e² studio IDE

Usage of Eventpoints Debug Feature

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Introduction

An event is used by setting combination of conditions for executing break or trace features during program execution. In e² studio IDE, Eventpoint view provides different categories of events for user to configure, i.e. trace start, trace stop, trace record, before PC, event break, timer start and timer stop.

This application note will focus on the usage of "event break" with Renesas Starter Kit for RX111 CPU board and E1 emulator in e² studio IDE.

e² studio V.2.2.0.13 and above

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

Target Device

RX Family

Contents

1. Overview

An event can be set by eventpoint (may include a combination of condition settings) to trigger break or execute trace features during program execution with the emulator debugger. A typical emulator (varies with the supporting MCU) supports 4~8 eventpoints for user to configure, i.e. trace start, trace stop, trace record, before PC, event break, timer start and timer stop.

This application note focuses on the usage of event break feature. Event break is more powerful than the breakpoint (i.e. software breakpoint and break by address only), because two (2) types of break event conditions are available:

- Execution address: The emulator detects execution of the instruction or function at the specified address by the CPU. When the event condition is satisfied, it allows instruction breaks before the execution or after the execution.
- Data access: The emulator detects data (must be a global variable) execution by the specified address or a specified address range with read/write condition is met.

The two (2) break events can be set in combination of:

- OR: Event break occurs when any one (1) of the conditions is satisfied.
- AND: Event break occurs both of the conditions are satisfied regardless of the timing sequence
- SEQUENCE: Event break occurs when the conditions are satisfied in the specified timing sequence.

Using Renesas Starter Kit for RX111 CPU board (referred as RX111 CPU Board) as an example, targets for RX111 MCU device with part number: F51115AxFM) as an example, the sections below explain the event break usage in the combination of OR and SEQUENCE.

2. Usage of Eventpoints View

This is to prepare a “Tutorial” project targets for the RX111 CPU Board.

In “Tutorial” project, there exist two (2) local variables: “flash_count” and “u1Led_Delay”. To capture these variables by the eventpoint (either by combination “OR” or “SEQUENCE”), it is a pre-requisite to assign the local variables as the global variables.

To prepare sample project workspace for RX111 CPU Board, refer to the Renesas Starter Kit for RX111: Quick Start Guide.

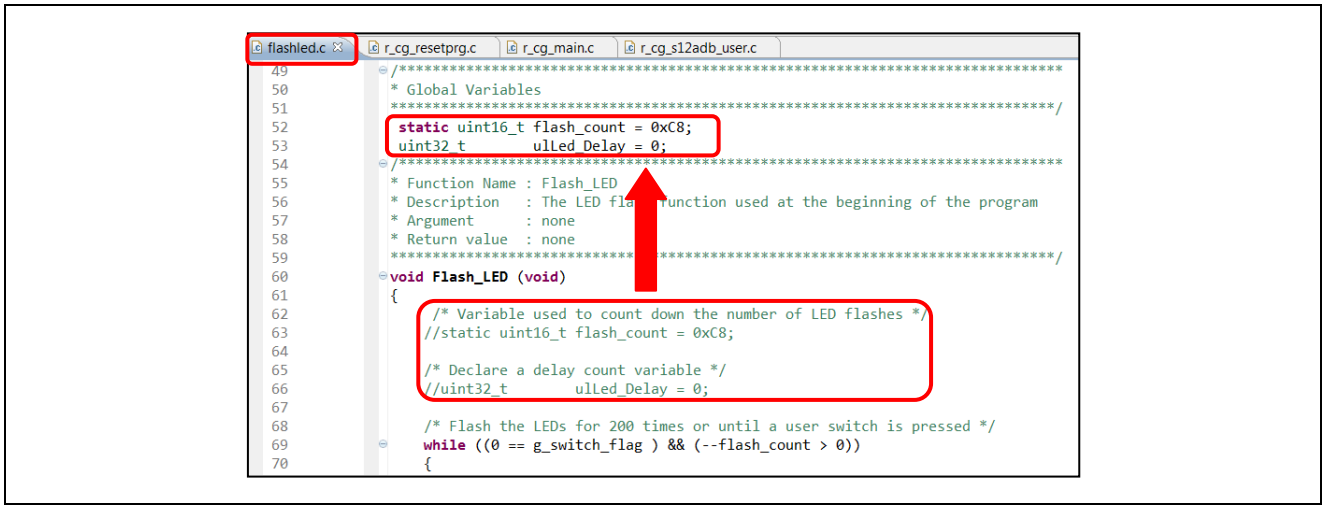

Figure 1 Assign Local Variables to Global Variables in “flashled.c”

1) Install RSK software from the DVD media and then import sample workspace “Tutorial” (located at the root project directory: ‘C:\Renesas\Workspace\RSK\RSKRX111’).

