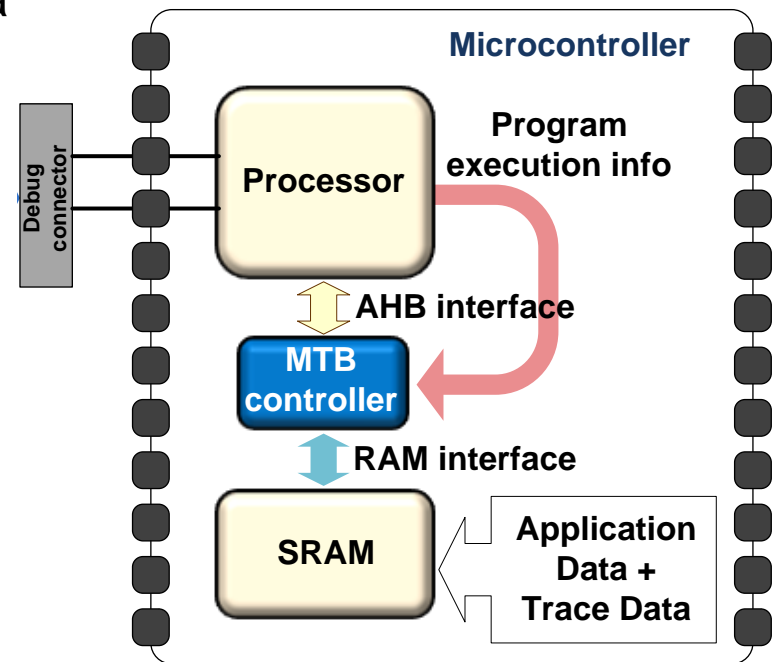




**MTB Instruction Trace
using LPCXpresso IDE**

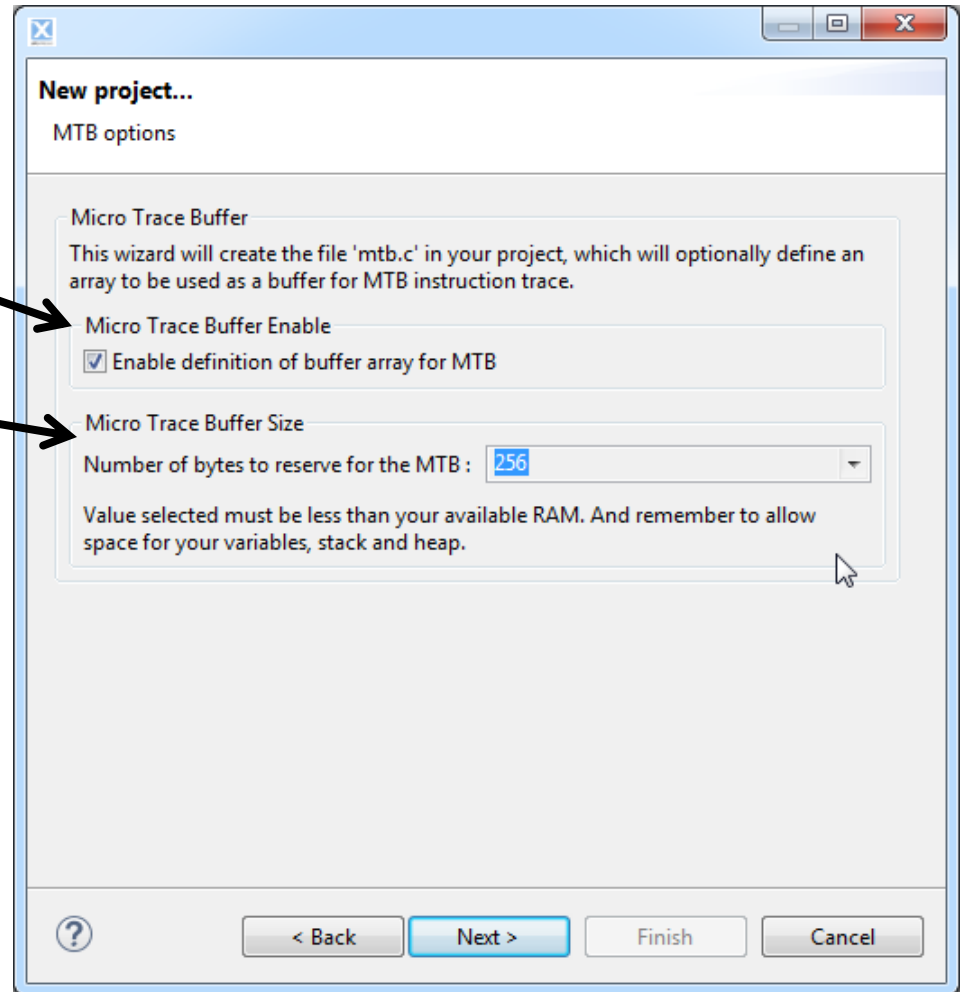
Micro Trace Buffer - Instruction Trace

- ▶ NXP Cortex-M0+ based MCUs implement a Micro Trace Buffer (MTB)
 - Mechanism to collect details of instructions being executed
- ▶ Allows complex program flow problems to be examined
 - Gives insight into what happened in system before a fault was encountered
 - For example : What was happened before a hard fault triggered?
- ▶ Small block at start of system RAM used as a circular buffer to store trace records generated by Cortex-M0+ CPU
- ▶ Available on
 - LPC81x / LPC82x
 - LPC11U6x / LPC11E6x



LPCXpresso project support for MTB

- ▶ Project wizards for parts with MTB have an options page for controlling settings
 - Enable / disable inclusion of buffer in image
