Last update: February 2014
Document Number: MQXCWPP

CW for Microcontrollers v10 and MQX™

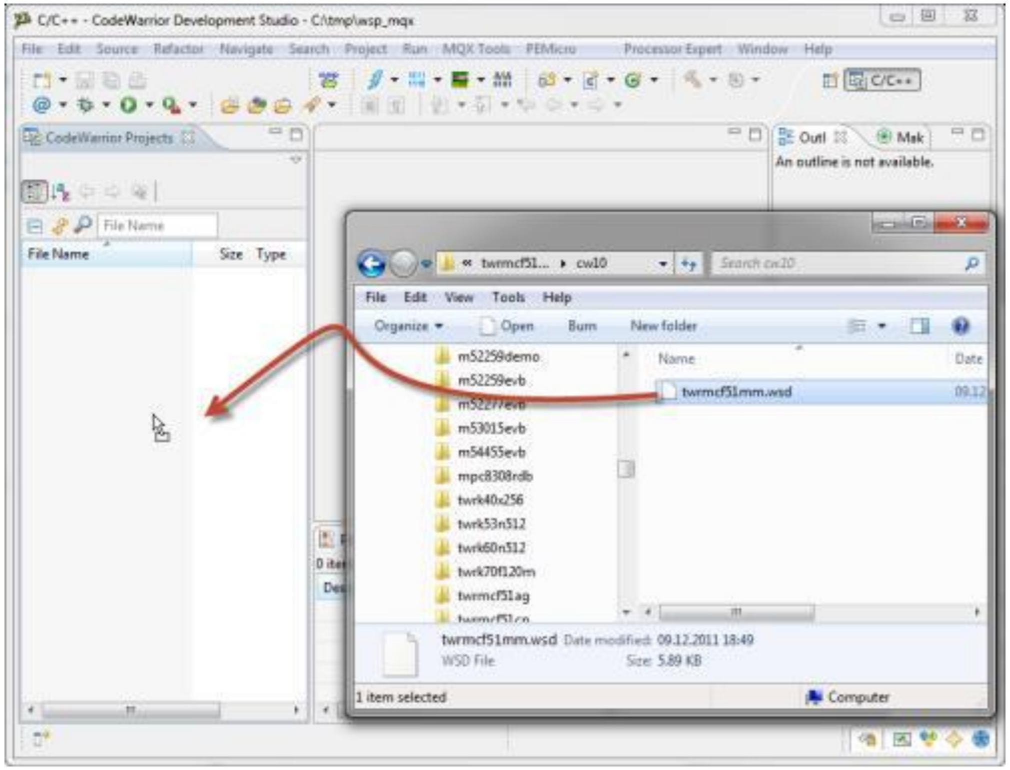
Contents

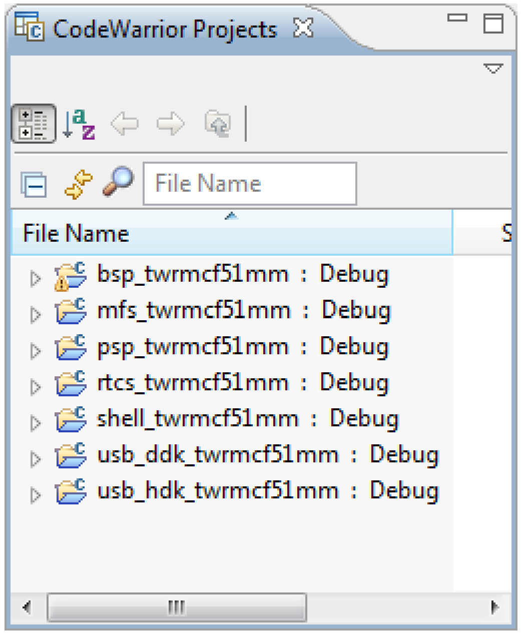
Import MQX Libraries

Import MQX Libraries

- Navigate to `C:\Freescale\Freescale MQXX.X\build\<board_name>\cw10gcc\` and drag <board>.wsd to the CodeWarrior

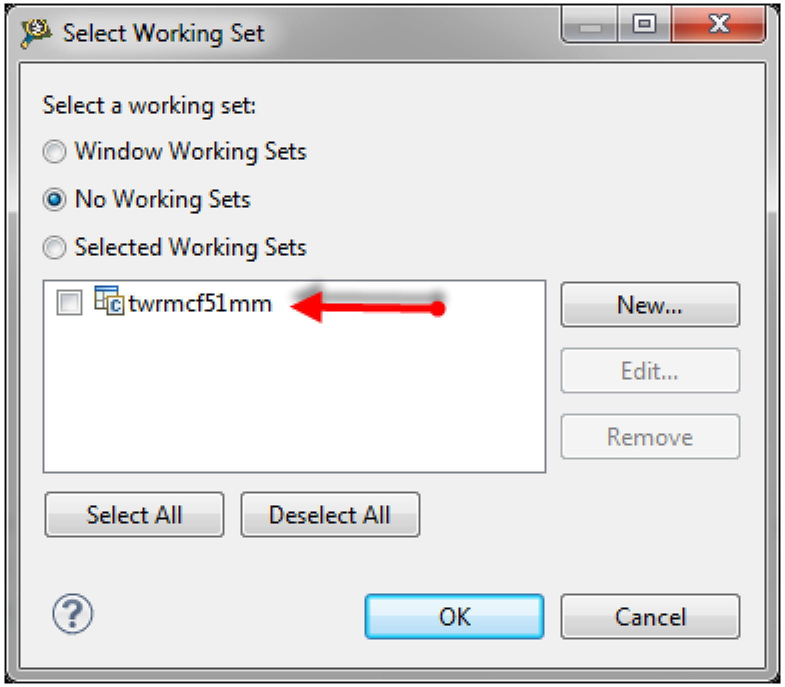
- All BSP libraries will be loaded to your environment automatically


C/C++ - CodeWarrior Development Studio - C:\tmp\wsp_mqx
File Edit Source Refactor Navigate Search Project Run MQX Tools PEMicro Processor Expert Window Help
CodeWarrior Projects
File Name
Size Type
An outline is not available.
twrmcf51... cw10
Search cw10
Organize Open Burn New folder
m52259demo
m52259evb
m52277evb
m53015evb
m54455evb
mpc8308rdb
twrk40x256
twrk53n512
twrk60n512
twrk70f120m
twrmcf51ag
twrmcf51cn
Name
Date
twrmcf51mm.wsd
twrmcf51mm.wsd Date modified: 09.12.2011 18:49
WSD File Size: 5.89 KB
1 item selected
Computer



Import MQX libraries

- Both, the projects, and the Working Set configuration have been imported.


Select Working Set

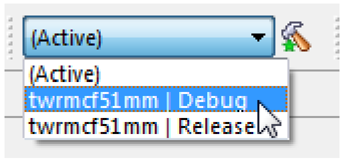
Select a working set:

( ) Window Working Sets
(●) No Working Sets
( ) Selected Working Sets

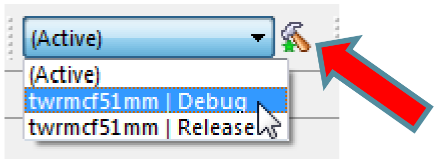
☐ twrmcf51mm

Building MQX Libraries

- Use MQX toolbar to select desired configuration you wish to build.



- Hit the icon to build all MQX libraries for a selected working set as shown below:

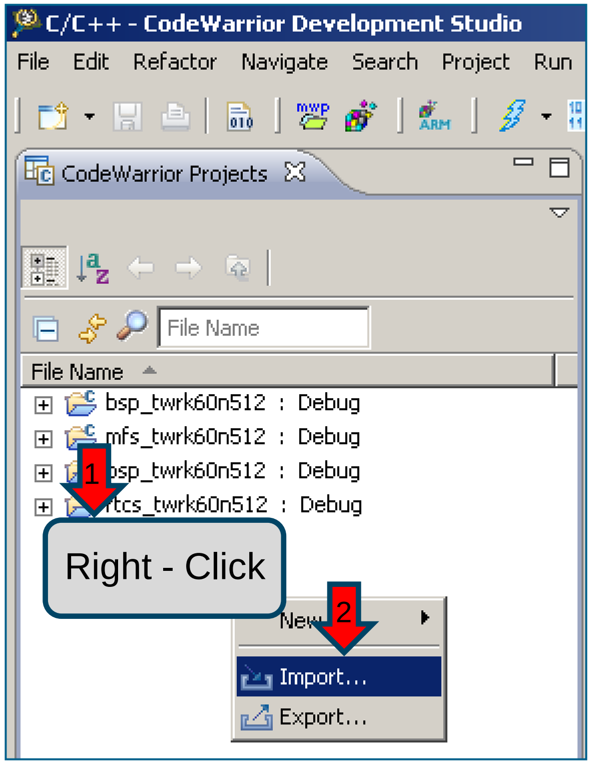


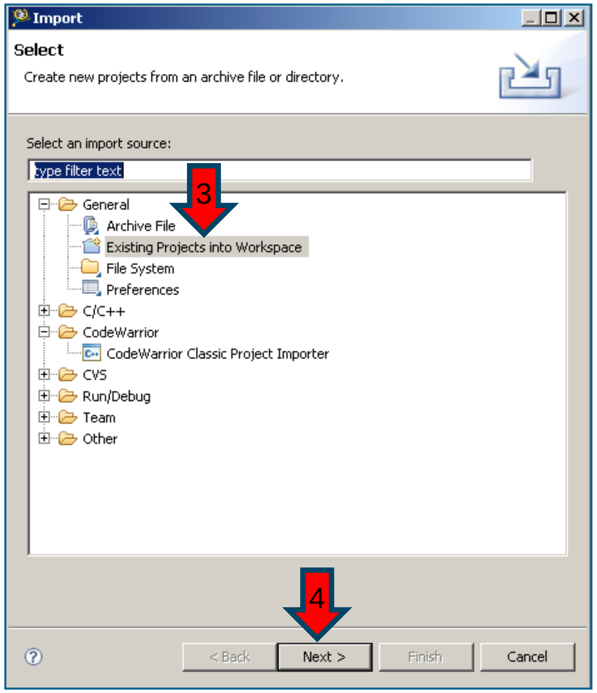
Note:
Debug configuration of MQX libraries, workingset, has the compiler optimization set to the lowest level for all imported projects. The **Release** configuration uses the highest possible compiler optimization setting.

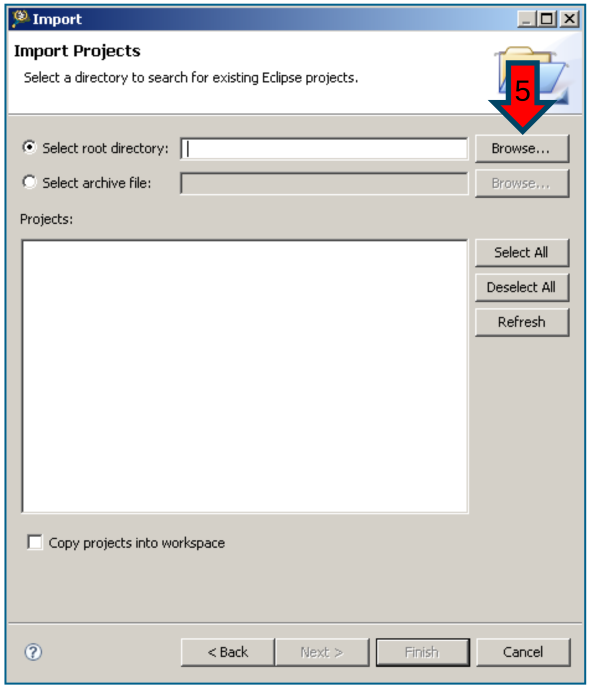
Import and Debug MXQ Hello World Project

Import ‘Hello World’ MQX example

- ► Right-Click on Project Explorer and Import.
- ► Select Existing Projects into Workspace and Browse.

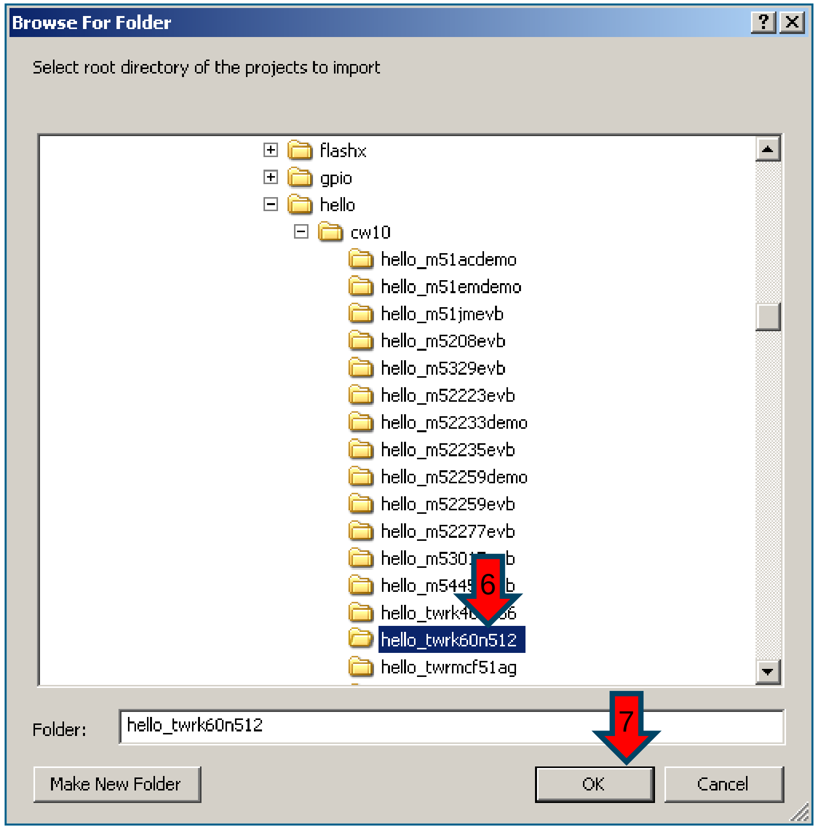






Import ‘Hello World’ MQX example

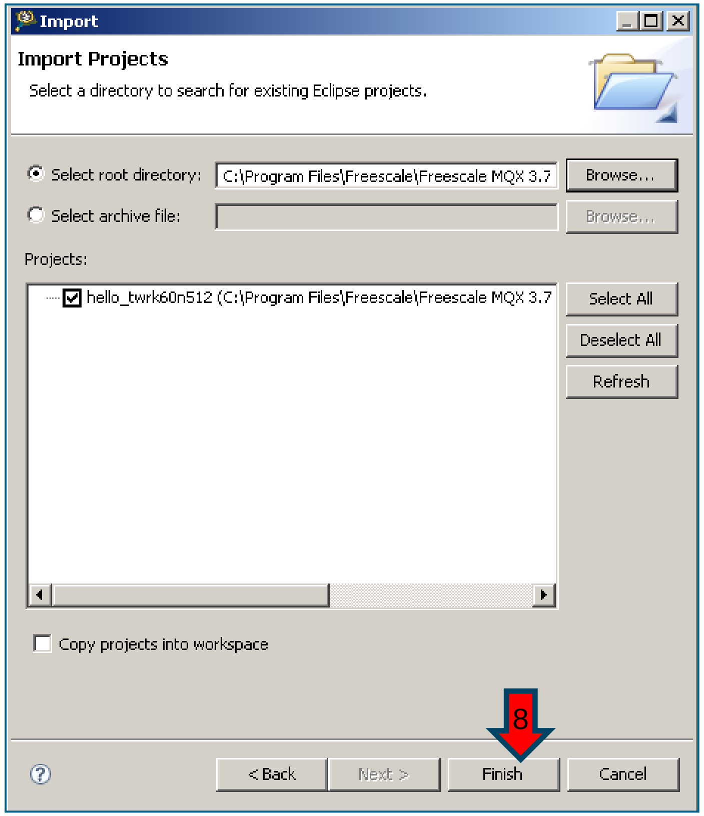
- Select *<installmqxfolder>\mqx\examples\hello\build\CW10\hello_twrk60n512*


Browse For Folder

Select root directory of the projects to import

flashx
gpio
hello
cw10
hello_m51acdemo
hello_m51emdemo
hello_m51jmevb
hello_m5208evb
hello_m5329evb
hello_m52223evb
hello_m52233demo
hello_m52235evb
hello_m52259demo
hello_m52259evb
hello_m52277evb
hello_m530
hello_m544
hello_twrk4
hello_twrk60n512
hello_twrmcf51ag

Folder: hello_twrk60n512


Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: C:\Program Files\Freescale\Freescale MQX 3.7

○ Select archive file:

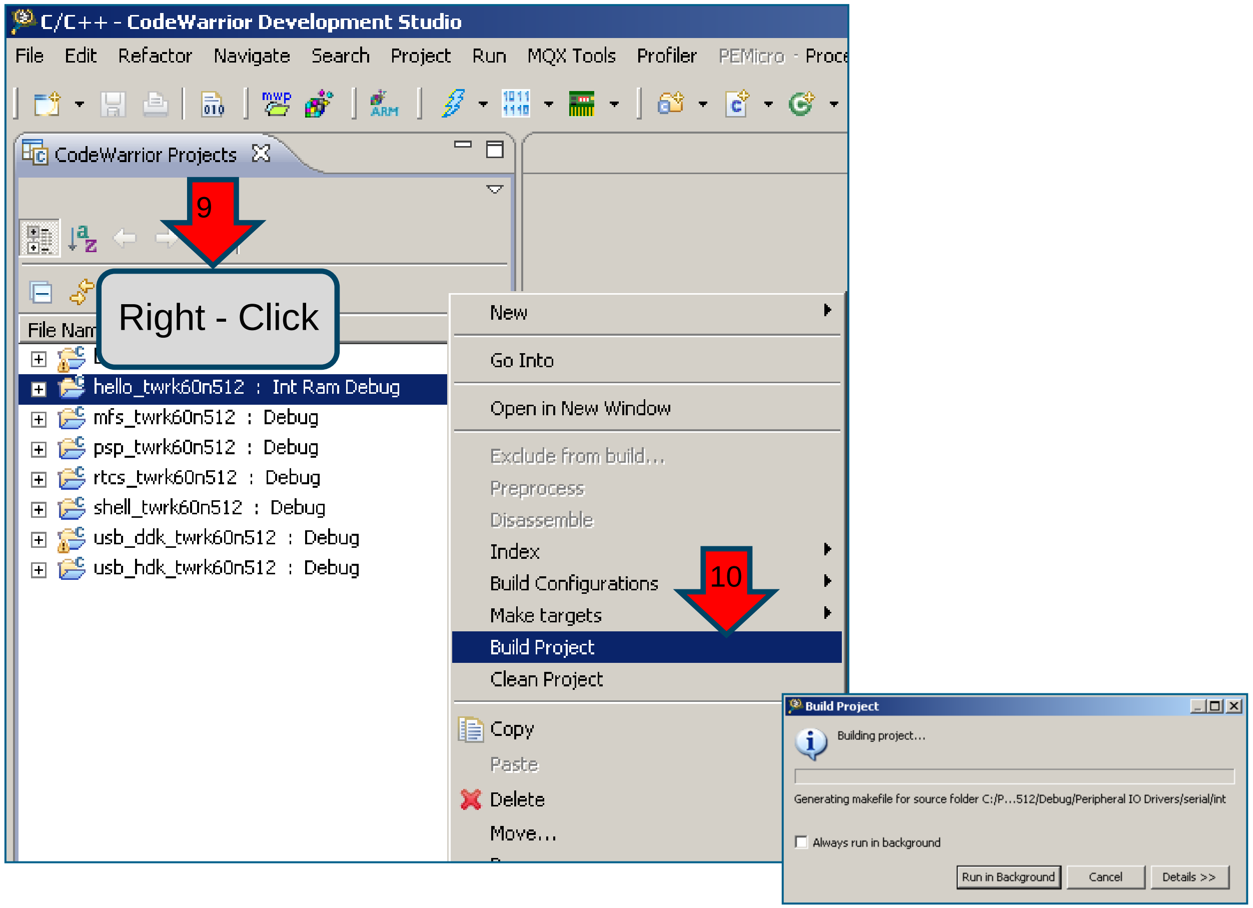
Projects:

☑ hello_twrk60n512 (C:\Program Files\Freescale\Freescale MQX 3.7

☐ Copy projects into workspace

Build ‘Hello World’ MQX example

- Right-Click on Project Explorer **hello_twrk60n512** and select Build Project.

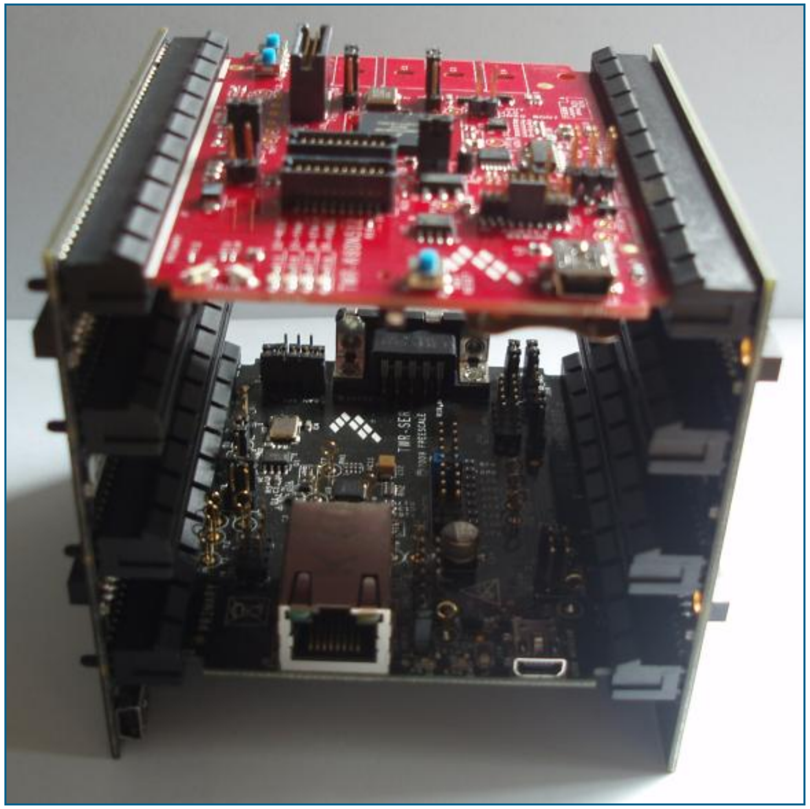


Building project...

Generating makefile for source folder C:/P...512/Debug/Peripheral IO Drivers/serial/int

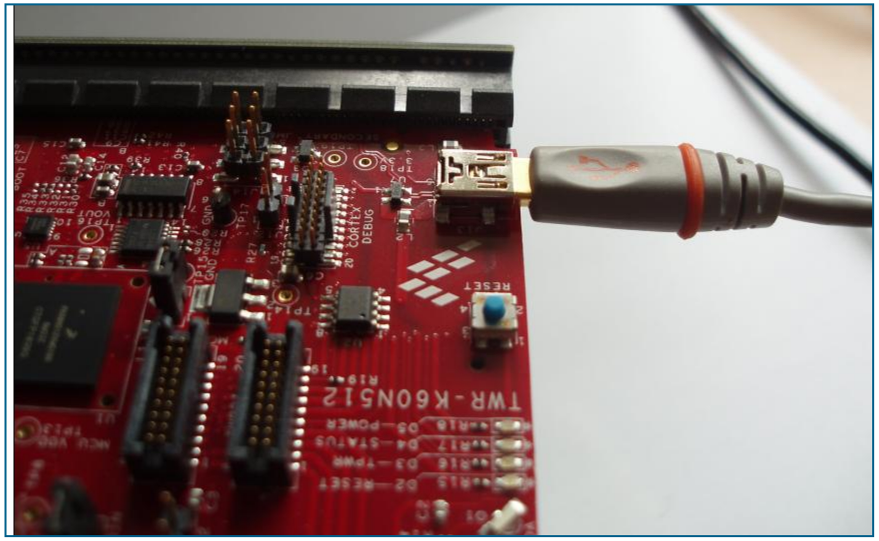
Prepare your hardware

- Prepare your Tower System:
  - Connect **TWR-SER** and **TWR-K60N512** to **TWR-ELEV** (primary and secondary).



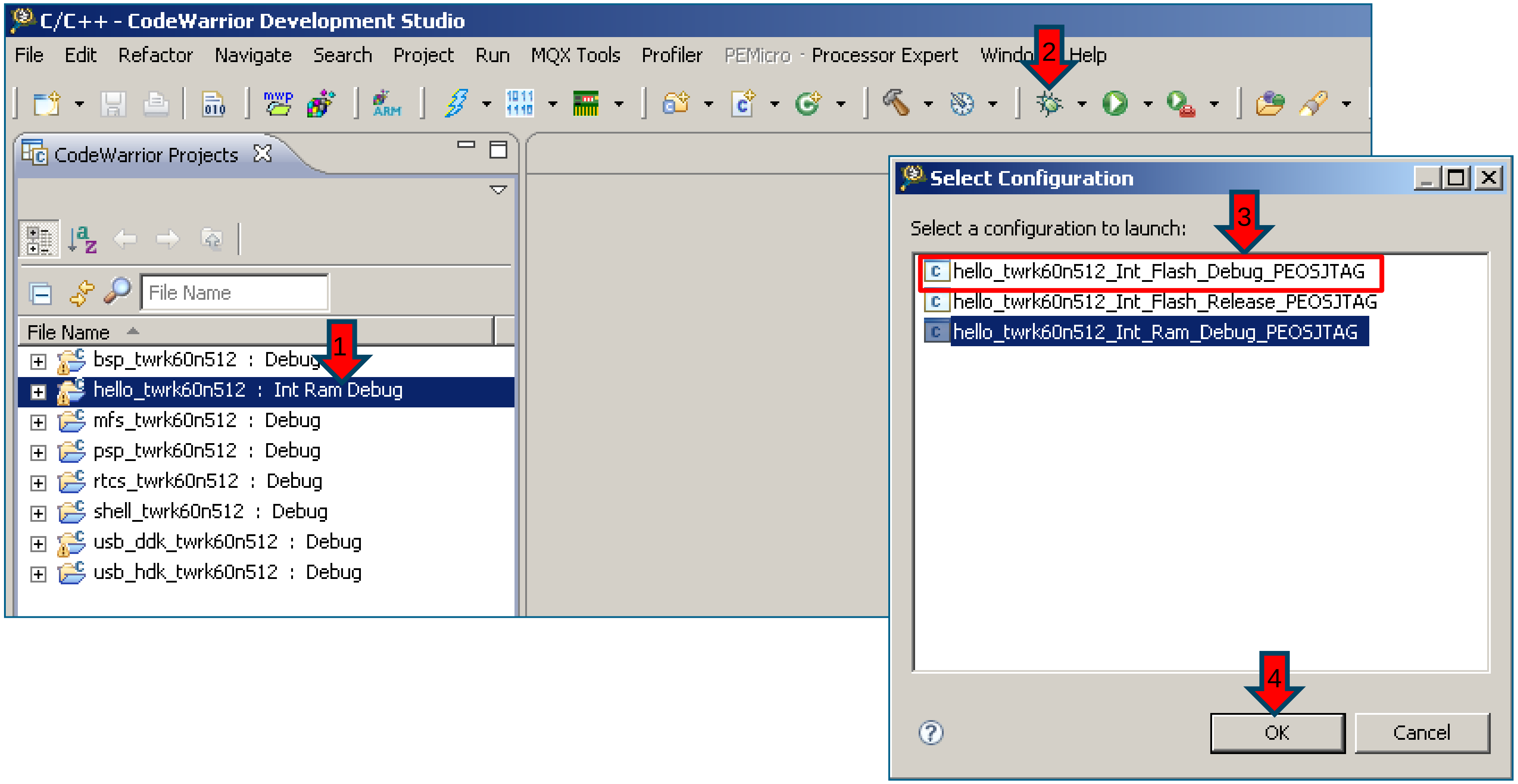
Prepare your hardware

▶ Connect USB Cable to the **TWR-K60N512** (J13) and to the laptop.



Debug MQX 'Hello World' example

- Select **hello_twrk60n512** project and Click 'Debug icon.'
- Select **hello_twrk60n512_Int_Flash_Debug_PEOSJTAG** connection.



C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Window Help
CodeWarrior Projects
File Name
1
2
3
4
Select Configuration
OK
Cancel

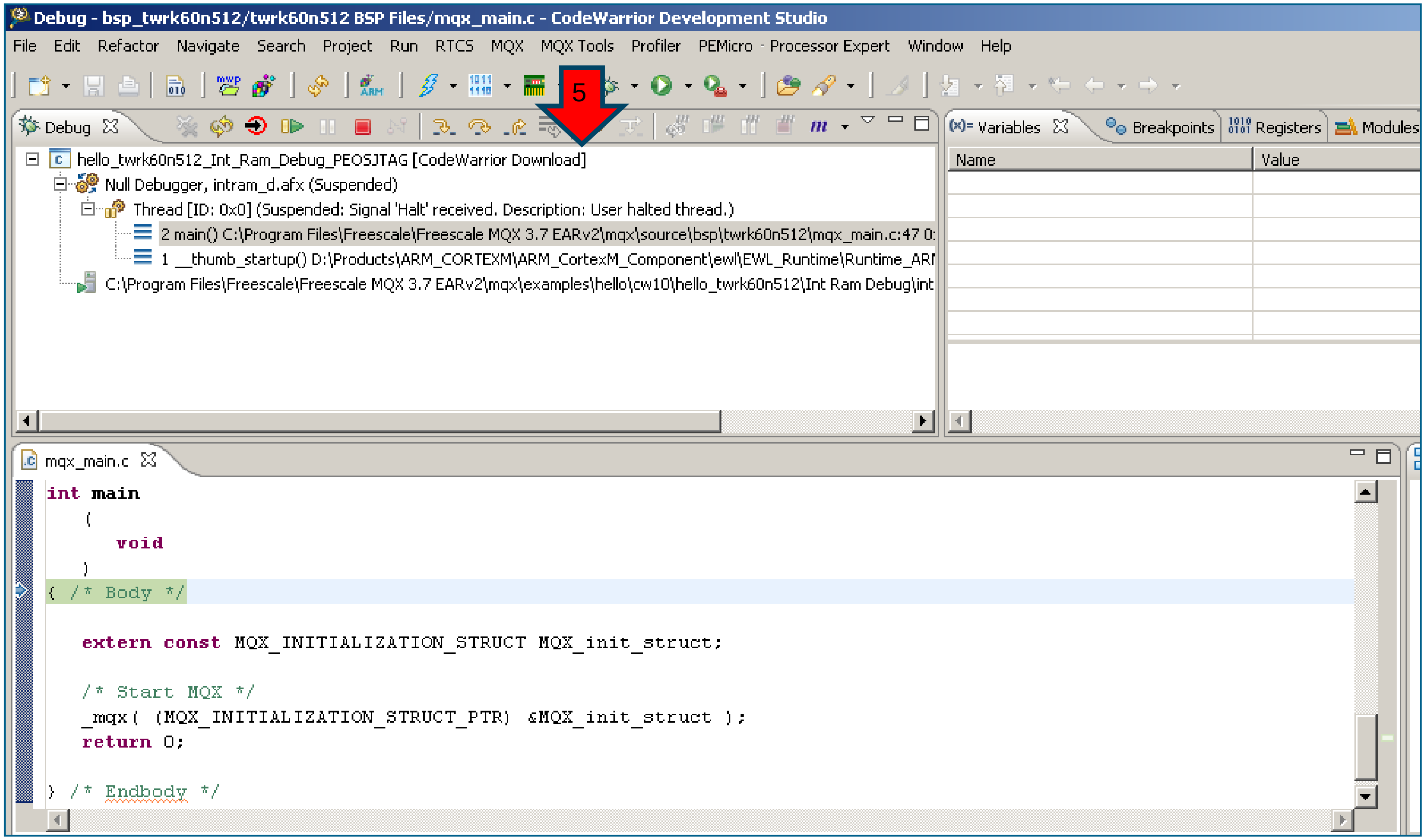
bsp_twrk60n512 : Debug
hello_twrk60n512 : Int Ram Debug
mfs_twrk60n512 : Debug
psp_twrk60n512 : Debug
rtcs_twrk60n512 : Debug
shell_twrk60n512 : Debug
usb_ddk_twrk60n512 : Debug
usb_hdk_twrk60n512 : Debug

Select a configuration to launch:

hello_twrk60n512_Int_Flash_Debug_PEOSJTAG
hello_twrk60n512_Int_Flash_Release_PEOSJTAG
hello_twrk60n512_Int_Ram_Debug_PEOSJTAG

Debug MQX ‘Hello World’ example

- You are ready to Run and Debug the project.

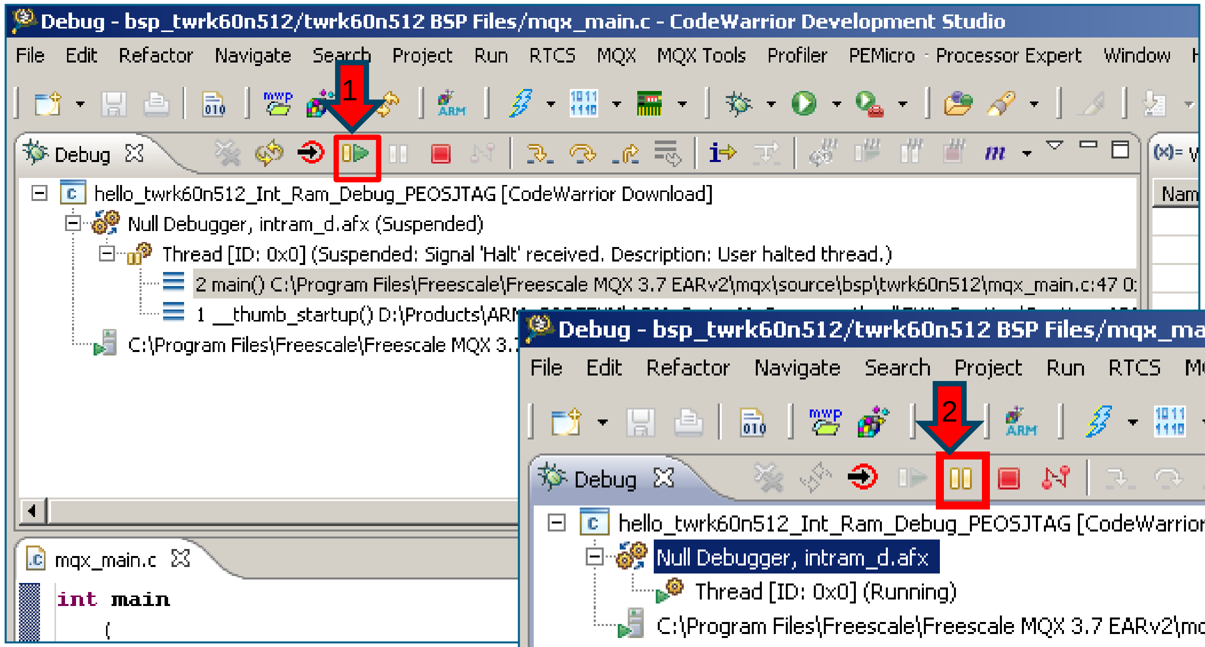

Debug - bsp_twrk60n512/twrk60n512 BSP Files/mqx_main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
5
Debug
Variables
Breakpoints
Registers
Modules
Name
Value
mqx_main.c

hello_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
Null Debugger, intram_d.afx (Suspended)
Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
1 __thumb_startup() D:\Products\ARM_CORTEXM\ARM_CortexM_Component\ewl\EWL_Runtime\Runtime_ARI
C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\cw10\hello_twrk60n512\Int Ram Debug\int

```
int main
   (
      void
   )
{ /* Body */

   extern const MQX_INITIALIZATION_STRUCT MQX_init_struct;

   /* Start MQX */
   _mqx( (MQX_INITIALIZATION_STRUCT_PTR) &MQX_init_struct );
   return 0;

} /* Endbody */
```

Run MQX ‘Hello World’ example

- Execute the code ‘Resume’ icon and ‘Pause’ execution.