2) For debugging purpose, in “flashled.c”, change the two (2) local variables “flash_count = 0xC8” and “ulLed_Delay = 0” to becomes global variables and save the project.

3) 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 “OR” Combination Events

This is to enable program breaks for the “OR” (default) combination events: either “flash_count” or “u1Led_Delay” satisfies the setting conditions of 100 and 10000 respectively.

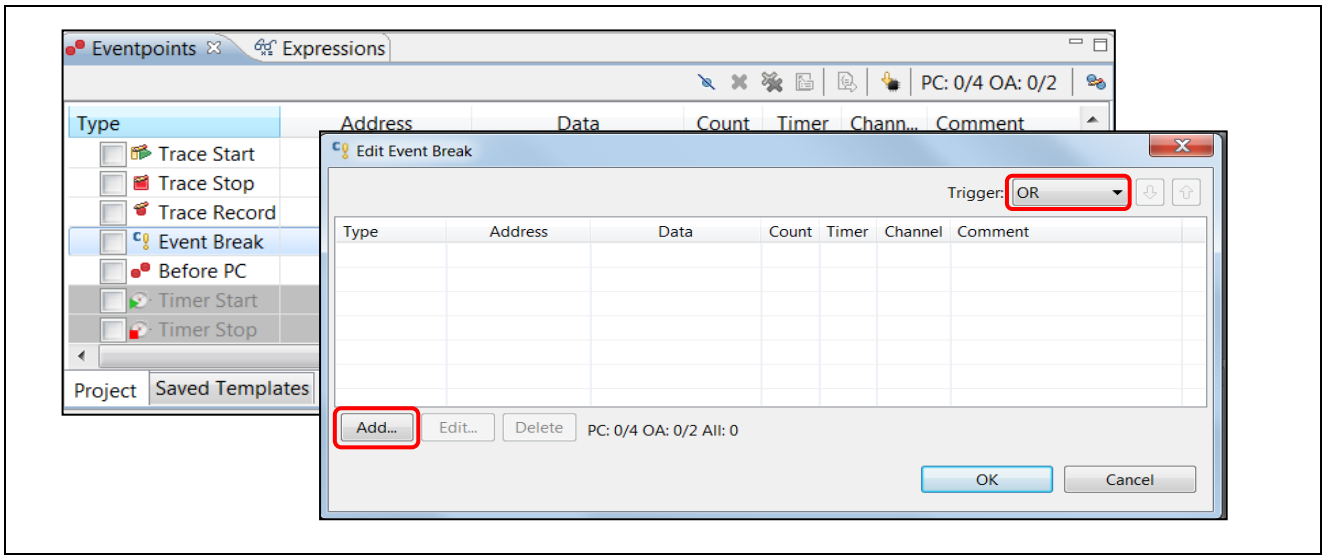

Figure 2 [Eventpoints] View

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

2) Double-click at the “Event Break” option to open the [Edit Event Break] dialog box. Ensure the Trigger is set to “OR” and then click [Add…] to proceed.