 - Size of trace buffer
- ▶ Created project will contain a file called “mtb.c”
 - Defines array variable which will be used as trace buffer
- ▶ LPCXpresso managed linker scripts will then locate this buffer at start of RAM



Modifying MTB settings after project creation

Display the compiler, assembler and linker settings for the selected project

Settings for specified Build Configuration

OR

Configuration: Debug [Active]

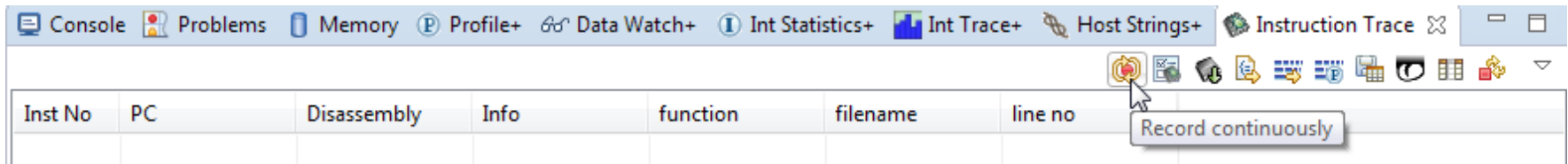
Defined symbols (-D)

- __REDLIB__
- DEBUG
- __CODE_RED
- USE_LPCOPEN
- MTB_BUFFER_SIZE=128**
- CORE_M0PLUS

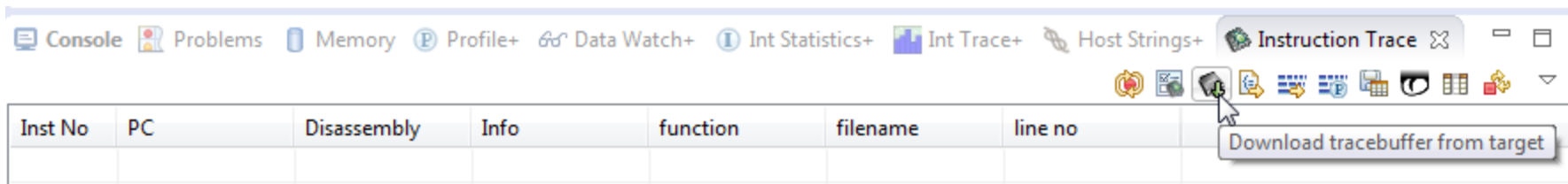
- ▶ Size of buffer can be modified by changing value of symbol `__MTB_BUFFER_SIZE` (defaults to 128 bytes if not defined)
- ▶ Buffer can be disabled (excluded from build) by defining the symbol `__MTB_DISABLE` (or just delete `mtb.c` !)