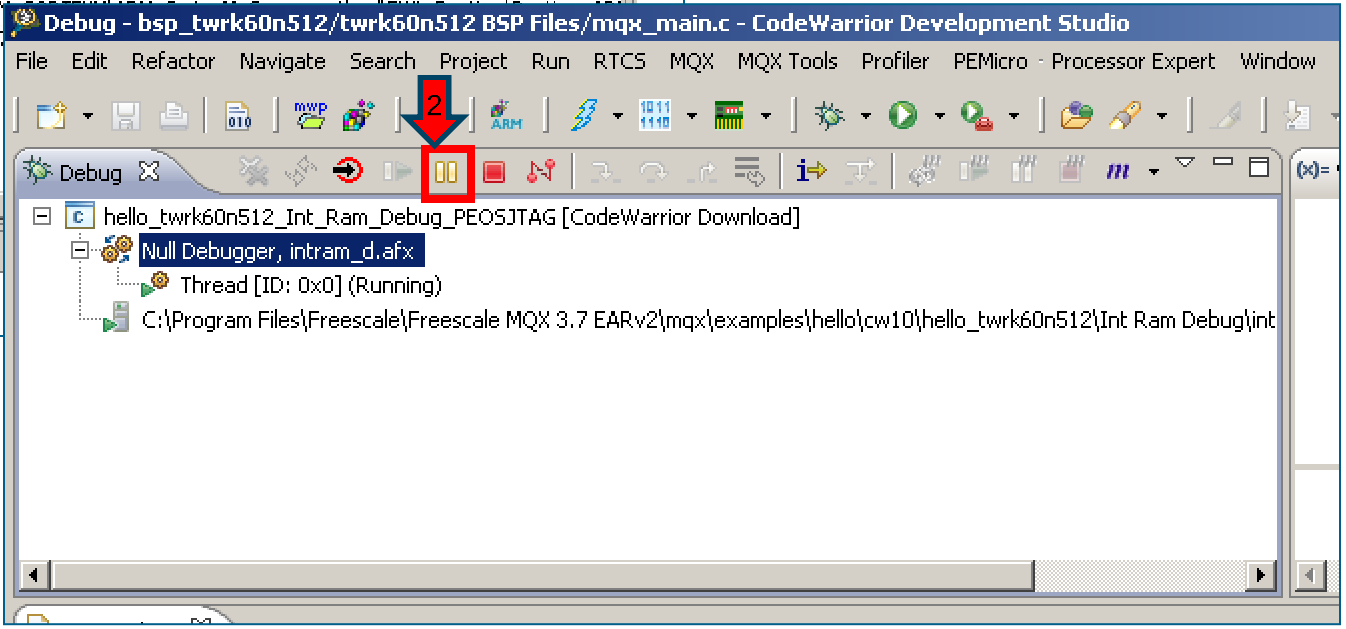
Debug - bsp_twrk60n512/twrk60n512 BSP Files/mqx_main.c - CodeWarrior Development Studio

File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window

```
hello_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  Null Debugger, intram_d.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
      1 __thumb_startup() D:\Products\ARM
  C:\Program Files\Freescale\Freescale MQX 3.7
```

mqx_main.c

```
int main
   (
```



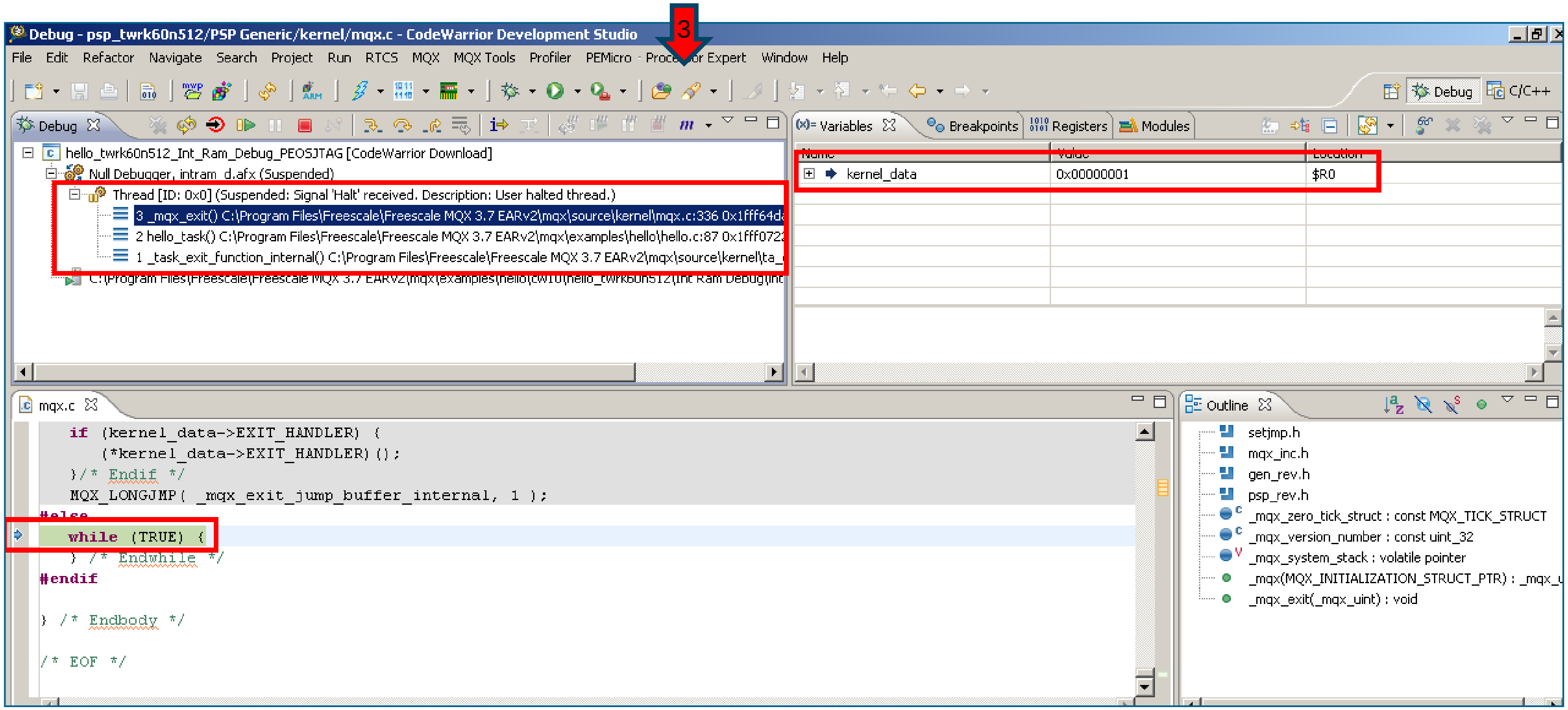
Debug - bsp_twrk60n512/twrk60n512 BSP Files/mqx_main.c - CodeWarrior Development Studio

File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window

```
hello_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  Null Debugger, intram_d.afx
    Thread [ID: 0x0] (Running)
  C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\cw10\hello_twrk60n512\Int Ram Debug\int
```

Run MQX ‘Hello World’ example

- You can explore the Debugging Eclipse perspective.


3
Debug - psp_twrk60n512/PSP Generic/kernel/mqx.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
Debug
C/C++
Debug
Variables
Breakpoints
Registers
Modules
mqx.c
Outline

```
hello_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  Null Debugger, intram_d.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      3 _mqx_exit() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\kernel\mqx.c:336 0x1fff64da
      2 hello_task() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\hello.c:87 0x1fff0722
      1 _task_exit_function_internal() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\kernel\ta_
  C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\cw10\hello_twrk60n512\Int Ram Debug\inc
```

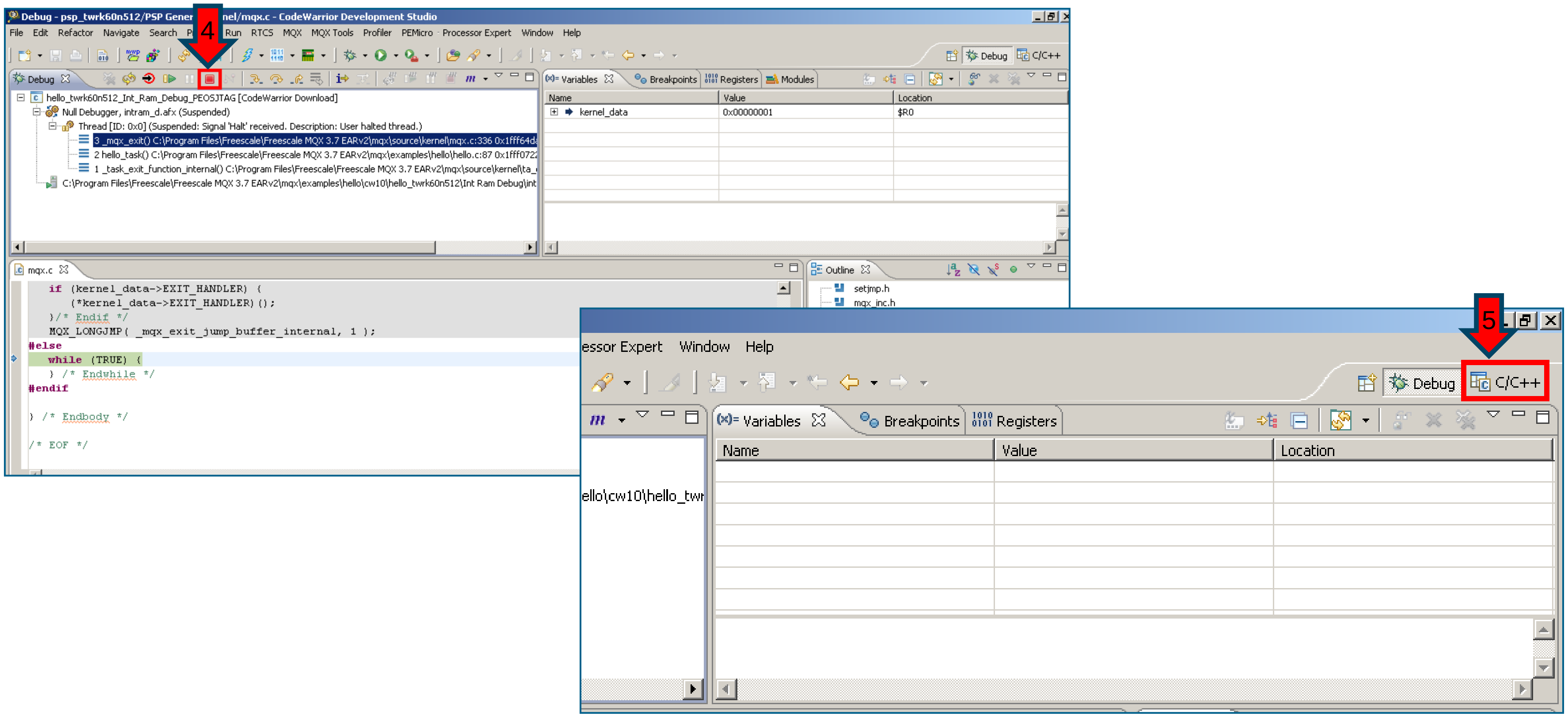
Name	Value	Location
kernel_data	0x00000001	$R0

```
    if (kernel_data->EXIT_HANDLER) {
        (*kernel_data->EXIT_HANDLER)();
    }/* Endif */
    MQX_LONGJMP( _mqx_exit_jump_buffer_internal, 1 );
#else
    while (TRUE) {
    } /* Endwhile */
#endif

} /* Endbody */

/* EOF */
```

```
setjmp.h
mqx_inc.h
gen_rev.h
psp_rev.h
_mqx_zero_tick_struct : const MQX_TICK_STRUCT
_mqx_version_number : const uint_32
_mqx_system_stack : volatile pointer
_mqx(MQX_INITIALIZATION_STRUCT_PTR) : _mqx_u
_mqx_exit(_mqx_uint) : void
```

Run MQX ‘Hello World’ example

- Terminate the Debugging session and change Eclipse perspective.
- You have Run and Debug your first MQX CW10 project.


Debug - psp_twrk60n512/PSP Gener nel/mqx.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search P Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
4
Debug
C/C++
Variables
Breakpoints
Registers
Modules
Outline
setjmp.h
mqx_inc.h
5
essor Expert Window Help
Debug
C/C++
Variables
Breakpoints
Registers
Name
Value
Location
ello\cw10\hello_twr

```
hello_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  Null Debugger, intram_d.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      3 _mqx_exit() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\kernel\mqx.c:336 0x1fff64da
      2 hello_task() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\hello.c:87 0x1fff0722
      1 _task_exit_function_internal() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\kernel\ta_
  C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\examples\hello\cw10\hello_twrk60n512\Int Ram Debug\int
```

Name	Value	Location
kernel_data	0x00000001	$R0

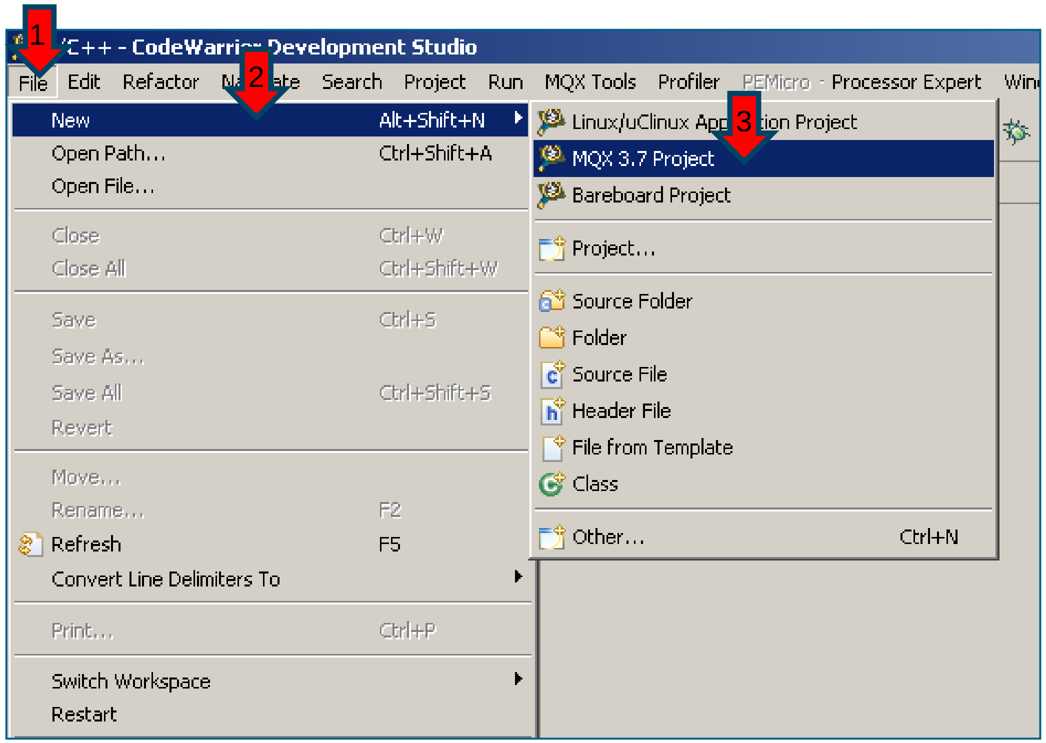
mqx.c

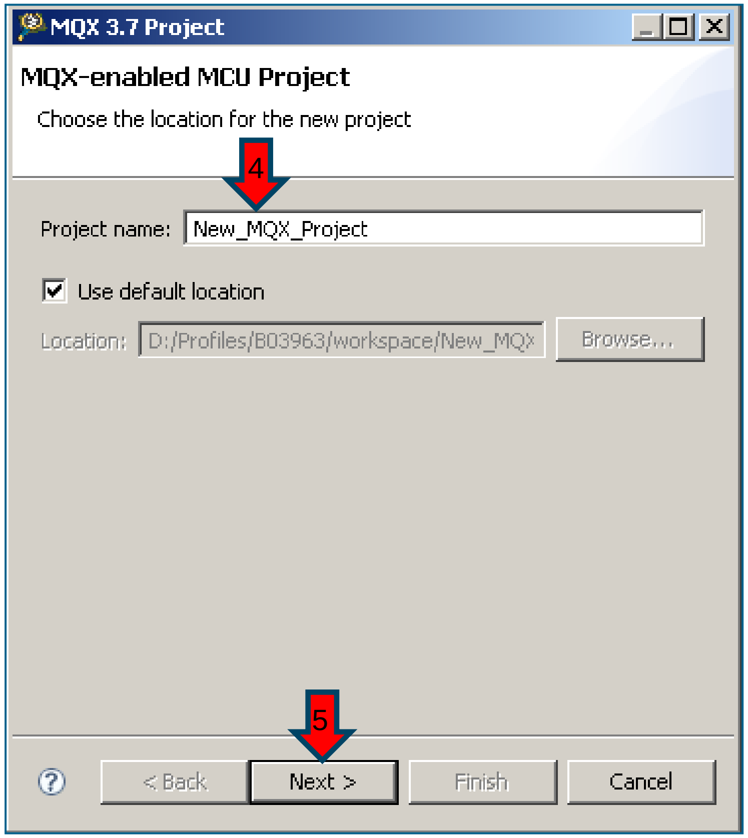
```
   if (kernel_data->EXIT_HANDLER) {
      (*kernel_data->EXIT_HANDLER)();
   }/* Endif */
   MQX_LONGJMP( _mqx_exit_jump_buffer_internal, 1 );
#else
   while (TRUE) {
   } /* Endwhile */
#endif

} /* Endbody */

/* EOF */
```

New MQX project

New MQX Project

- File -> New -> MQX Project
- Give it a name and click Next.





MQX-enabled MCU Project

Choose the location for the new project

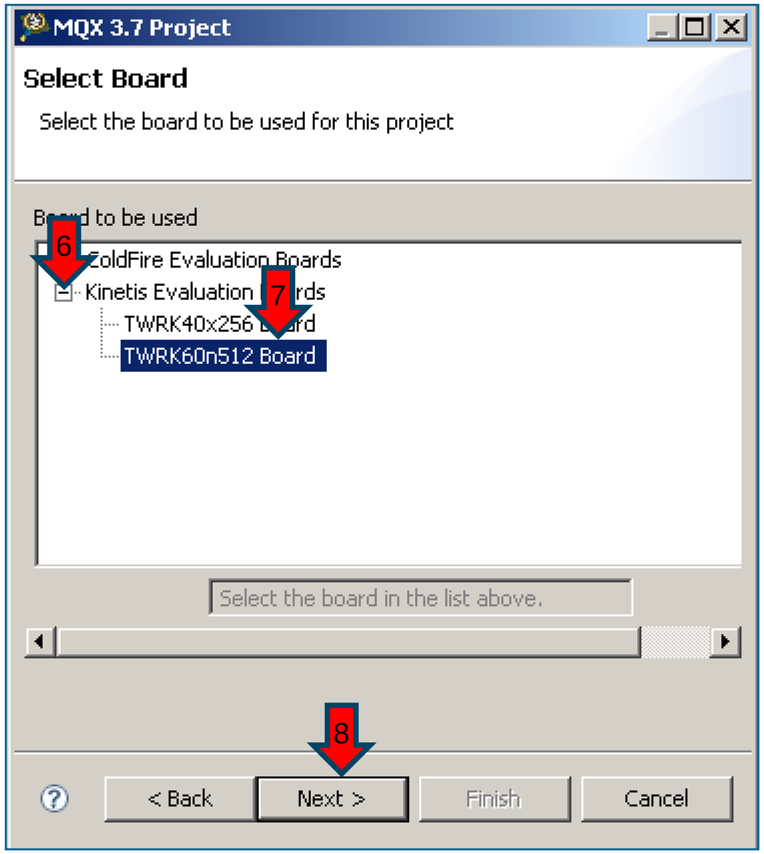
Project name: New_MQX_Project

☑ Use default location

Location: D:/Profiles/B03963/workspace/New_MQX

New MQX Project

▶ Select **TWRK60n512** Board.



MQX 3.7 Project

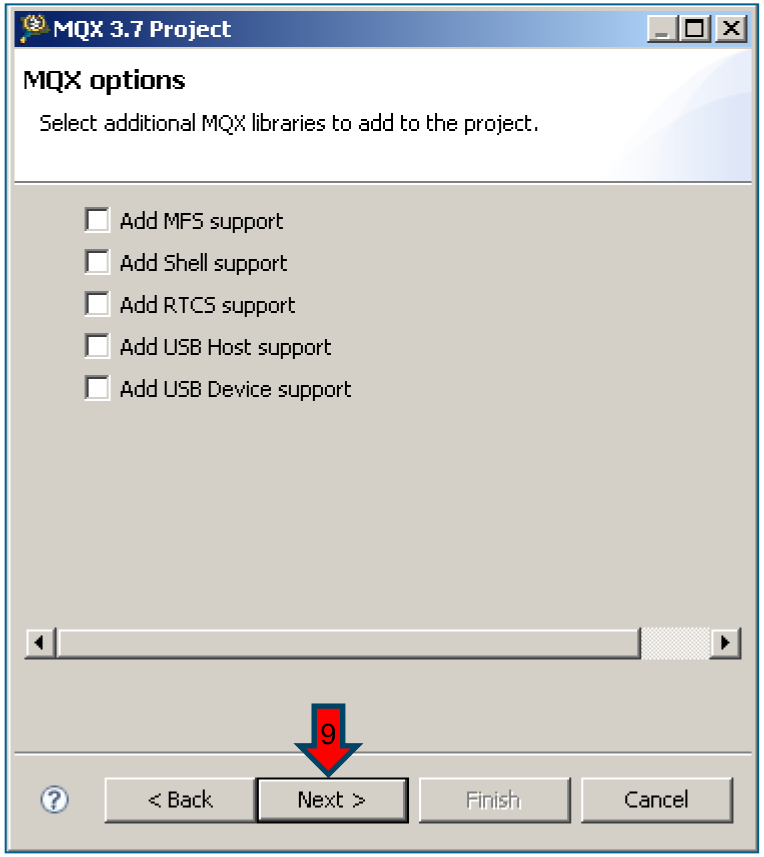
Select Board

Select the board to be used for this project

Board to be used

- ColdFire Evaluation Boards
- Kinetis Evaluation Boards
  - TWRK40x256 Board
  - TWRK60n512 Board

Select the board in the list above.



MQX 3.7 Project

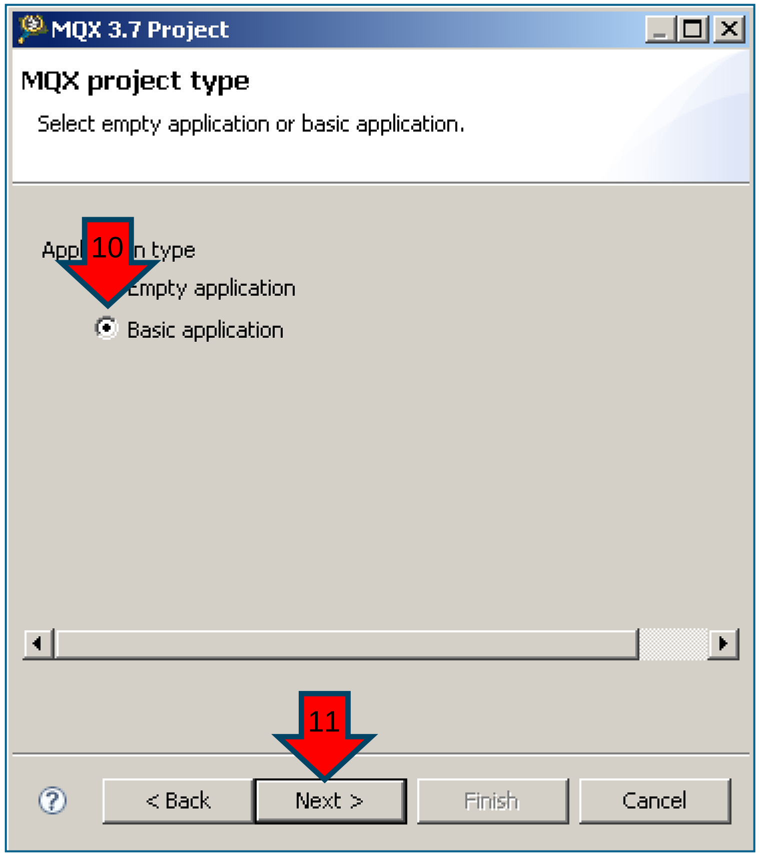
MQX options

Select additional MQX libraries to add to the project.

- ☐ Add MFS support
- ☐ Add Shell support
- ☐ Add RTCS support
- ☐ Add USB Host support
- ☐ Add USB Device support

New MQX Project

- Select Basic application.



MQX 3.7 Project

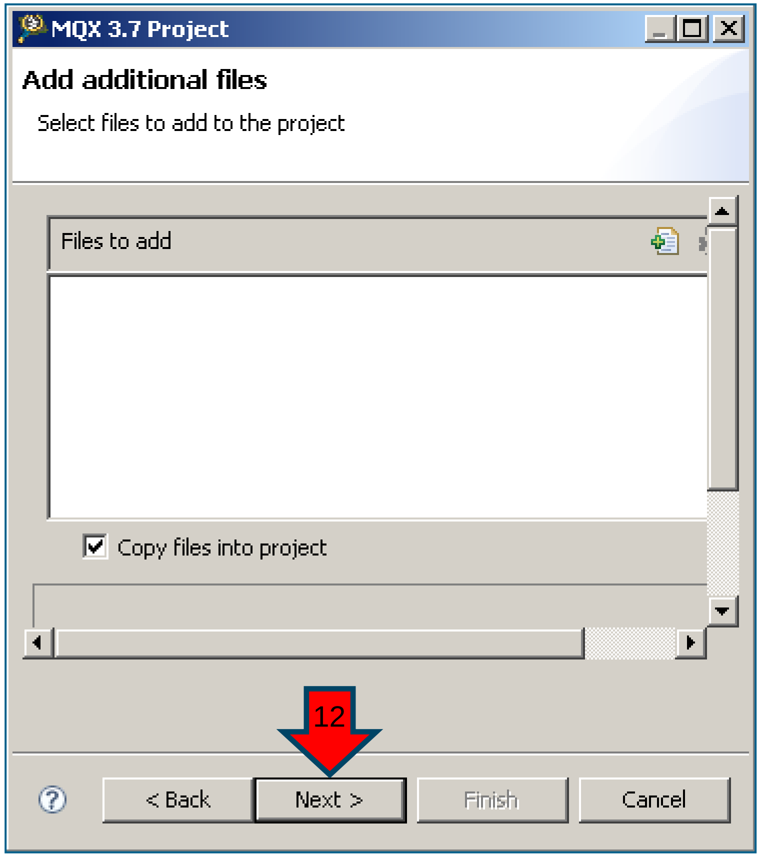
MQX project type

Select empty application or basic application.

Application type

( ) Empty application

(•) Basic application



MQX 3.7 Project

Add additional files

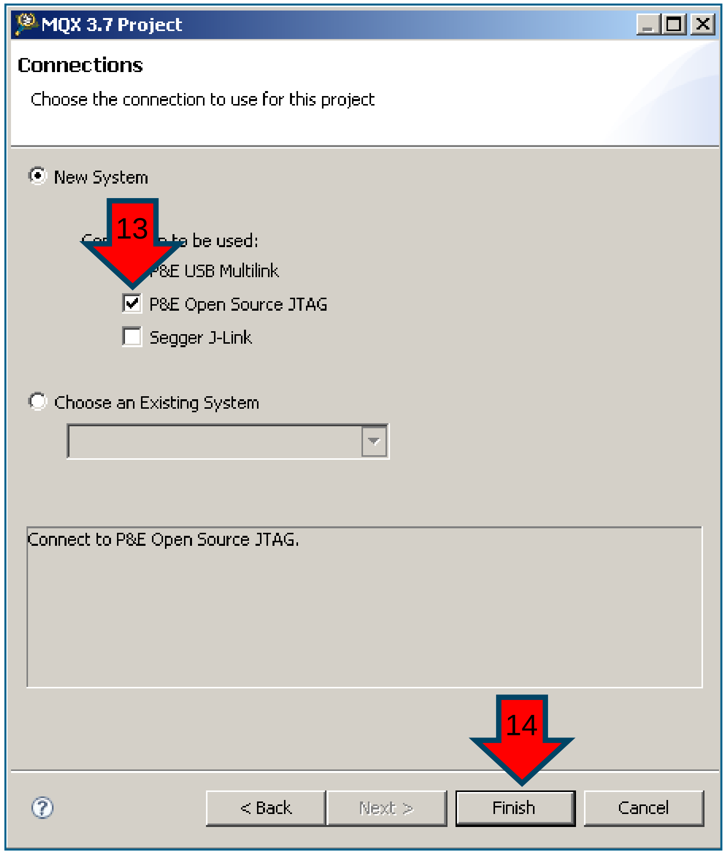
Select files to add to the project

Files to add

[✓] Copy files into project

New MQX Project

- Select P&E Open Source JTAG.
- A project is created.



MQX 3.7 Project

Connections

Choose the connection to use for this project

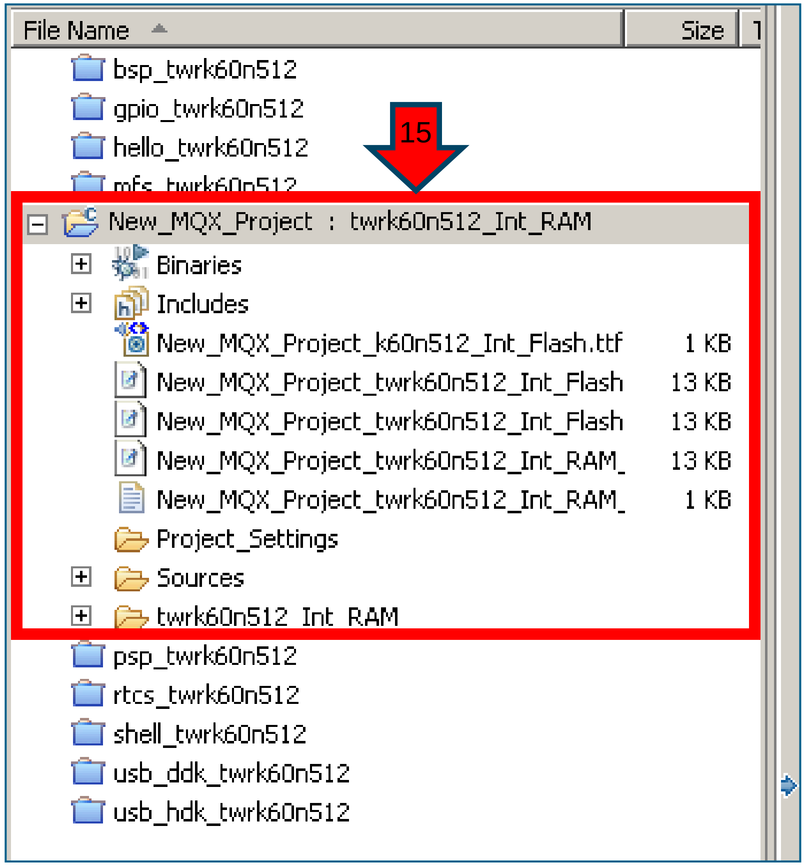
(● New System)

Connections to be used:

- [ ] P&E USB Multilink
- [✓] P&E Open Source JTAG
- [ ] Segger J-Link

○ Choose an Existing System

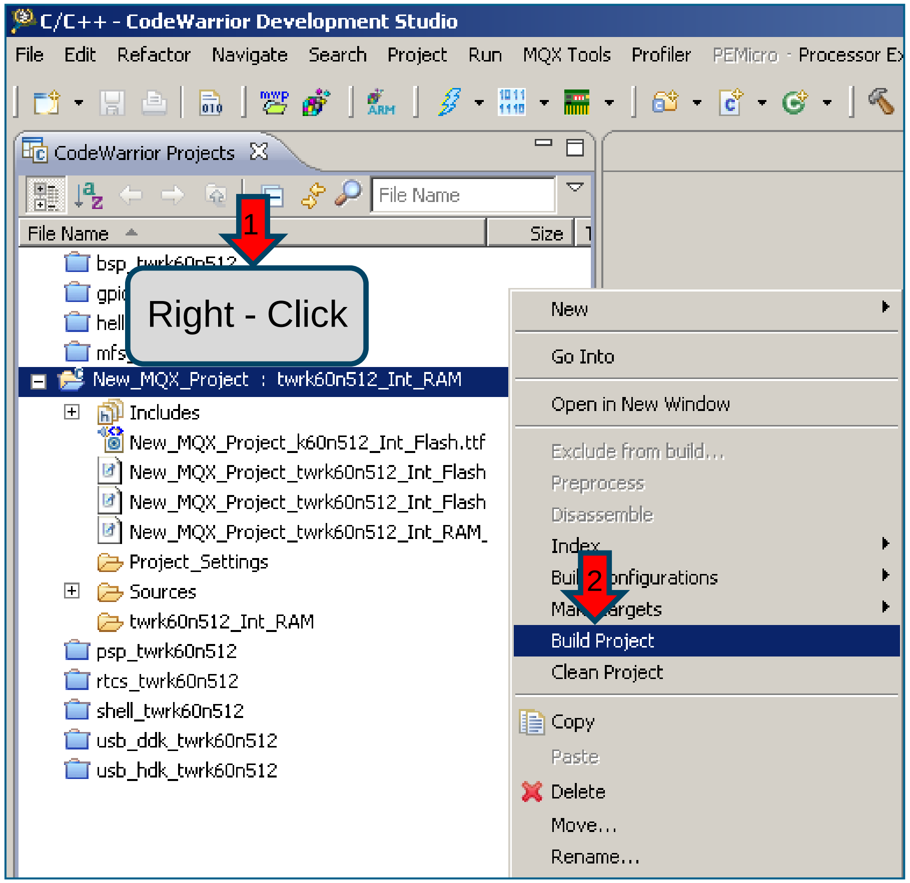
Connect to P&E Open Source JTAG.

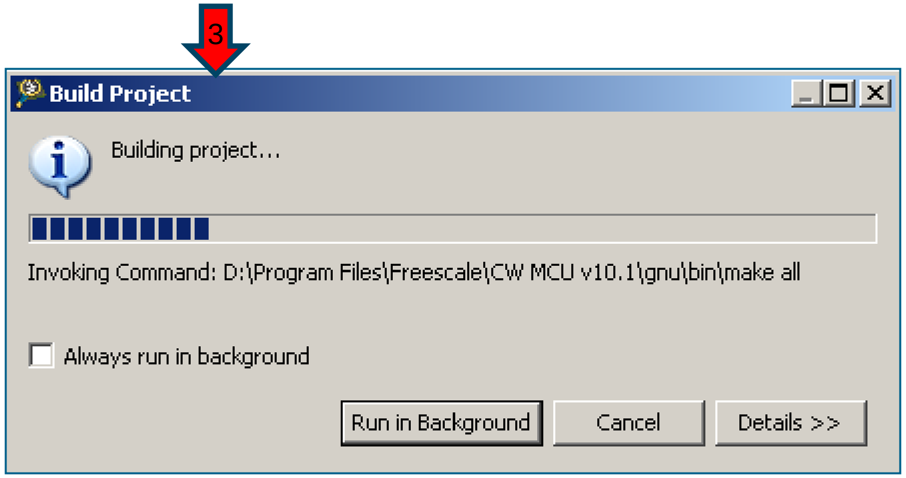


File Name	Size
bsp_twrk60n512	
gpio_twrk60n512	
hello_twrk60n512	
mfs_twrk60n512	
New_MQX_Project : twrk60n512_Int_RAM	
Binaries	
Includes	
New_MQX_Project_k60n512_Int_Flash.ttf	1 KB
New_MQX_Project_twrk60n512_Int_Flash	13 KB
New_MQX_Project_twrk60n512_Int_Flash	13 KB
New_MQX_Project_twrk60n512_Int_RAM_	13 KB
New_MQX_Project_twrk60n512_Int_RAM_	1 KB
Project_Settings	
Sources	
twrk60n512_Int_RAM	
psp_twrk60n512	
rtcs_twrk60n512	
shell_twrk60n512	
usb_ddk_twrk60n512	
usb_hdk_twrk60n512	

Build New MQX Project

- Right-Click on Project Explorer **New_MQX_Project** and Build Project.



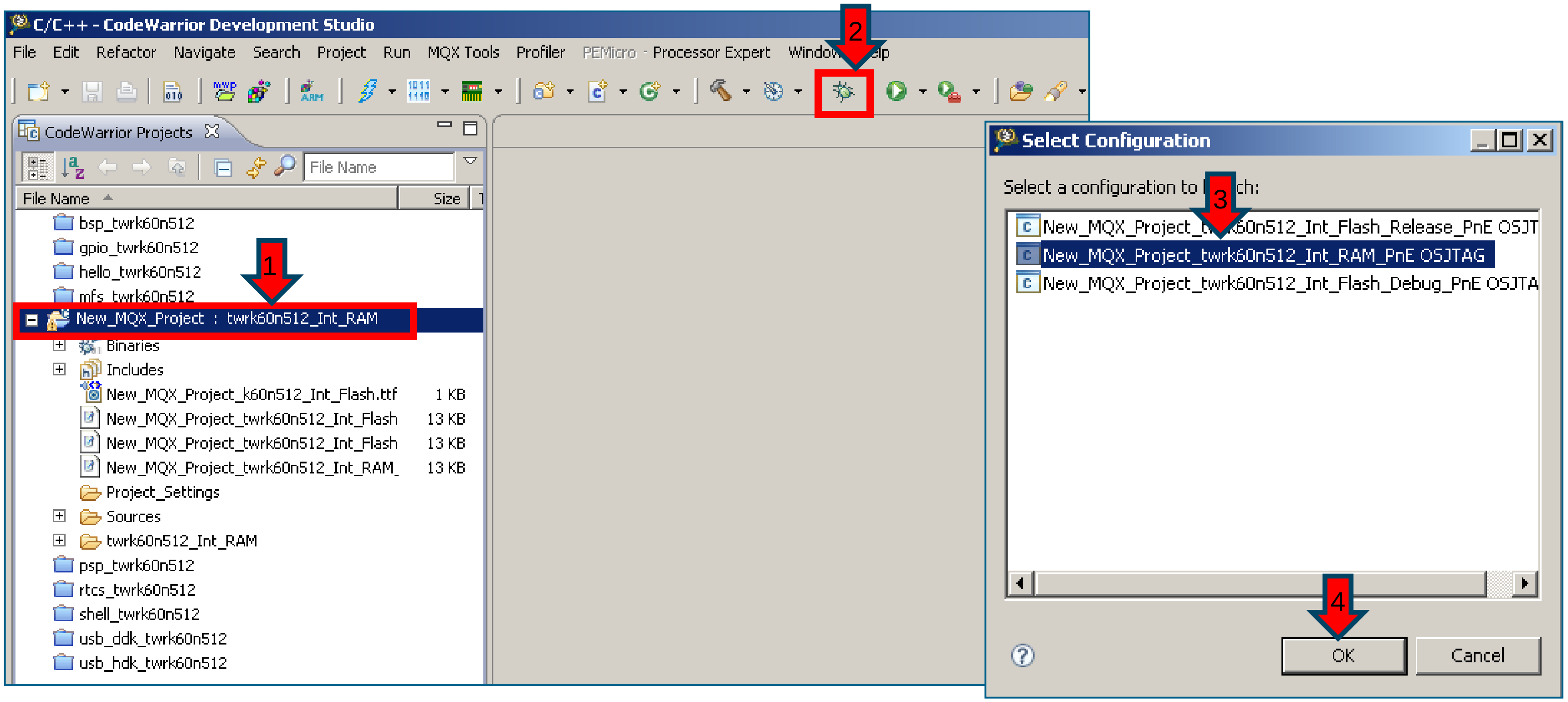


Building project...

