e² studio IDE

Usage of Memory Debug Feature

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Introduction

The Memory view in the debug perspective enables user to monitor and modify user memory of interest.

This application note focuses on the usage of memory view demonstrating 'Image' and 'Hex Integer' data formats, with Renesas Starter Kit for RX111 CPU board (referred as RX111 CPU Board) and E1 emulator under the e² studio IDE.

e² studio V.2.2.0.13

C/C++ Compiler for Renesas RX Family: V2.01.00

Target Device

RX Family

Contents

1. Overview

The "Memory" includes two (2) panes: the Memory Monitors pane and the Memory Rendering pane. The monitor represents a section of memory specified by its location called "base address". The memory data in each Memory Monitor represents in different "Memory Renderings", which are the pre-defined data format (e.g.: Hew Integer, Signed Integer, Unsigned Integer, Floating Points, ASCII, Image and etc). 'Hex Integer' is displayed automatically as the default format when global variable is added in Memory Monitor pane. In common practice, to monitor a variable, it is always useful to monitor it by the label (e.g. variable name prefix with '&'), and not by address.

As shown in Figure 1, the Memory Rendering pane also can be configured to display the renderings simultaneously by using the toolbar option: Toggle spilt pane. Besides, the Memory view provides other toolbar options, e.g. New Memory View, Toggle Memory Monitor Pane, Real-time Refresh, Import/export and etc.

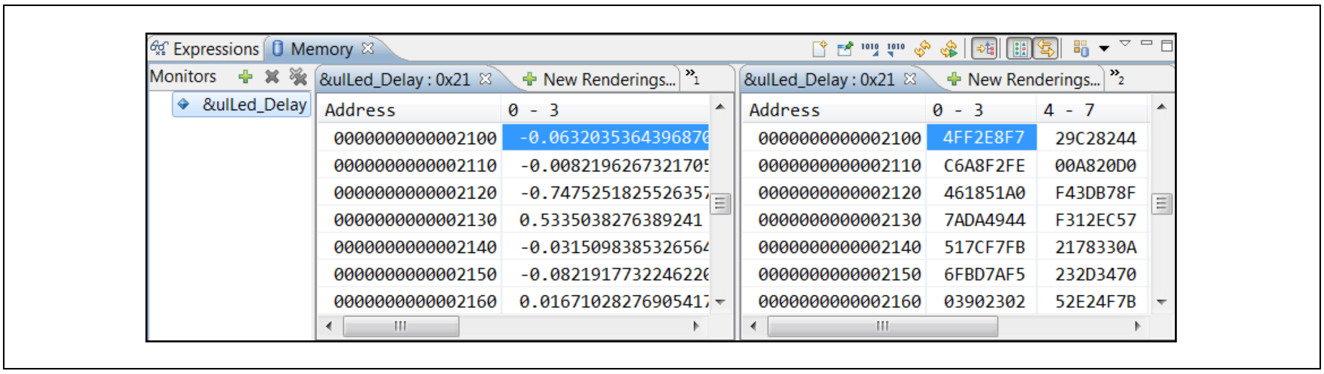

Figure 1 Memory View

2. Usage of Memory View

Using RX111 CPU Board as an example, targets for RX111 MCU device (part number: R51115AxFM), the sections below explain the usage of Memory by selecting 'Image' and 'Hex integer' formats.

