by using the pull down box in the toolbar section of HEW as shown to the right.
   Click Yes when prompted to save the session.

5. **Verify** that your "Emulator Settings" window "Emulation mode" tab matches what is shown below.



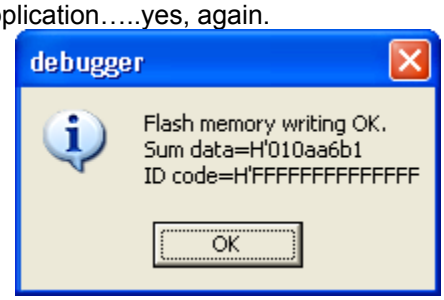
Your power supply should still be connected, so you **don't** have to select this.

The "Program Flash" connection option tells HEW to NOT download the debugger monitor kernel when connecting or programming. This will allow you to program your device with the final firmware image (without debugging capabilities) just like you did with FDT. If you were to select a connection option other than Program Flash so you could do software debugging, your application would not be able to run without being connected to a HEW debugging session.

6. **Click** OK. You are now in a programming mode session within HEW.
7. To download your application within HEW, in the file tree list on the left, **double click** the file icon labeled "Flash_Lab_M16C_29.x30 – 00000000" under the "Download modules" folder. Device programming will then start and continue until a completion message window appears.

NOTE: There is no progress bar window for programming in this mode

8. **Click** OK on the message window saying “Flash memory writing OK” (shown below). You have now successfully programmed your device with your application…..yes, again.



9. **Click** OK on the message window saying “Please Restart or Exit”.
10. On the HEW tool bar at top of HEW, **click** the Disconnect button.
11. **Disconnect** your E8a ribbon cable from your target board.
12. **Press** the RESET button on your board and **verify** that your application runs