Invoking Command: D:\Program Files\Freescale\CW MCU v10.1\gnu\bin\make all

Debug New MQX Project

- Select **New_MQX_Project : twrk60n512_Int_RAM**
- Select **New_MQX_Project_twrk60n512_Int_Ram_PnE OSJTAG**

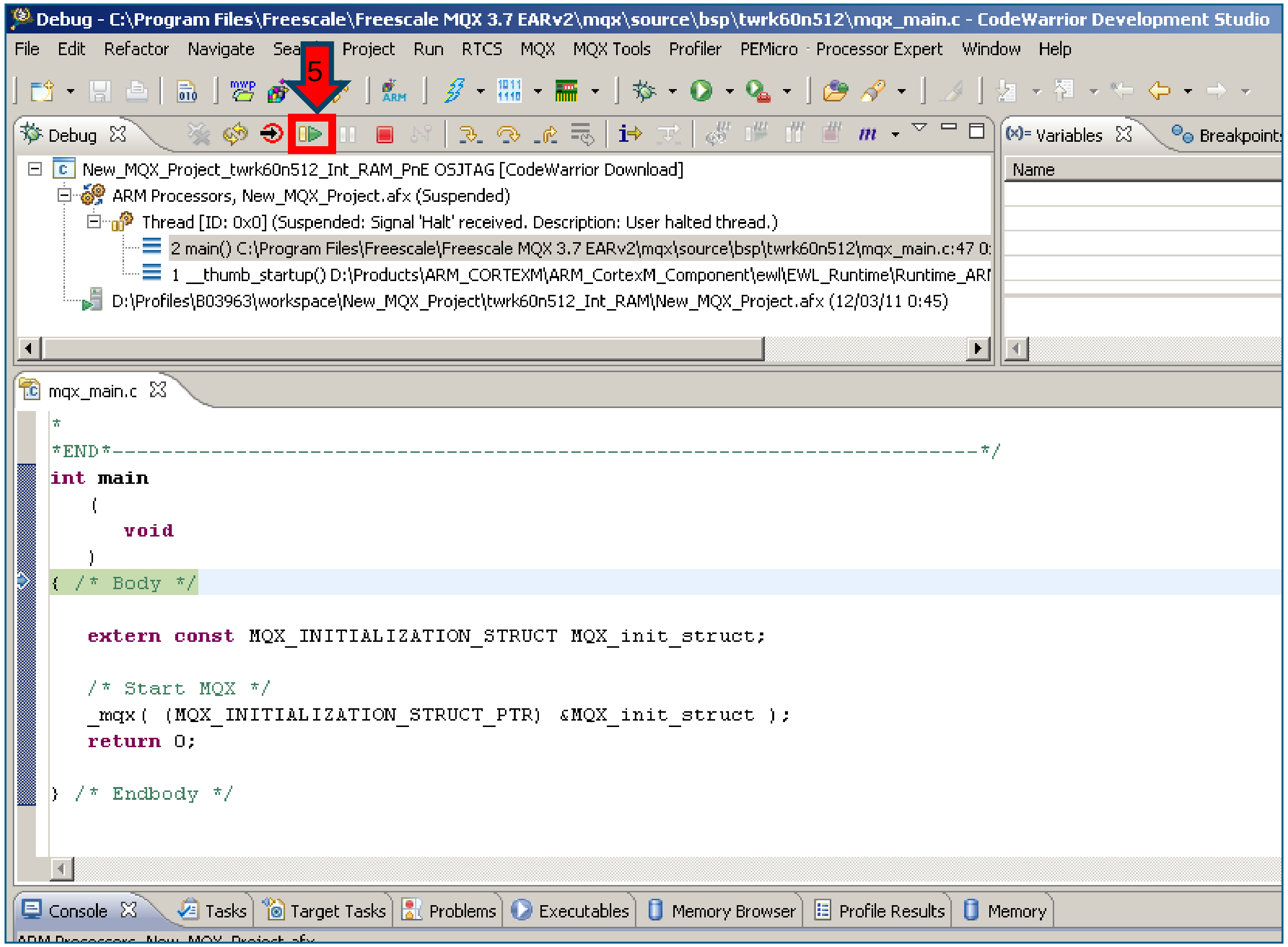

C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Window Help
CodeWarrior Projects
File Name
Size
1
2
3
4
Select Configuration
OK
Cancel

bsp_twrk60n512
gpio_twrk60n512
hello_twrk60n512
mfs_twrk60n512
New_MQX_Project : twrk60n512_Int_RAM
Binaries
Includes
New_MQX_Project_k60n512_Int_Flash.ttf 1 KB
New_MQX_Project_twrk60n512_Int_Flash 13 KB
New_MQX_Project_twrk60n512_Int_Flash 13 KB
New_MQX_Project_twrk60n512_Int_RAM_ 13 KB
Project_Settings
Sources
twrk60n512_Int_RAM
psp_twrk60n512
rtcs_twrk60n512
shell_twrk60n512
usb_ddk_twrk60n512
usb_hdk_twrk60n512

Select a configuration to launch:
New_MQX_Project_twrk60n512_Int_Flash_Release_PnE OSJT
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG
New_MQX_Project_twrk60n512_Int_Flash_Debug_PnE OSJTA

Run New MQX Project

- Execute the code ‘**Run**’ icon.

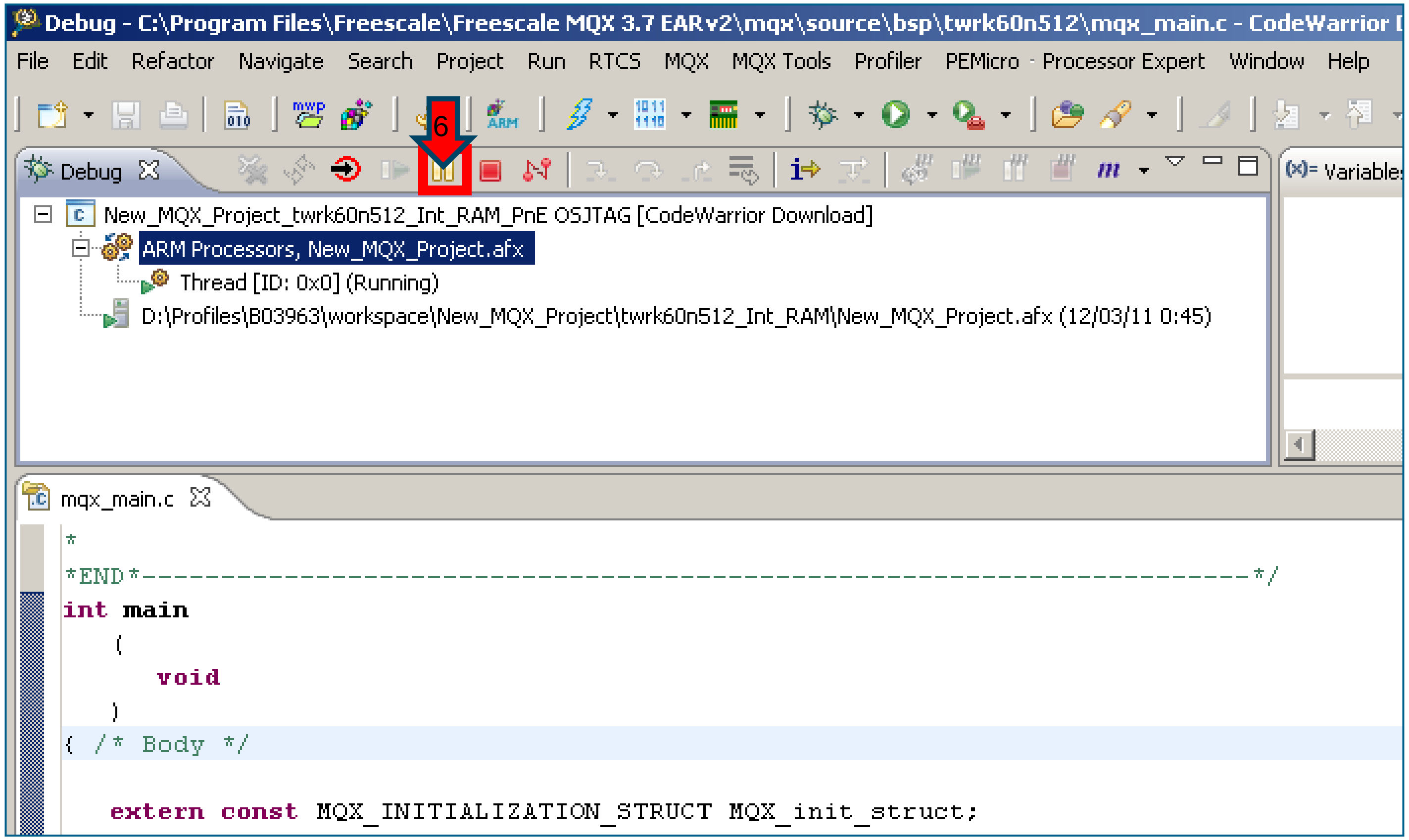

Debug - C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Sea Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
5
Debug
Variables
Breakpoint
Name
mqx_main.c
Console
Tasks
Target Tasks
Problems
Executables
Memory Browser
Profile Results
Memory

```
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [CodeWarrior Download]
  ARM Processors, New_MQX_Project.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
      1 __thumb_startup() D:\Products\ARM_CORTEXM\ARM_CortexM_Component\ewl\EWL_Runtime\Runtime_ARI
  D:\Profiles\B03963\workspace\New_MQX_Project\twrk60n512_Int_RAM\New_MQX_Project.afx (12/03/11 0:45)
```

```
*
*END*-----------------------------------------------------------------------*/
int main
   (
      void
   )
{ /* Body */

   extern const MQX_INITIALIZATION_STRUCT MQX_init_struct;

   /* Start MQX */
   _mqx( (MQX_INITIALIZATION_STRUCT_PTR) &MQX_init_struct );
   return 0;

} /* Endbody */
```

Run New MQX Project

- Pause execution.

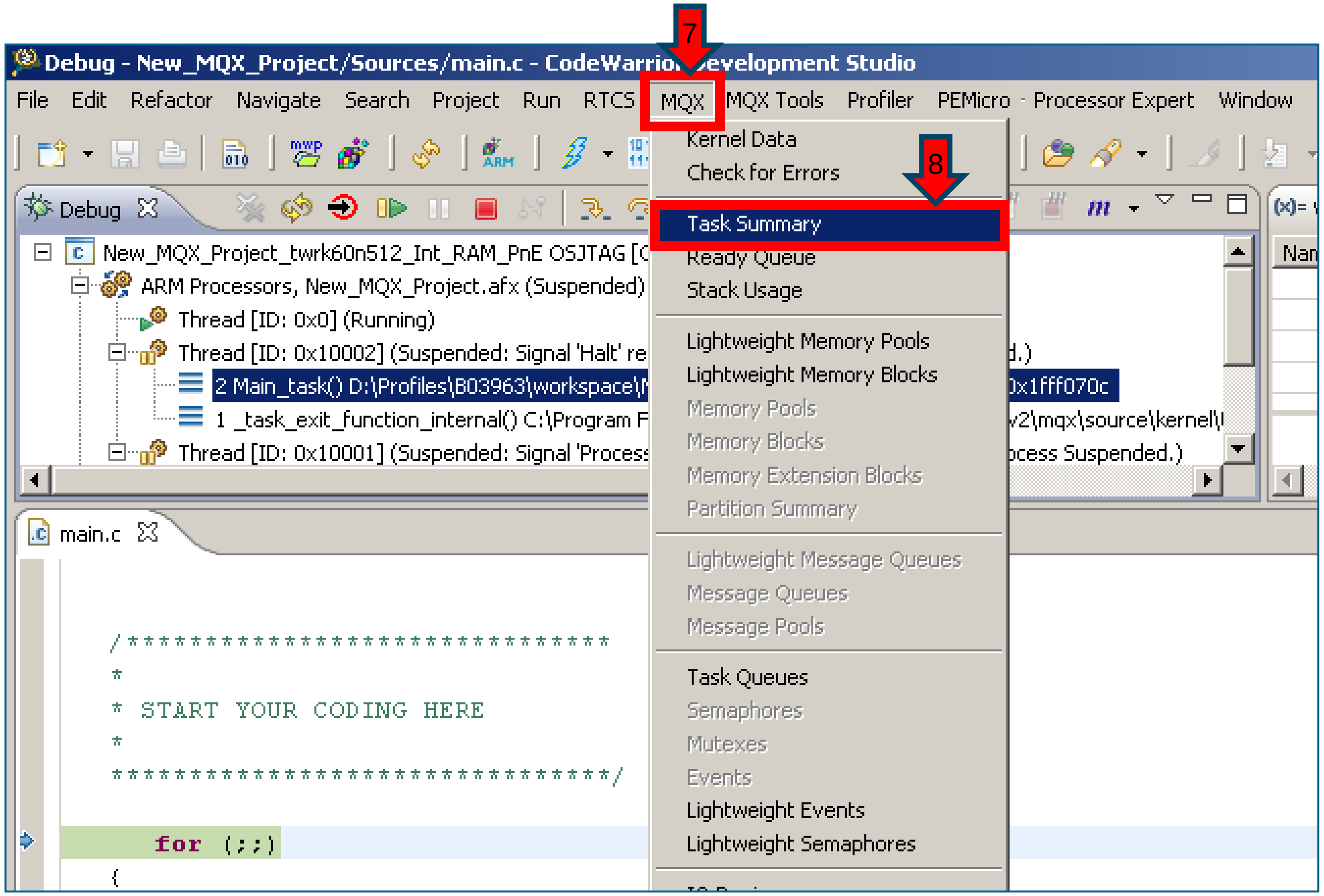

Debug - C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c - CodeWarrior
File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
6
Debug
Variable
mqx_main.c

```
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [CodeWarrior Download]
  ARM Processors, New_MQX_Project.afx
    Thread [ID: 0x0] (Running)
  D:\Profiles\B03963\workspace\New_MQX_Project\twrk60n512_Int_RAM\New_MQX_Project.afx (12/03/11 0:45)
```

```
*
*END*-----------------------------------------------------------------------*/
int main
   (
      void
   )
{ /* Body */

   extern const MQX_INITIALIZATION_STRUCT MQX_init_struct;
```

TAD: Task Summary

- MQX -> Task Summary

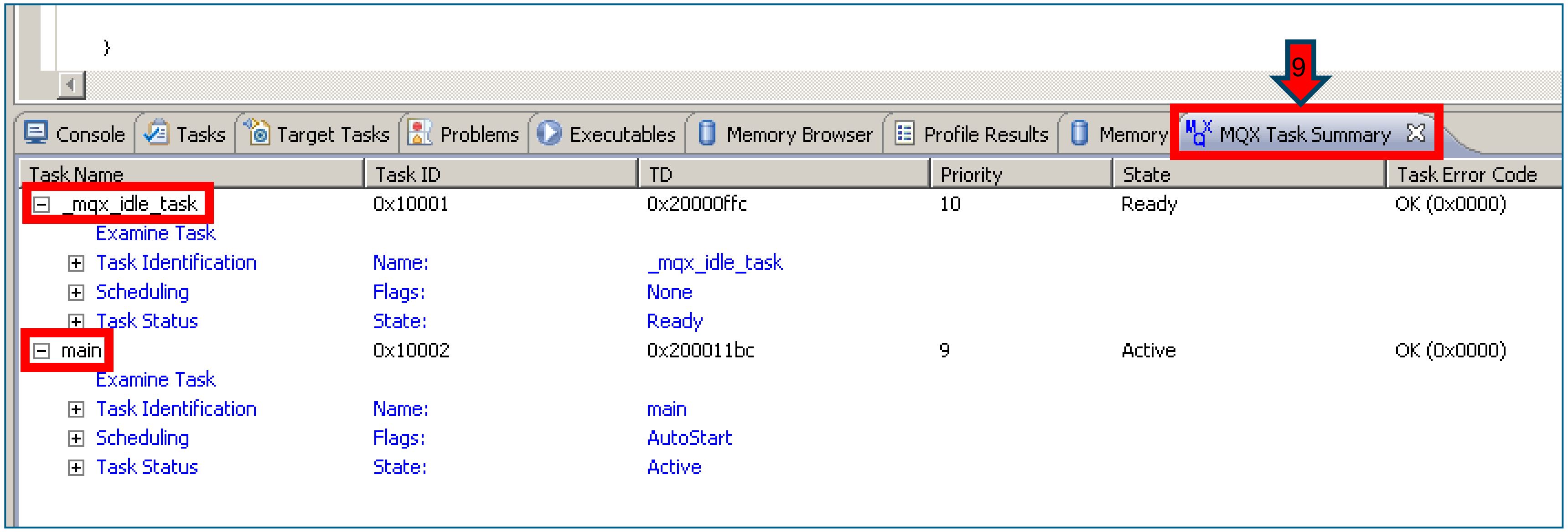


```
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [C
  ARM Processors, New_MQX_Project.afx (Suspended)
    Thread [ID: 0x0] (Running)
    Thread [ID: 0x10002] (Suspended: Signal 'Halt' re                d.)
      2 Main_task() D:\Profiles\B03963\workspace\M          0x1fff070c
      1 _task_exit_function_internal() C:\Program F         v2\mqx\source\kernel\
    Thread [ID: 0x10001] (Suspended: Signal 'Process        ocess Suspended.)
```

```
/*********************************
*
* START YOUR CODING HERE
*
*********************************/

   for (;;)
{
```

TAD: Task Summary

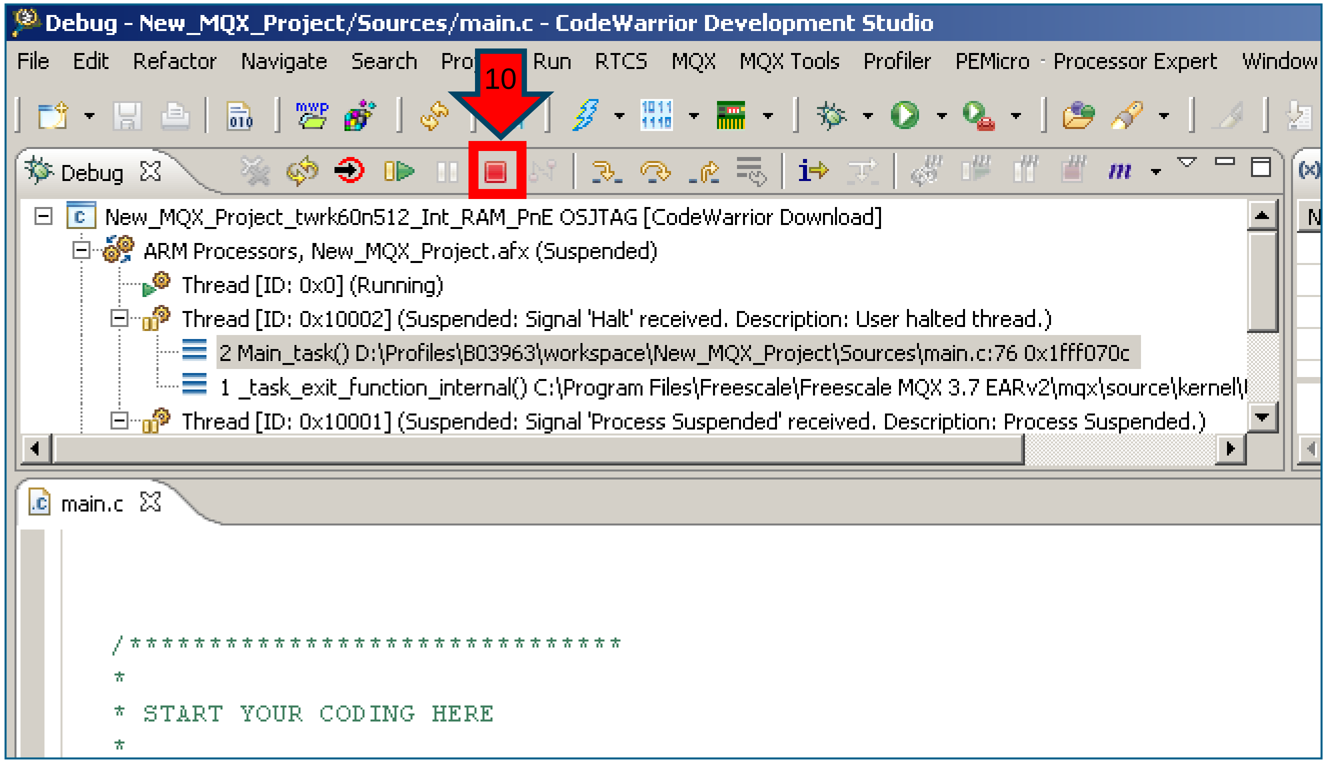
- Observe Tasks in your Application.



Task Name	Task ID	TD	Priority	State	Task Error Code
⊟ _mqx_idle_task	0x10001	0x20000ffc	10	Ready	OK (0x0000)
Examine Task					
⊞ Task Identification	Name:	_mqx_idle_task			
⊞ Scheduling	Flags:	None			
⊞ Task Status	State:	Ready			
⊟ main	0x10002	0x200011bc	9	Active	OK (0x0000)
Examine Task					
⊞ Task Identification	Name:	main			
⊞ Scheduling	Flags:	AutoStart			
⊞ Task Status	State:	Active			

Run New MQX Project

- Terminate execution.


Debug - New_MQX_Project/Sources/main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Pro Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window
10
Debug
main.c

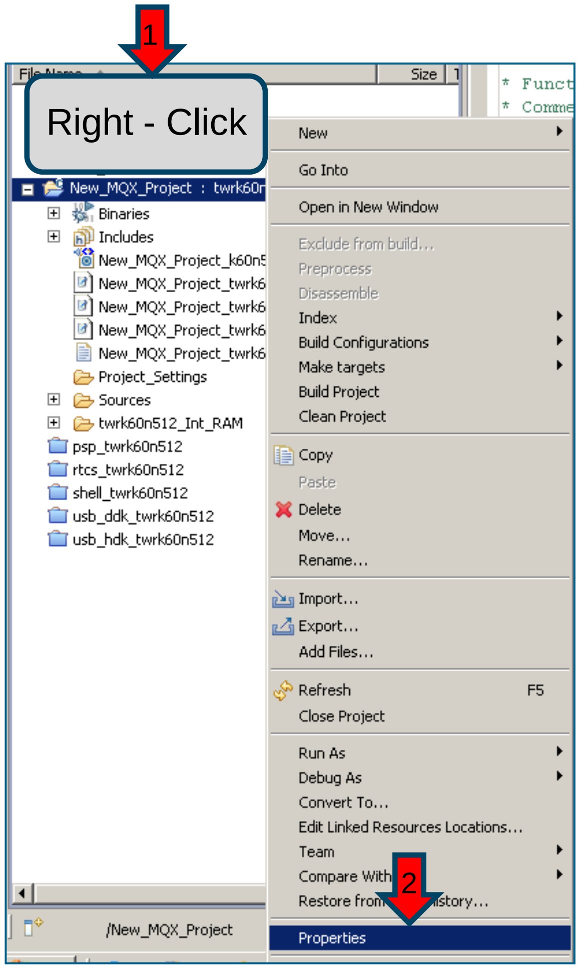
```
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [CodeWarrior Download]
  ARM Processors, New_MQX_Project.afx (Suspended)
    Thread [ID: 0x0] (Running)
    Thread [ID: 0x10002] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      2 Main_task() D:\Profiles\B03963\workspace\New_MQX_Project\Sources\main.c:76 0x1fff070c
      1 _task_exit_function_internal() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\kernel\
    Thread [ID: 0x10001] (Suspended: Signal 'Process Suspended' received. Description: Process Suspended.)
```

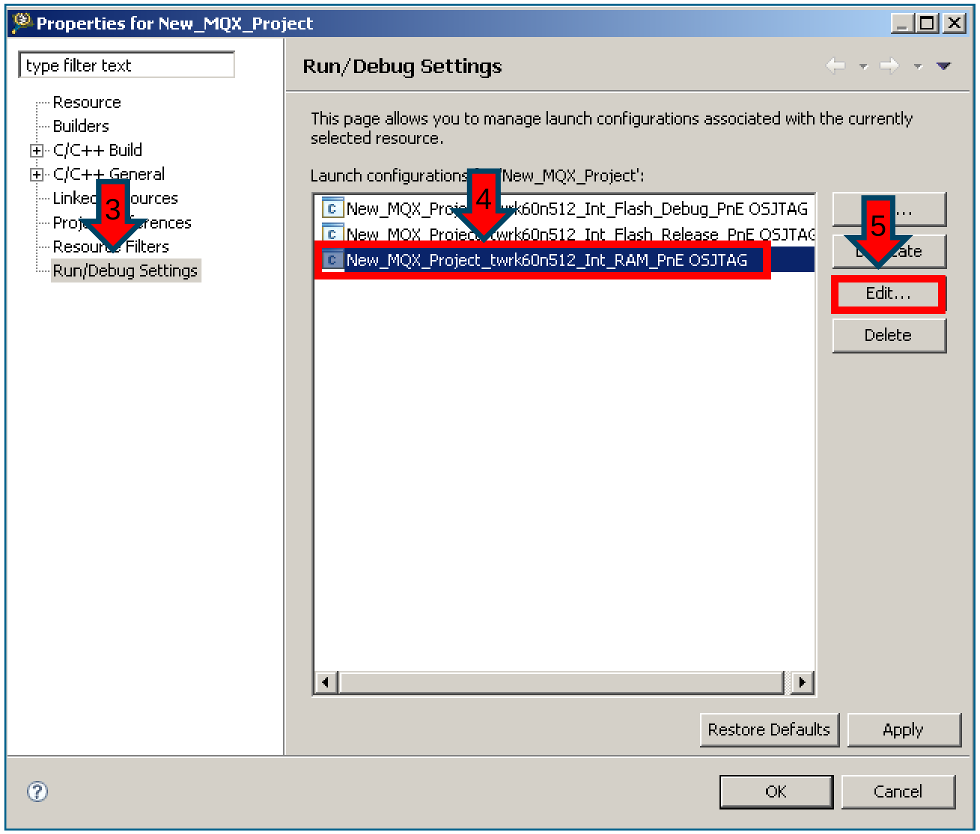
```
/*********************************
*
* START YOUR CODING HERE
*
```

Debugging with J-Link

Change Connection Type

► Edit the Connection Settings of the project.

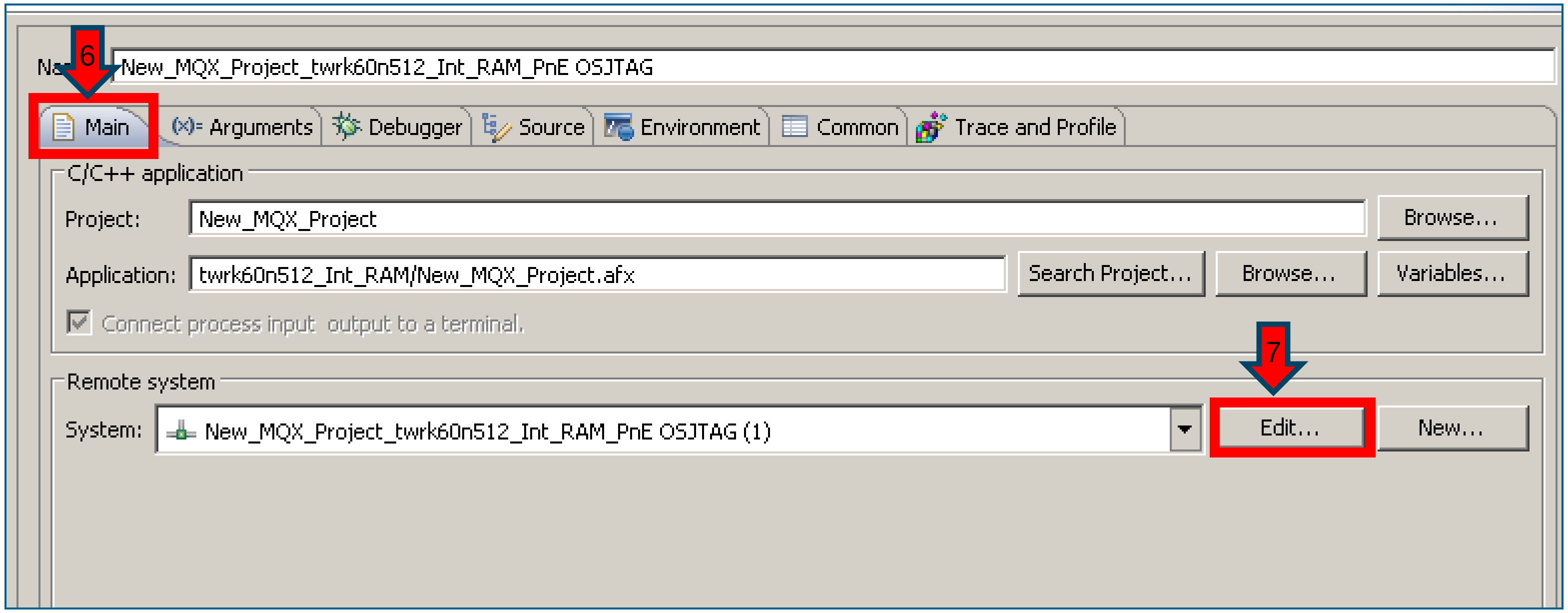



Properties for New_MQX_Project
type filter text
Resource
Builders
C/C++ Build
C/C++ General
Linked Resources
Project References
Resource Filters
Run/Debug Settings
3
Run/Debug Settings
Launch configurations for 'New_MQX_Project':
4
New_MQX_Project_twrk60n512_Int_Flash_Debug_PnE OSJTAG
New_MQX_Project_twrk60n512_Int_Flash_Release_PnE OSJTAG
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG
5
New...
Duplicate
Edit...
Delete
Restore Defaults
Apply
OK
Cancel

This page allows you to manage launch configurations associated with the currently selected resource.

Change Connection Type

- Edit the Remote System.

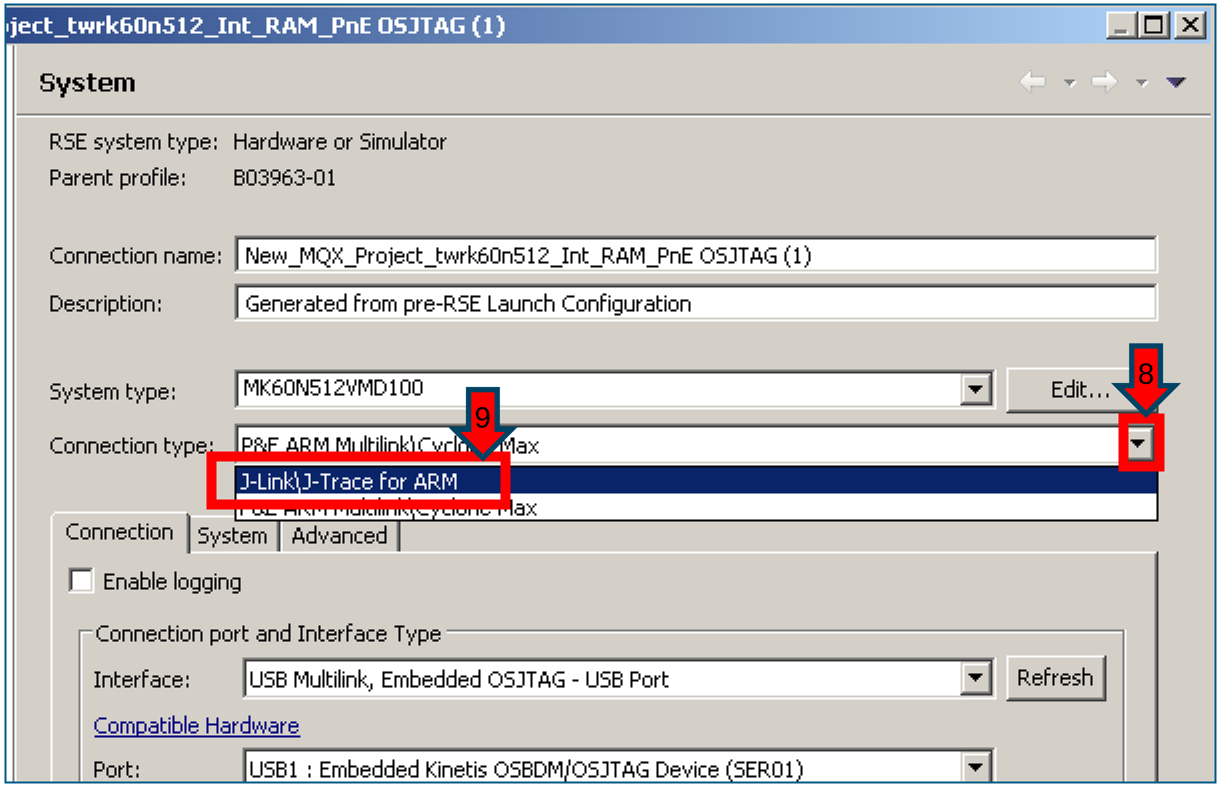

Name: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG

C/C++ application
Project: New_MQX_Project
Application: twrk60n512_Int_RAM/New_MQX_Project.afx
[✓] Connect process input output to a terminal.

Remote system
System: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG (1)

Change Connection Type

- Select **J-Link\J-Trace for ARM®**



ject_twrk60n512_Int_RAM_PnE OSJTAG (1)

System

RSE system type: Hardware or Simulator

Parent profile: B03963-01

Connection name: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG (1)

Description: Generated from pre-RSE Launch Configuration

System type: MK60N512VMD100

Connection type: P&E ARM Multilink\Cyclone Max

Enable logging

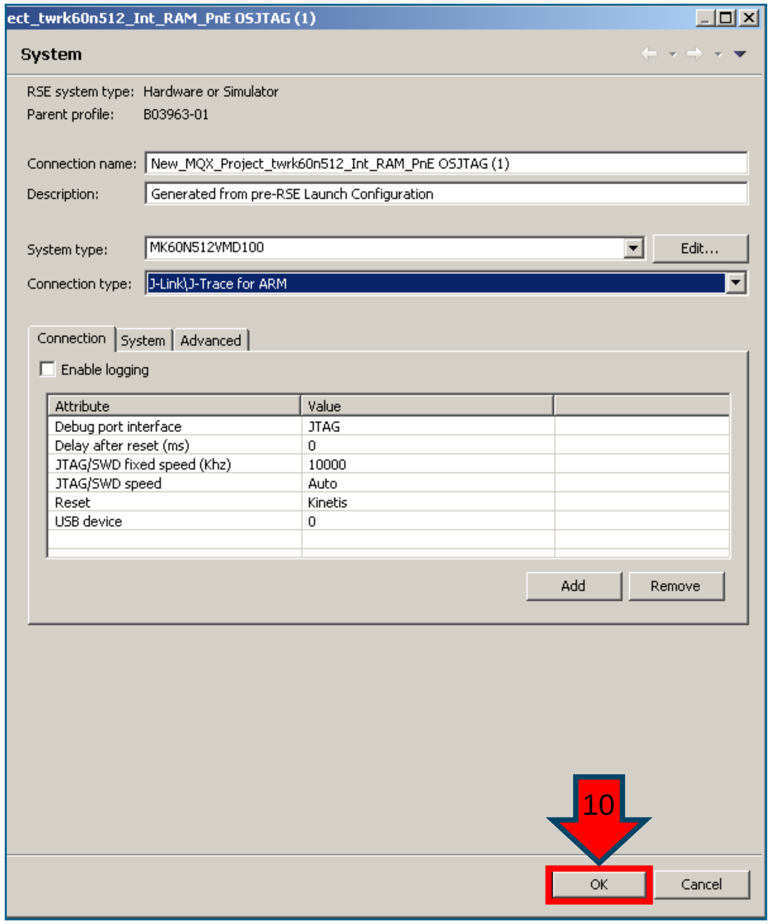
Connection port and Interface Type

Interface: USB Multilink, Embedded OSJTAG - USB Port

Port: USB1 : Embedded Kinetis OSBDM/OSJTAG Device (SER01)

Change Connection Type

- Confirm changes.


ect_twrk60n512_Int_RAM_PnE OSJTAG (1)

System

RSE system type: Hardware or Simulator
Parent profile: B03963-01

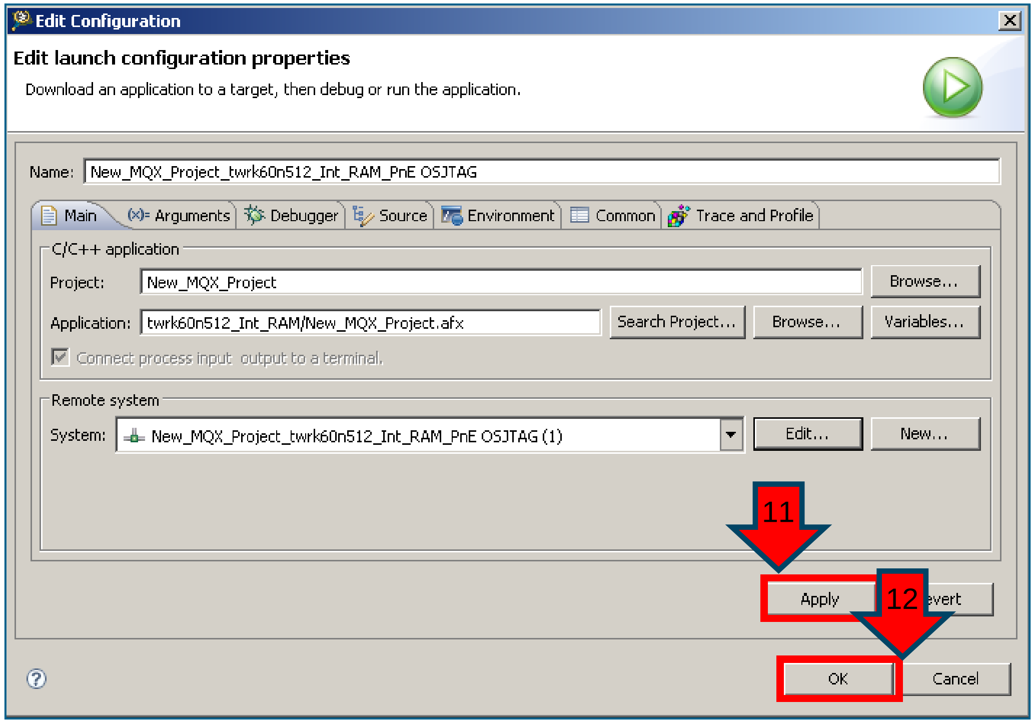
Connection name: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG (1)
Description: Generated from pre-RSE Launch Configuration

System type: MK60N512VMD100
Connection type: J-Link\J-Trace for ARM

Connection | System | Advanced

☐ Enable logging

Attribute	Value
Debug port interface	JTAG
Delay after reset (ms)	0
JTAG/SWD fixed speed (Khz)	10000
JTAG/SWD speed	Auto
Reset	Kinetis
USB device	0


Edit Configuration

Edit launch configuration properties

Download an application to a target, then debug or run the application.