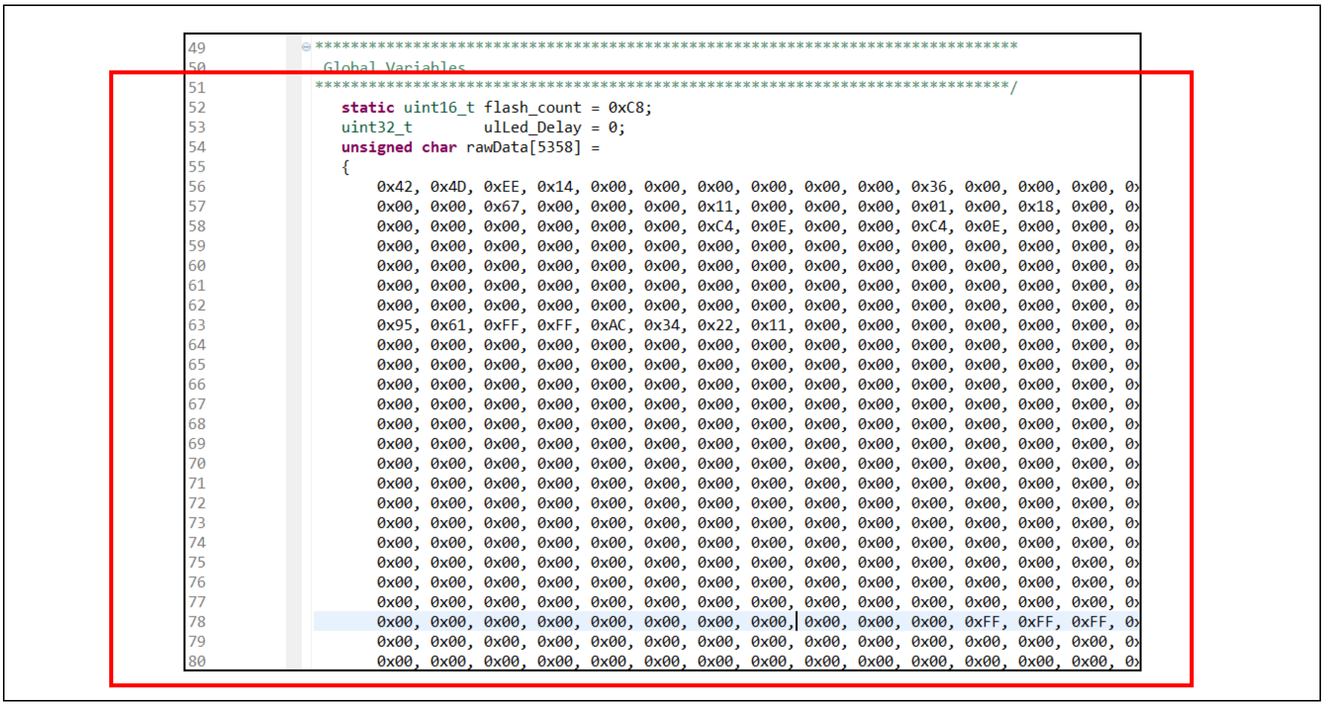

Figure 2 Assign Global Variable in "flashled.c"

It is a pre-requisite to prepare a 'Tutorial' project with a graphical image targets for the RX111 CPU Board.

1) Convert image file (.bmp) into char array named 'rawData[5358]' using image converter software.

   Refer to the "Renesas Starter Kit for RX111: Quick Start Guide" to prepare for a sample project workspace:

2) Install RSK software from the DVD. Invoke e² studio IDE to import sample workspace "Tutorial" (located at the root project directory: 'C:\Renesas\Workspace\RSK\RSKRX111').

3) Copy array data "rawData[5358]" to "flashled.c" (as shown in Figure 2). Then, assign array data "rawData" and local variable "ulLed_Delay" as global variables in the "flashled.c".

4) Click [Project] → [Build All] to build the project, and then click [Run] → [Debug configuration] to connect E1 emulator to the RX111 target board.