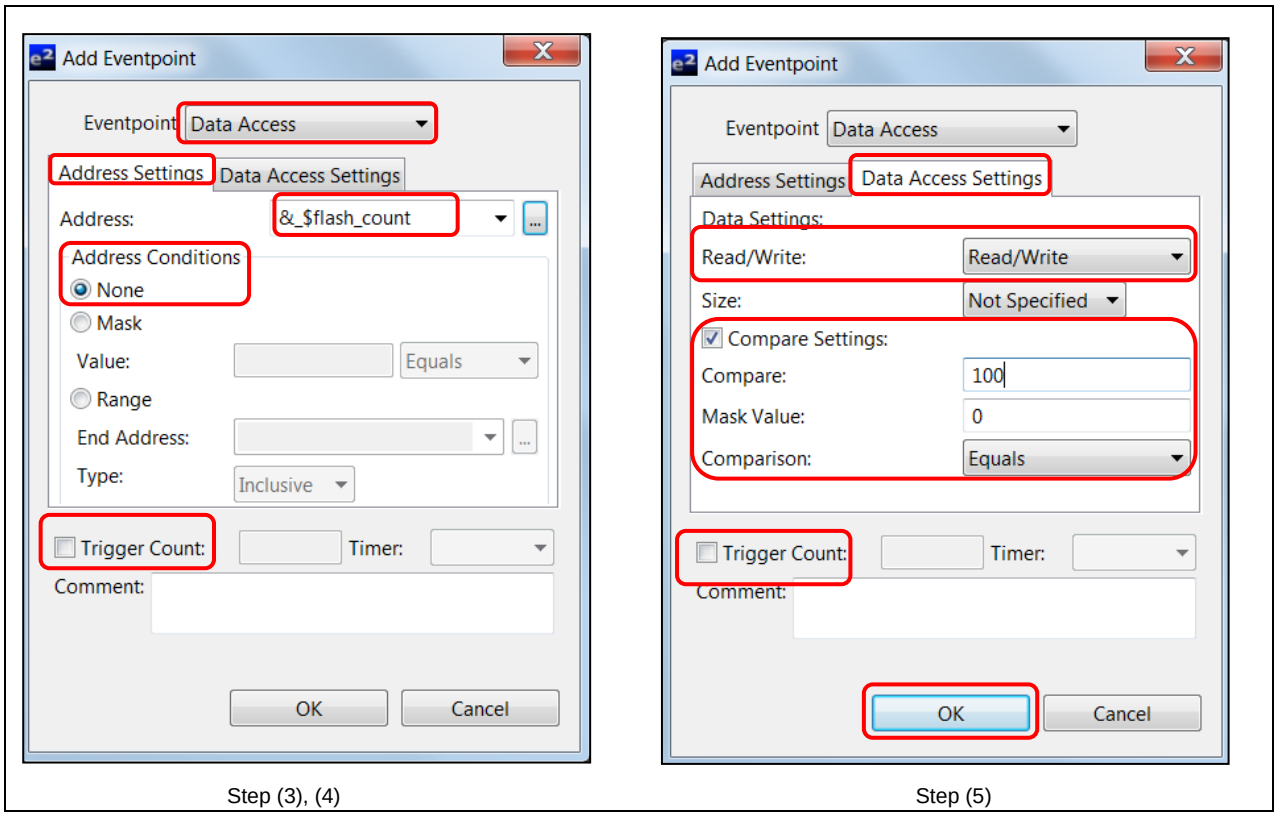

Figure 3 [Add Eventpoint] Settings for global variable "flash_count"

3) Select "Data Access" as the "Eventpoint" type.

4) Under [Address Settings] tab, click […] button to browse for the address "&_$flash_count". Ensure the address condition of "None" is set and the "Trigger Count" is unchecked.

5) Switch to [Data Access Settings] tab, set "Read Write" and check on "Compare Settings" checkbox to enter a compare value "100", and then click [OK] to proceed.

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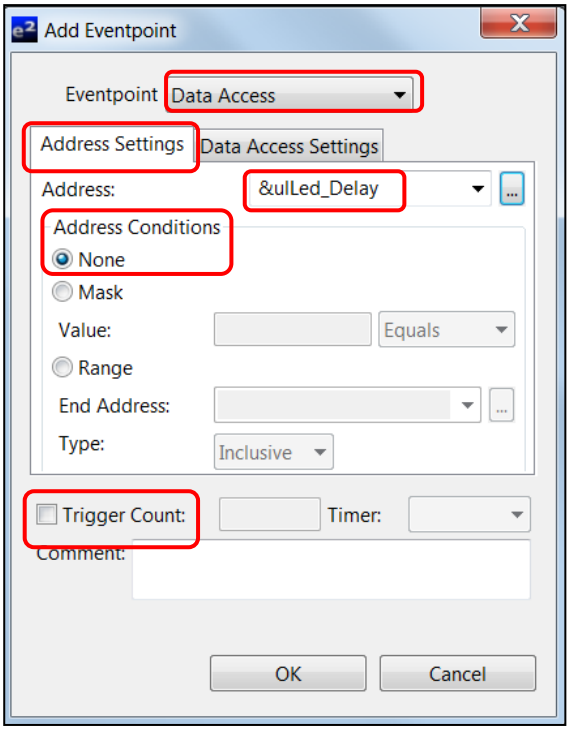
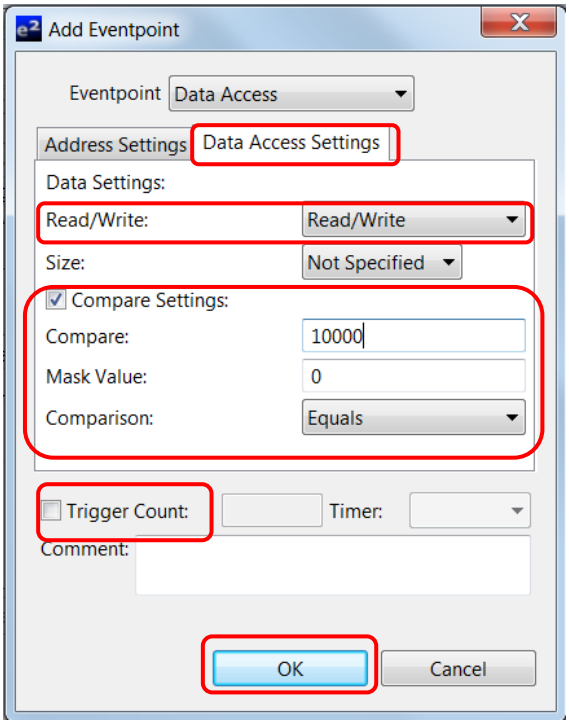