Name: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG

Main | Arguments | Debugger | Source | Environment | Common | Trace and Profile

C/C++ application

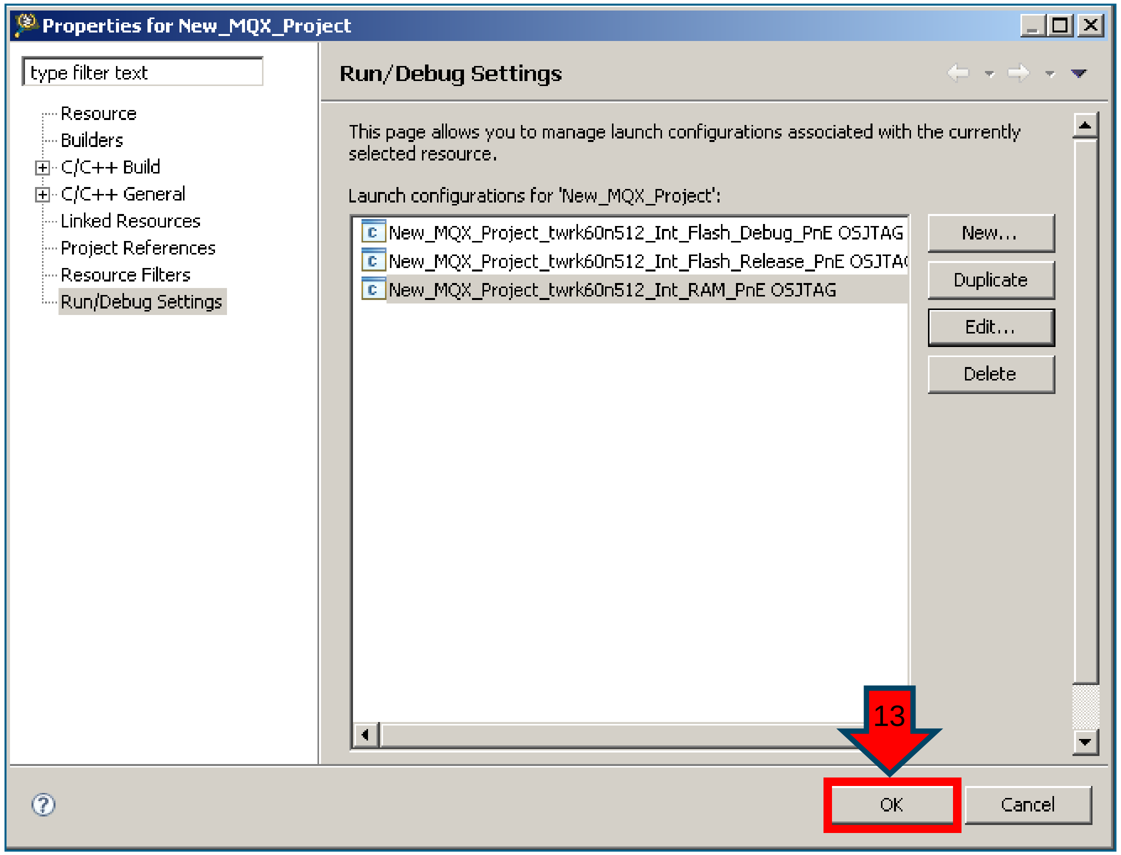
Project: New_MQX_Project
Application: twrk60n512_Int_RAM/New_MQX_Project.afx
☑ Connect process input output to a terminal.

Remote system

System: New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG (1)

Change Connection Type

- Click OK.


Properties for New_MQX_Project

type filter text

- Resource
- Builders
- C/C++ Build
- C/C++ General
- Linked Resources
- Project References
- Resource Filters
- Run/Debug Settings

Run/Debug Settings

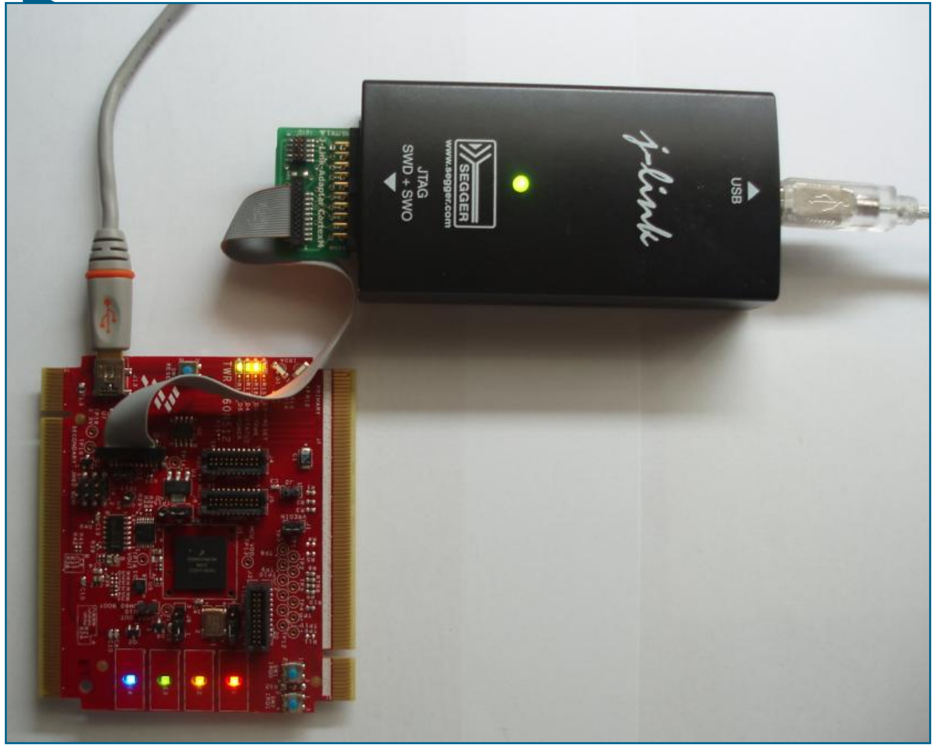
This page allows you to manage launch configurations associated with the currently selected resource.

Launch configurations for 'New_MQX_Project':

- New_MQX_Project_twrk60n512_Int_Flash_Debug_PnE OSJTAG
- New_MQX_Project_twrk60n512_Int_Flash_Release_PnE OSJTA(
- New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG

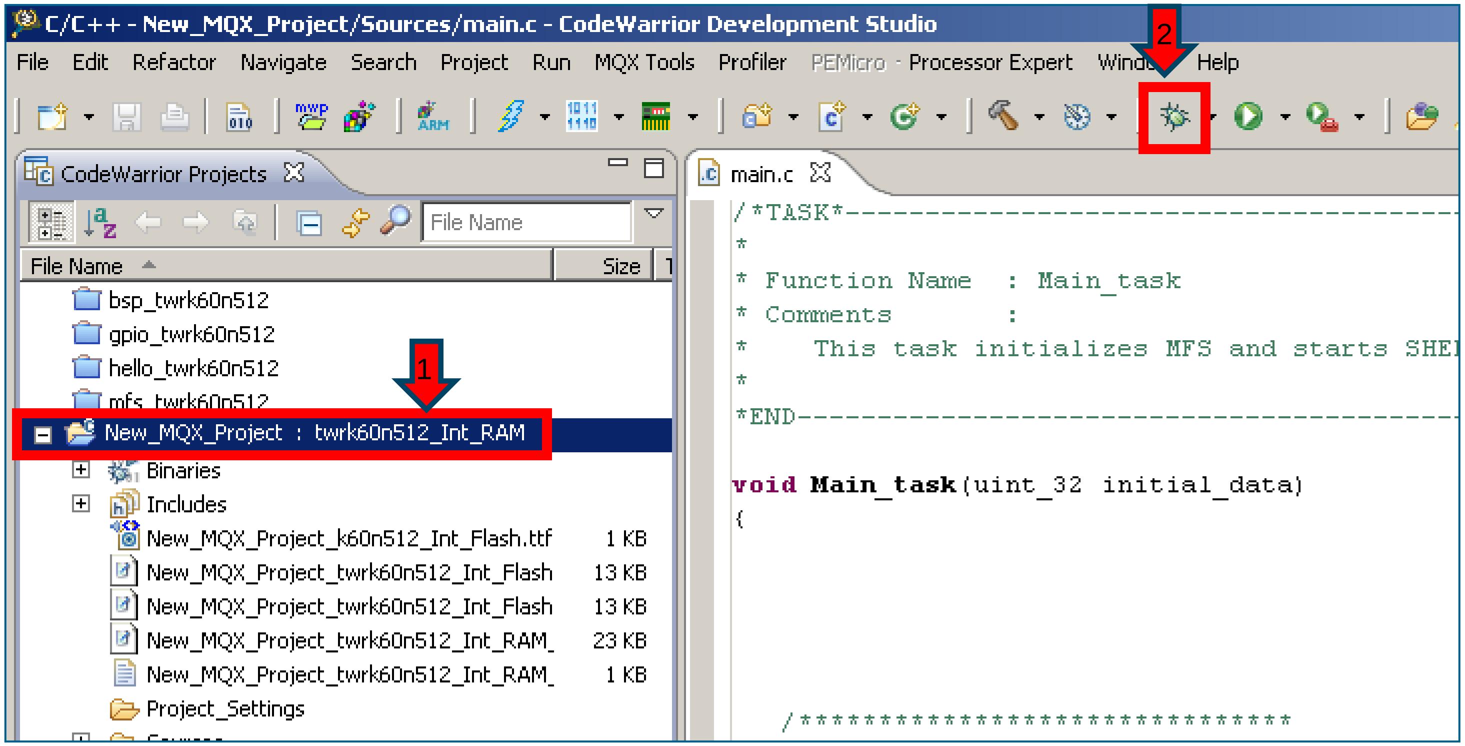
Debug with J-Link

- Connect J-Link target cable to TWR-K60N512 (J11).
- Connect USB J-Link cable to laptop.
- Connect USB Cable to TWR-K60N512 (J13) and laptop.



Change Connection Type

- Select **New_MQX_Project : twrk60n512_Int_RAM**
- Click Debug.

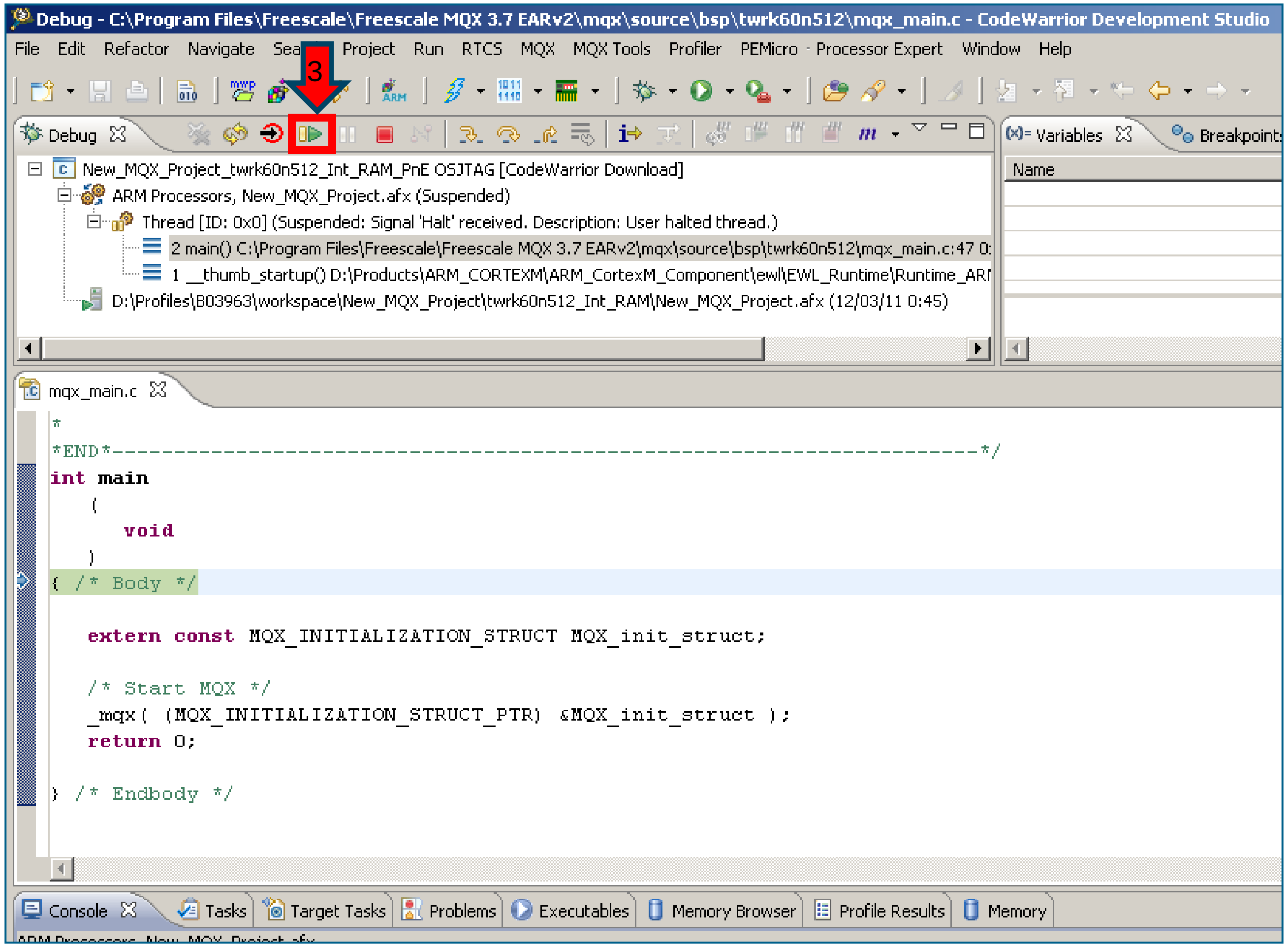

C/C++ - New_MQX_Project/Sources/main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Window Help
CodeWarrior Projects
File Name
1
2
main.c

File Name	Size
bsp_twrk60n512	
gpio_twrk60n512	
hello_twrk60n512	
mfs_twrk60n512	
New_MQX_Project : twrk60n512_Int_RAM	
Binaries	
Includes	
New_MQX_Project_k60n512_Int_Flash.ttf	1 KB
New_MQX_Project_twrk60n512_Int_Flash	13 KB
New_MQX_Project_twrk60n512_Int_Flash	13 KB
New_MQX_Project_twrk60n512_Int_RAM_	23 KB
New_MQX_Project_twrk60n512_Int_RAM_	1 KB
Project_Settings	

```
/*TASK*-----------------------------------------------
*
* Function Name   : Main_task
* Comments        :
*    This task initializes MFS and starts SHE
*
*END-------------------------------------------------

void Main_task(uint_32 initial_data)
{



   /*********************************
```

Run New MQX Project

- Execute the code ‘**Resume**’ icon.

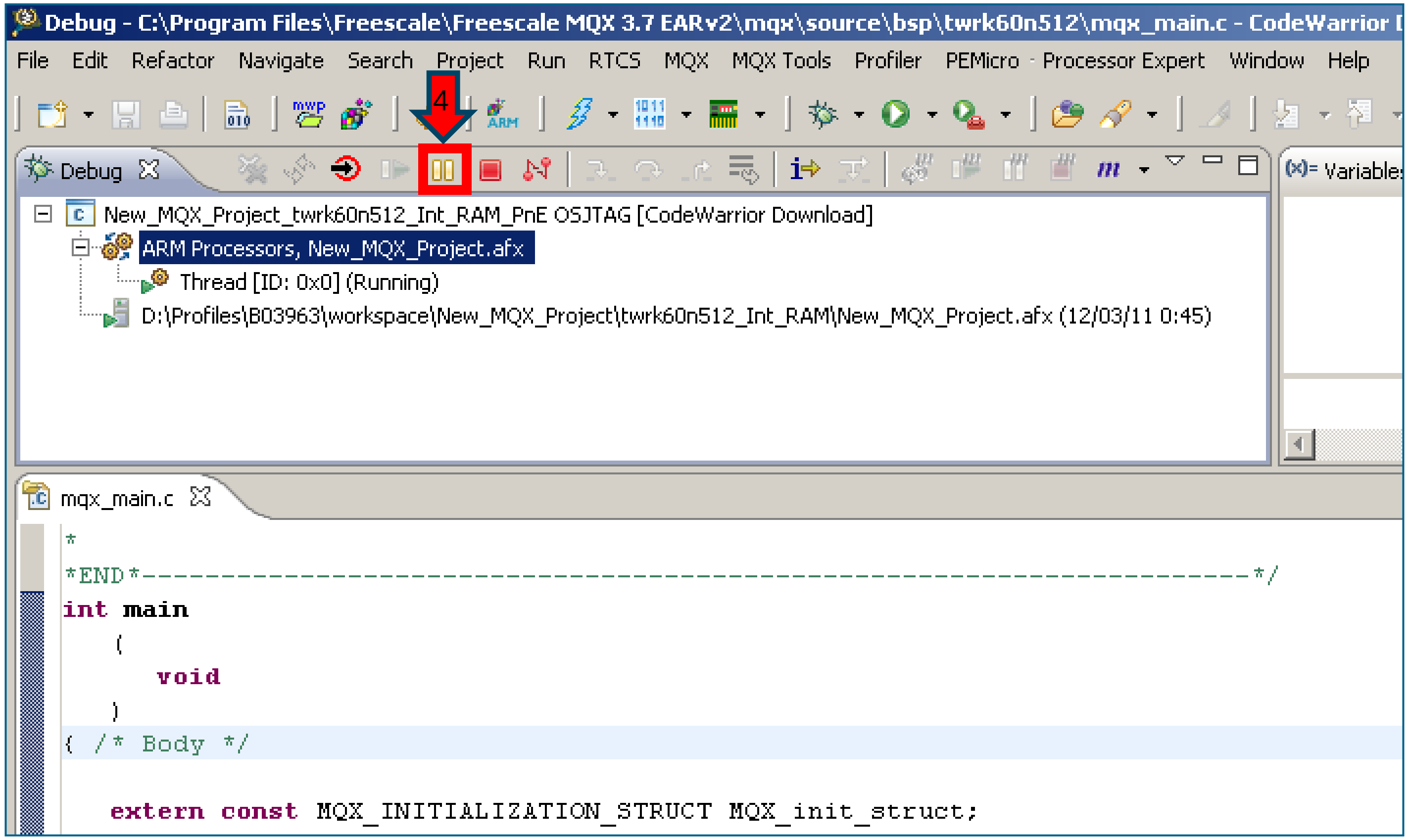

Debug - C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Sea Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
3
Debug
Variables
Breakpoints
Name
mqx_main.c
Console Tasks Target Tasks Problems Executables Memory Browser Profile Results Memory

New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [CodeWarrior Download]
ARM Processors, New_MQX_Project.afx (Suspended)
Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
1 __thumb_startup() D:\Products\ARM_CORTEXM\ARM_CortexM_Component\ewl\EWL_Runtime\Runtime_ARI
D:\Profiles\B03963\workspace\New_MQX_Project\twrk60n512_Int_RAM\New_MQX_Project.afx (12/03/11 0:45)

```
*
*END*------------------------------------------------------------------*/
int main
   (
      void
   )
{ /* Body */

   extern const MQX_INITIALIZATION_STRUCT MQX_init_struct;

   /* Start MQX */
   _mqx( (MQX_INITIALIZATION_STRUCT_PTR) &MQX_init_struct );
   return 0;

} /* Endbody */
```

Run New MQX Project

- Pause execution.

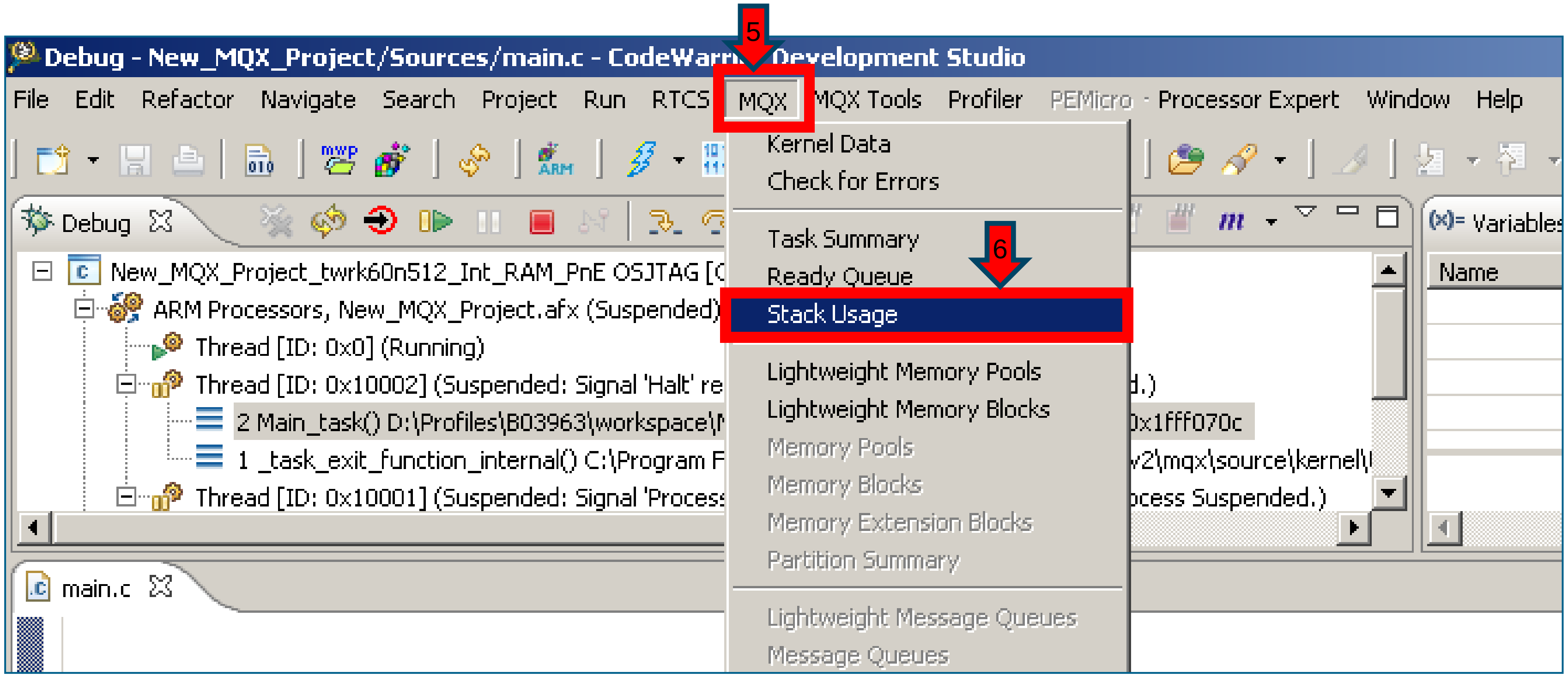

Debug - C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c - CodeWarrior
File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
4
Debug
(x)= Variable
mqx_main.c

```
New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [CodeWarrior Download]
  ARM Processors, New_MQX_Project.afx
    Thread [ID: 0x0] (Running)
  D:\Profiles\B03963\workspace\New_MQX_Project\twrk60n512_Int_RAM\New_MQX_Project.afx (12/03/11 0:45)
```

```
*
*END*-----------------------------------------------------------------------*/
int main
   (
      void
   )
{ /* Body */

   extern const MQX_INITIALIZATION_STRUCT MQX_init_struct;
```

TAD: Stack Usage

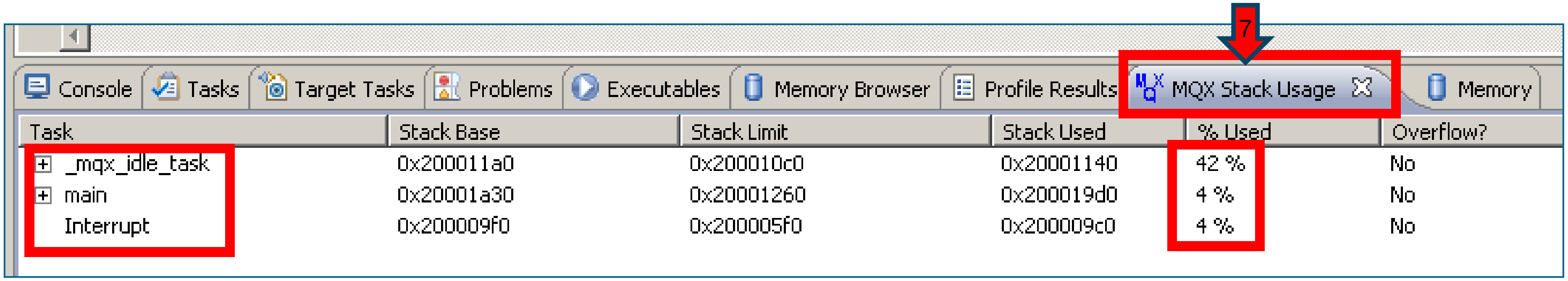
▶ MQX -> Stack Usage.



New_MQX_Project_twrk60n512_Int_RAM_PnE OSJTAG [C
ARM Processors, New_MQX_Project.afx (Suspended)
Thread [ID: 0x0] (Running)
Thread [ID: 0x10002] (Suspended: Signal 'Halt' re ...d.)
2 Main_task() D:\Profiles\B03963\workspace\N ... 0x1fff070c
1 _task_exit_function_internal() C:\Program F ... v2\mqx\source\kernel\
Thread [ID: 0x10001] (Suspended: Signal 'Process ... ocess Suspended.)

TAD: Stack Usage

- Observe Stack Data.

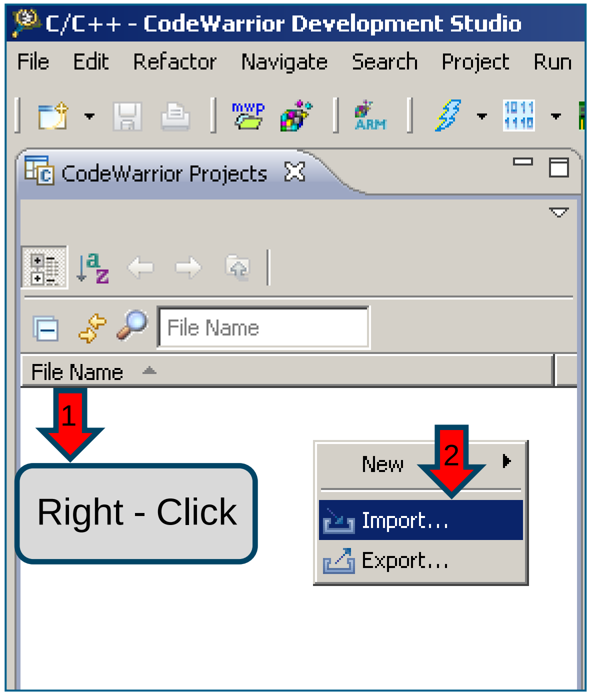


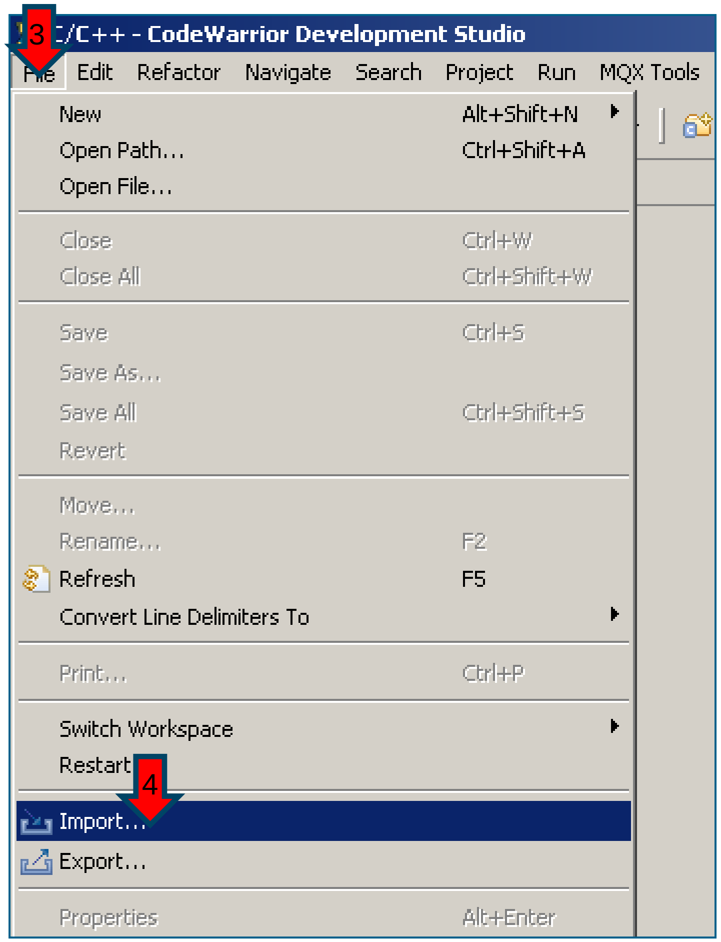
Task	Stack Base	Stack Limit	Stack Used	% Used	Overflow?
_mqx_idle_task	0x200011a0	0x200010c0	0x20001140	42 %	No
main	0x20001a30	0x20001260	0x200019d0	4 %	No
Interrupt	0x200009f0	0x200005f0	0x200009c0	4 %	No

CW10.x, MQX and Processor Expert

Import MQX BSP

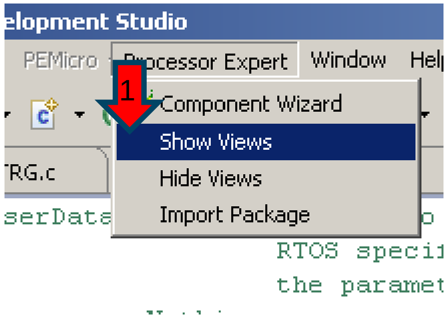
- Right-Click on Project Explorer and Import (or) File -> Import.
- All Kinetis BSP projects are Processor Expert Ready.


C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run
CodeWarrior Projects
File Name
1
Right - Click
New
2
Import…
Export…

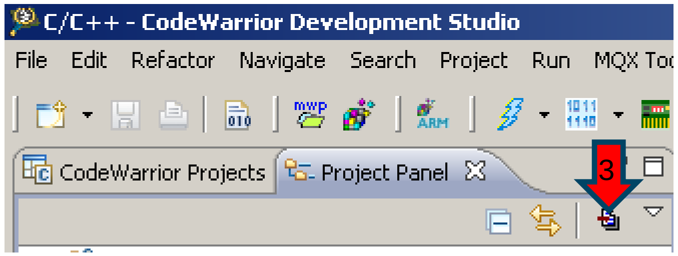


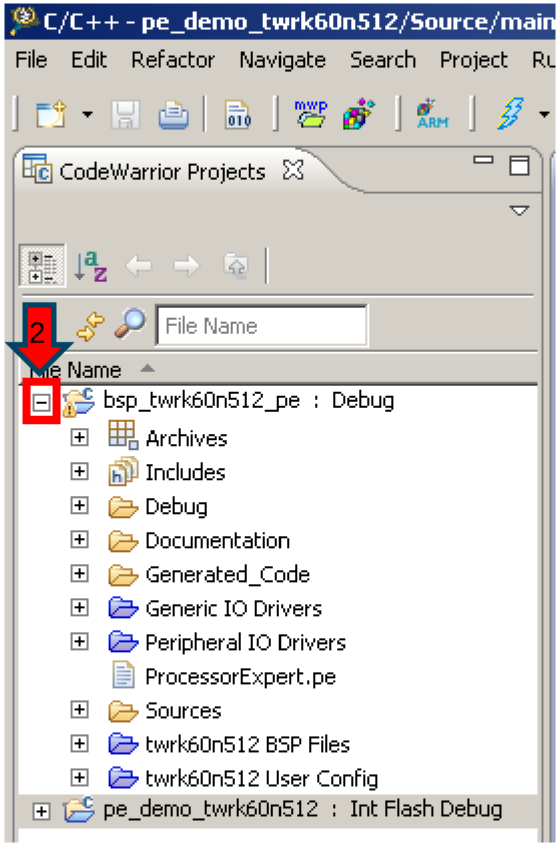
Processor Expert in MQX BSP

- Expand **bsp_twrk60n512 project view:**
- Show Processor Expert View:



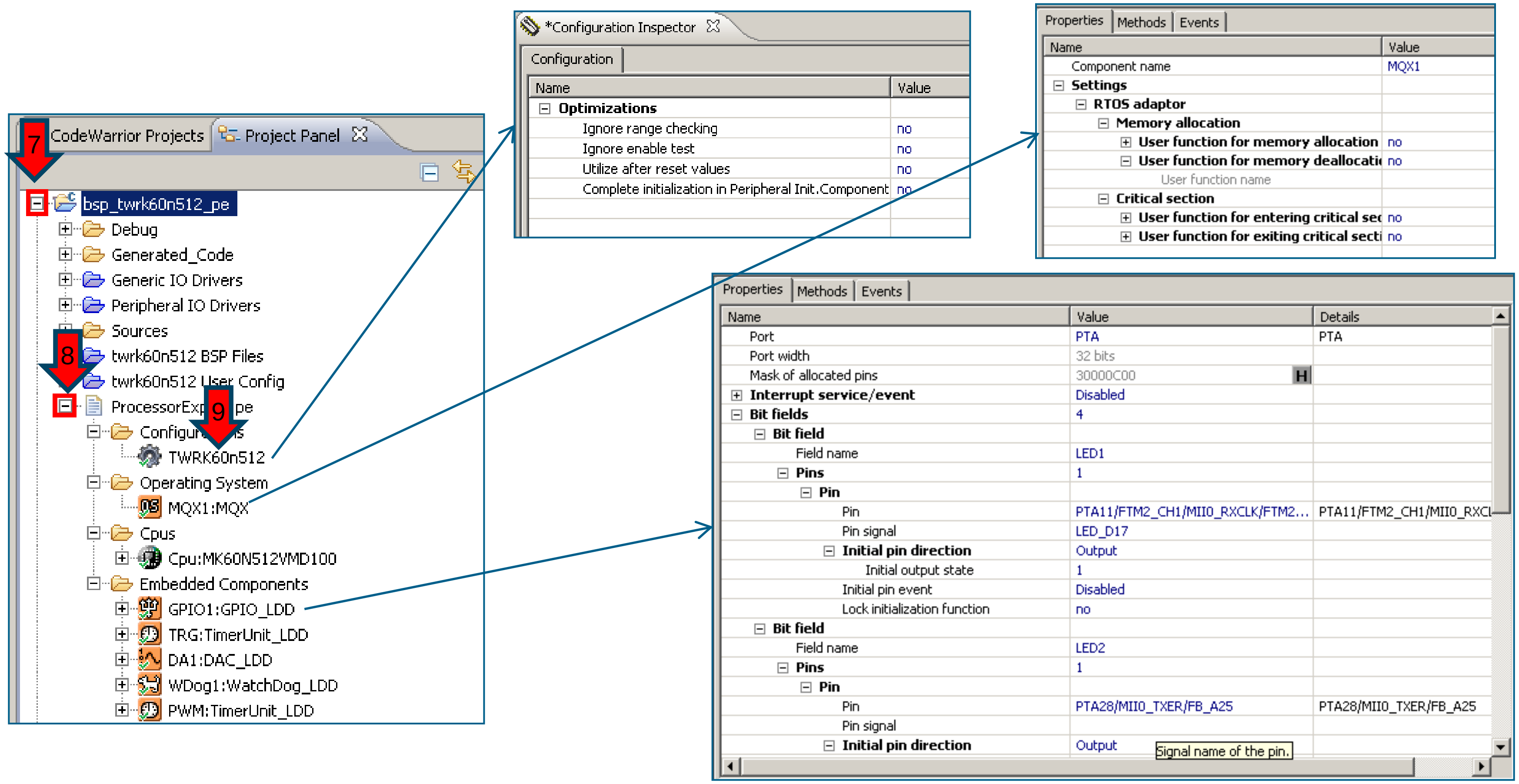
- Generate code:





Processor Expert in MQX BSP

► Click on PE components to watch the properties.



- bsp_twrk60n512_pe
  - Debug
  - Generated_Code
  - Generic IO Drivers
  - Peripheral IO Drivers
  - Sources
  - twrk60n512 BSP Files
  - twrk60n512 User Config
  - ProcessorExpert.pe
    - Configurations
      - TWRK60n512
    - Operating System
      - MQX1:MQX
    - Cpus
      - Cpu:MK60N512VMD100
    - Embedded Components
      - GPIO1:GPIO_LDD
      - TRG:TimerUnit_LDD
      - DA1:DAC_LDD
      - WDog1:WatchDog_LDD
      - PWM:TimerUnit_LDD

*Configuration Inspector

Configuration

Name	Value
Optimizations	
Ignore range checking	no
Ignore enable test	no
Utilize after reset values	no
Complete initialization in Peripheral Init.Component	no

Properties | Methods | Events

Name	Value
Component name	MQX1
Settings	
RTOS adaptor	
Memory allocation	
User function for memory allocation	no
User function for memory deallocati	no
User function name	
Critical section	
User function for entering critical sec	no
User function for exiting critical secti	no

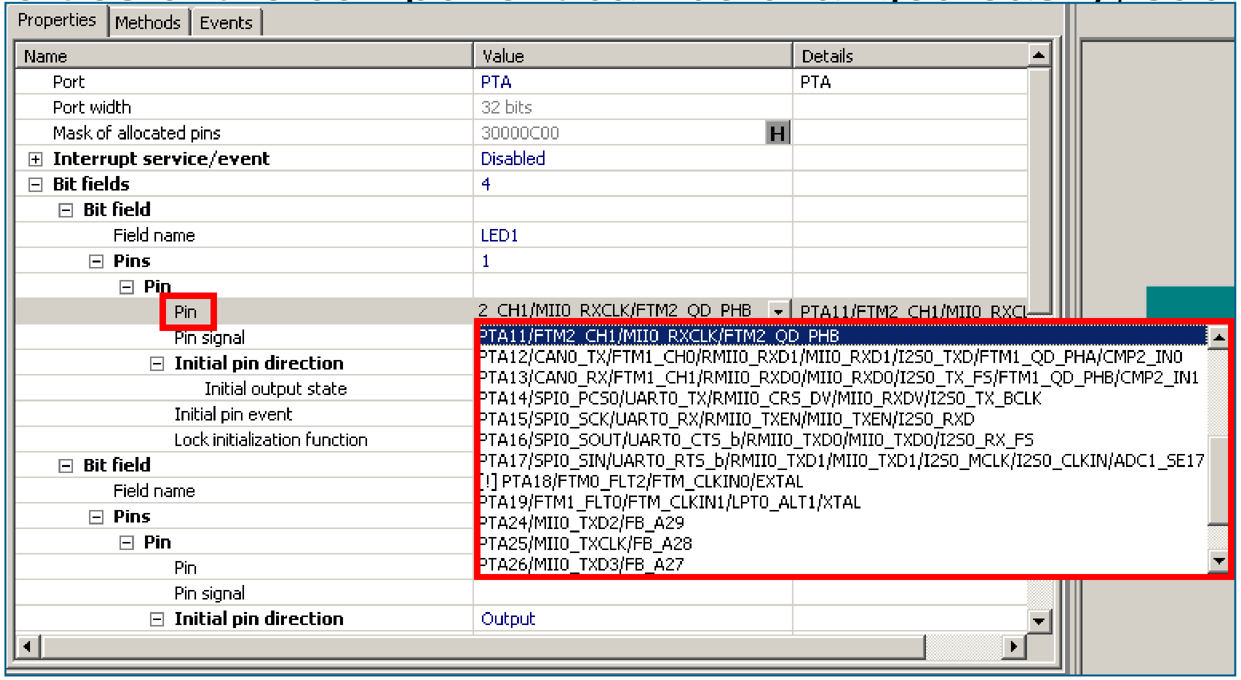
Properties | Methods | Events

Name	Value	Details
Port	PTA	PTA
Port width	32 bits	
Mask of allocated pins	30000C00 H	
Interrupt service/event	Disabled	
Bit fields	4	
Bit field		
Field name	LED1	
Pins	1	
Pin		
Pin	PTA11/FTM2_CH1/MII0_RXCLK/FTM2...	PTA11/FTM2_CH1/MII0_RXCL
Pin signal	LED_D17	
Initial pin direction	Output	
Initial output state	1	
Initial pin event	Disabled	
Lock initialization function	no	
Bit field		
Field name	LED2	
Pins	1	
Pin		
Pin	PTA28/MII0_TXER/FB_A25	PTA28/MII0_TXER/FB_A25
Pin signal		
Initial pin direction	Output	

Signal name of the pin.

