

INSTALLATION GUIDE

Eclipse IDE in firmware development with IOsonata

Version 1.3



Revision history

Version	Date	Note	Contributor(s)	Approver
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3514, 1re Rue, Saint-Hubert, QC., Canada J3Y 8Y5

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1. Introduction

This document shows step-by-step how easy it is to install the Eclipse IDE in firmware development with IOsonata.

1.1 Required components

The following are needed for a full development environment for IOsonata and Nordic SDK:

- Eclipse CDT (for C/C++ Development) with GNU MCU plugins
- ARM GCC compiler
- OpenOCD for debugging
- IDAPnRFProg command line utility for flashing
- The SDK and all the external libraries

2. Installation

2.1 Installing ARM GCC compiler

Download the ARM GCC compiler package for your OS

GNU Toolchain | GNU Arm Embedded Toolchain Downloads – Arm Developer

You can either select an installer or a tar/zip package. Once installation is completed, note where you have installed it. You'll need this to set the full path to the compiler later in Eclipse settings.

The current installer version is GNU Arm Embedded Toolchain: 10-2020-q4-major December 11, 2020

2.2 Installing Build Tools for Windows

Follow these instruction to install the xPack Windows Build Tools binaries (not required on MacOS and GNU/Linux, use the system tools)

How to install the xPack Windows Build Tools binaries | The xPack Project

2.3 Installing OpenOCD for Source Debugging

In order to do source level debugging in Eclipse, OpenOCD is required. Installing OpenOCD differs depending on which OS your PC is running.

2.3.1 For OSX use

Use this command in the CLI: brew install openocd --HEAD

2.3.2 For Windows and Linux use

Follow these instructions on GNU MCU

How to install the xPack OpenOCD binaries | The xPack Project

Again, remember the path location where OpenOCD was installed. This path will be set in Eclipse settings later

2.4 Installing IOsonata and its dependencies

IOsonata is an open source, multi-architecture, highly optimized, hardware abstraction library. Compiling the IOsonata target libraries requires external SDK & libraries.

Follow the instructions below to download and install with appropriate locations and naming:

nRF5_SDK: Nordic nRF5x Bluetooth Low Energy. Select the latest nRF5_SDK. Unzip it and rename the folder to nRF5_SDK



nrf5_SDK_Mesh: Nordic nRF5 SDK for Bluetooth Mesh. Unzip it & rename the folder to nrf5_SDK_Mesh.

ICM-20948 Motion_Driver: First, create a user. In the "Development Kits" block, download "DK-20948 SmartMotion eMD 1.1.0". Unzip the downloaded file and navigate to EMD-Core/sources. Copy the folder Invn to external/Invn as indicated in the folder tree below.

BSEC: Bosch Sensortec Environmental Cluster (BSEC) Software for #BME680 environmental sensor. BSEC is needed for calculating Air Quality Index.

Go to https://www.bosch-sensortec.com/bst/products/all_products/bsec. At the end of the page select the checkbox to accept license terms and download. Unzip the downloaded file. Rename the extracted folder BSEC, then copy the whole folder to external as indicated in the folder tree below.

LWIP: A Lightweight TCP/IP stack. This library is required for IoT network connectivity over Ethernet, Wifi, LTE etc. Download it via this link. Rename the extracted folder as lwip and copy it to external.