Step (6), (7)



Step (8)

Figure 4 [Add Eventpoint] Settings for global variable "Led_Delay"

6) Continue to click [Add…] in the [Edit Event Break] dialog to add eventpoint for "Led_Delay"

7) Select "Data Access" as the "Eventpoint" type..

8) Go to the [Address Settings] tab, click […] to browse for the address "&ulLed_Delay". Ensure the address condition of "None" is set and the "Trigger Count" is unchecked.

9) Switch to "Data Access Settings" tab, set "Read Write" and check on "Compare Settings" checkbox to enter a compare value "10000", and then click [OK] to proceed.

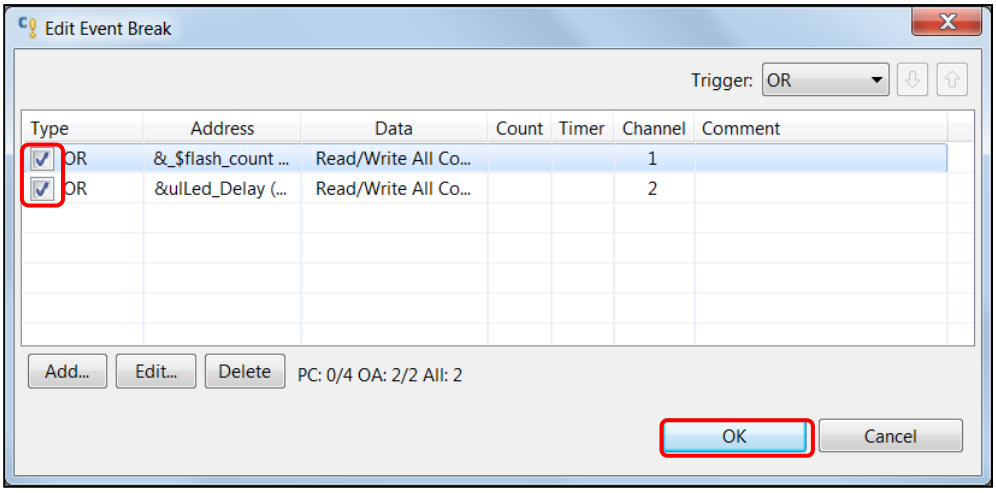


Figure 5 [Edit Event Break] Dialog – "OR" Events

10) Ensure the two (2) events are selected in [Edit Event Break] dialog. Click [OK] to continue.

Note: User can click at the specified event and then click [Edit] or [Delete] button to modify or remove the event.