2.1 Usage of 'Image' Memory Type

The 'Image' Memory Rendering represents the memory content in graphical image format in the Memory view. It supports the following formats:

- Windows BMP, GIF, ICO, JPEG, PNG, TIFF, OS/2 BMP

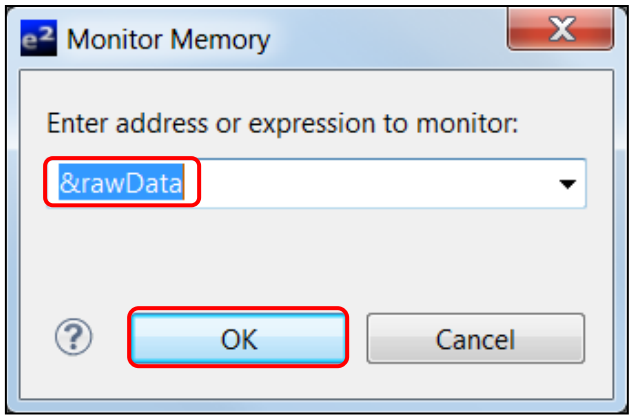

Figure 3 Add Memory Monitor - &rawData

To monitor global variable "rawData" using Image format:

1) Click [Windows] → [Show View] → [Memory] or icon  to open the Memory view.

2) In 'Memory Monitor' pane, click icon  to add monitor: &rawData or address: 0x800 and click [OK] to proceed.

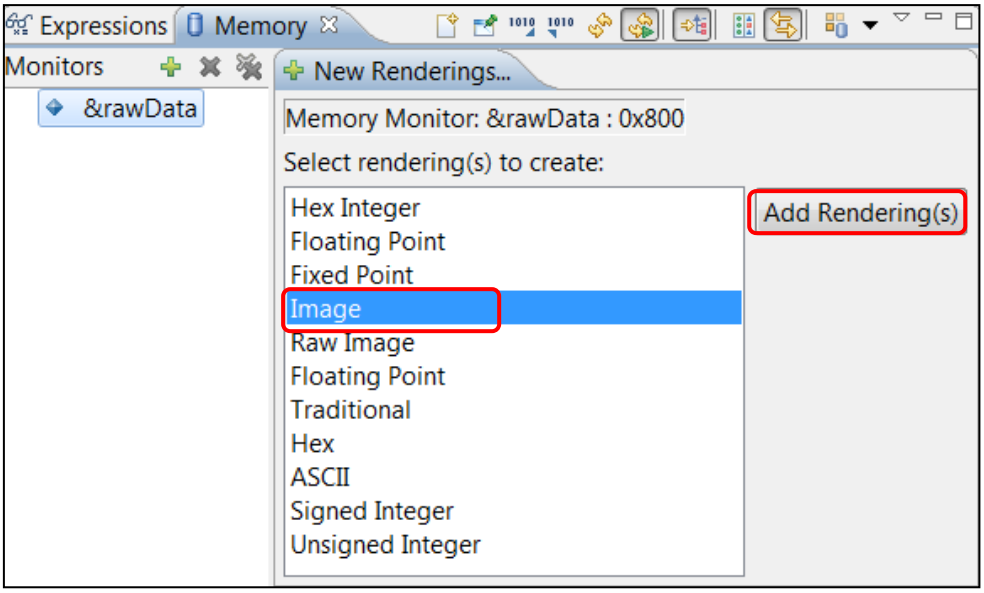

Figure 4 Add Rendering(s) – 'Image' Type

To choose an image format to present "&rawData":

3) Click 'New Renderings…' in Memory Rendering pane. Select 'Image' and click 'Add Rendering(s)' to display the graphical image – 'Renesas' logo.

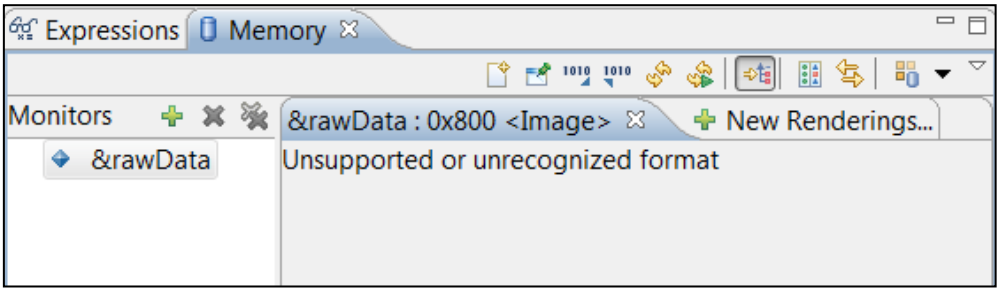

Figure 5 Message Shown on Image Rendering.