The way the IOsonata folder is structured is simple. The deeper you go inside, the more specific it is to the architecture or platform. The parent folder contains everything commonly available to the child folder. This means source files from the child folder can access any source in the upper parent folder, but not the other way around. This keeps the abstraction separated from implementation and makes it easier to keep track of things.

```
/your_root
            - Development root directory
 -- external
                  - Contains downloaded SDKs from silicon vendors
|-- nRF5_SDK - Latest Nordic SDK (https://developer.nordicsemi.com)
 | | |-- components
 | | |-- examples
 |...
                   - Last version of Nordick SDK12 for nRF51 series
-- nRF5_SDK_12
| | -- components
 | | |-- examples
 |...
-- nrf5_SDK_Mesh - Latest Nordic SDK for Mesh
      | -- Mesh
 | | |-- Models
 |...
-- BSEC
                     - Bosch Sensortec Environmental Cluster (BSEC) Software (https://www.bosch-
sensortec.com/bst/products/all_products/bsec) for #BME680
| |-- Invn
                    - Invensense SmartMotion Driver (download
https://www.invensense.com/developers)
| | |-- Devices
    | |...
- Lightweight TCP/IP stack (download
|-- lwip
https://download.savannah.nongnu.org/releases/lwip/)
| |-- Others as require
   |...
-- IOsonata - Put the IOsonata here
| |-- include - Generic include common to all platforms
 -- bluetooth - Generic definition for Bluetooth
```



```
|-- converters - Generic definition for ADV, DAC, etc...
I
       -- coredev
                      - Generic definition MCU builtin devices such as i2c, uart, spi, timer, etc...
       -- miscdev
                      - Generic definition for other non categorized devices
- Generic definition for al sort of sensors (environmental, motion, etc...)
-- sensors
       l-- usb
                      - Generic definition for USB
       |...
- Generic implementation source common to all platforms
l-- src
       |-- bluetooth - Generic source for Bluetooth
|-- converters - Generic source for ADV, DAC, etc...
I
       -- coredev
                      - Generic source for MCU builtin devices such as i2c, uart, spi, timer, etc...
-- miscdev
                      - Generic source for other non categorized devices
       -- sensors
                      - Generic source for al sort of sensors (environmental, motion, etc...)
L
       -- usb
                      - Generic source for USB
       |...
T
I
    -- ARM
                  - ARM series based MCU
       -- include
- Common include for all ARM platform
    - Common source for all ARM platform
-- src
       |-- DbgConfig - Debugger configuration files.
-- ldscript
I
                      - Linker script files
-- Nordic
                      - Nordic Semiconductor based MCU
                          - nRF52 serie MCU
-- nRF52
             -- include
                             - Common include for this target series
-- src
                              - Common source for this target series
-- nRF52832 - Target MCU
- IOsonata library for this target
-- lib
                      |-- Eclipse - Eclipse project for this lib
-- IAR
                                   - IAR project for this lib
|-- CrossWorks- CrossWorks project for this lib
I
|...
|-- exemples - Example projects for this target
                      |-- Blink - Blink example
-- src
                                     - Source code for this exaple
                          |-- Eclipse - Eclipse project for this example
I
                          -- IAR
                                     - IAR project for this example
                          |-- CrossWorks- CrossWorks project for this example
|...
                      |-- Many other examples same
-- nRF52840
                            - Target MCU
- IOsonata library for this target
|-- lib
I
                  | |-- Eclipse - Eclipse project for this lib
               |-- IAR
                                   - IAR project for this lib
-- CrossWorks- CrossWorks project for this lib
|...
T
```



			exemples - Example projects for this target
			Blink - Blink example
			src - Source code for this exaple
			<pre> Eclipse - Eclipse project for this example</pre>
			IAR - IAR project for this example
			CrossWorks- CrossWorks project for this example
			Many other examples same

2.5 Installing Eclipse

Start by downloading Eclipse IDE for C/C++ Developers here: https://www.eclipse.org/downloads/. 1. Start the Eclipse installer.

2. Select "Eclipse IDE for C/C++ Developers".



3. Select the install directory



eclipseins	taller by Comph
C Eclipse II An IDE for	DE for C/C++ Developers details C/C++ developers.
Java 11+ VM	l.eclipse.org/justj/jres/15/updates/release/15.0.2 🔻 ≽
Installation Folder	D:\i_syst\Development\eclipse\cpp-2021-03
	✓ create start menu entry✓ create desktop shortcut
	📩 INSTALL
< ВАСК	

4. Click "Install". Installation will start with a pop-up asking you to agree to the license. Accept and continue.

5. Now that is installed, start Eclipse and select where you want your workspace location.

Eclipse IDE Launcher		×
Select a directory as workspace		
Eclipse IDE uses the workspace directory to store its preferences and development artifacts.		
Workspace: ⁹ D:\i_syst\Development\eclipse-workspace ~	Browse	
Use this as the default and do not ask again		
Launch	Cancel	

6. Be patient, Eclipse is a bit slow to start. A welcome screen will show up. On the top right, select Open Workbench perspective. Select from the menu 'Help/Eclipse Marketplace...'. A pop-up will appear. Type 'arm' in the search box and install the 'GNU MCU Eclipse ...'. Again, say "yes" to all the licenses.