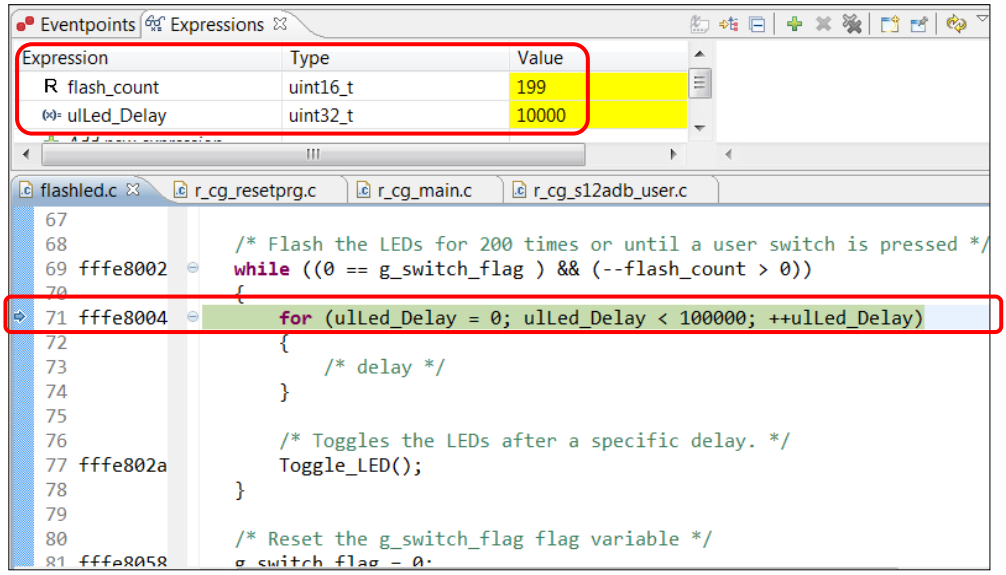


Figure 6 Execution of Event Break – "OR" Events

11) Reset and then run to execute the program.

Program breaks successfully when "ulLed_Delay" reaches the value of 10000. After the break, user may open the [Expression] view to read the value of "ulLed_Delay" (10000) and "flash_count" (199).

2.2 "SEQUENCE" Combination Events

This is to enable program breaks for the "SEQUENCE" combination events: in the order of "flash_count" and then "u1Led_Delay" that satisfies the setting conditions of 100 and 10000.

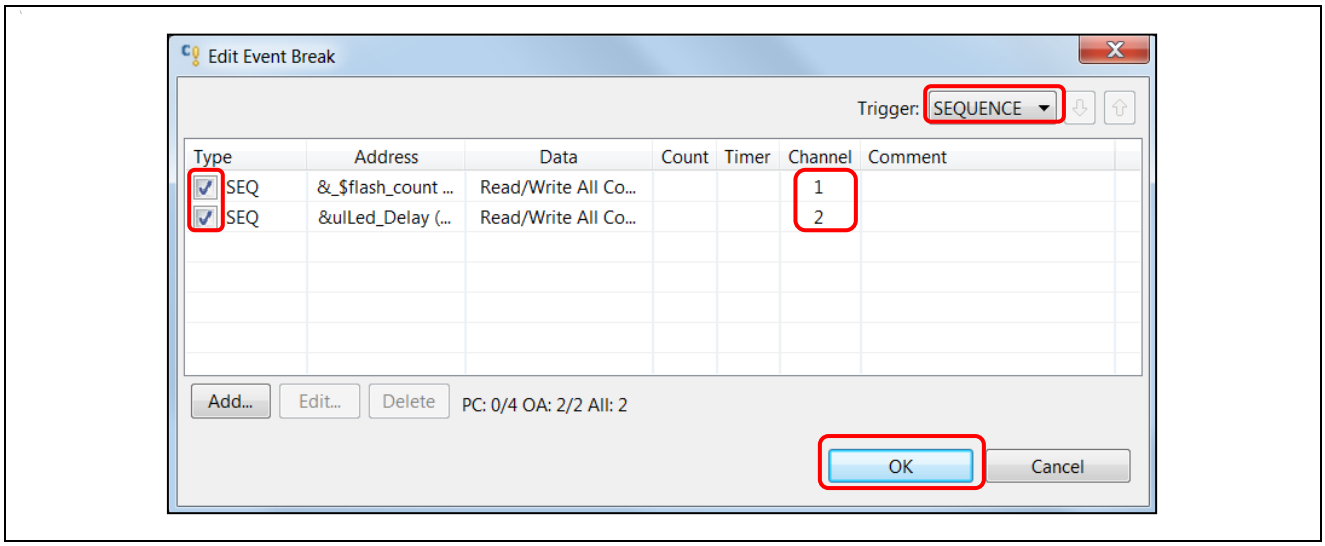


Figure 7 [Edit Event Break] Dialog – "SEQUENCE" Events

1) Follow Section 2 - steps (1) to (3) and Section - 2.1 steps (1) to (9) to add events for global variables "flash_count" and "ulLed_Delay".
2) Open the [Eventpoints] view and double-click at "Event Break" option to open the [Edit Event Break] dialog box.
3) Select "SEQUENCE" from the "Trigger" drop-down box.
4) Set channel 1 for "flash_count" and channel 2 for "ulLed_Delay". Ensure both of the two events are selected, then click [OK] button to proceed.