Processor Expert in MQX BSP

- Processor Expert gives you a easy way to add device drivers to the MQX BSP.
- In the BSP example two Timers, GPIO, WatchDog, and DAC are included.
- Properties of the component can be changed easily, such as GPIO pin.



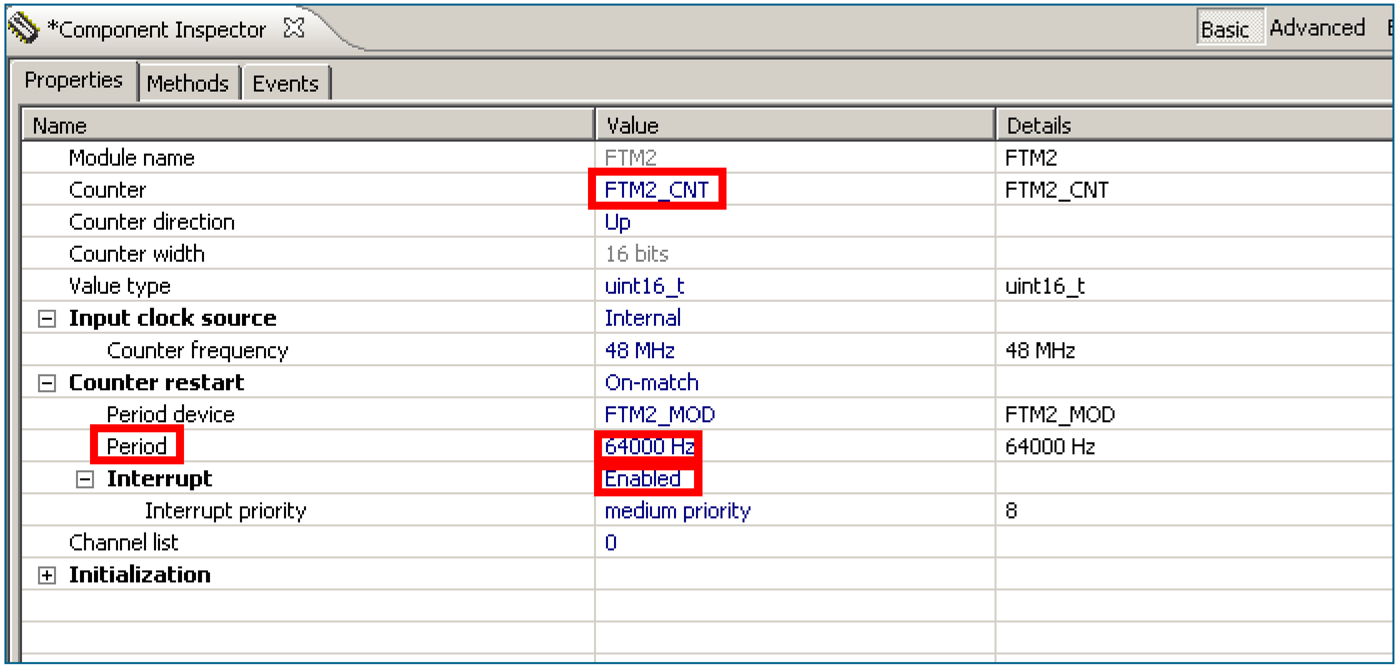
Properties | Methods | Events

Name	Value	Details
Port	PTA	PTA
Port width	32 bits	
Mask of allocated pins	30000C00 H	
⊞ Interrupt service/event	Disabled	
⊟ Bit fields	4	
⊟ Bit field		
Field name	LED1	
⊟ Pins	1	
⊟ Pin		
Pin	2_CH1/MII0_RXCLK/FTM2_QD_PHB	PTA11/FTM2_CH1/MII0_RXCL
Pin signal		
⊟ Initial pin direction		
Initial output state		
Initial pin event		
Lock initialization function		
⊟ Bit field		
Field name		
⊟ Pins		
⊟ Pin		
Pin		
Pin signal		
⊟ Initial pin direction	Output	

```
PTA11/FTM2_CH1/MII0_RXCLK/FTM2_QD_PHB
PTA12/CAN0_TX/FTM1_CH0/RMII0_RXD1/MII0_RXD1/I2S0_TXD/FTM1_QD_PHA/CMP2_IN0
PTA13/CAN0_RX/FTM1_CH1/RMII0_RXD0/MII0_RXD0/I2S0_TX_FS/FTM1_QD_PHB/CMP2_IN1
PTA14/SPI0_PCS0/UART0_TX/RMII0_CRS_DV/MII0_RXDV/I2S0_TX_BCLK
PTA15/SPI0_SCK/UART0_RX/RMII0_TXEN/MII0_TXEN/I2S0_RXD
PTA16/SPI0_SOUT/UART0_CTS_b/RMII0_TXD0/MII0_TXD0/I2S0_RX_FS
PTA17/SPI0_SIN/UART0_RTS_b/RMII0_TXD1/MII0_TXD1/I2S0_MCLK/I2S0_CLKIN/ADC1_SE17
[!] PTA18/FTM0_FLT2/FTM_CLKIN0/EXTAL
PTA19/FTM1_FLT0/FTM_CLKIN1/LPT0_ALT1/XTAL
PTA24/MII0_TXD2/FB_A29
PTA25/MII0_TXCLK/FB_A28
PTA26/MII0_TXD3/FB_A27
```

Processor Expert in MQX BSP

- **GPIO1** component in BSP is driving LED's in Tower board.
- **TRG** Timer will generate a 64KHz interrupt.


*Component Inspector

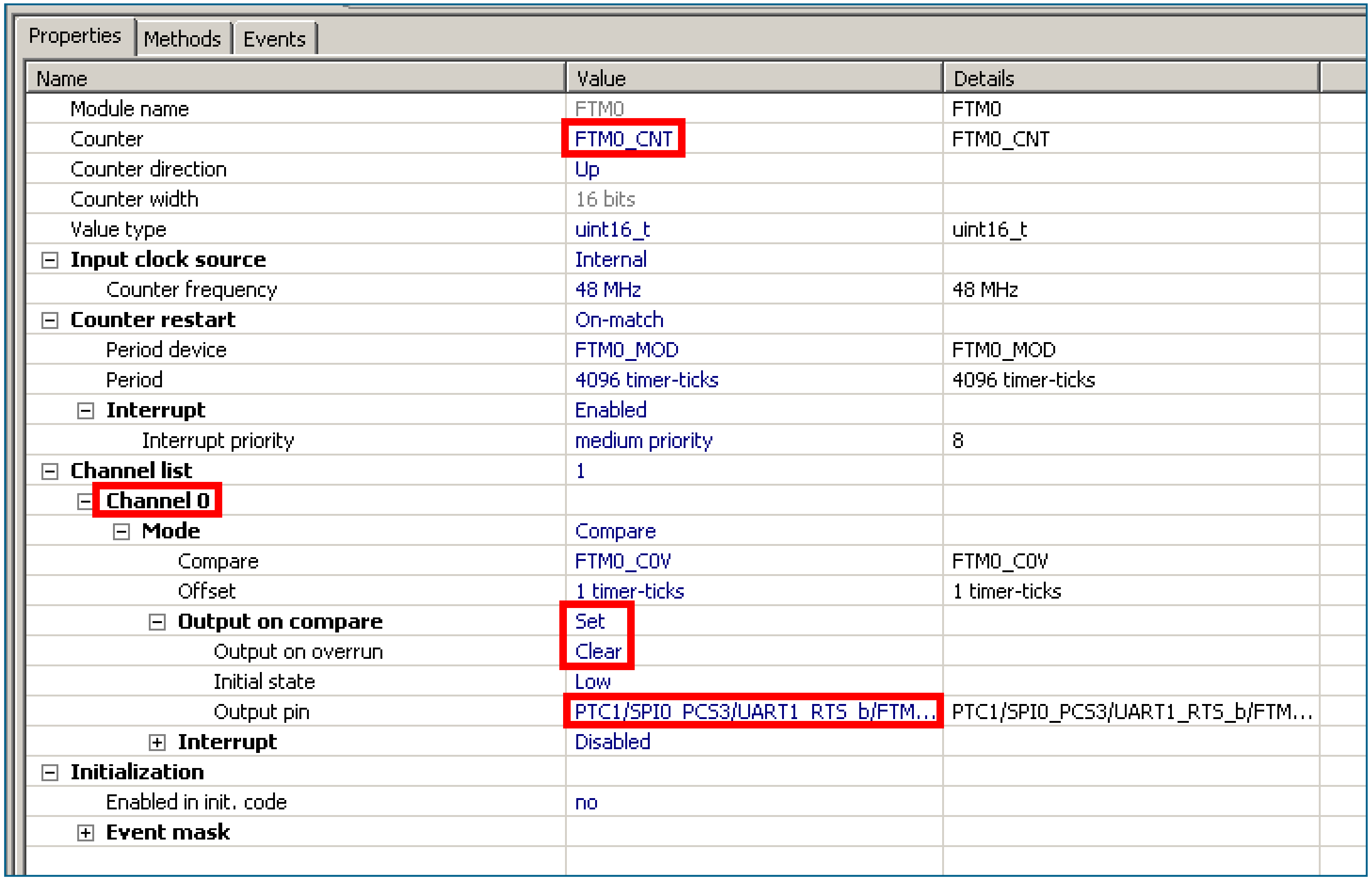
Basic | Advanced

Properties | Methods | Events

Name	Value	Details
Module name	FTM2	FTM2
Counter	FTM2_CNT	FTM2_CNT
Counter direction	Up	
Counter width	16 bits	
Value type	uint16_t	uint16_t
Input clock source	Internal	
Counter frequency	48 MHz	48 MHz
Counter restart	On-match	
Period device	FTM2_MOD	FTM2_MOD
Period	64000 Hz	64000 Hz
Interrupt	Enabled	
Interrupt priority	medium priority	8
Channel list	0	
Initialization		

Processor Expert in MQX BSP

- **PWM** configures Channel 0 in Flex Timer 0 a PWM of 4096 timer-ticks

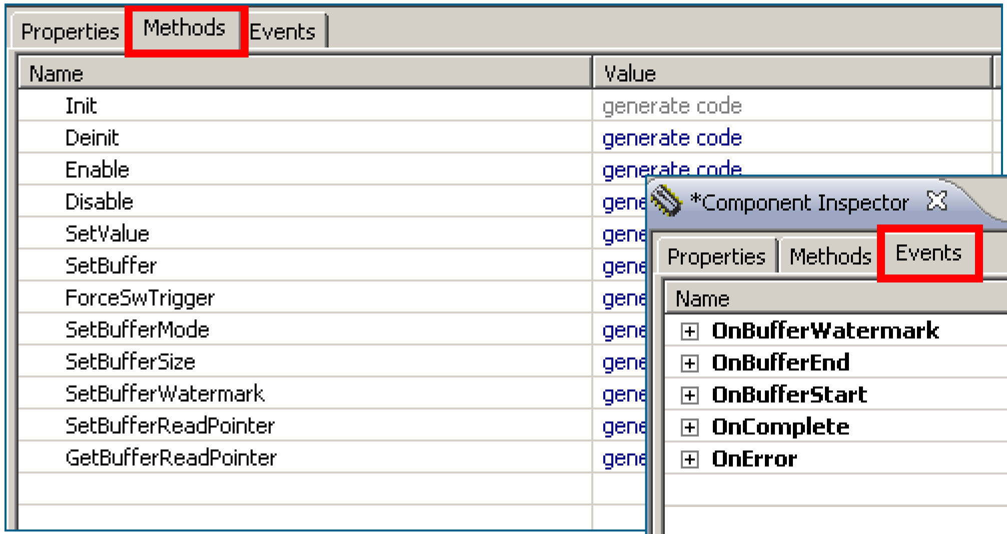


Properties | Methods | Events

Name	Value	Details
Module name	FTM0	FTM0
Counter	FTM0_CNT	FTM0_CNT
Counter direction	Up	
Counter width	16 bits	
Value type	uint16_t	uint16_t
⊟ **Input clock source**	Internal	
Counter frequency	48 MHz	48 MHz
⊟ **Counter restart**	On-match	
Period device	FTM0_MOD	FTM0_MOD
Period	4096 timer-ticks	4096 timer-ticks
⊟ **Interrupt**	Enabled	
Interrupt priority	medium priority	8
⊟ **Channel list**	1	
⊟ **Channel 0**		
⊟ **Mode**	Compare	
Compare	FTM0_C0V	FTM0_C0V
Offset	1 timer-ticks	1 timer-ticks
⊟ **Output on compare**	Set	
Output on overrun	Clear	
Initial state	Low	
Output pin	PTC1/SPI0_PCS3/UART1_RTS_b/FTM...	PTC1/SPI0_PCS3/UART1_RTS_b/FTM...
⊞ **Interrupt**	Disabled	
⊟ **Initialization**		
Enabled in init. code	no	
⊞ **Event mask**		

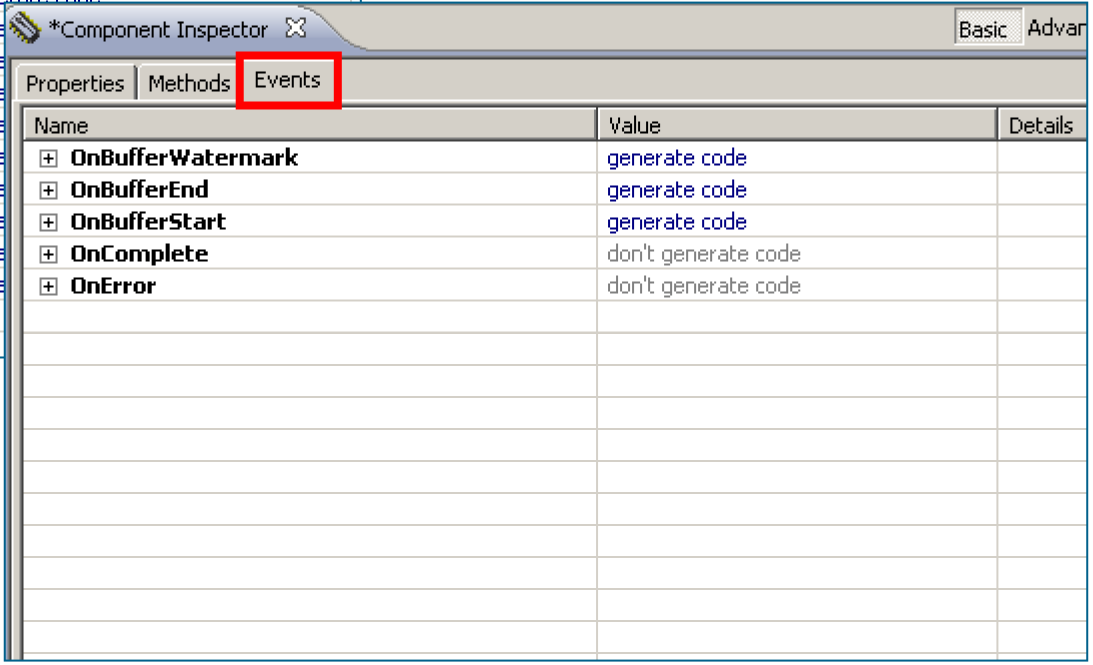
Processor Expert in MQX BSP

- Besides Properties, Components also include Methods and Events that we can enable or disable.



Properties | Methods | Events

Name	Value
Init	generate code
Deinit	generate code
Enable	generate code
Disable	gene
SetValue	gene
SetBuffer	gene
ForceSwTrigger	gene
SetBufferMode	gene
SetBufferSize	gene
SetBufferWatermark	gene
SetBufferReadPointer	gene
GetBufferReadPointer	gene



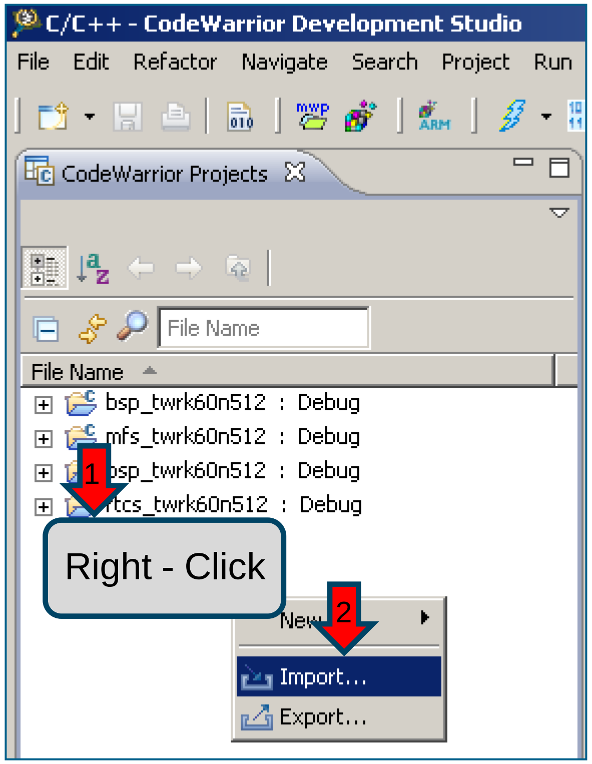
*Component Inspector | Basic | Advan

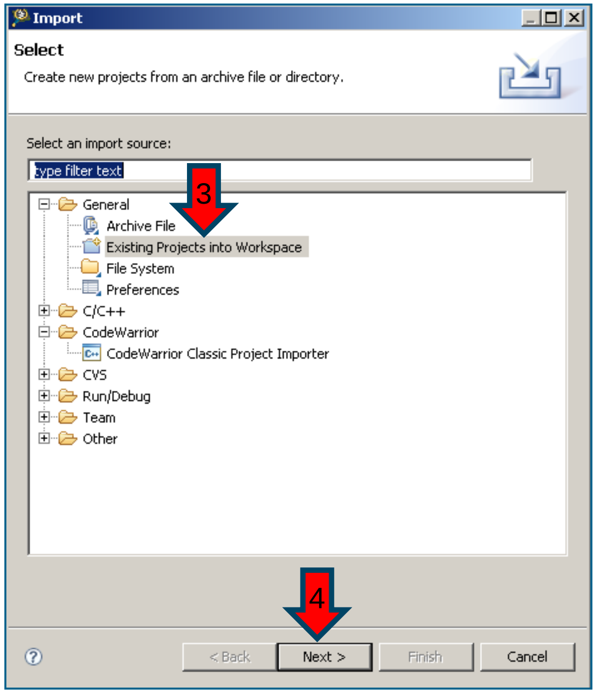
Properties | Methods | Events

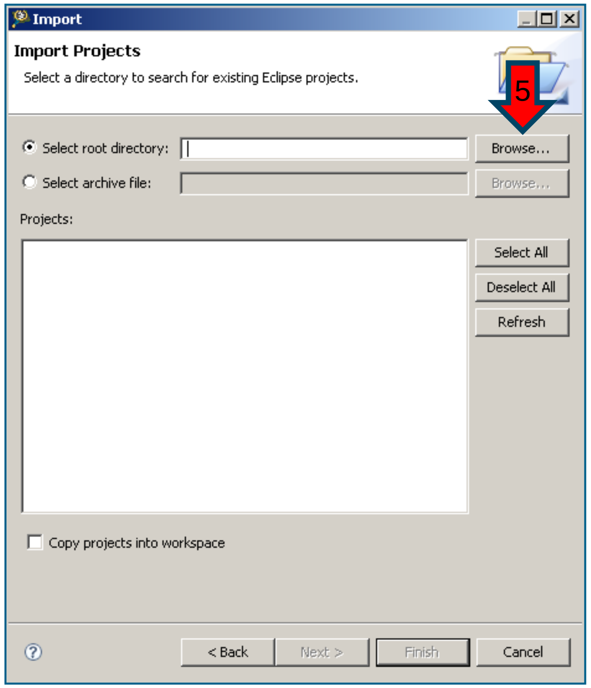
Name	Value	Details
OnBufferWatermark	generate code	
OnBufferEnd	generate code	
OnBufferStart	generate code	
OnComplete	don't generate code	
OnError	don't generate code	

Import MQX PE Demo

- Right-Click on Project Explorer and Import.
- Select Existing Projects into Workspace and Browse.

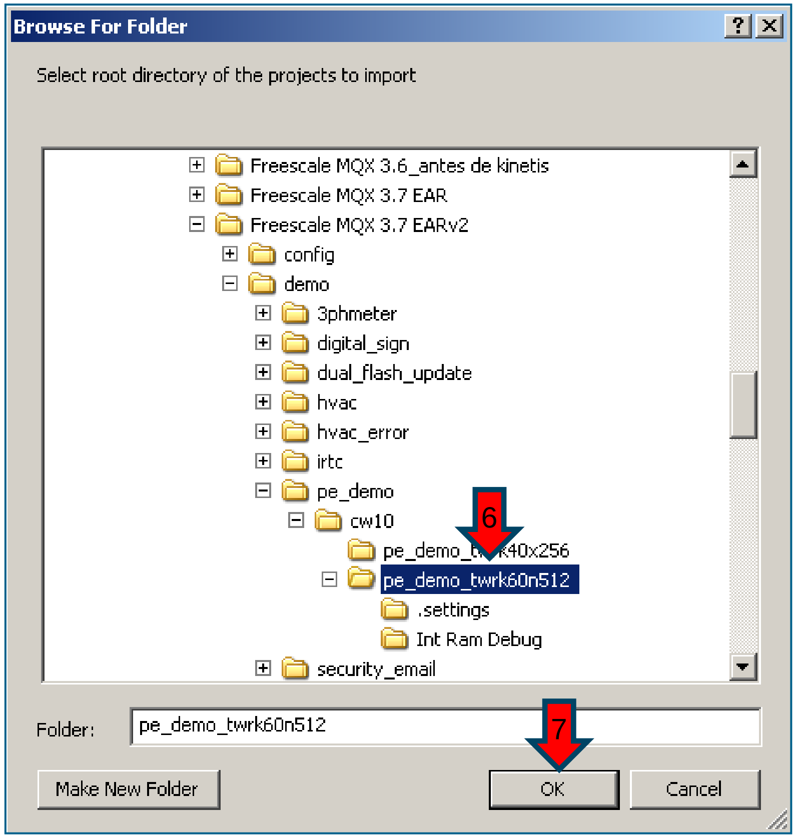




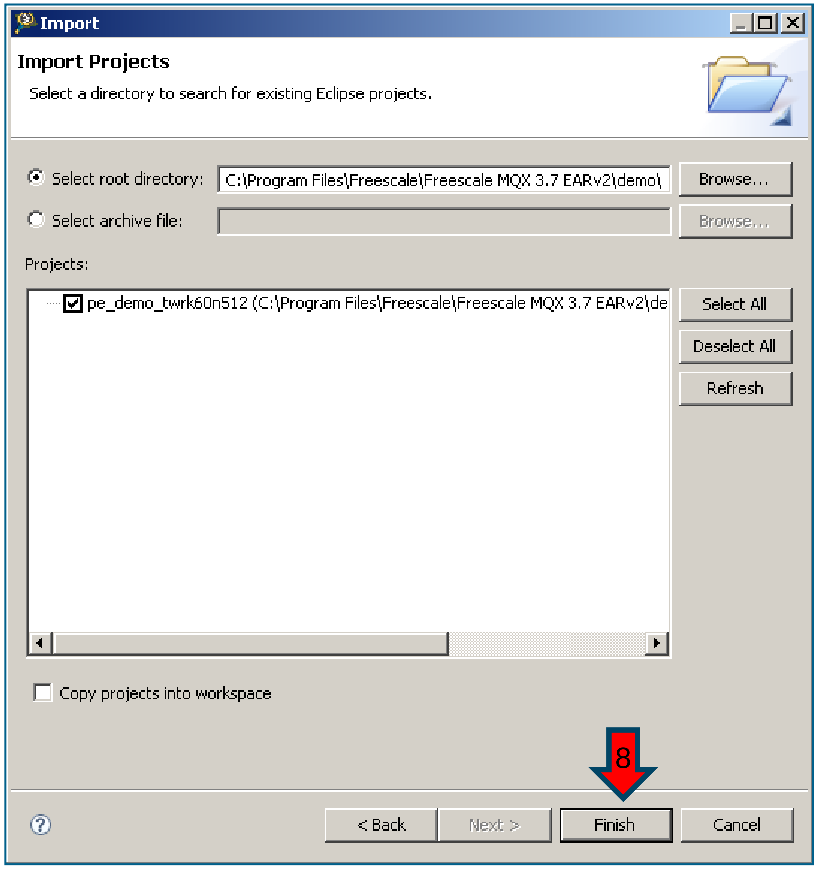


Import MQX PE Demo

► Select ***<install mqx folder>\mqx\pe_demo\pe_demo_twrk60n512***



Folder: pe_demo_twrk60n512



(●) Select root directory: C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\demo\

( ) Select archive file:

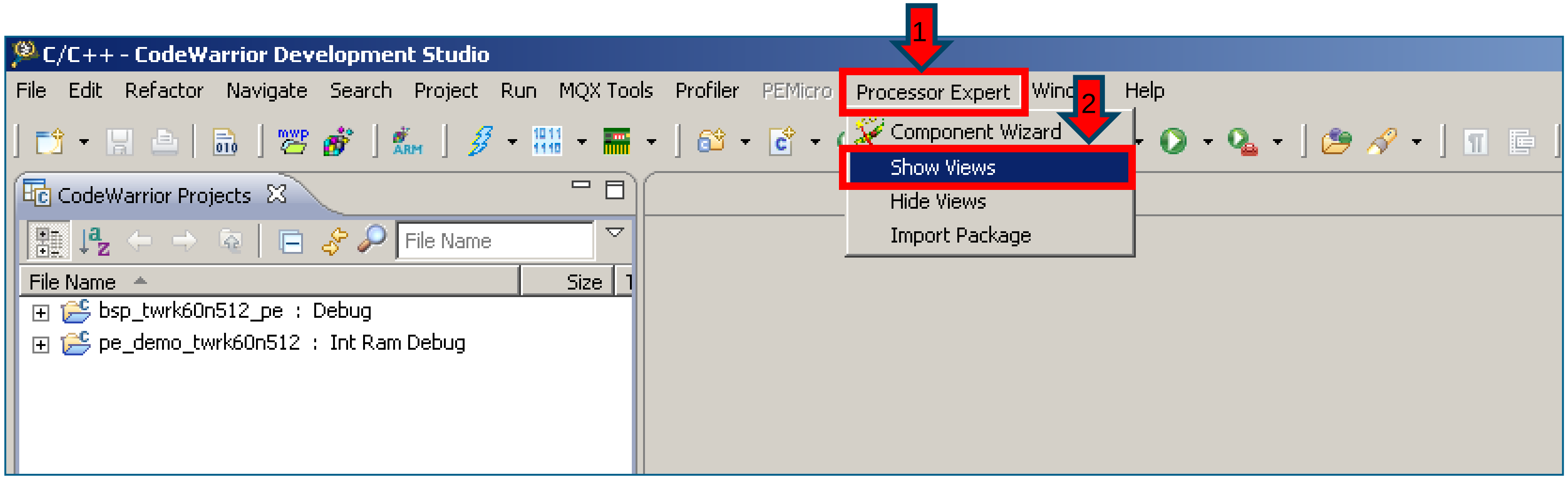
Projects:

[✓] pe_demo_twrk60n512 (C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\de

[ ] Copy projects into workspace

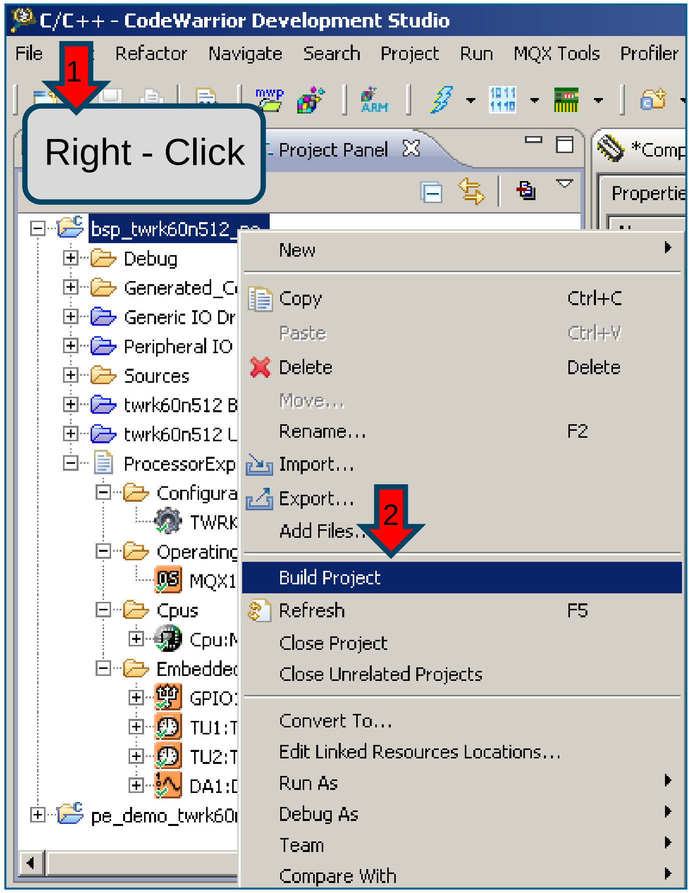
MQX PE Demo

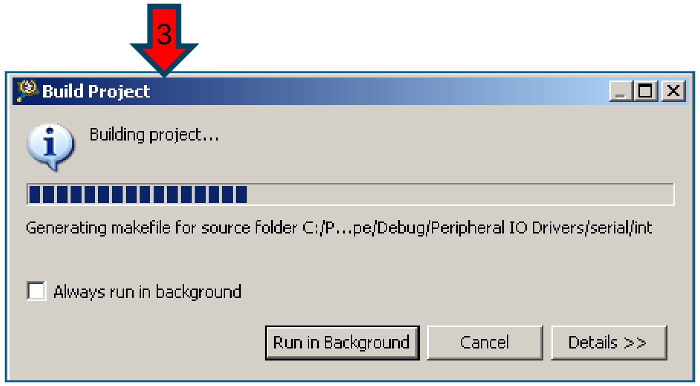
- Select in Menu : Processor Expert -> Show Views.


C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Wind Help
1
2
Component Wizard
Show Views
Hide Views
Import Package
CodeWarrior Projects
File Name
File Name
Size
bsp_twrk60n512_pe : Debug
pe_demo_twrk60n512 : Int Ram Debug

Build PE BSP

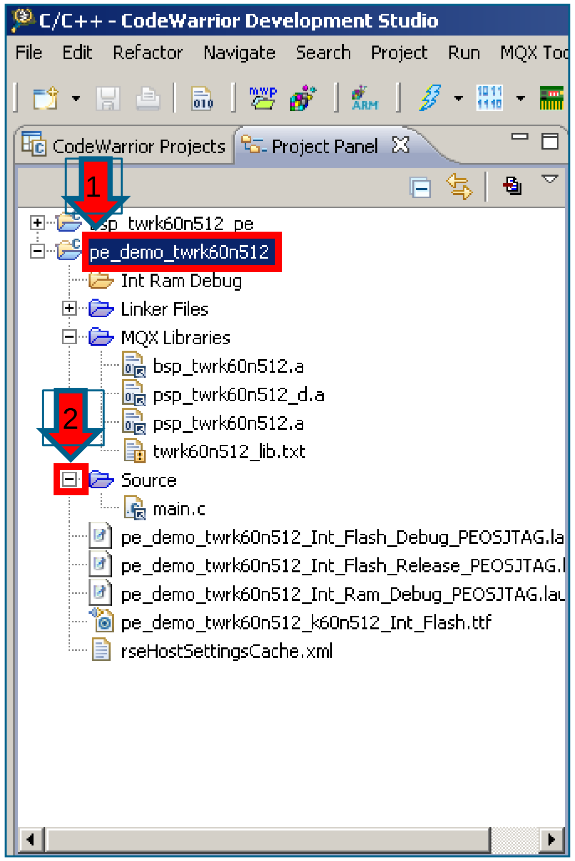
▶ Right-Click on Project Explorer **bsp_twrk60n512_pe** and Build Project.

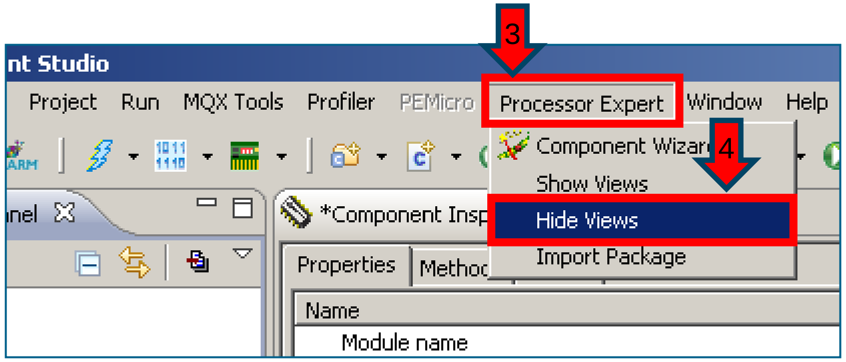




Build PE Demo

- Expand **pe_demo_twrk60n512** project view.
- Hide Processor Expert View.

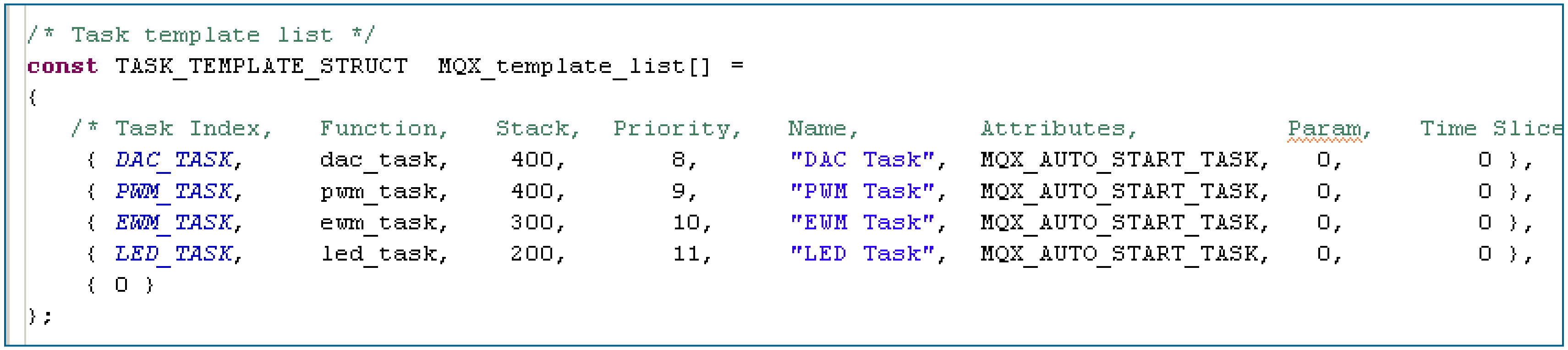

C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Too
CodeWarrior Projects
Project Panel
1
sp_twrk60n512_pe
pe_demo_twrk60n512
Int Ram Debug
Linker Files
MQX Libraries
bsp_twrk60n512.a
psp_twrk60n512_d.a
psp_twrk60n512.a
twrk60n512_lib.txt
2
Source
main.c
pe_demo_twrk60n512_Int_Flash_Debug_PEOSJTAG.la
pe_demo_twrk60n512_Int_Flash_Release_PEOSJTAG.l
pe_demo_twrk60n512_Int_Ram_Debug_PEOSJTAG.lau
pe_demo_twrk60n512_k60n512_Int_Flash.ttf
rseHostSettingsCache.xml



MQX PE Demo

- Demo Application demonstrates how to use Processor Expert to configure MQX BSP:
  - It generates sine signal with given period on DACO pin.
  - PWM signal is generated using FlexTimer FTM0 Channel 0.
  - It toggles LEDs (D9-D11) on board using GPIO driver.
  - ewm_task task is periodically refreshing watchdog.