Eclipse Marketplace		×						
Eclipse Marketplace Select solutions to install. Press Install Now to proceed with installation. Press the "more info" link to learn more about a solution.	Ę	3						
Search Recent Popular Favorites Installed 💡 Giving IoT an Edge								
Find: Parm × All Markets × All Categories	~	Go						
Eclipse Embedded C/C++ 6.1.2		^						
The Eclipse Embedded CDT (C/C++ Development Tools, formed MCU/ARM Eclipse) is an open source project that includes a function of the Eclipse plug-ins and tools <u>more info</u>	arly GNU amily of							
GNU Arm Cortex-M RISC-V J-Link								
★ 172 Ministalls: 121K (3,985 last month)	Instal							
EmbSysRegView 0.2.6								
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by <u>Missing name Mising name</u> , EPL <u>EmbSysRegView memory memory view memory values mem</u> monitoring	<u>ory</u>							
★ 12	Instal							
impulse Embedded Extension 2.1.4								
This solution listing is an extension for impulse. The main imp solution listing can be found here (with the option to install m extensions). impulse <u>more info</u>	ulse ultiple							
by <u>toem GmbH</u> , Free for non-commerical use impulse Waveform Plot signal analysis		~						
Marketplaces								
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O < Back Install Now > Finish	Cance	2						

7. Next step is to set the path to the toolchains. Open Eclipse preferences. For Linux & Windows, look in Help menu list. For OSX, prefs are in the usual place. A pop-up will appear. Find 'MCU' from the list on the left side and open it. Inside, set the path for both GCC and OpenOCD in the global section.



			_	пх
type filter text		ilobal Arm Toolchains Paths		(- ▼ -> ▼ 8
ChangeLog	<u></u>	Configure the locations where various GNU Arm toolchains are installed. The values are stored	within Eclipse. Unless	redefined more
> Docker	s	pecifically, they are used for all projects in all workspaces.		
> Help		Default toolchain: xPack GNU Arm Embedded GCC		~
> Install/Update	Т	oolchain name: xPack GNU Arm Embedded GCC		
> Library Hover		DVI and Development CNU And Fache dated Teacherin 10,2020 at an in	Derever	D.e.e.l.
✓ MCU		oolchain folder: D:\I_syst\Development\GNU Arm Embedded Toolchain\Tu 2020-q4-majo	Browse	хРаск
Global Arm Toolchains Paths				
Global Build Tools Path				
Global OpenOCD Path				
Global pyOCD Path				
Global QEMU Path				
Global RISC-V Toolchains Paths				
Global SEGGER J-Link Path				
Workspace Arm Toolchains Paths				
Workspace Build Tools Path				
Workspace OpenOCD Path				
Workspace pyOCD Path				
Workspace QEMU Path				
Workspace RISC-V Toolchains Paths				
Workspace SEGGER J-Link Path				
> Mylyn				
> Oomph			Restore Defaults	Apply
Preferences			_	
type filter text	G	lobal OpenOCD Path		₽ ♥ 52 ♥ 8
> C/C++	^ _ c	onfigure the location where xPack OpenOCD is installed. The values are stored within Eclipse.	Unless redefined more	e specifically,
Docker	tł	ney are used for all projects in all workspaces.		
Help	A	fter installing OpenOCD updates, restart Eclipse for the defaults to be re-evaluated and use th	e Restore Defaults but	ton to configure
> Install/Update	tł	ne new location.		ion to comgute
> Library Hover	E	xecutable: openocd.exe		
✓ MCU				
Global Arm Toolchains Paths	F	older: C:/Users/TAIHM/AppData/Roaming/xPacks/openocd/0.11.0-1/bin	Browse	xPack
Global Build Tools Path				
Global OpenOCD Path				
Global pyOCD Path				
Global QEMU Path				
Global RISC-V Toolchains Paths				
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Workspace RISC-V Toolchains Paths Workspace SEGGER J-Link Path				
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Workspace QCMO Path Workspace RISC-V Toolchains Paths Workspace SEGGER J-Link Path > Mylyn > Oomph > Remote Development			Restore Defaults	Apply
Workspace QCWD Path Workspace RISC-V Toolchains Paths Workspace SEGGER J-Link Path > Mylyn > Oomph > Remote Development	•		Restore Defaults	Apply

That is all that's needed for Eclipse and toolchain installations. This Eclipse installation is not limited to Nordic based development. It is a generic installation that allows you to work with any ARM Cortex MCU from any vendor. It works for RISC-V as well. You will need to install toolchains for RISC-V if you want to work with that in Eclipse.