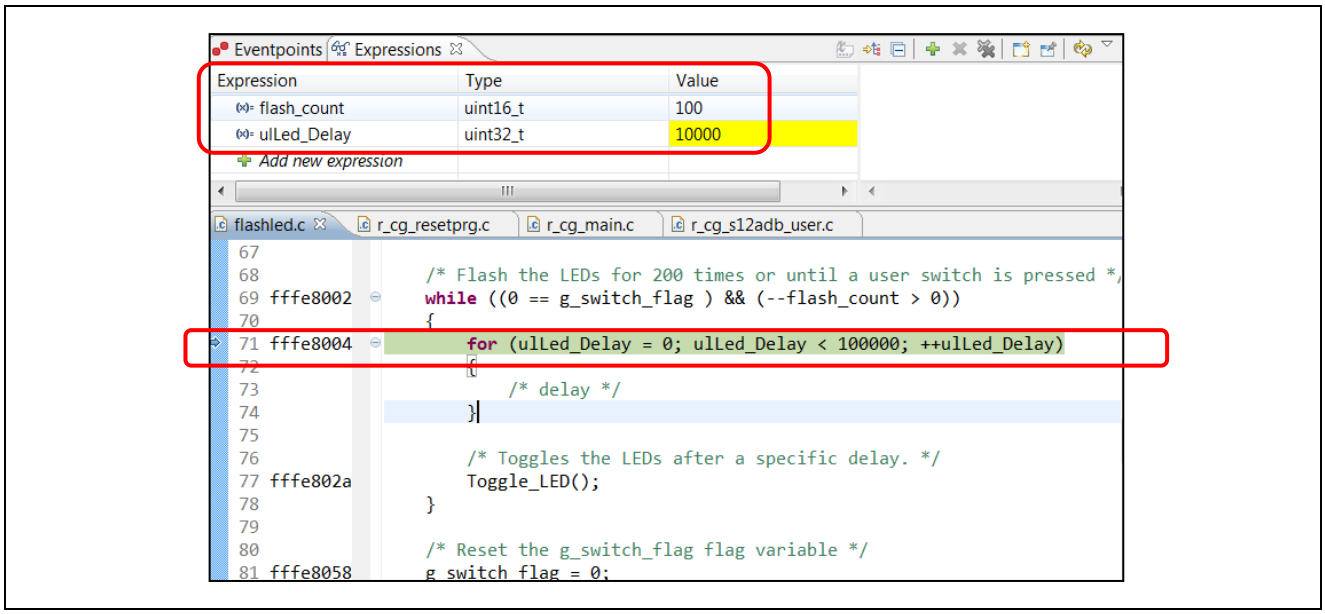


Figure 8 Execution of Event Break - "SEQUENCE" Events

5) Reset and then run to execute the program.

Program breaks successfully when "flash_count" first reaches 100 and "ulLed_Delay" steps up to increase till 10000. User may open the [Expression] view to read the value of "flash_count" (100) and "ulLed_Delay" (10000).

Next, repeat the “SEQUENCE” combination events by switching channels: channel 1 for “uILed_Delay” and channel 2 for “flash_count” at this case.

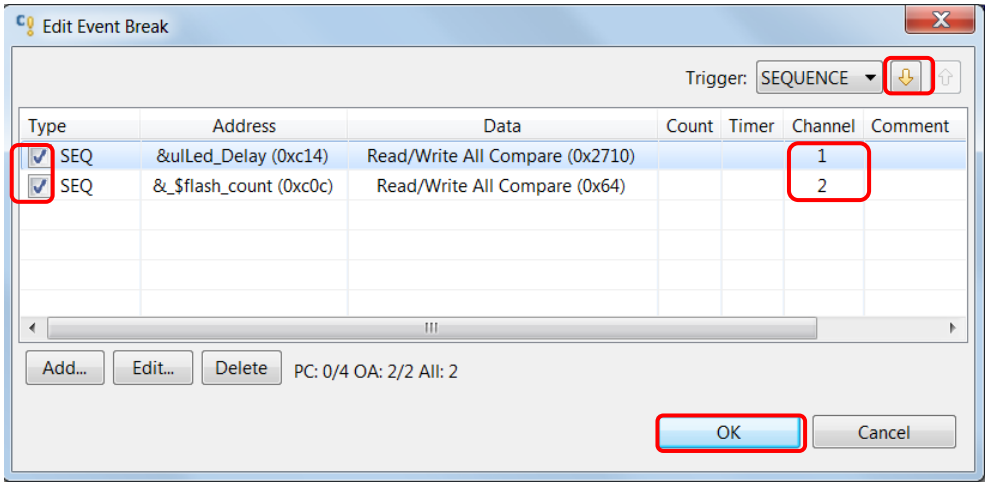


Figure 9 [Edit Event Break] - Switch Channel “SEQUENCE”

6) Choose event by click, and then press  button to switch the channels. Click [OK] button to end.