Collecting instruction trace

- ▶ Ensure target is paused, then switch to Instruction Trace view and click on the “Record Continuously” toolbar button
 - Error if no buffer is defined



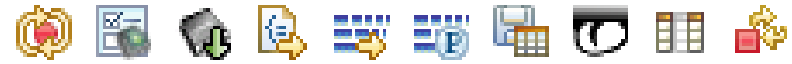
- ▶ When ready to examine trace information, ensure target is paused and click on the “Download tracebuffer...” toolbar button



- ▶ Instruction trace information will then be displayed...

Trace display

Link to Source Show Profile Save table



Link to Disassembly

Select columns

Profile highlighting shows code coverage

Profile info shows how often instruction in buffer

The screenshot shows three main windows: Source Code, Disassembly, and a Trace Table. The Source Code window shows a C function with several lines highlighted in green and blue. The Disassembly window shows the corresponding assembly instructions for the highlighted code. The Trace Table window shows a list of instructions with columns for Inst No, PC, Disassembly, Info, function, filename, and line no. Arrows indicate the following links:

- From the Source Code window to the Disassembly window (labeled "Linked").
- From the Disassembly window to the Trace Table window (labeled "Linked").
- From the Trace Table window back to the Source Code window (labeled "Linked").

Inst No	PC	Disassembly	Info	function	filename	line no
2344	0x00000408	lsls r3, r3, #2		main	../src/main.c	98
2345	0x0000040a	cmp r2, r3		main	../src/main.c	98
2346	0x0000040c	bls.n 0x426 <...>		main	../src/main.c	98
2347	0x0000040e	ldr r3, [pc, #56...		main	../src/main.c	98
2348	0x00000410	ldr r2, [r3, #0]		main	../src/main.c	98
2349	0x00000412	movs r3, #150 ...		main	../src/main.c	98
2350	0x00000414	lsls r3, r3, #3		main	../src/main.c	98
2351	0x00000416	cmp r2, r3		main	../src/main.c	98
2352	0x00000418	bhi.n 0x426 <...>		main	../src/main.c	98

Controlling Trace capture

- ▶ Size of trace buffer is limited
 - Information needed to debug fault may not be in buffer when fault occurs
- ▶ Can disable and then re-enable trace collection from within application code itself – for example to exclude collection during delay loops
- ▶ Done using the "External trace buffer command register" in the System Configuration Peripheral (SYSCON or SYSCTL)

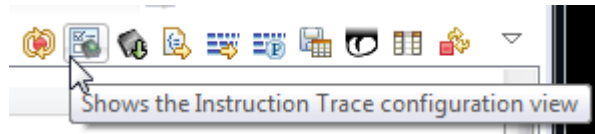
```
// Disable trace collection
LPC_SYSCTL ->EXTTRACECMD = 2;

// .. Do stuff ..

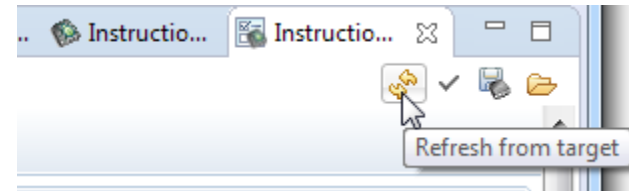
// Re-enable trace collection
LPC_SYSCTL ->EXTTRACECMD = 1;
```