Important notes for OSX users

Since the Catalina update, there is a new security measure that blocks the execution of command line tools such as the GCC compiler and OpenOCD and other downloaded executables. First thing, open System Preferences/Security & Privacy/Privacy. Select 'Developer Tools'. Then add Eclipse to the list.



Now that Eclipse and all the toolchains are fully installed, lets start compiling. Select menu 'File/Open Projects from File System...'.

•	eclipse-workspace - Eclipse	IDE						_		×
File	Edit Source Refactor New	Navigate Search Project Alt+Shift+N >	Run Window He	elp v on:		~ ‡		~	-	-
	Open File		Q + : 🍅 🖨 🔗	-i№ Π ¶ :μ-	和 -	****	1 -1			re 67
	Open Projects from File Sy	/stem			B		B Halp 😚 🛞 Walco	me	• .0	
	Recent Files	>			-		Whelp 🛛 💽 Welco			- 8
	Close Editor	Ctrl+W				⊖″ŏ	Contents 00 Com	-1-		~~ ×
	Close All Editors	Ctrl+Shift+W				that provides an outline.	Contents X Search	cn		
B	Save	Ctrl+S					Related lopics	BOOKI	marks	
8	Save As						i index			
Ð	Save All	Ctrl+Shift+S					Search expression:			
	Revert								`	∽ Go
	Move						Scope Default			
P	Rename	F2								
8	Refresh	F5								
	Convert Line Delimiters To	,								
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è	Import									
4	Export									
	Properties	Alt+Enter								
	Switch Workspace	>								
	Restart									
	Exit									
_		🕄 Problems 💥 🔎 Tas	iks 🗉 Console 🥅 I	Properties						
		0 items				<i>v v</i>				
		Description	^	Resource	Path	Location				
		<				>				

A pop-up will open. Click on the "Directory" button, navigate to, and select the 'nRF52832' folder in the IOsanota/ARM/Nordic/nRF52/ location. Eclipse will search and list all projects available within that folder. Deselect the first checkbox 'nRF52832' and keep all the others. For the BLYST840, use the 'nRF52840' instead.



Import Projects from File System or Archive			_		×
Import Projects from File System or Archive This wizard analyzes the content of your folder or archive file to find projects and import t	hem in the IDE.				
Import source: D:\i_syst\Development\IOsonata\ARM\Nordic\nRF52\nRF52840		~ Dire	ectory	Archive.	
type filter text			Selec	ct All	
Folder MRF52840 Folder	Import as		Desele	ect All	
InR 52840\exemples\AnalogCompDemo\Eclipse RF52840\exemples\BleAdvertise\Eclipse RF52840\exemples\Blink\Eclipse	Eclipse project Eclipse project Eclipse project Eclipse project	39) of 39 selecter	cted ady open projects	
Close newly imported projects upon completion					
Use <u>installed project configurators</u> to:					
Detect and configure project natures					
Working sets					_
Add project to working sets				New	
Working sets:			~	Select	
		Show oth	er specialized	import wi	zards
?	< Back Next >	F	Finish	Cance	I

Click 'Finish'. Eclipse will load all projects into the project explorer on the left pane. Select & rightclick on the 'IOsonata_nRF52832' project. Then select 'Build Configuration/Build All' to build all variants of the IOsonata library for the nRF52832.



eclipse-work	eclipse-workspace - Eclipse IDE											
File Edit Sou	rce	Refactor Navigate Search	Project Run Wi	ndow Help	_			,				_
S ()		~	No Launch Configur	rations 🗸 🗸	on:	-		~ 🌣	- 🖬 🖬 🕷 🛛) - 🔨	- 🗟	Ð
🐴 🔪 🕹		New	>	- 😰 🗀 🛷 - 🖻 🛙	1 π į	<u>ب</u> ال			- 3		Q 1	2 6
Project Expl		Go Into			_	- 8			n Help 🛛 🖓 W	elcome		
		Open in New Window						59 8		000		⇒ 8
√ 💕 dfu_uart		Show In	Alt+Shift+W >				There is no activ	/e editor	Contents 🖉 S	earch		
> 🗊 Inclu		Show in Local Terminal	>				that provides an	n outline.	Related Topics	Bool	marks	
> 🚰 src	D	Сору	Ctrl+C						Index			
> 💕 Eeproml	Ġ	Paste	Ctrl+V						Search expression	on:		
✓ S ^C IOsonata	×	Delete	Delete									
> 🛐 Inclu		Source	>						A Come Default			
> 👉 src		Move							 Scope Default 			
∽ 🔂 nRF5284		Rename	F2									
> 🔂 exem	2	Import										
> 🔂 lib	4	Export										
		Build Project										
		Clean Project										
4	\$ ``	Refresh	F5									
		Close Project										
		Close Unrelated Projects										
		Build Targets	>									
		Index	>									
		Build Configurations	>	Set Active	>							
		Profiling Tools	>	Manage			7 8					
	0	Run As	>	Build All				1				
-	\$	Debug As	>	Clean All		Path		Location				
		Profile As	>	Build Selected								
		Restore from Local History										
7	×9	Run C/C++ Code Analysis						>				
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M TO SOLUCE III		Compare With	>					1.1				