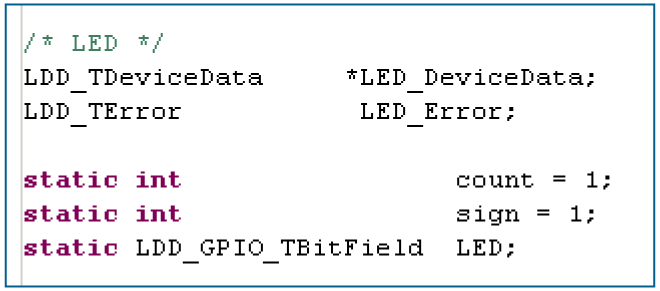
- Application creates four tasks as shown below:



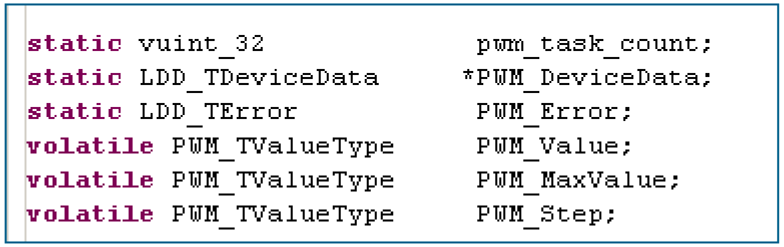
```
/* Task template list */
const TASK_TEMPLATE_STRUCT  MQX_template_list[] =
{
   /* Task Index,    Function,    Stack,  Priority,   Name,         Attributes,          Param,    Time Slice
    { DAC_TASK,      dac_task,     400,        8,     "DAC Task",  MQX_AUTO_START_TASK,   0,            0 },
    { PWM_TASK,      pwm_task,     400,        9,     "PWM Task",  MQX_AUTO_START_TASK,   0,            0 },
    { EWM_TASK,      ewm_task,     300,       10,     "EWM Task",  MQX_AUTO_START_TASK,   0,            0 },
    { LED_TASK,      led_task,     200,       11,     "LED Task",  MQX_AUTO_START_TASK,   0,            0 },
    { 0 }
};
```

MQX PE Demo

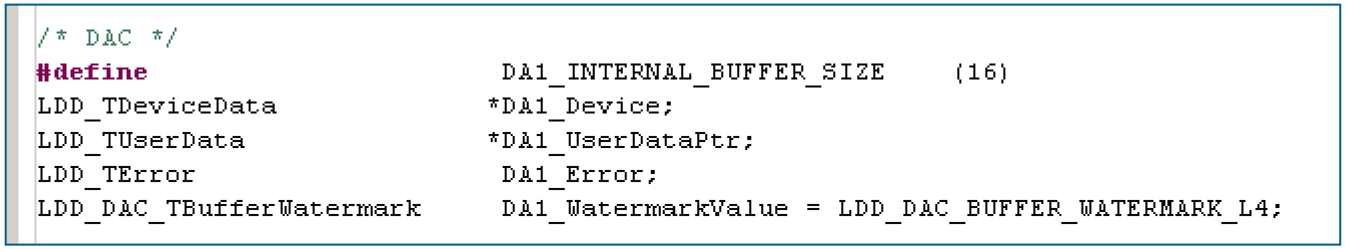
- ▶ Application uses PE LDD drivers.
- ▶ To use PE drivers, some ‘handler’ variables must be declared:



```
/* LED */
LDD_TDeviceData      *LED_DeviceData;
LDD_TError            LED_Error;

static int                    count = 1;
static int                    sign = 1;
static LDD_GPIO_TBitField     LED;
```

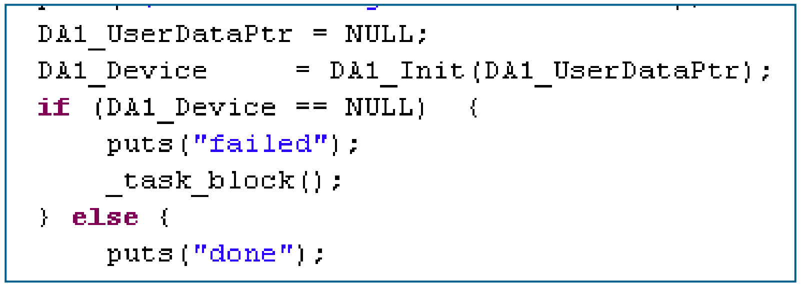


```
static vuint_32                pwm_task_count;
static LDD_TDeviceData        *PWM_DeviceData;
static LDD_TError              PWM_Error;
volatile PWM_TValueType        PWM_Value;
volatile PWM_TValueType        PWM_MaxValue;
volatile PWM_TValueType        PWM_Step;
```

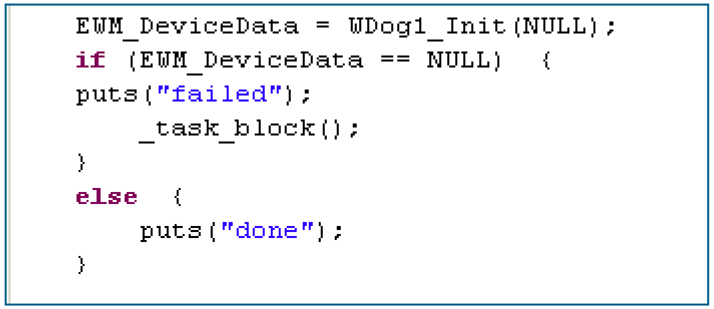


```
/* DAC */
#define                        DA1_INTERNAL_BUFFER_SIZE    (16)
LDD_TDeviceData               *DA1_Device;
LDD_TUserData                 *DA1_UserDataPtr;
LDD_TError                     DA1_Error;
LDD_DAC_TBufferWatermark       DA1_WatermarkValue = LDD_DAC_BUFFER_WATERMARK_L4;
```

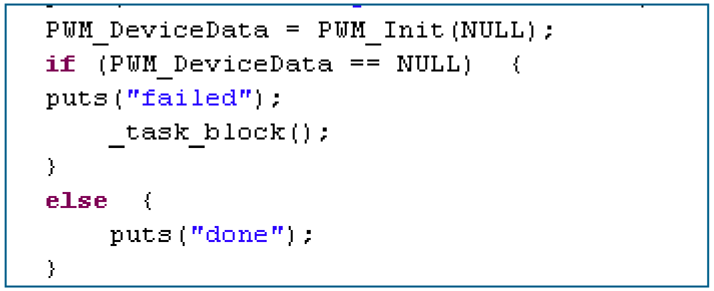
- Task must initialize the LDD components.



```
DA1_UserDataPtr = NULL;
DA1_Device      = DA1_Init(DA1_UserDataPtr);
if (DA1_Device == NULL)  {
    puts("failed");
    _task_block();
} else {
    puts("done");
```



```
EWM_DeviceData = WDog1_Init(NULL);
if (EWM_DeviceData == NULL)  {
puts("failed");
    _task_block();
}
else  {
    puts("done");
}
```



```
PWM_DeviceData = PWM_Init(NULL);
if (PWM_DeviceData == NULL)  {
puts("failed");
    _task_block();
}
else  {
    puts("done");
}
```

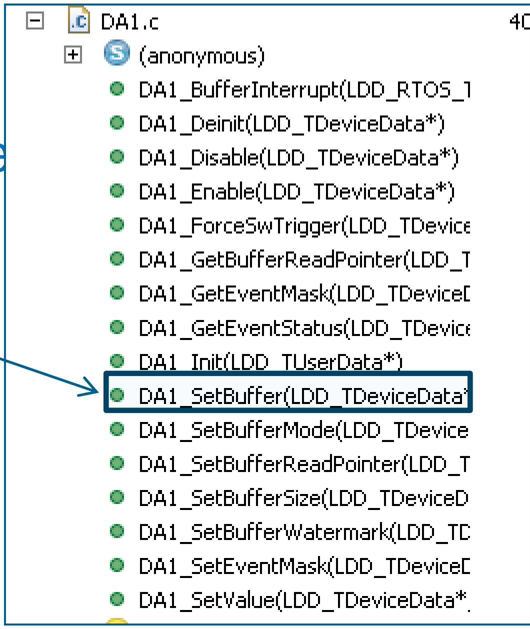
MQX PE Demo

- Enable the components:

```
PWM_Error = PWM_Enable(PWM_DeviceData);
EWM_Error = WDog1_Enable(EWM_DeviceData);
```

- Application can use the components Methods:

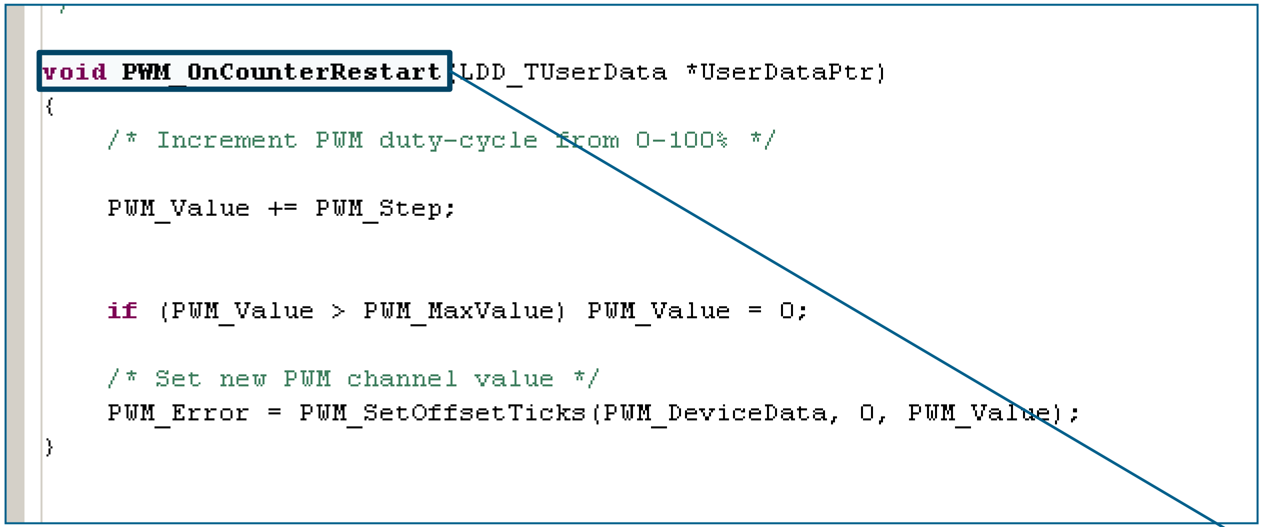
```
DA1_Error = DA1_SetBuffer(DA1_Device, GEN_Buffe
   DA1_INTERNAL_BUFFER_SIZE, 0);
```



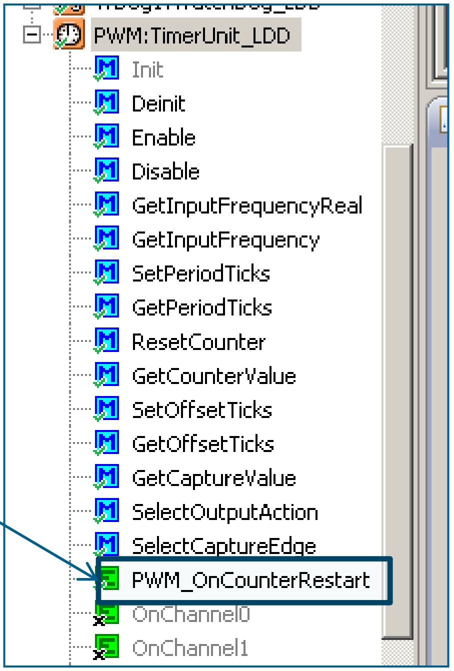
```
⊟ DA1.c                                  4C
  ⊞ (anonymous)
    ● DA1_BufferInterrupt(LDD_RTOS_1
    ● DA1_Deinit(LDD_TDeviceData*)
    ● DA1_Disable(LDD_TDeviceData*)
    ● DA1_Enable(LDD_TDeviceData*)
    ● DA1_ForceSwTrigger(LDD_TDevice
    ● DA1_GetBufferReadPointer(LDD_T
    ● DA1_GetEventMask(LDD_TDeviceD
    ● DA1_GetEventStatus(LDD_TDevice
    ● DA1_Init(LDD_TUserData*)
    ● DA1_SetBuffer(LDD_TDeviceData*
    ● DA1_SetBufferMode(LDD_TDevice
    ● DA1_SetBufferReadPointer(LDD_T
    ● DA1_SetBufferSize(LDD_TDeviceD
    ● DA1_SetBufferWatermark(LDD_TD
    ● DA1_SetEventMask(LDD_TDeviceD
    ● DA1_SetValue(LDD_TDeviceData*
```

MQX PE Demo

- Finally, implement the Events.



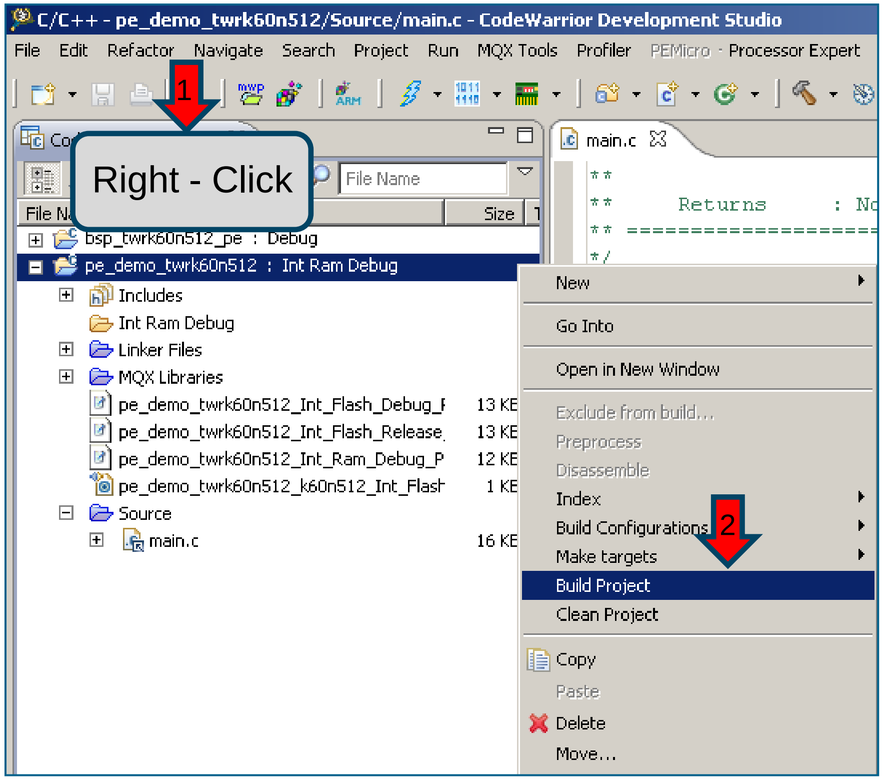
```
void PWM_OnCounterRestart(LDD_TUserData *UserDataPtr)
{
    /* Increment PWM duty-cycle from 0-100% */

    PWM_Value += PWM_Step;


    if (PWM_Value > PWM_MaxValue) PWM_Value = 0;

    /* Set new PWM channel value */
    PWM_Error = PWM_SetOffsetTicks(PWM_DeviceData, 0, PWM_Value);
}
```

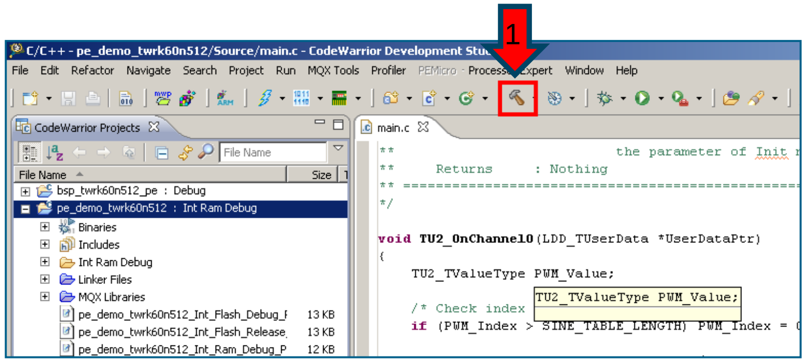


PWM:TimerUnit_LDD
- Init
- Deinit
- Enable
- Disable
- GetInputFrequencyReal
- GetInputFrequency
- SetPeriodTicks
- GetPeriodTicks
- ResetCounter
- GetCounterValue
- SetOffsetTicks
- GetOffsetTicks
- GetCaptureValue
- SelectOutputAction
- SelectCaptureEdge
- PWM_OnCounterRestart
- OnChannel0
- OnChannel1

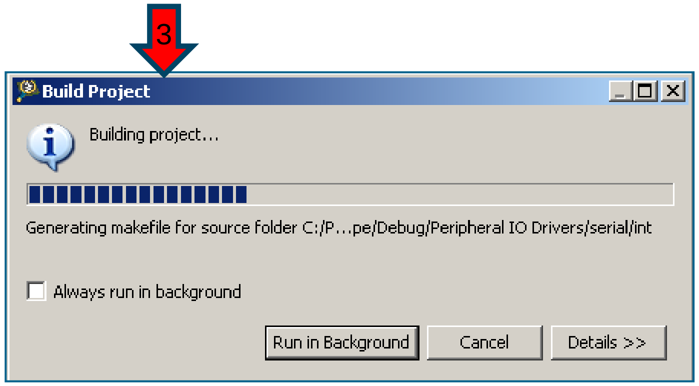
Build PE Demo

► Right-Click on the Project Explorer **pe_demo_twrk60n512** and Build Project or click on the icon




1
C/C++ - pe_demo_twrk60n512/Source/main.c - CodeWarrior Development Studio
CodeWarrior Projects
main.c

```
** Returns : Nothing
void TU2_OnChannel0(LDD_TUserData *UserDataPtr)
{
  TU2_TValueType PWM_Value;
  /* Check index
  if (PWM_Index > SINE_TABLE_LENGTH) PWM_Index = 0
```

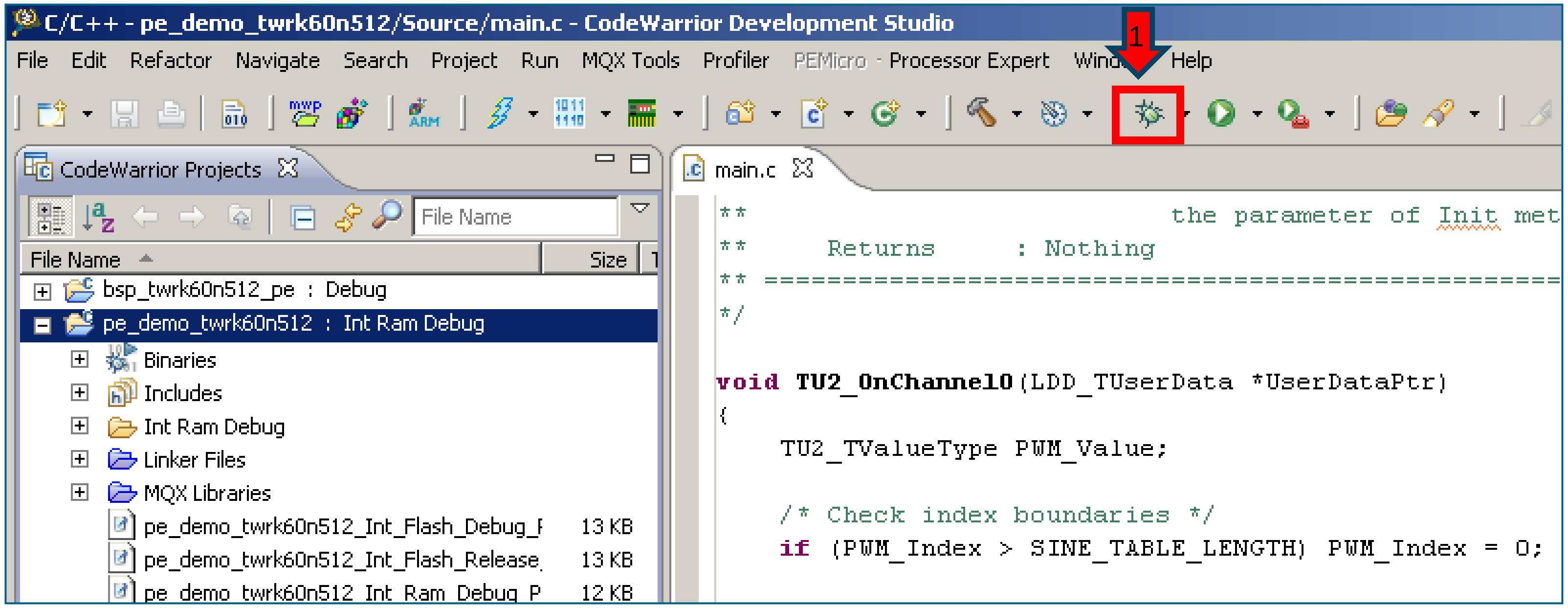


Building project...

Generating makefile for source folder C:/P...pe/Debug/Peripheral IO Drivers/serial/int

Run MQX PE Demo

- Click on the Debug icon.

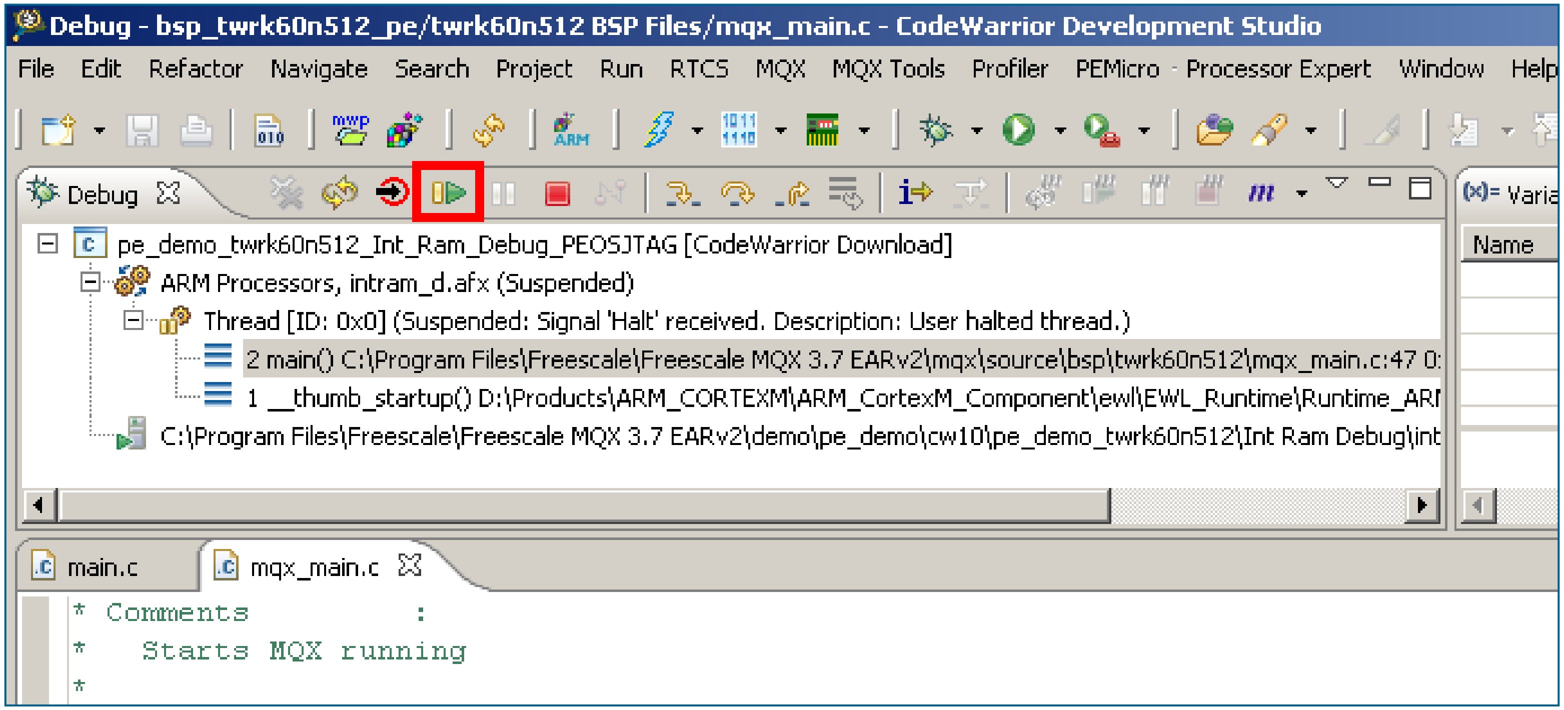

C/C++ - pe_demo_twrk60n512/Source/main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Wind Help
1
CodeWarrior Projects
File Name
main.c

File Name	Size
bsp_twrk60n512_pe : Debug	
pe_demo_twrk60n512 : Int Ram Debug	
Binaries	
Includes	
Int Ram Debug	
Linker Files	
MQX Libraries	
pe_demo_twrk60n512_Int_Flash_Debug_F	13 KB
pe_demo_twrk60n512_Int_Flash_Release_	13 KB
pe_demo_twrk60n512_Int_Ram_Debug_P	12 KB

```
**                                       the parameter of Init met
**       Returns      : Nothing
** ==================================================================
*/

void TU2_OnChannel0(LDD_TUserData *UserDataPtr)
{
    TU2_TValueType PWM_Value;

    /* Check index boundaries */
    if (PWM_Index > SINE_TABLE_LENGTH) PWM_Index = 0;
```

Run MQX PE Demo

- Click on the Resume (F8).

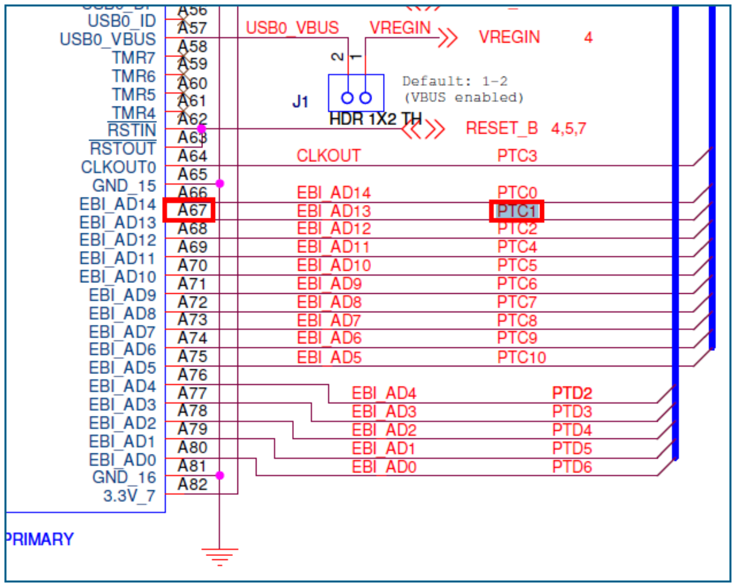

Debug - bsp_twrk60n512_pe/twrk60n512 BSP Files/mqx_main.c - CodeWarrior Development Studio

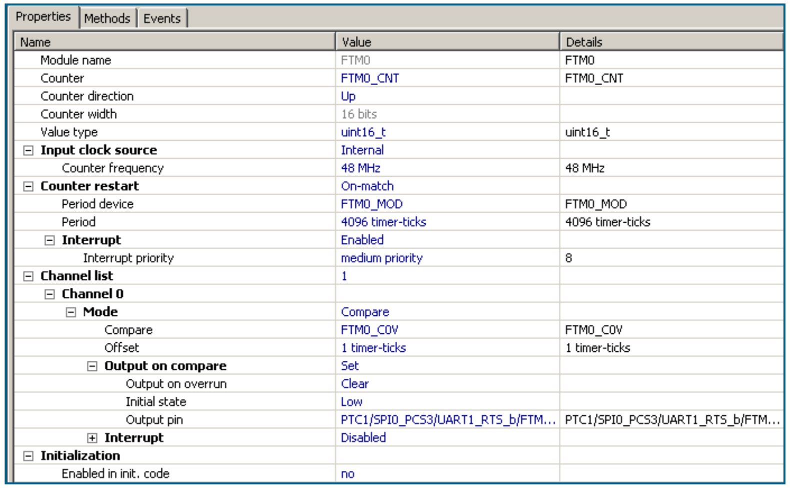
```
pe_demo_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  ARM Processors, intram_d.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
      1 __thumb_startup() D:\Products\ARM_CORTEXM\ARM_CortexM_Component\ewl\EWL_Runtime\Runtime_ARI
  C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\demo\pe_demo\cw10\pe_demo_twrk60n512\Int Ram Debug\int
```

```
* Comments          :
*   Starts MQX running
*
```

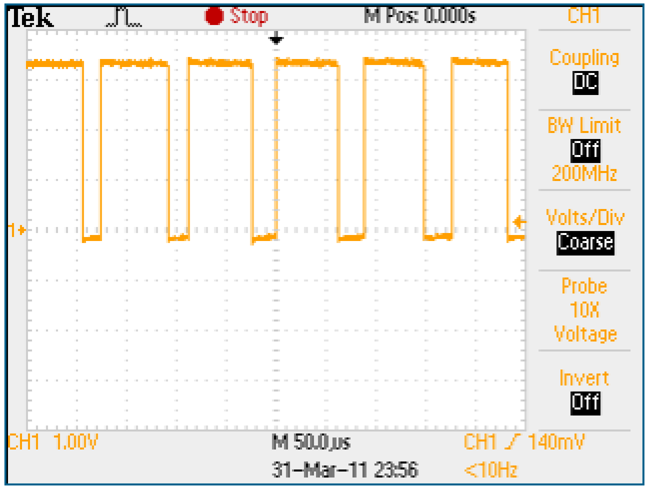
Run MQX PE Demo

- Check PWM output on A67.





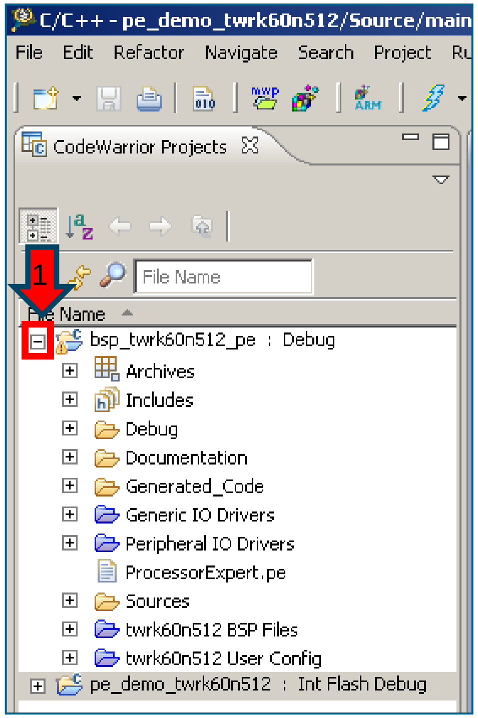
Name	Value	Details
Module name	FTM0	FTM0
Counter	FTM0_CNT	FTM0_CNT
Counter direction	Up	
Counter width	16 bits	
Value type	uint16_t	uint16_t
⊟ Input clock source	Internal	
Counter frequency	48 MHz	48 MHz
⊟ Counter restart	On-match	
Period device	FTM0_MOD	FTM0_MOD
Period	4096 timer-ticks	4096 timer-ticks
⊟ Interrupt	Enabled	
Interrupt priority	medium priority	8
⊟ Channel list	1	
⊟ Channel 0		
⊟ Mode	Compare	
Compare	FTM0_C0V	FTM0_C0V
Offset	1 timer-ticks	1 timer-ticks
⊟ Output on compare	Set	
Output on overrun	Clear	
Initial state	Low	
Output pin	PTC1/SPI0_PCS3/UART1_RTS_b/FTM...	PTC1/SPI0_PCS3/UART1_RTS_b/FTM...
⊞ Interrupt	Disabled	
⊟ Initialization		
Enabled in init. code	no	

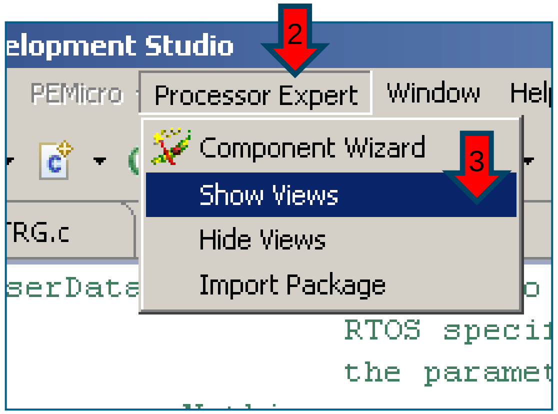


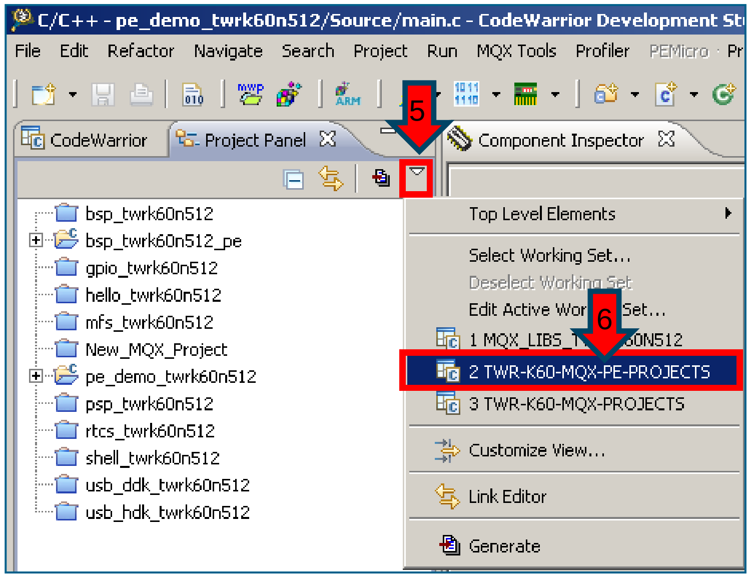
CW10.x, MQX and PE : New LDD driver

New LLD Driver

- ▶ Expand **bsp_twrk60n512_pe** project view.
- ▶ Show Processor Expert View.
- ▶ Select PE Projects Working Set.

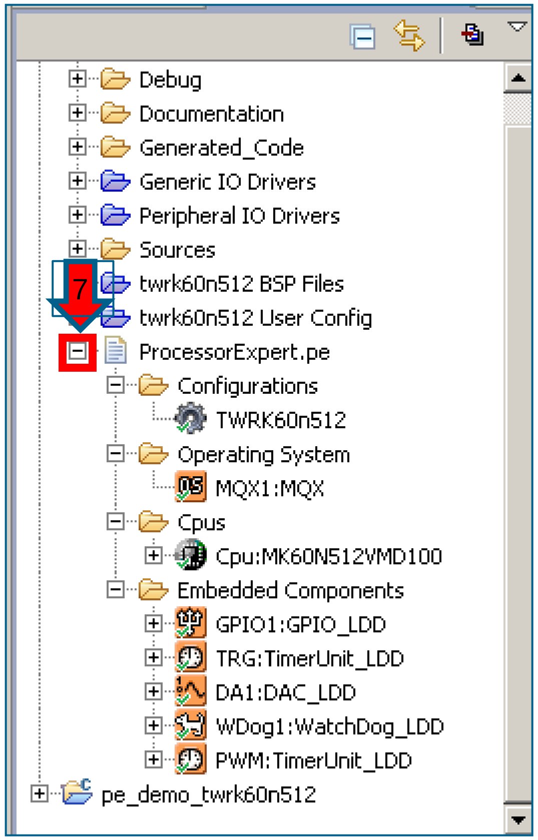


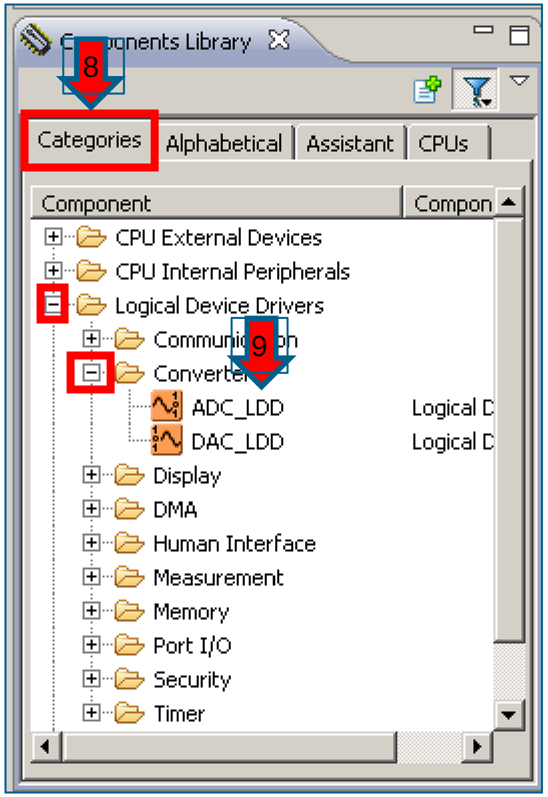




New LLD Driver

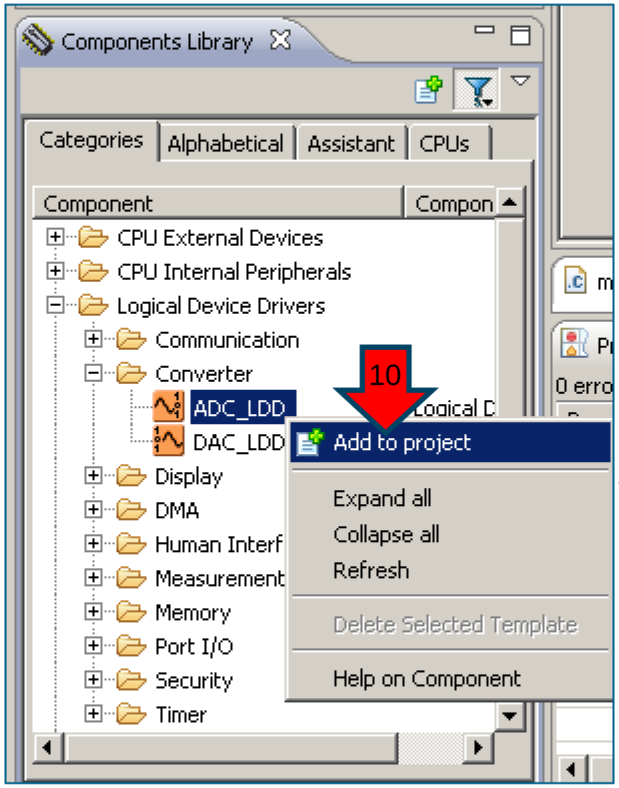
- Expand Processor Expert Project View.
- Search ADC_LDD in the Components Library window.

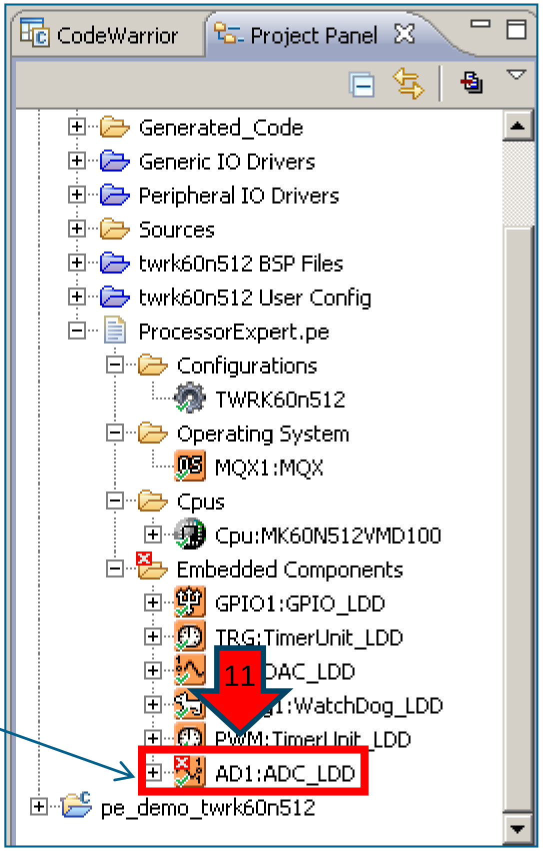




New LLD Driver

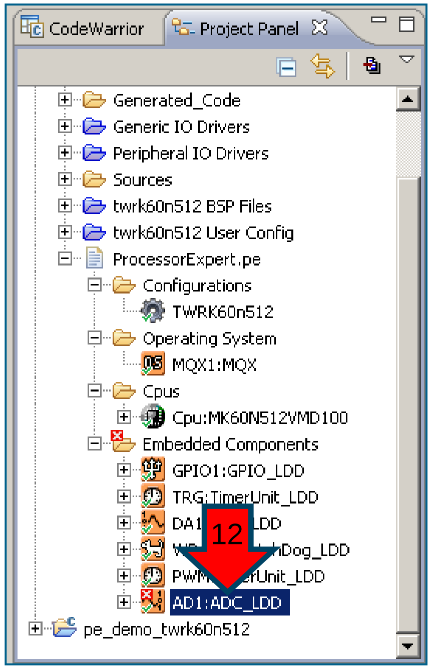
- Right click on the component.
- Select Add to project.