At first, due to uninitialized section, "&rawData" memory rendering pane shows the "Unsupported or unrecognized format" message.

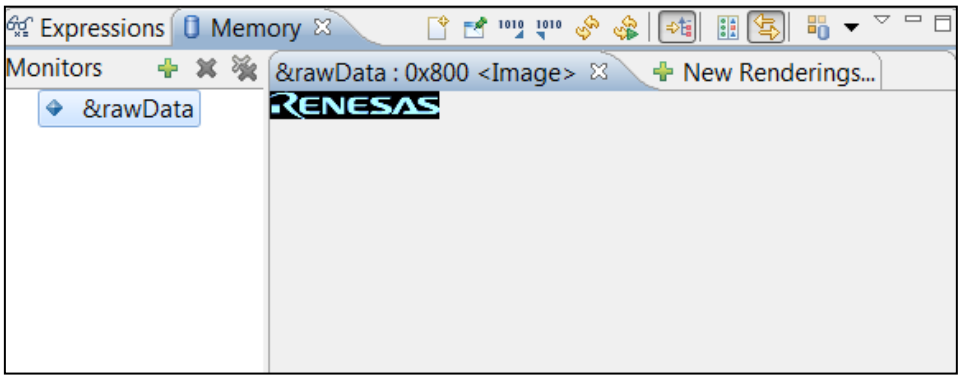

Figure 6 Memory Rendering Pane – 'Renesas' Logo

4) Click  to execute a section initialization routine (ie. function "_INITSCT()") for sections initialization to reflect the memory monitor "&rawData" in the Memory Rendering pane. As shown in Figure 6, the 'Renesas' logo is displayed in Memory Rendering pane.

Typically, if the content of memory at the specified start address is not recognized as a valid image in any of the supported image formats (e.g. Windows BMP, GIF, ICO, JPEG, PNG, TIFF, OS/W BMP), an error message (similar to Figure 5) is shown within the image rendering.

2.2 Usage of 'Hex Integer' Memory Type

The 'Hex Integer' (default) Memory Rendering represents the memory content in Hexadecimal format in Memory view.

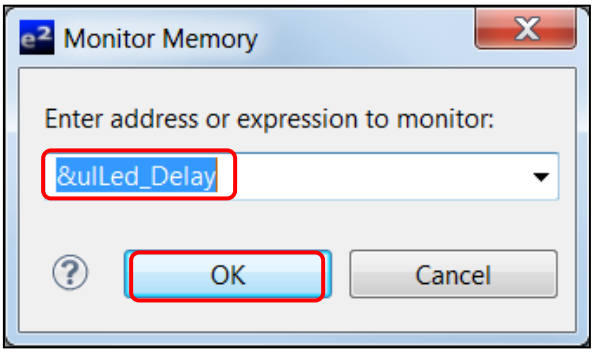

Figure 7 Add Memory Monitor – &ulLed_Delay

To monitor global variable "ulLed_Delay" using 'Hex Integer' format:

1) Click [Windows] → [Show View] → [Memory] or icon  to open the Memory view.

2) In Memory Monitor pane, click icon  to add monitor: &ulLed_Delay or address: 0x2100 and click [OK] to proceed.