Configuring Trace capture for Stop / Start

1 Open the Configuration view

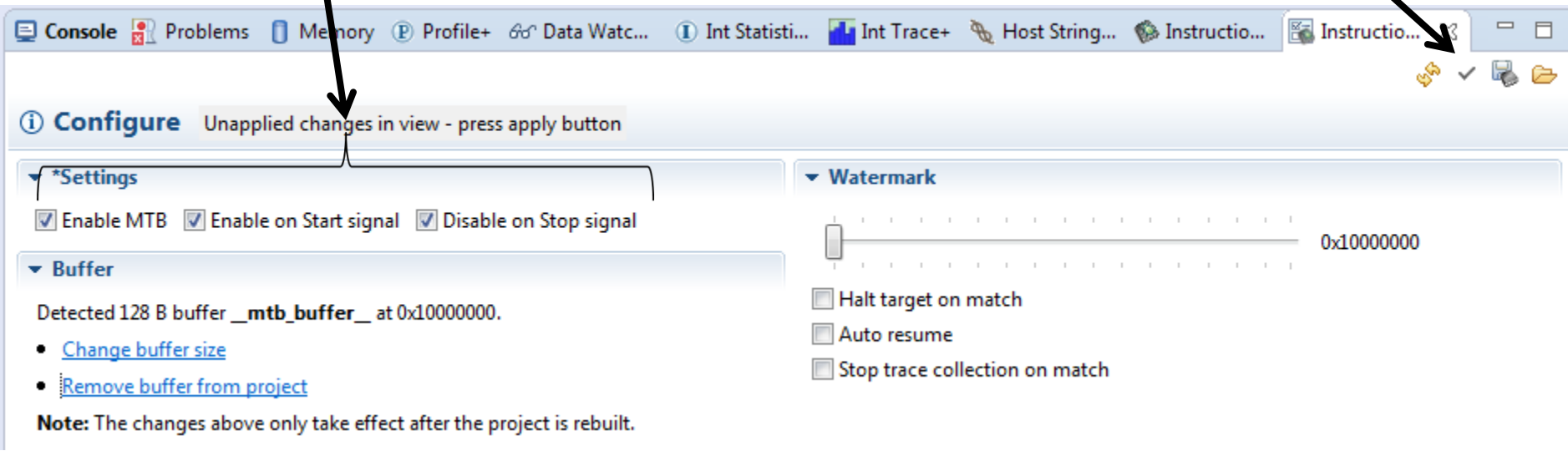


2 Refresh, if required



3 Ensure all 3 settings enabled

4 Click "Apply" button



The screenshot shows the IDE Configuration view for Instruction Trace. The top bar includes tabs for Console, Problems, Memory, Profile+, Data Watch, Int Statist..., Int Trace+, Host String..., and Instruction Trace. The main area is titled "Configure" and shows "Unapplied changes in view - press apply button".

***Settings**

- Enable MTB
- Enable on Start signal
- Disable on Stop signal

Buffer

Detected 128 B buffer `__mtb_buffer__` at 0x10000000.

- [Change buffer size](#)
- [Remove buffer from project](#)