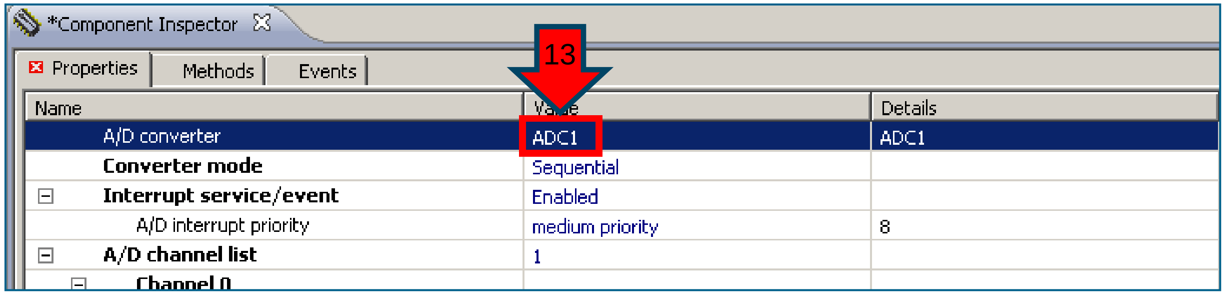




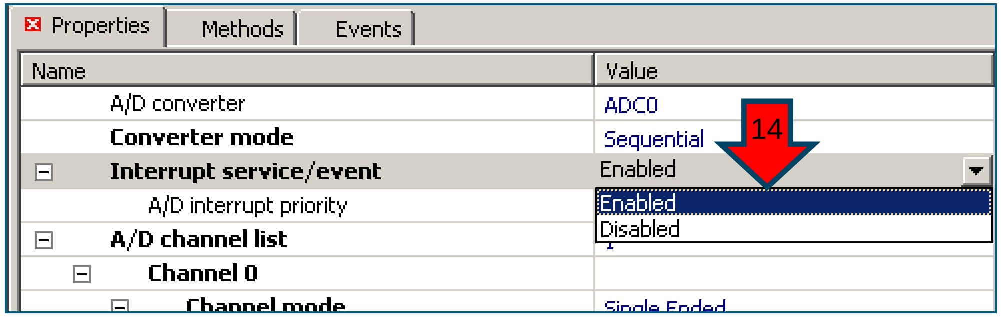
New LLD Driver

- Double click on ADC_LDD.
- Select ADC1.
- Enable Interrupt service.





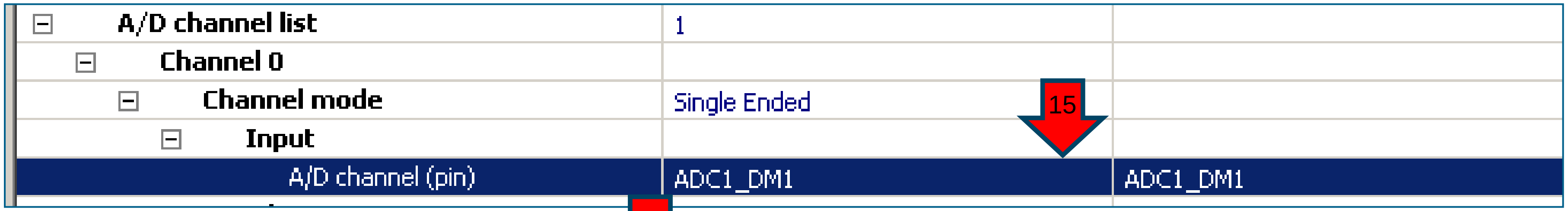
Name	Value	Details
A/D converter	ADC1	ADC1
Converter mode	Sequential	
Interrupt service/event	Enabled	
A/D interrupt priority	medium priority	8
A/D channel list	1	
Channel 0		



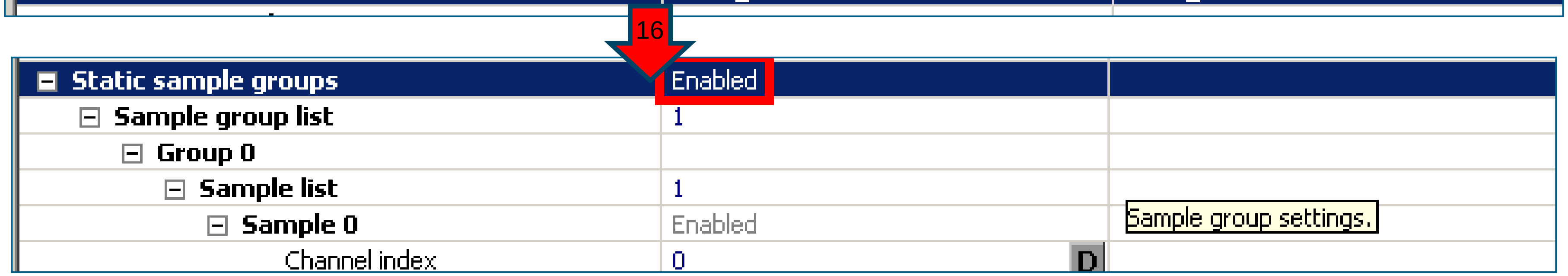
Name	Value
A/D converter	ADC0
Converter mode	Sequential
Interrupt service/event	Enabled
A/D interrupt priority	
A/D channel list	1
Channel 0	
Channel mode	Single Ended

New LLD Driver

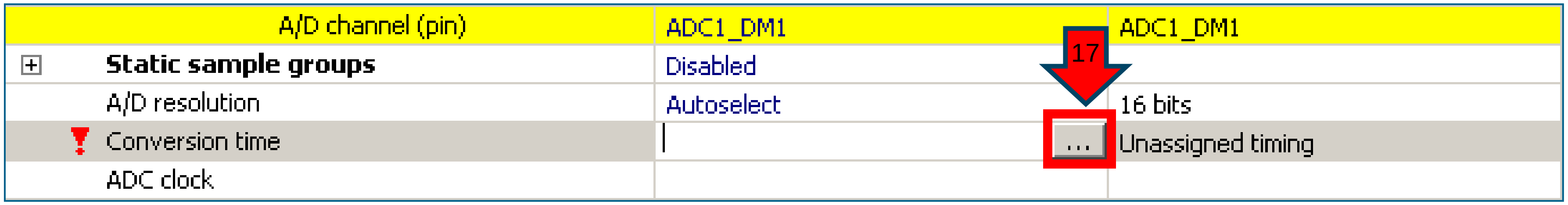
- Select **ADC1_DM1** Channel.
- Enable Static sample groups.
- Open Conversion Time Window.



⊟ A/D channel list	1	
⊟ Channel 0		
⊟ Channel mode	Single Ended	
⊟ Input		
A/D channel (pin)	ADC1_DM1	ADC1_DM1



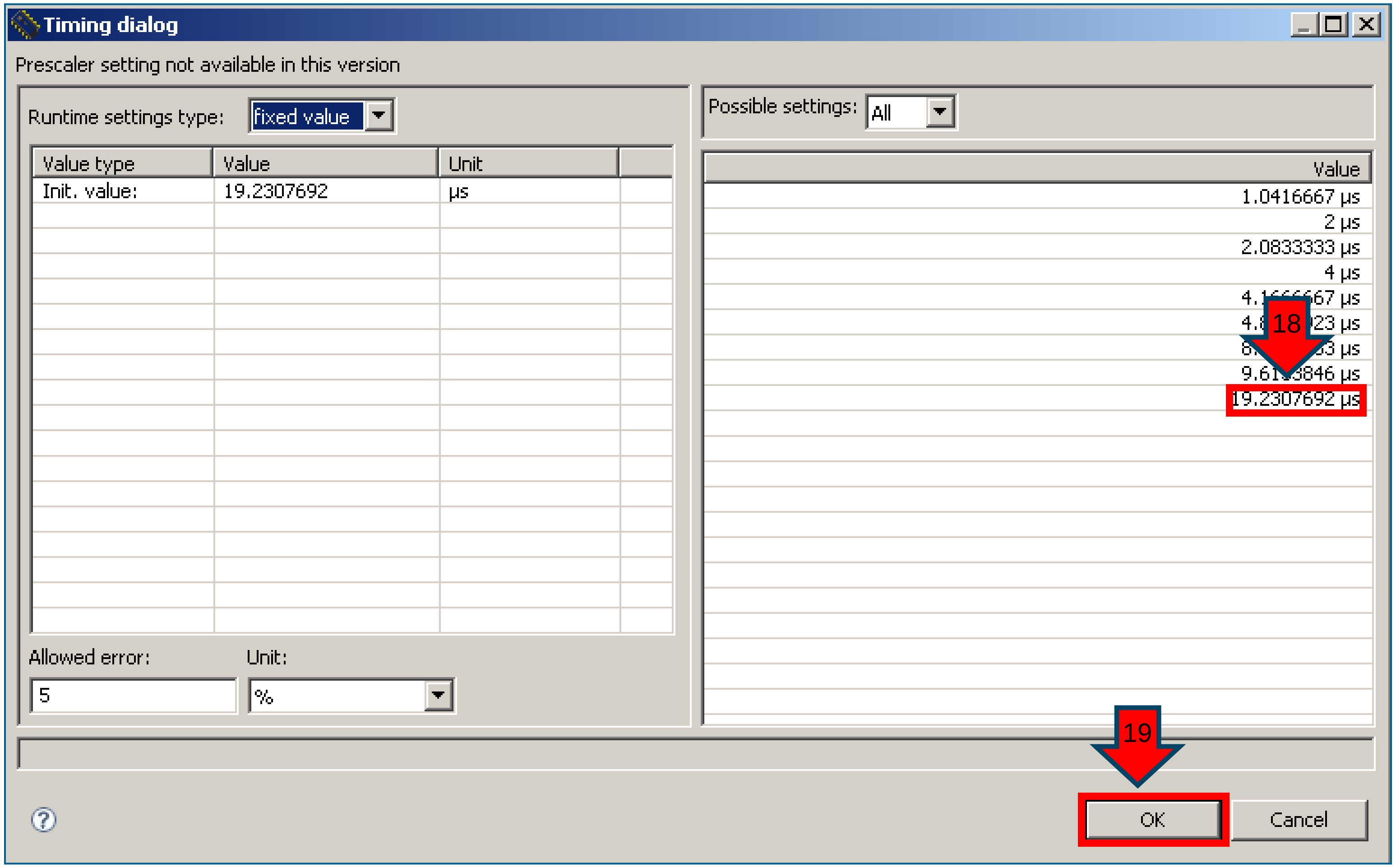
⊟ Static sample groups	Enabled	
⊟ Sample group list	1	
⊟ Group 0		
⊟ Sample list	1	
⊟ Sample 0	Enabled	Sample group settings.
Channel index	0	



A/D channel (pin)	ADC1_DM1	ADC1_DM1
⊞ Static sample groups	Disabled	
A/D resolution	Autoselect	16 bits
Conversion time		Unassigned timing
ADC clock		

New LLD Driver

- Select **19.23** us.



Prescaler setting not available in this version

Runtime settings type: fixed value

Value type	Value	Unit
Init. value:	19.2307692	µs

Allowed error: 5

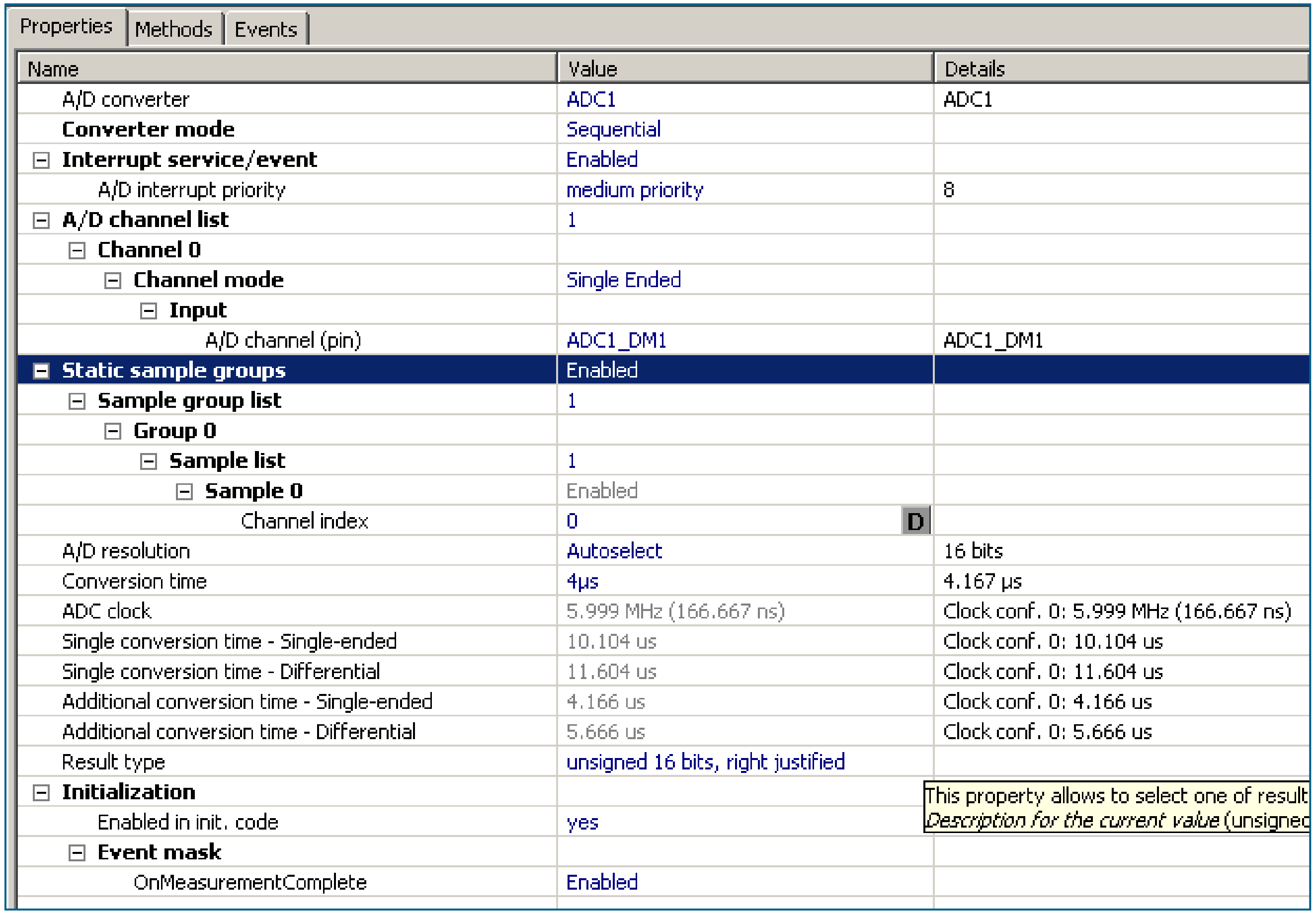
Unit: %

Possible settings: All

Value
1.0416667 µs
2 µs
2.0833333 µs
4 µs
4.1666667 µs
4.8[illegible]23 µs
8.[illegible]3 µs
9.61[illegible]3846 µs
19.2307692 µs

New LLD Driver

- ADC LLD Driver is configured.

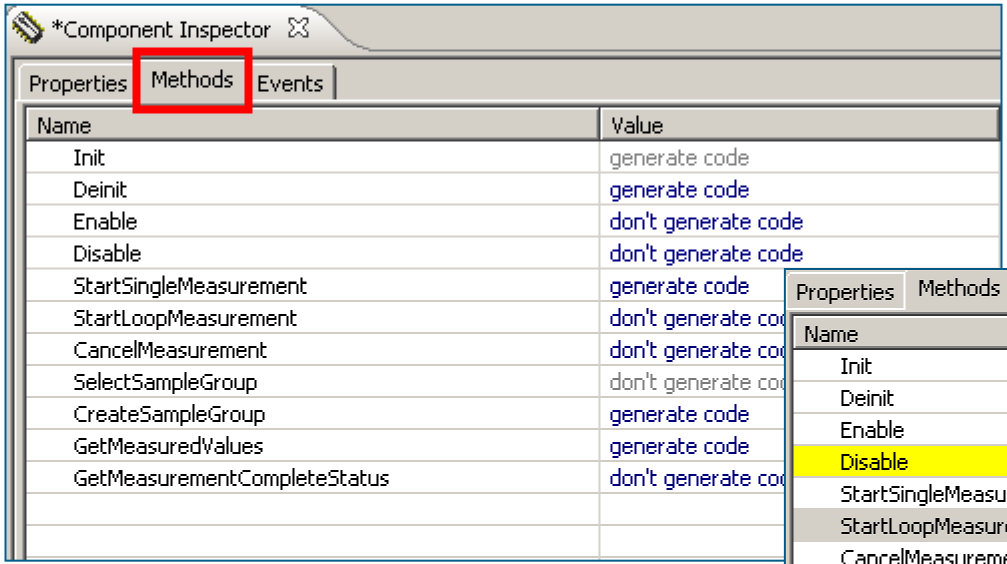


Properties | Methods | Events

Name	Value	Details
A/D converter	ADC1	ADC1
Converter mode	Sequential	
⊟ **Interrupt service/event**	Enabled	
A/D interrupt priority	medium priority	8
⊟ **A/D channel list**	1	
⊟ **Channel 0**		
⊟ **Channel mode**	Single Ended	
⊟ **Input**		
A/D channel (pin)	ADC1_DM1	ADC1_DM1
⊟ **Static sample groups**	Enabled	
⊟ **Sample group list**	1	
⊟ **Group 0**		
⊟ **Sample list**	1	
⊟ **Sample 0**	Enabled	
Channel index	0 D	
A/D resolution	Autoselect	16 bits
Conversion time	4µs	4.167 µs
ADC clock	5.999 MHz (166.667 ns)	Clock conf. 0: 5.999 MHz (166.667 ns)
Single conversion time - Single-ended	10.104 us	Clock conf. 0: 10.104 us
Single conversion time - Differential	11.604 us	Clock conf. 0: 11.604 us
Additional conversion time - Single-ended	4.166 us	Clock conf. 0: 4.166 us
Additional conversion time - Differential	5.666 us	Clock conf. 0: 5.666 us
Result type	unsigned 16 bits, right justified	
⊟ **Initialization**		This property allows to select one of result
Enabled in init. code	yes	*Description for the current value* (unsigned
⊟ **Event mask**		
OnMeasurementComplete	Enabled	

New LLD Driver

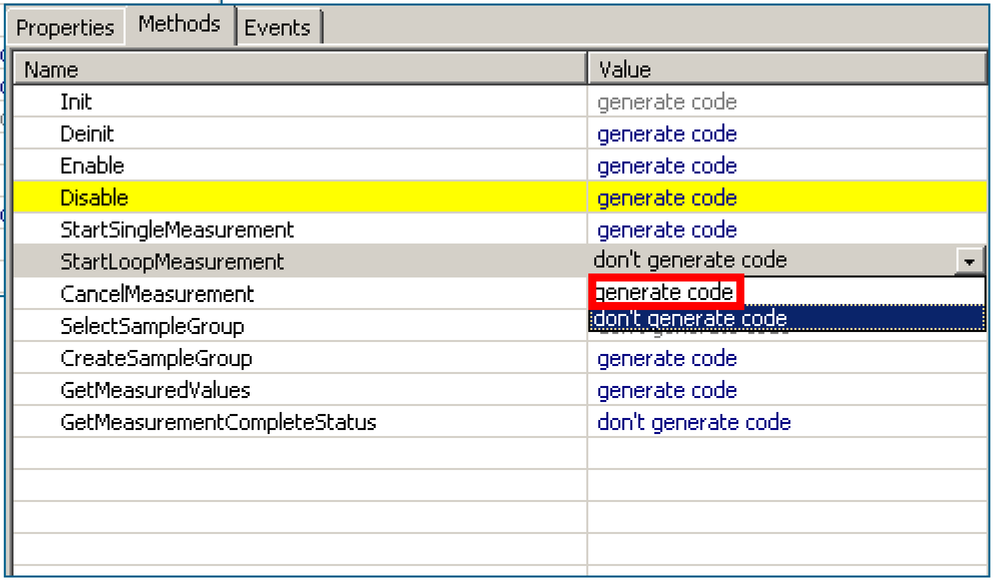
- Click Methods Tab.
- Click to generate code for methods.



*Component Inspector

Properties | Methods | Events

Name	Value
Init	generate code
Deinit	generate code
Enable	don't generate code
Disable	don't generate code
StartSingleMeasurement	generate code
StartLoopMeasurement	don't generate co
CancelMeasurement	don't generate co
SelectSampleGroup	don't generate co
CreateSampleGroup	generate code
GetMeasuredValues	generate code
GetMeasurementCompleteStatus	don't generate co

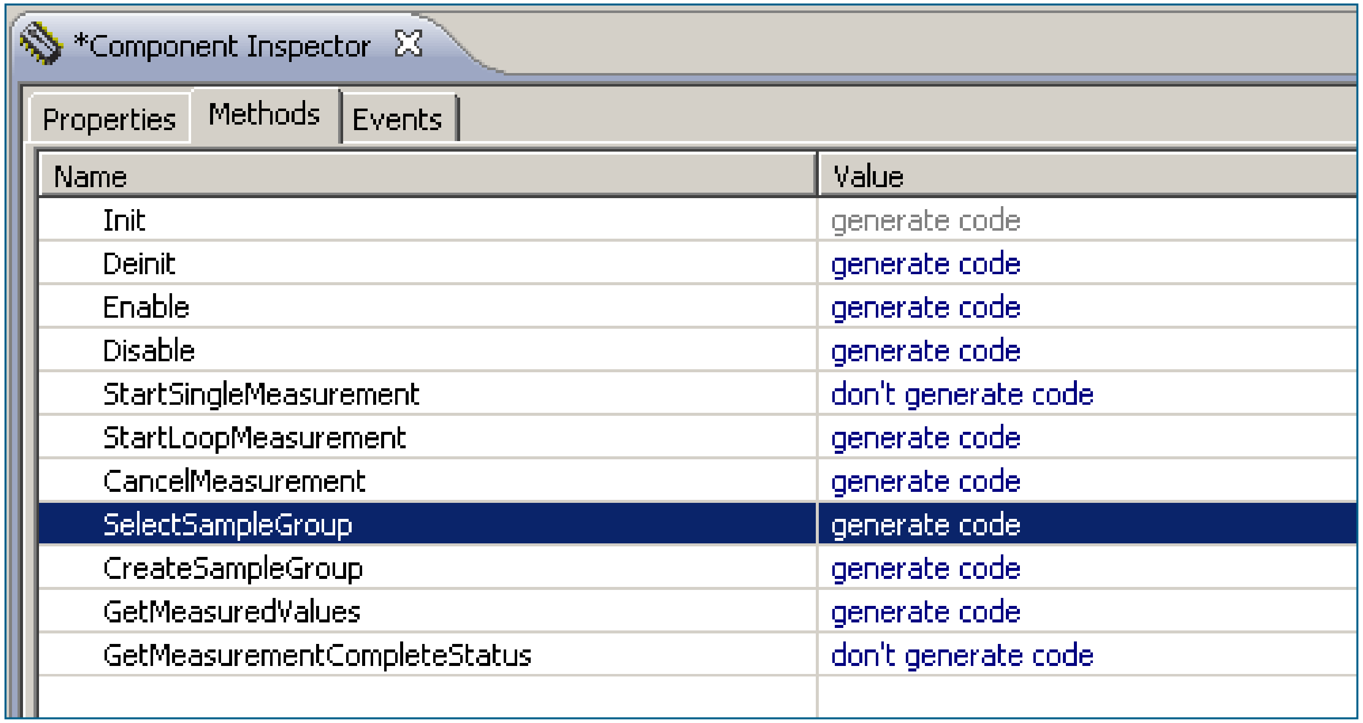


Properties | Methods | Events

Name	Value
Init	generate code
Deinit	generate code
Enable	generate code
Disable	generate code
StartSingleMeasurement	generate code
StartLoopMeasurement	don't generate code
CancelMeasurement	generate code
SelectSampleGroup	don't generate code
CreateSampleGroup	generate code
GetMeasuredValues	generate code
GetMeasurementCompleteStatus	don't generate code

New LLD Driver

- Set ‘generate code’ for the next Methods:



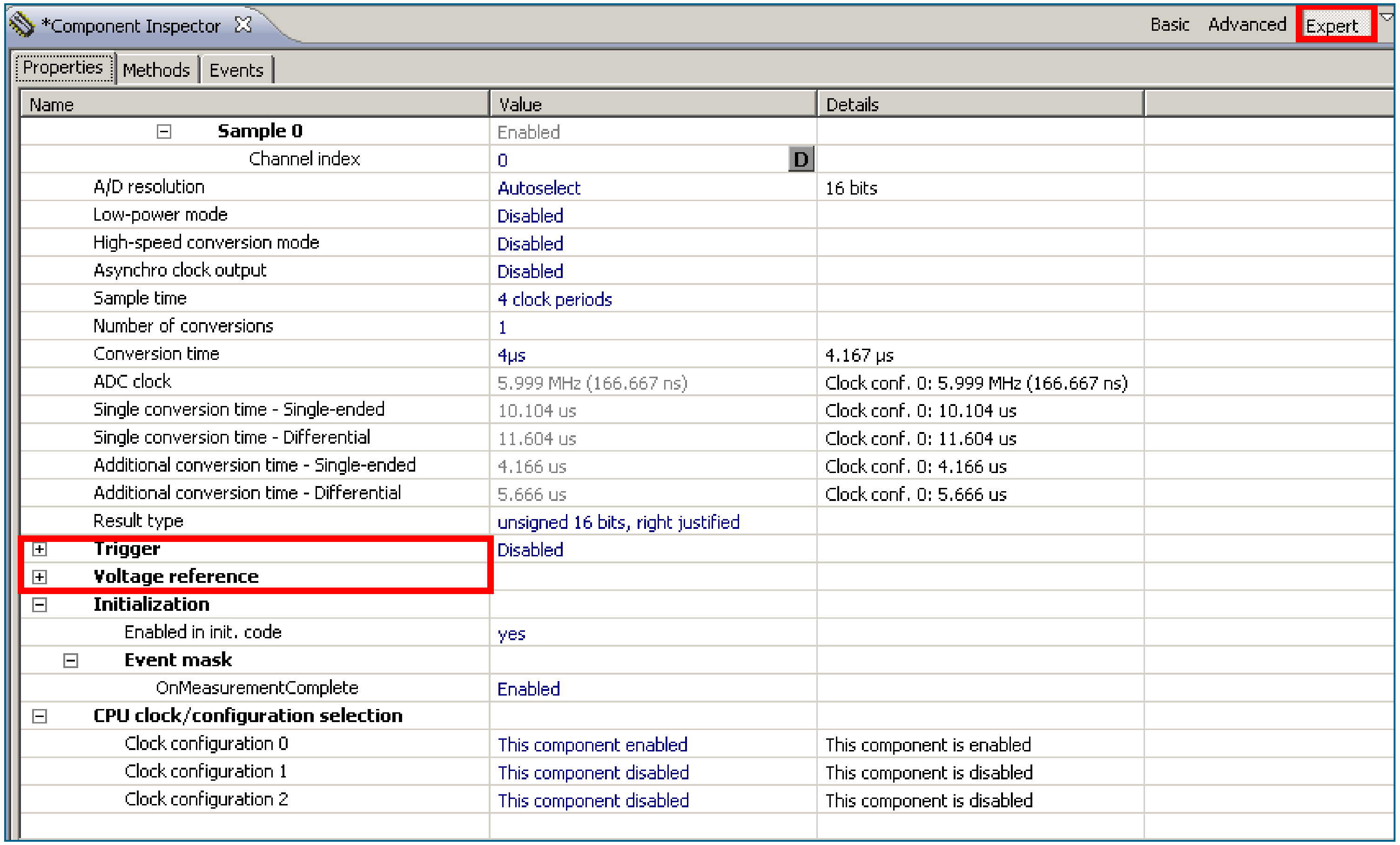
*Component Inspector

Properties | Methods | Events

Name	Value
Init	generate code
Deinit	generate code
Enable	generate code
Disable	generate code
StartSingleMeasurement	don't generate code
StartLoopMeasurement	generate code
CancelMeasurement	generate code
SelectSampleGroup	generate code
CreateSampleGroup	generate code
GetMeasuredValues	generate code
GetMeasurementCompleteStatus	don't generate code

New LLD Driver

- You can configure more parameters of the components by selecting the Expert View.



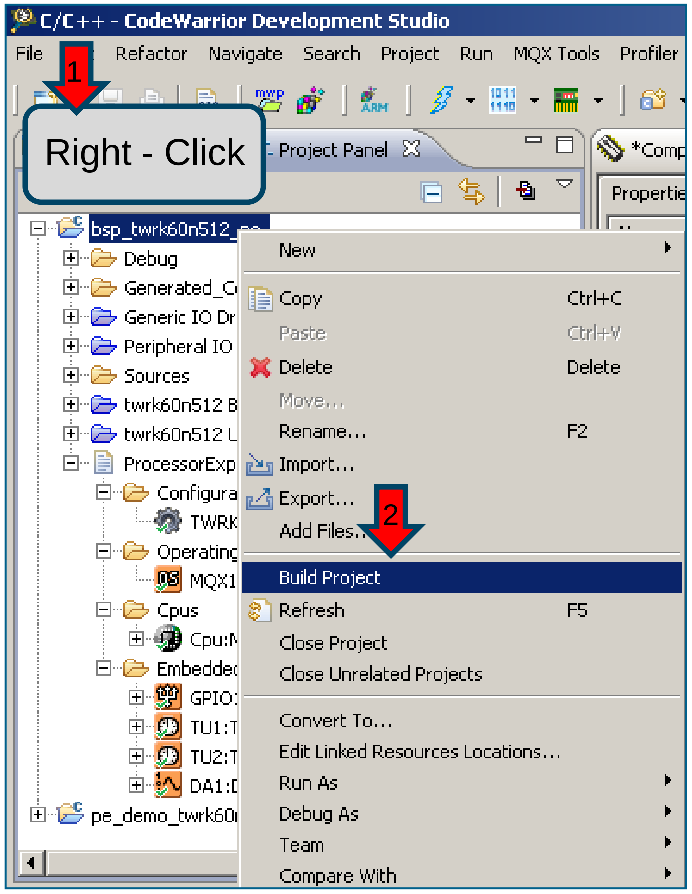
*Component Inspector — Basic | Advanced | Expert

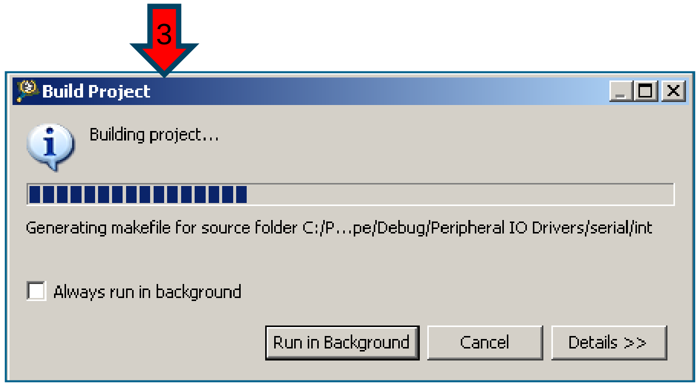
Properties | Methods | Events

Name	Value	Details
⊟ **Sample 0**	Enabled	
Channel index	0	
A/D resolution	Autoselect	16 bits
Low-power mode	Disabled	
High-speed conversion mode	Disabled	
Asynchro clock output	Disabled	
Sample time	4 clock periods	
Number of conversions	1	
Conversion time	4µs	4.167 µs
ADC clock	5.999 MHz (166.667 ns)	Clock conf. 0: 5.999 MHz (166.667 ns)
Single conversion time - Single-ended	10.104 us	Clock conf. 0: 10.104 us
Single conversion time - Differential	11.604 us	Clock conf. 0: 11.604 us
Additional conversion time - Single-ended	4.166 us	Clock conf. 0: 4.166 us
Additional conversion time - Differential	5.666 us	Clock conf. 0: 5.666 us
Result type	unsigned 16 bits, right justified	
⊞ **Trigger**	Disabled	
⊞ **Voltage reference**		
⊟ **Initialization**		
Enabled in init. code	yes	
⊟ **Event mask**		
OnMeasurementComplete	Enabled	
⊟ **CPU clock/configuration selection**		
Clock configuration 0	This component enabled	This component is enabled
Clock configuration 1	This component disabled	This component is disabled
Clock configuration 2	This component disabled	This component is disabled

Build PE BSP

▶ Right-Click on the Project Explorer **bsp_twrk60n512_pe** and Build Project.





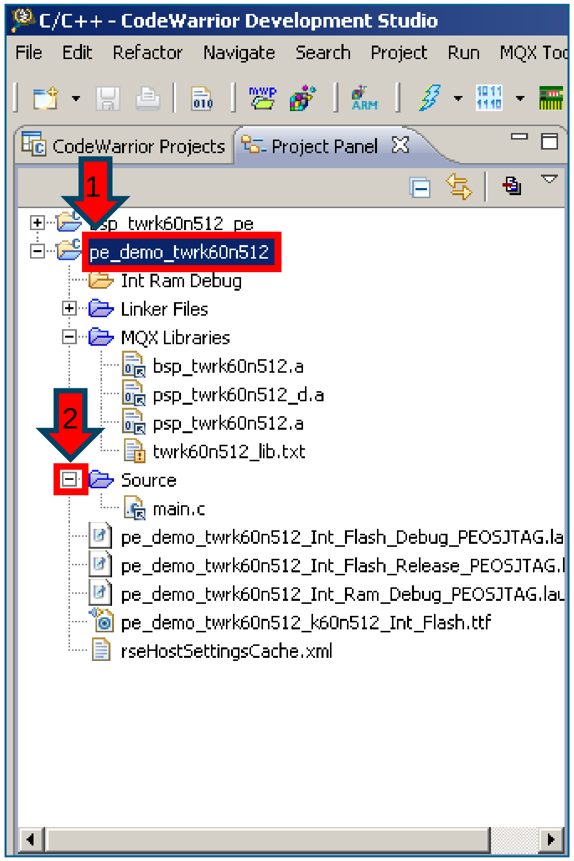
Building project...

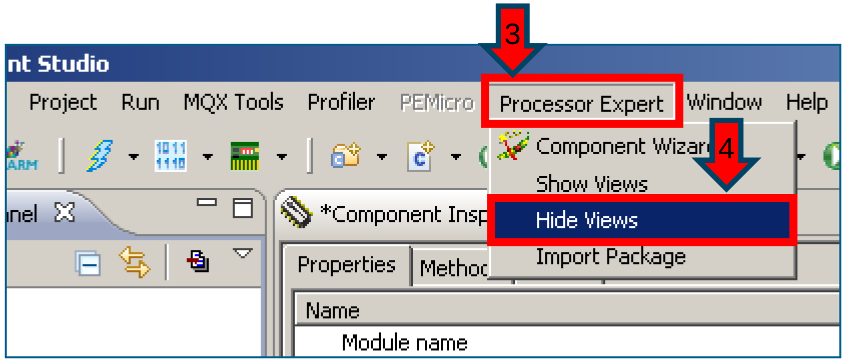
Generating makefile for source folder C:/P...pe/Debug/Peripheral IO Drivers/serial/int

☐ Always run in background

New LDD driver

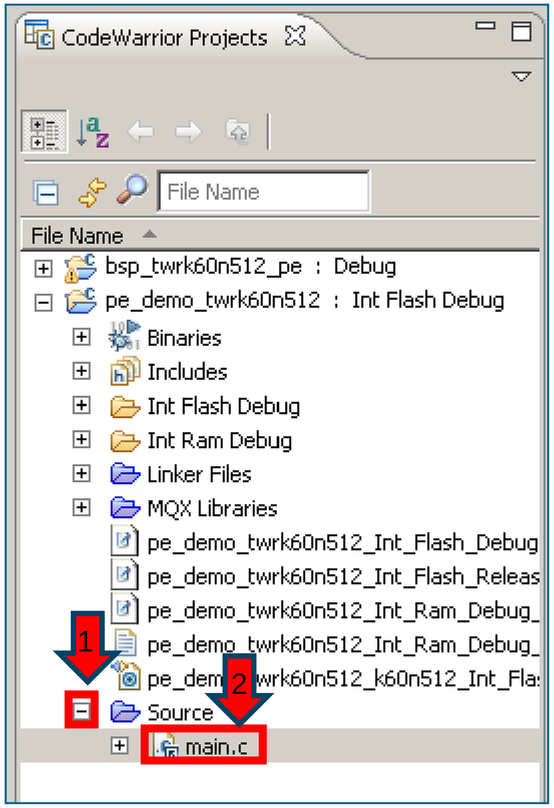
- Expand **pe_demo_twrk60n512** project view.
- Hide Processor Expert View.