You may encounter the following failure



If you are using GNU MCU Eclipse on Windows, make sure <u>Windows Build Tools</u> are installed, then check the installation path and fill the "Global Build Tools Path" inside Eclipse Window/Preferences... :



Preferences	- D X
type filter text	Global Build Tools Path $\diamond \star \diamond \star$
Seneral Seneral C/C++ ChangeLog Docker Help Install/Update Library Hover MCU Global Arm Toolchains Paths Global OpenOCD Path Global OpenOCD Path Global RSC-V Toolchains Paths Workspace Arm Toolchains Paths Workspace Build Tools Path	Could build tools Path Image: Could build tools are installed. Unless defined more specifically, they are used for all projects in all workspaces. Build tools folder: C:\Users\AppData\Roaming\xPacks\windows-build-tools\xpack-windows-build-tools-4.2.1-2\bin Browse xPack
Workspace OpenOCD Path Workspace pVOCD Path Workspace QEMU Path Workspace RISC-V Toolchains Paths Workspace SEGGER J-Link Path > Myth > Oomph ? ? ? ? ? ? ? ? ? ? ?	Restore Defaults Apply Apply and Close Cancel

It will take a while to compile all the libraries. There is a lot of source code. Look at the bottom pane in the 'Console' tab for the compilation results.



Once the library compilations are complete, you can build any example project listed. To start, let's build the Blinky example. Select the Blinky project to highlight it. Find the hammer in the middle of the toolbar and click on it to build the highlighted project.



eclipse-workspace - Blinky/src/board.h - Eclipse	IDE	
Eile Edit Source Refactor Navigate Search	n <u>Project Run Window H</u> elp	
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½ ▼ 🕅 ▼ 🏷 🗘 🗸 → マ) ▼ 🛃		
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓<	<pre> Binky.c B beach 33 If #define LED3_PIN BLUETO_LED3_PIN BLUETO_LED3_PIN BLUETO_LED3_PINOP BLUETO_LED3_PINOP BLUETO_LED3_PINOP BLUETO_LED4_PORT BLUETO_LED4_PORT BLUETO_LED4_PINOP BLUETO_LED5_PINOP BLUETO_LED5_PI</pre>	
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 PulseTrain (in Eclipse) PulseTrain (in Eclipse) Paradic tet (in Eclipse) Tore Tore (in Eclipse) Statistic entral Deno (in Eclipse) Statistic Tet (in Eclipse) Statistic Post (in Eclipse) 	DI Frovens C make & Consort & D Properts g include Donser COTBuild Console[Binky] arm=none=eab:gcc =mcpu=cortex=m4=mtnume =mrioat=abi=hard =mtpu=tpv4-sp=dib =vs =mtessage=lengtn=0 =rsigned=cnar =rtunction=sections =r Finished building : C/l.syst/Development/IOsonata/exemples/misc/blinky.c Building target: Blinky.elf Invoking: Cross ARM GL Clanker arm=none=eabi-cortex=vad==mthumb =mfloat=abi=hard =mtpu=fpv4-sp=dib =0s =fmessage=lengtn=0 =fsigned=char =ffunction=sections =fr finished building target: Blinky.elf Invoking: Cross ARM GNU Create Flash Image arm=none=eabi-cortex=vad=mthumb !=mfloat=abi=hard =mtpu=fpv4-sp=dib =0s =fmessage=lengtn=0 =fsigned=char =ffunction=sections =fr finished building target: Blinky.elf Invoking: Cross ARM GNU Create Flash Image arm=none=eabi-size =-format=berkely "Blinky.elf" text date bss dec hex filename text date bss dec hex filename 20:44:25 Build finished. 0 errors, 0 warnings. (took 834ms)	data-sectic
🚰 Blinky		