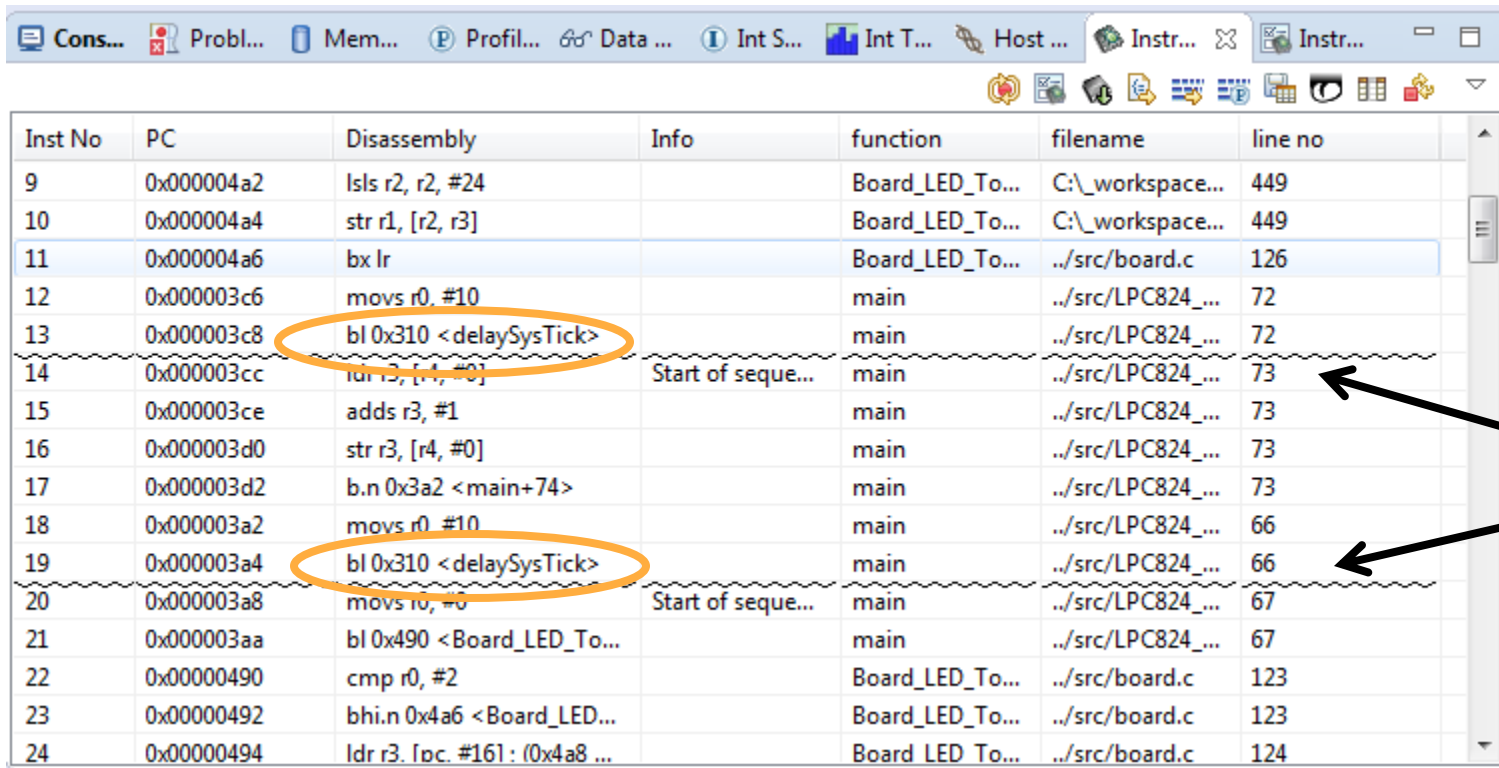
Note: The changes above only take effect after the project is rebuilt.

Watermark

0x10000000

- Halt target on match
- Auto resume
- Stop trace collection on match

Trace Display, with Stop / Start capturing



Inst No	PC	Disassembly	Info	function	filename	line no
9	0x000004a2	lsls r2, r2, #24		Board_LED_To...	C:_workspace...	449
10	0x000004a4	str r1, [r2, r3]		Board_LED_To...	C:_workspace...	449
11	0x000004a6	bx lr		Board_LED_To...	../src/board.c	126
12	0x000003c6	movs r0, #10		main	../src/LPC824_...	72
13	0x000003c8	bl 0x310 <delaySysTick>		main	../src/LPC824_...	72
14	0x000003cc	ldr r3, [r4, #0]	Start of seque...	main	../src/LPC824_...	73
15	0x000003ce	adds r3, #1		main	../src/LPC824_...	73
16	0x000003d0	str r3, [r4, #0]		main	../src/LPC824_...	73
17	0x000003d2	b.n 0x3a2 <main+74>		main	../src/LPC824_...	73
18	0x000003a2	movs r0, #10		main	../src/LPC824_...	66
19	0x000003a4	bl 0x310 <delaySysTick>		main	../src/LPC824_...	66
20	0x000003a8	movs r0, #0	Start of seque...	main	../src/LPC824_...	67
21	0x000003aa	bl 0x490 <Board_LED_To...		main	../src/LPC824_...	67
22	0x00000490	cmp r0, #2		Board_LED_To...	../src/board.c	123
23	0x00000492	bhi.n 0x4a6 <Board_LED...		Board_LED_To...	../src/board.c	123
24	0x00000494	ldr r3, [pc, #16]: (0x4a8 ...		Board_LED_To...	../src/board.c	124

Trace capture
paused during
delaySysTick()



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