7) Double-click on the “Event Break” in [Eventpoint] view, then confirm the event order from the [Edit Event Break] dialog box. When done, click [OK] button to close the dialog.

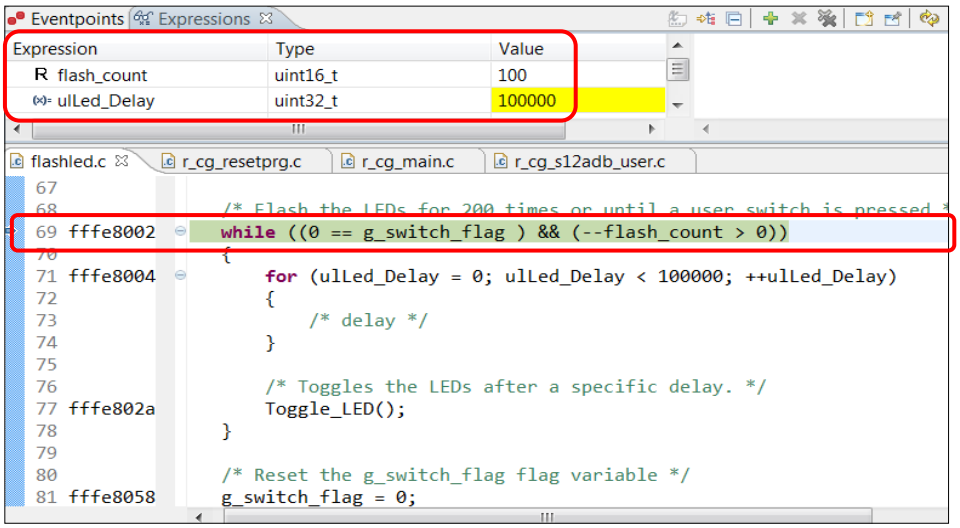


Figure 2-9 Execution of Event Break – Switch “SEQUENCE”

8) Reset and then run to execute the program.

Program breaks successfully when “flash_count” first reaches 100 and “ulLed_Delay” reaches 100000 (value reaches 10000 but continue to count up to 100000 at “flash_count” equals to 101). User may open the [Expression] view to read the value of “flash_count” (100) and “ulLed_Delay” (100000).

2.3 "AND" Combination Events

This is to enable program break for "AND" combination events: both "flash_count" and "ulLed_delay" satisfies the setting conditions of "100" and "10000" for the 1st sequence order.