Note:

The differences between "Hex Integer" and "Hex" are
"Hex integer": Always set as big endian, regardless of debugger endian setting
"Hex": To display with the debugger endian setting

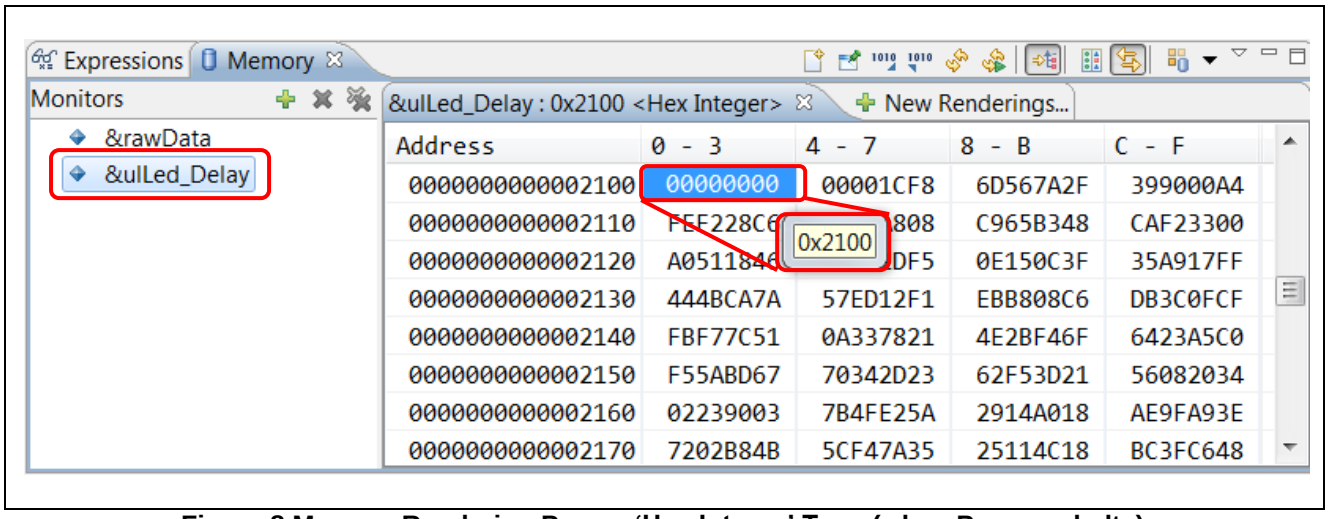

Figure 8 Memory Rendering Pane – 'Hex Integer' Type (when Program halts)

The 'Hex Integer' Rendering (by default) is displayed automatically when the Memory Monitor is created. The address shown for "&ulLed_Delay" is 0x2100 as in Figure 8.

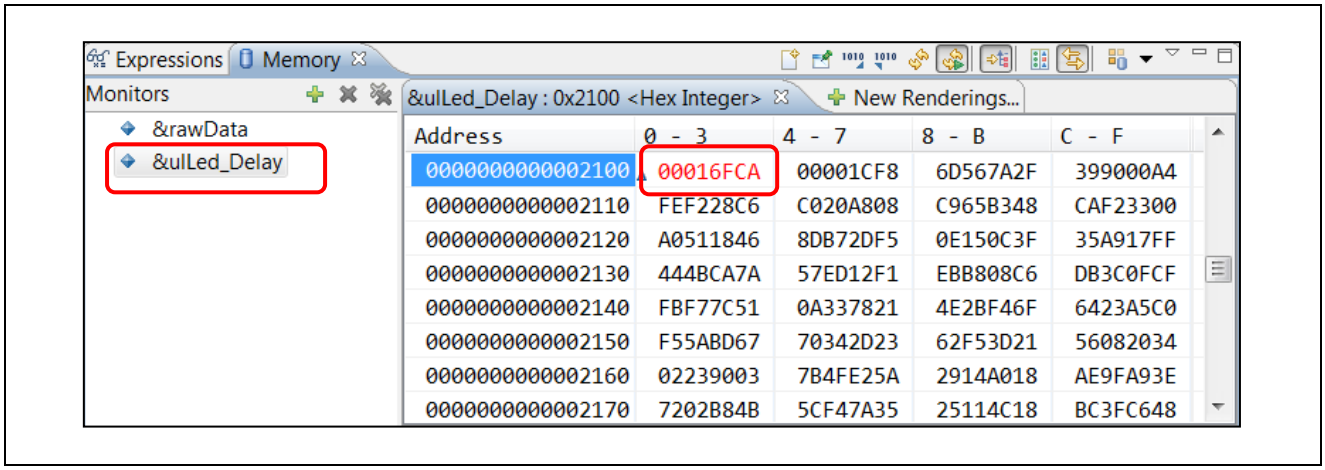

Figure 9 Memory Rendering Pane – 'Real-time Refresh' (when Program is running)