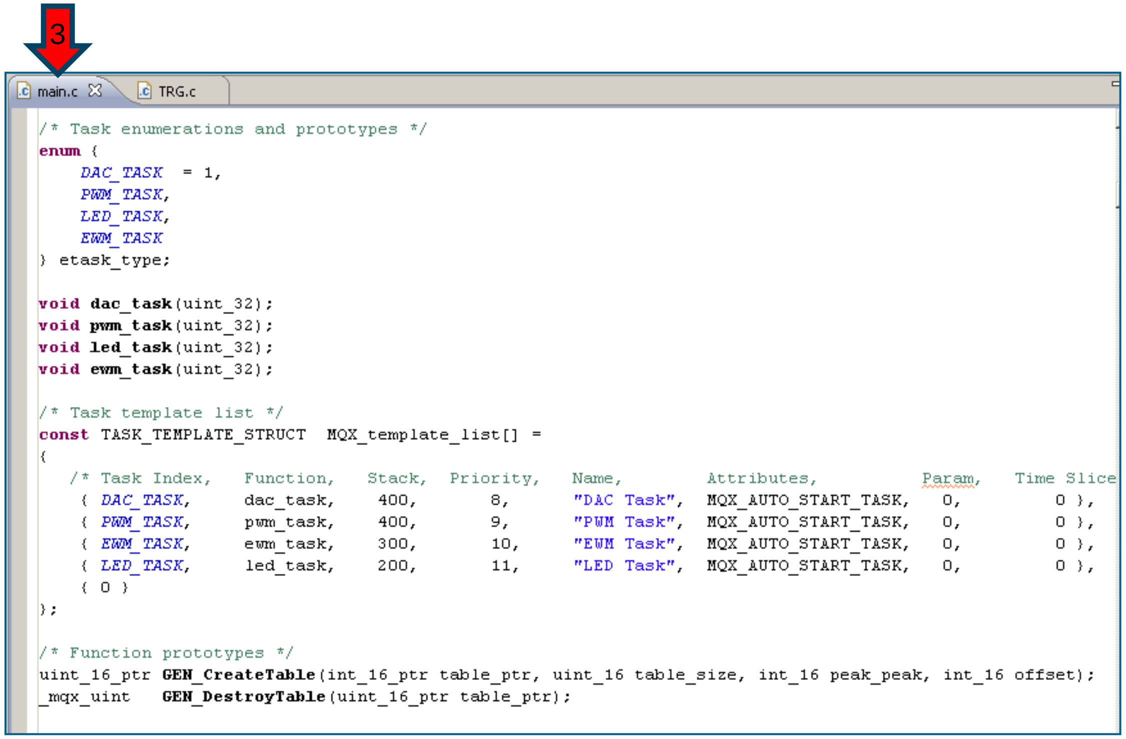

C/C++ - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Too
CodeWarrior Projects
Project Panel
1
sp_twrk60n512_pe
pe_demo_twrk60n512
Int Ram Debug
Linker Files
MQX Libraries
bsp_twrk60n512.a
psp_twrk60n512_d.a
psp_twrk60n512.a
twrk60n512_lib.txt
2
Source
main.c
pe_demo_twrk60n512_Int_Flash_Debug_PEOSJTAG.la
pe_demo_twrk60n512_Int_Flash_Release_PEOSJTAG.l
pe_demo_twrk60n512_Int_Ram_Debug_PEOSJTAG.lau
pe_demo_twrk60n512_k60n512_Int_Flash.ttf
rseHostSettingsCache.xml



New LLD Driver

- Double click in **main.c** to view code.

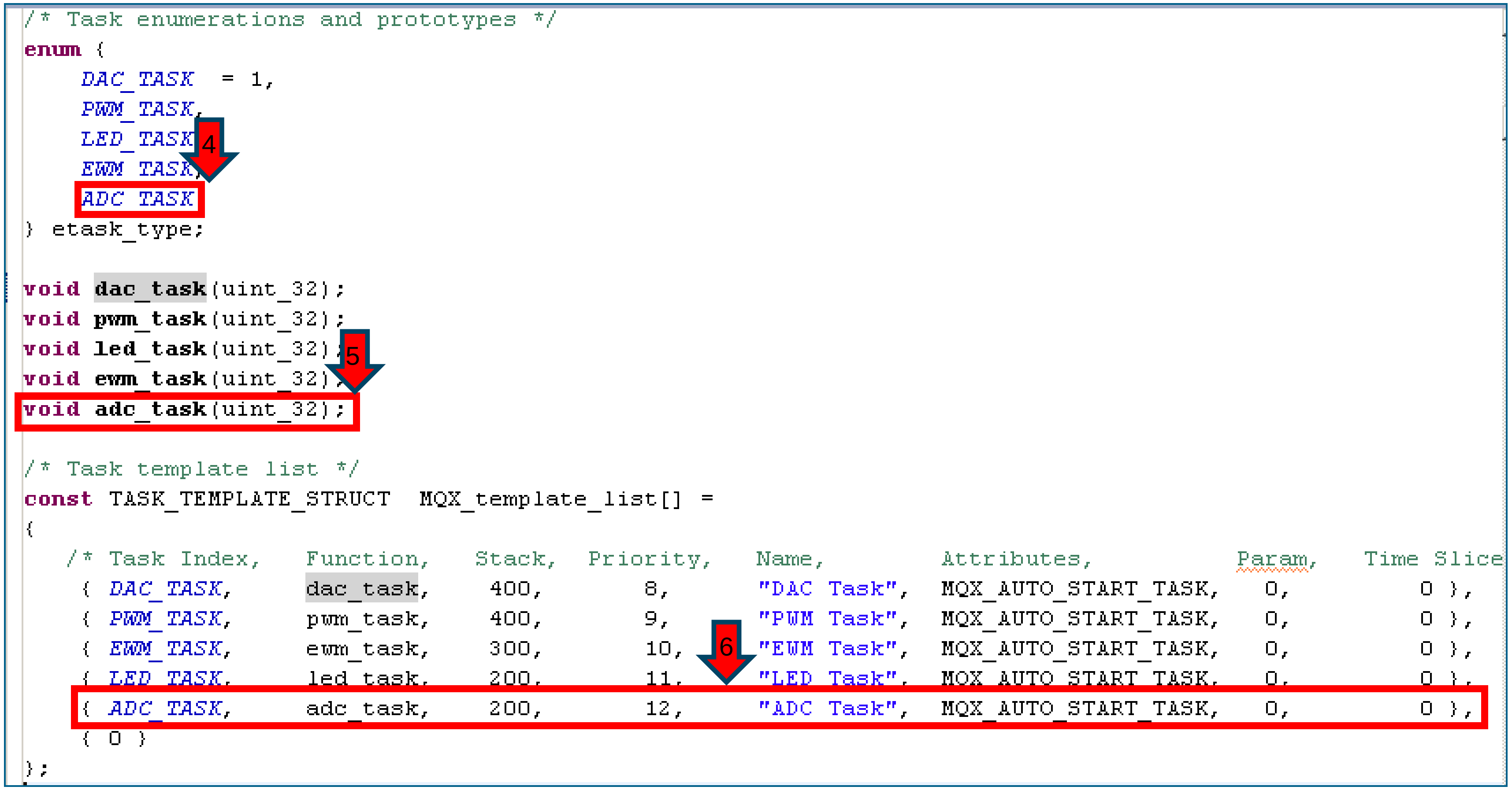

CodeWarrior Projects
File Name
File Name
bsp_twrk60n512_pe : Debug
pe_demo_twrk60n512 : Int Flash Debug
Binaries
Includes
Int Flash Debug
Int Ram Debug
Linker Files
MQX Libraries
pe_demo_twrk60n512_Int_Flash_Debug
pe_demo_twrk60n512_Int_Flash_Releas
pe_demo_twrk60n512_Int_Ram_Debug_
pe_demo_twrk60n512_Int_Ram_Debug_
pe_demo_twrk60n512_k60n512_Int_Fla
Source
main.c
1
2



```
/* Task enumerations and prototypes */
enum {
    DAC_TASK  = 1,
    PWM_TASK,
    LED_TASK,
    EWM_TASK
} etask_type;

void dac_task(uint_32);
void pwm_task(uint_32);
void led_task(uint_32);
void ewm_task(uint_32);

/* Task template list */
const TASK_TEMPLATE_STRUCT  MQX_template_list[] =
{
   /* Task Index,   Function,   Stack,  Priority,   Name,        Attributes,          Param,    Time Slice
    { DAC_TASK,     dac_task,    400,        8,     "DAC Task",  MQX_AUTO_START_TASK,  0,            0 },
    { PWM_TASK,     pwm_task,    400,        9,     "PWM Task",  MQX_AUTO_START_TASK,  0,            0 },
    { EWM_TASK,     ewm_task,    300,       10,     "EWM Task",  MQX_AUTO_START_TASK,  0,            0 },
    { LED_TASK,     led_task,    200,       11,     "LED Task",  MQX_AUTO_START_TASK,  0,            0 },
    { 0 }
};

/* Function prototypes */
uint_16_ptr GEN_CreateTable(int_16_ptr table_ptr, uint_16 table_size, int_16 peak_peak, int_16 offset);
_mqx_uint    GEN_DestroyTable(uint_16_ptr table_ptr);
```

New LLD Driver

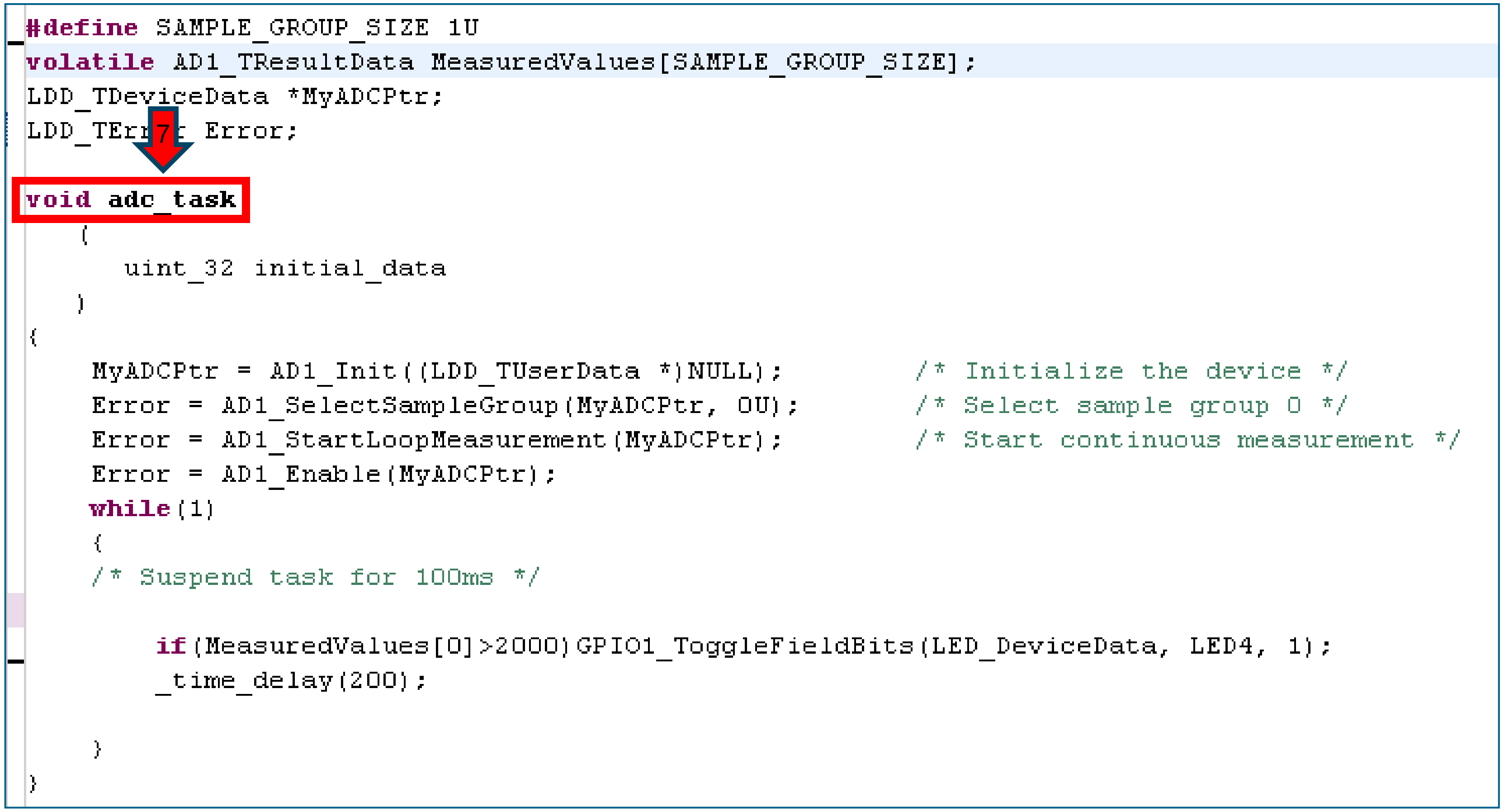
- Add new task : ADC.



```
/* Task enumerations and prototypes */
enum {
    DAC_TASK  = 1,
    PWM_TASK,
    LED_TASK,
    EWM_TASK,
    ADC_TASK
} etask_type;

void dac_task(uint_32);
void pwm_task(uint_32);
void led_task(uint_32);
void ewm_task(uint_32);
void adc_task(uint_32);

/* Task template list */
const TASK_TEMPLATE_STRUCT  MQX_template_list[] =
{
   /* Task Index,   Function,   Stack,  Priority,   Name,       Attributes,          Param,   Time Slice
    { DAC_TASK,     dac_task,    400,       8,      "DAC Task", MQX_AUTO_START_TASK,  0,          0 },
    { PWM_TASK,     pwm_task,    400,       9,      "PWM Task", MQX_AUTO_START_TASK,  0,          0 },
    { EWM_TASK,     ewm_task,    300,      10,      "EWM Task", MQX_AUTO_START_TASK,  0,          0 },
    { LED_TASK,     led_task,    200,      11,      "LED Task", MQX_AUTO_START_TASK,  0,          0 },
    { ADC_TASK,     adc_task,    200,      12,      "ADC Task", MQX_AUTO_START_TASK,  0,          0 },
    { 0 }
};
```

New LLD Driver

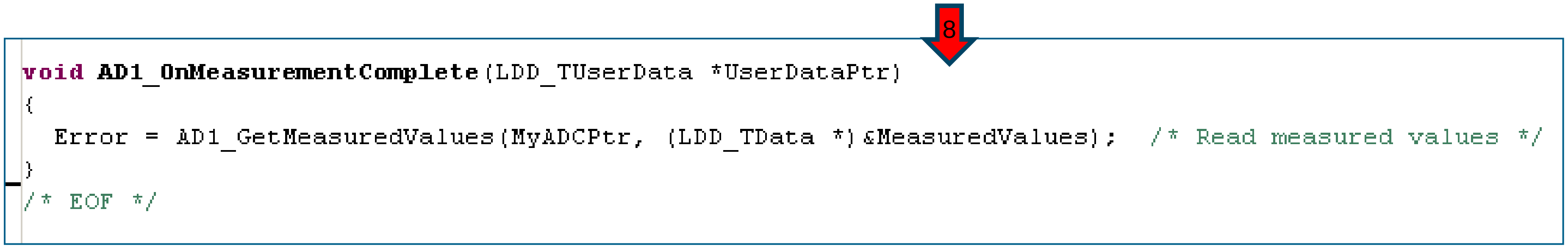
- Add Task function and code.



```
#define SAMPLE_GROUP_SIZE 1U
volatile AD1_TResultData MeasuredValues[SAMPLE_GROUP_SIZE];
LDD_TDeviceData *MyADCPtr;
LDD_TError Error;

void adc_task
   (
      uint_32 initial_data
   )
{
    MyADCPtr = AD1_Init((LDD_TUserData *)NULL);          /* Initialize the device */
    Error = AD1_SelectSampleGroup(MyADCPtr, 0U);         /* Select sample group 0 */
    Error = AD1_StartLoopMeasurement(MyADCPtr);          /* Start continuous measurement */
    Error = AD1_Enable(MyADCPtr);
    while(1)
    {
    /* Suspend task for 100ms */

        if(MeasuredValues[0]>2000)GPIO1_ToggleFieldBits(LED_DeviceData, LED4, 1);
        _time_delay(200);

    }
}
```

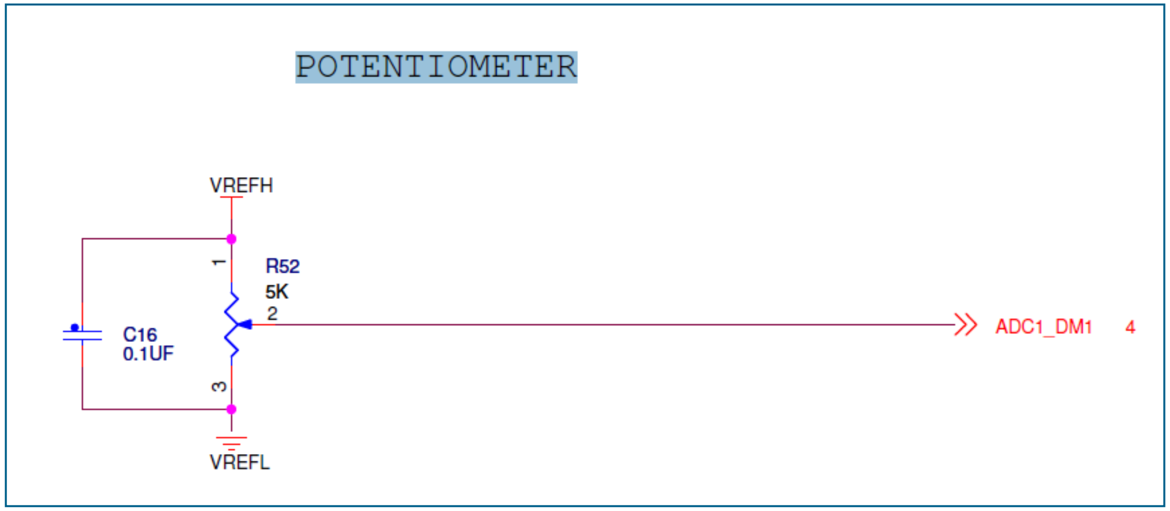
New LLD Driver

- Add **ADC1** Event function code.



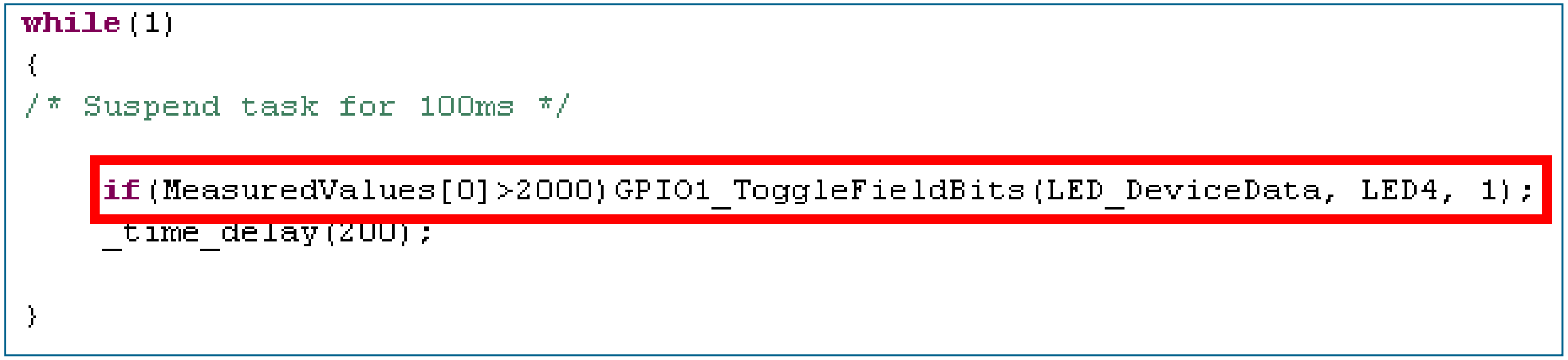
```
void AD1_OnMeasurementComplete(LDD_TUserData *UserDataPtr)
{
  Error = AD1_GetMeasuredValues(MyADCPtr, (LDD_TData *)&MeasuredValues);   /* Read measured values */
}
/* EOF */
```

- ADC1 channel is connected to TWR-K60N512 Potentiometer.



New LLD Driver

- When ADC value is greater than 20000, LED4 (Blue) toggles.

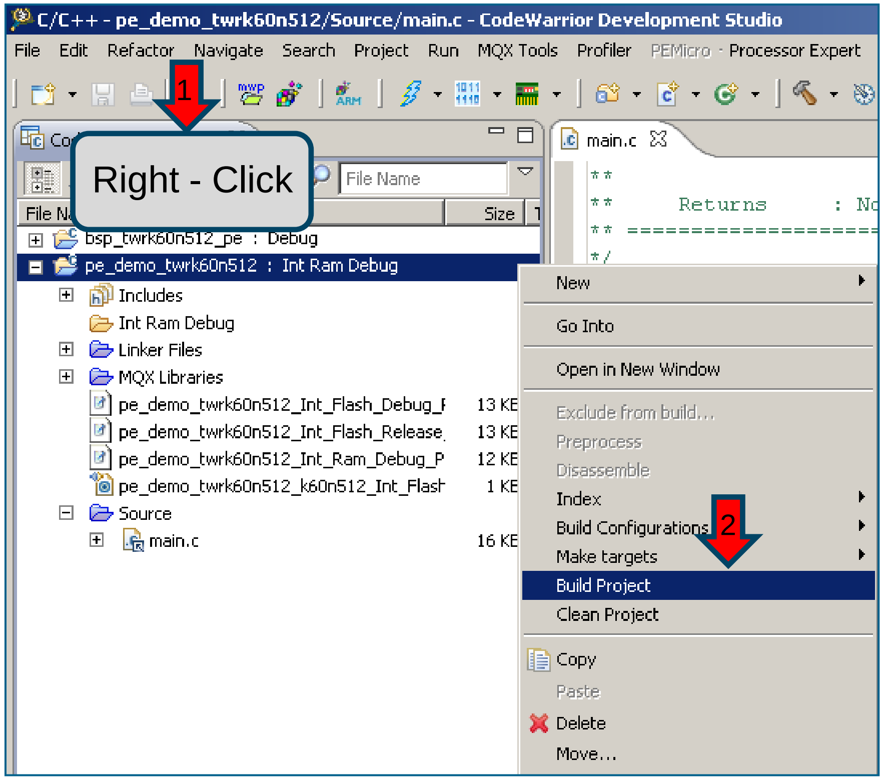


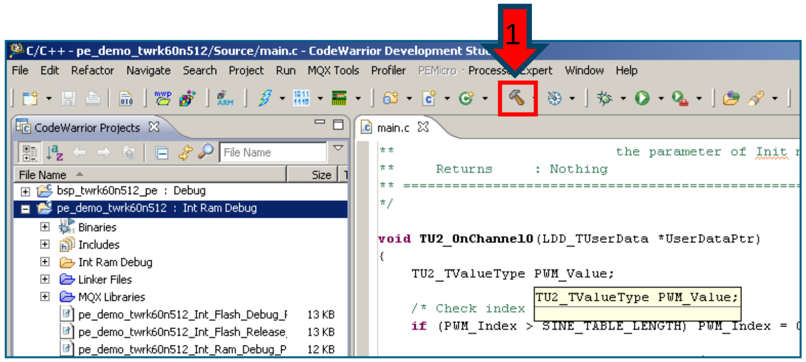
```
while(1)
{
/* Suspend task for 100ms */

    if(MeasuredValues[0]>2000)GPIO1_ToggleFieldBits(LED_DeviceData, LED4, 1);
    _time_delay(200);

}
```

- Moving potentiometer R52 can start/stop LED4 toggle.

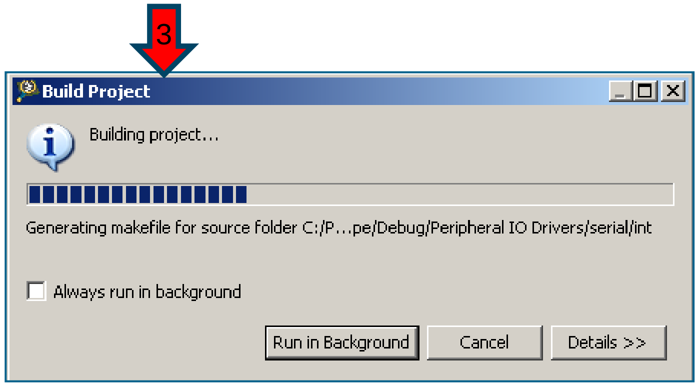
Build PE Demo

- Right-Click on the Project Explorer **pe_demo_twrk60n512** and Build the Project or click on the icon.



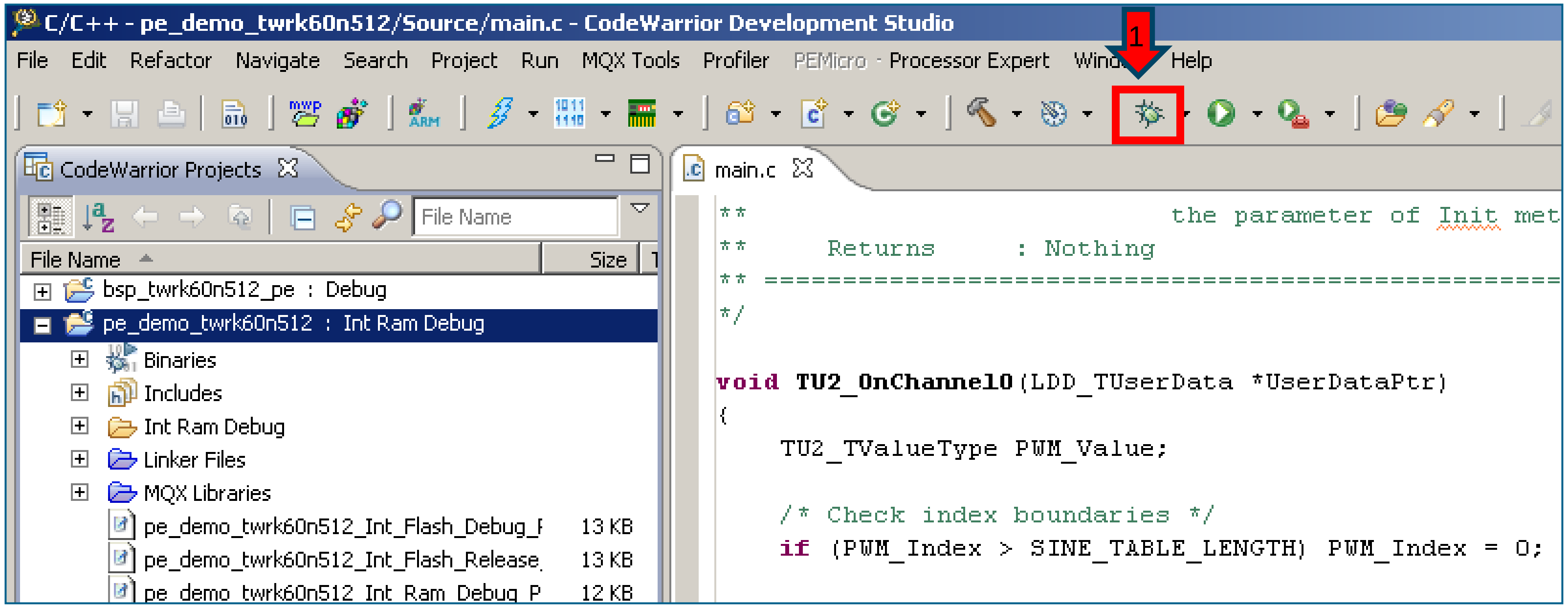

C/C++ - pe_demo_twrk60n512/Source/main.c - CodeWarrior Development Studio
1
CodeWarrior Projects
main.c

```
void TU2_OnChannel0(LDD_TUserData *UserDataPtr)
{
  TU2_TValueType PWM_Value;
```



Run MQX PE Demo

- Click Debug icon.

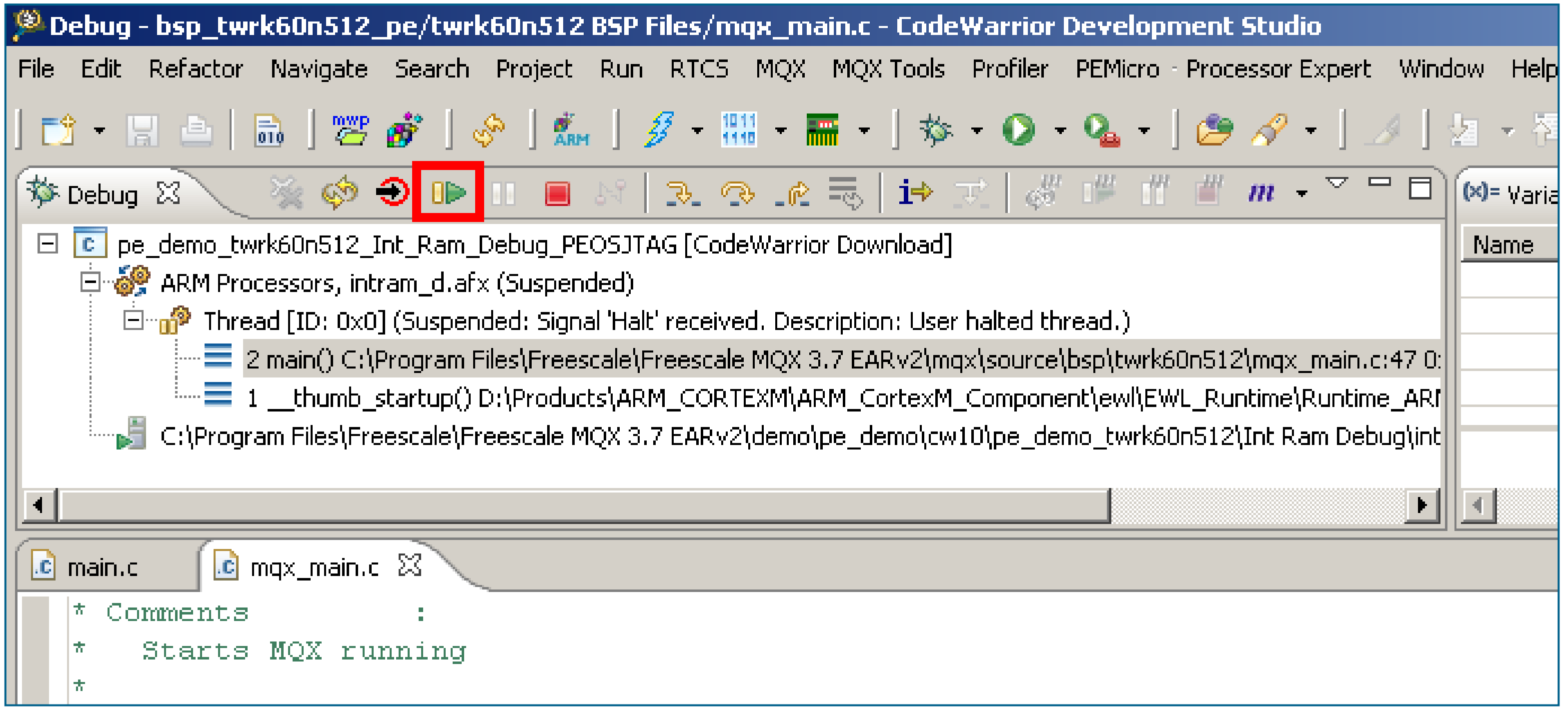

C/C++ - pe_demo_twrk60n512/Source/main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run MQX Tools Profiler PEMicro Processor Expert Wind Help
1
CodeWarrior Projects
File Name
main.c

File Name	Size
bsp_twrk60n512_pe : Debug	
pe_demo_twrk60n512 : Int Ram Debug	
Binaries	
Includes	
Int Ram Debug	
Linker Files	
MQX Libraries	
pe_demo_twrk60n512_Int_Flash_Debug_F	13 KB
pe_demo_twrk60n512_Int_Flash_Release_	13 KB
pe_demo_twrk60n512_Int_Ram_Debug_P	12 KB

```
**                                     the parameter of Init met
**     Returns      : Nothing
** ==================================================
*/

void TU2_OnChannel0(LDD_TUserData *UserDataPtr)
{
    TU2_TValueType PWM_Value;

    /* Check index boundaries */
    if (PWM_Index > SINE_TABLE_LENGTH) PWM_Index = 0;
```

Run MQX PE Demo

- Click Resume (F8).

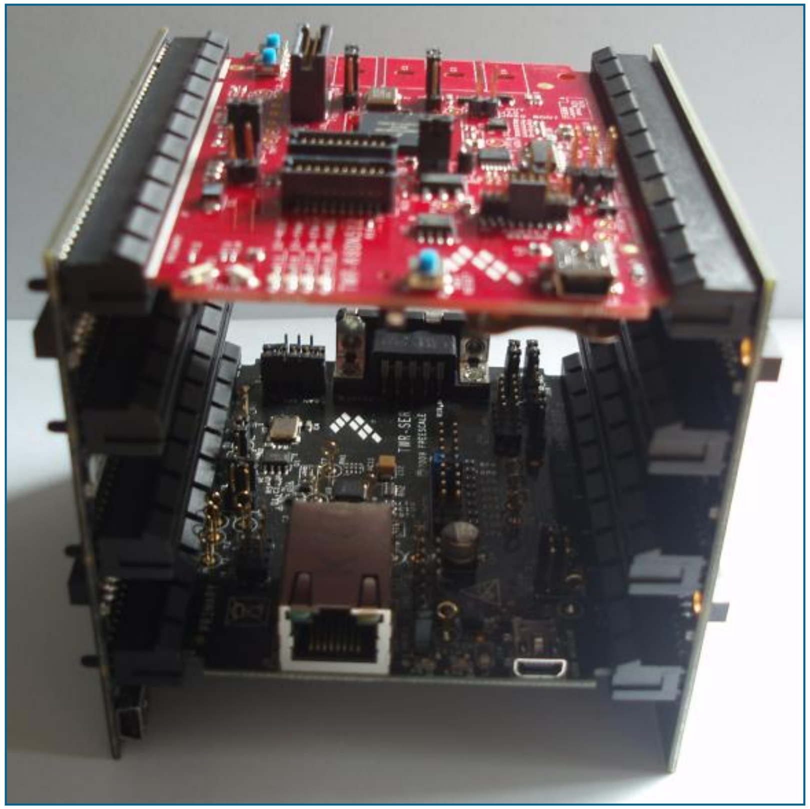

Debug - bsp_twrk60n512_pe/twrk60n512 BSP Files/mqx_main.c - CodeWarrior Development Studio
File Edit Refactor Navigate Search Project Run RTCS MQX MQX Tools Profiler PEMicro Processor Expert Window Help
Debug
Varia
Name
main.c
mqx_main.c

```
pe_demo_twrk60n512_Int_Ram_Debug_PEOSJTAG [CodeWarrior Download]
  ARM Processors, intram_d.afx (Suspended)
    Thread [ID: 0x0] (Suspended: Signal 'Halt' received. Description: User halted thread.)
      2 main() C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\mqx\source\bsp\twrk60n512\mqx_main.c:47 0:
      1 __thumb_startup() D:\Products\ARM_CORTEXM\ARM_CortexM_Component\ewl\EWL_Runtime\Runtime_ARI
  C:\Program Files\Freescale\Freescale MQX 3.7 EARv2\demo\pe_demo\cw10\pe_demo_twrk60n512\Int Ram Debug\int
```

```
* Comments          :
*   Starts MQX running
*
```

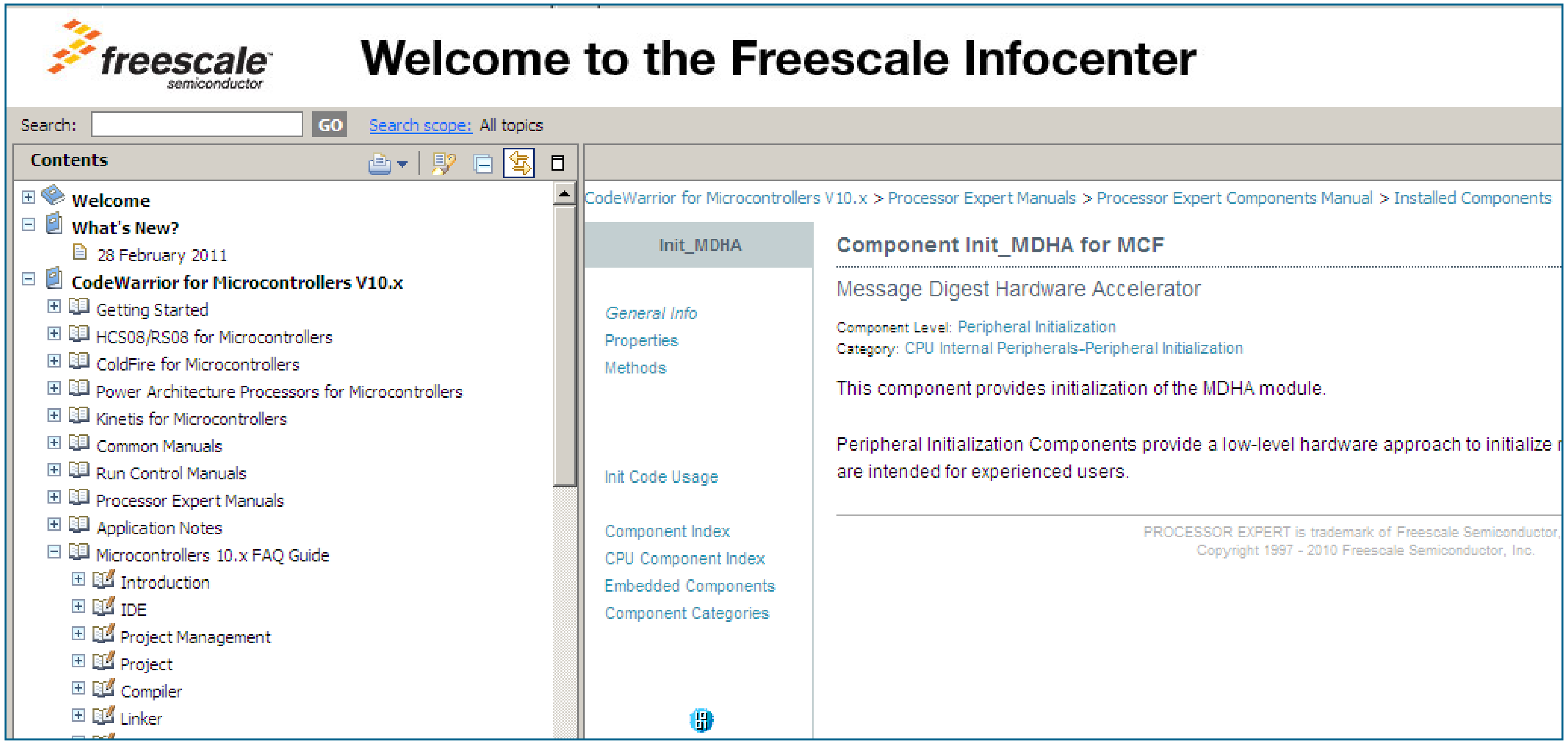
New LLD Driver

- Test the new functionality in the application and the new LDD driver.



CodeWarrior

- Use this link to access Freescale Infocenter:
- freescale.com/infocenter/index.jsp



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CodeWarrior for Microcontrollers V10.x > Processor Expert Manuals > Processor Expert Components Manual > Installed Components

Init_MDHA

General Info
Properties
Methods

Init Code Usage

Component Index
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Embedded Components
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Component Init_MDHA for MCF

Message Digest Hardware Accelerator

Component Level: Peripheral Initialization
Category: CPU Internal Peripherals-Peripheral Initialization

This component provides initialization of the MDHA module.

Peripheral Initialization Components provide a low-level hardware approach to initialize r
are intended for experienced users.

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Document Number MQXCWPP
02/2014