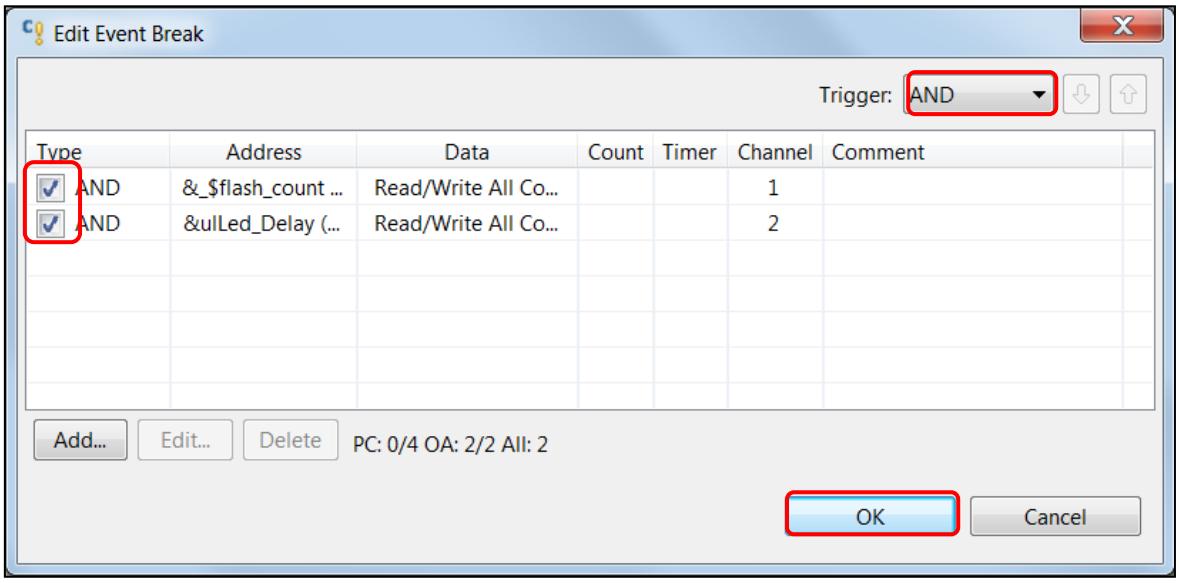


Figure 2-10 [Edit Event Break] – "AND" Events

1) Follow Section 2 - steps (1) to (3) and Section - 2.1 steps (1) to (9) to add events for global variables "flash_count" and "ulLed_Delay".
2) Open the [Eventpoints] view and double-click at "Event Break" option to open the [Edit Event Break] dialog box.
3) Select "AND" from the "Trigger" drop-down list. Click [OK] button to proceed.

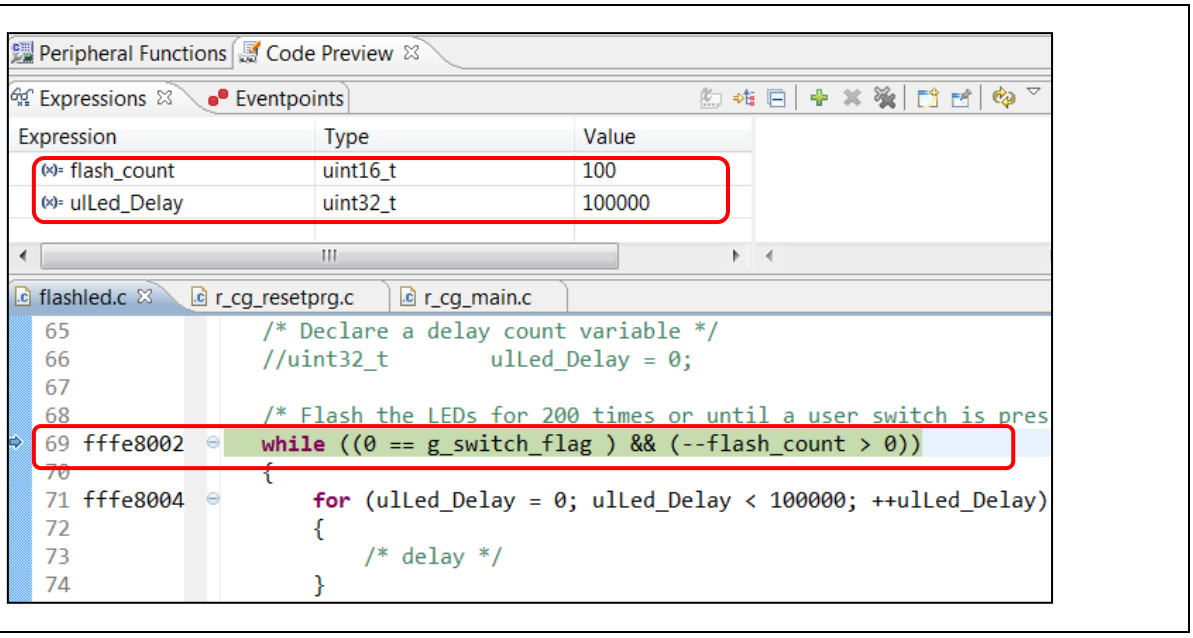


Figure 2-11 Execution of Event Break – "AND" Events

4) Reset and then run to execute the program.

Program breaks successfully when "flash_count" first reaches 100 and "ulLed_Delay" reaches 100000 (value reaches 10000 but continue to count up to 100000 at "flash_count" equals to 101). User may open the [Expression] view to read the value of "flash_count" (100) and "ulLed_Delay" (100000). This result is same as the "SEQUENCE" events: channel 1 for "ulLed_Delay" and channel 2 for "flash_count".

3. Summary

The "event break" allows user to debug the program by setting event conditions. It offers event types of "Execution address" and "Data Access" for event configuration. "Data Access" type event break helps user to capture event when both address and data criteria are matched.

In this application note, "event break" is successfully demonstrated to capture combination events (using "OR", "SEQUENCE" and "AND") for the global variables.

"SEQUENCE" event only happens at a specific sequence order (i.e.: the specific Channel 1→Channel2 or Channel2→Channel1). By contrast, "AND" event happens at the 1st occurrence of the sequence orders (ie. either Channel →Channel2 or Channel 2→Channel1, whichever occurs first).

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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

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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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