To observe the updates for the memory monitor: "&ulLed_Delay" while the program is running:

3) Click icon  to enable the 'Real-time Refresh' and click icon  to execute the program.

The value of address '0x2100' keeps changing until icon  is pressed or it reaches the maximum value.

When debugging starts, the text shows in red which reflect a value change.

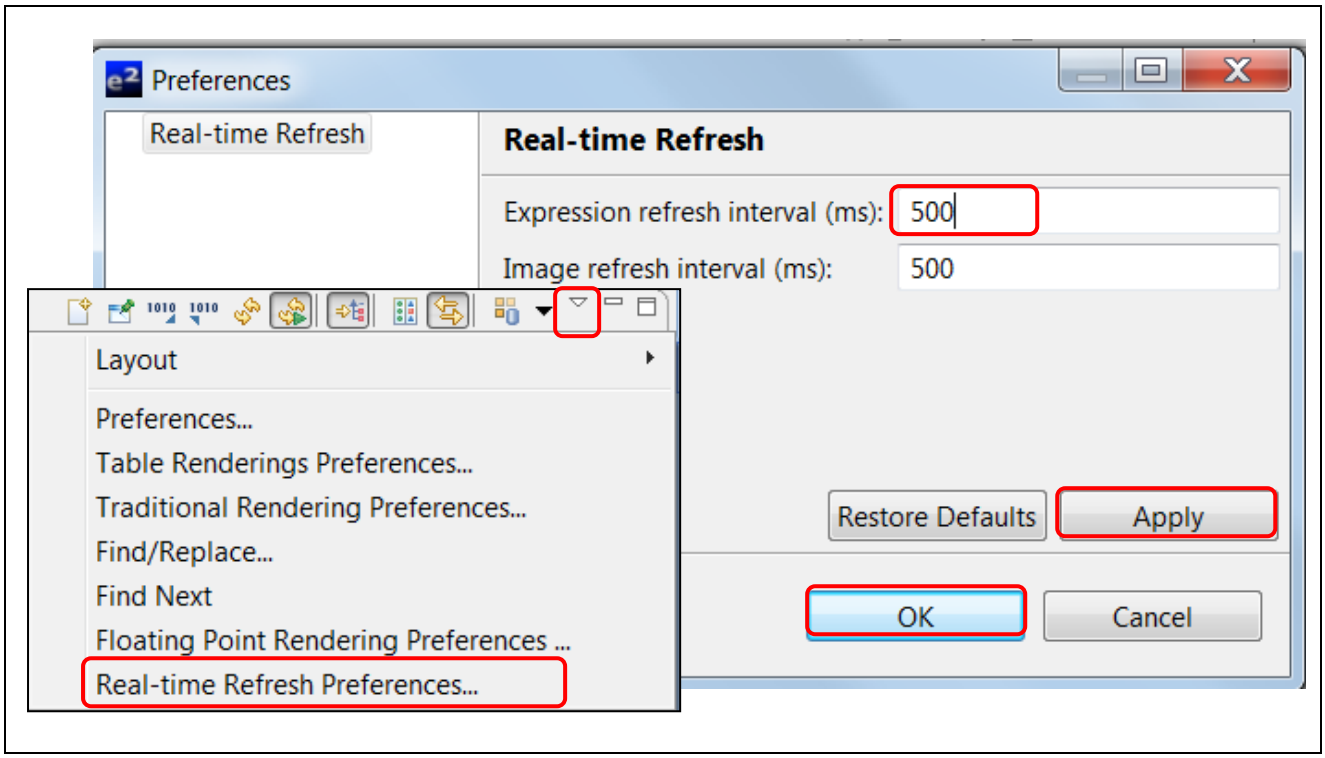

Figure 10 References - 'Real-time Refresh' Dialog

The Memory view allows user to configure the expression refresh interval via the 'Real-time Refresh' Preferences. By default, 'Expression refresh interval (ms)' is set as 200 while 'Image refresh interval (ms)' is set as 500. Before executed, user must ensure the 'Real-time Refresh' button is enabled.

4) Click the downward arrow  to select 'Real-time Refresh Preferences…' to open the 'Preferences' dialog box.
5) Type '500' in 'Expression refresh interval (ms)', click [Apply] and [OK] button to proceed.
6) Click icon  to perform the program. By monitoring the value for "&ulLed_Delay", the running speed becomes slower.

To modify the memory monitor, the program must be suspended.

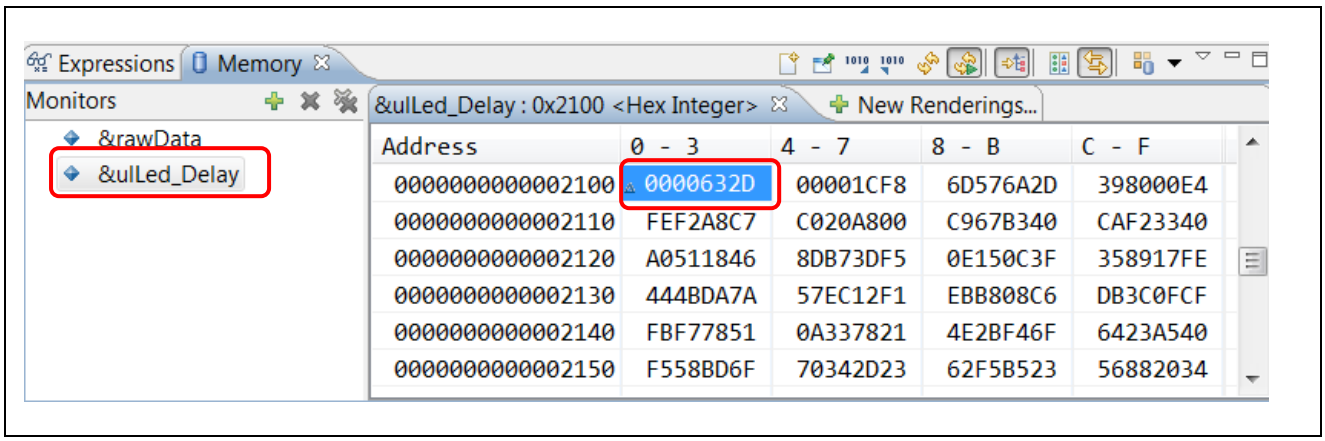

Figure 11 Memory View – Modify Memory Address

7) Click icon  to suspend the program, and then double-click the specified memory address to edit the value.

8) Click icon  to run the program, the value starts to execute after '0000632D'.

3. Summary

- The Memory view supports different Memory Rendering types (e.g. 'Image' and 'Hex Integer') for user to monitor and edit variable at the specific memory location.

- 'Hex Integer' is the default rendering format once the memory monitor is created. To add memory monitors, it is a pre-requisite to assign the specified local variables as global variables in program file.

- By using the 'Real-time Refresh' feature (e.g. 'Hex Integer' format), user can set refresh interval and track the changes for the memory monitors.

- The Memory display the graphic image in 'Image' rendering format after the section initialization (e.g. function "_INITISCT();").

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Revision History

		Description	
Rev.	**Date**	**Page**	**Summary**
1.00	Mar 15. 2014	-	First Edition Issued

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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