

User's Guide for the Xtrinsic Intelligent Sensing Framework v1.1 on the Kinetis KL25Z

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1 Introduction

Freescal's Xtrinsic Intelligent Sensing Framework software is comprehensive and robust with open APIs and sensor adapters simplifying acquisition of sensor data. This innovative software framework eliminates intensive sensor integration effort since the work is already done for you.

This document guides users in installing and exploring the features and use of ISF with the combined (dual-stack) FRDM-KL25Z and FRDM-FXLS-MULTI-B boards in the following three areas.

- Installing ISF for Kinetis KL25Z
- Using S19 Binary files (reference applications)
- Using ISF applications and templates

2 Installing Necessary Software

These are the required steps to properly build and install ISF for the Kinetis KL25Z. It is necessary for users to follow the steps in each of the following subsections.

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2.1 Installing CodeWarrior 10.5 or Newer

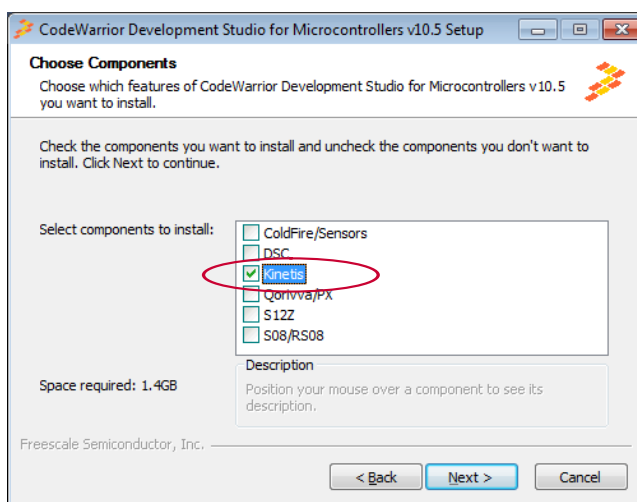
This procedure explains how to obtain and install the latest version of CodeWarrior.

NOTE

The installer and ISF v1.1 work with CodeWarrior 10.5 and newer. If CodeWarrior 10.5 or newer is already on your system, skip this procedure and go to [Installing ISF for Kinetis KL25Z](#).

1. Obtain the latest CodeWarrior 10.n installer file from the [Freescale CodeWarrior website](#).
2. Run the executable file and follow the instructions.

During the installation, there is a request to select components to install. You must install at least the Kinetis component.



2.2 Installing ISF for Kinetis KL25Z

This procedure explains how to obtain and install ISF for Kinetis KL25Z.

1. Go to the **Overview** page of the [Xtrinsic ISF website](#). Click the **Download the latest version of ISF for Kinetis KL25Z** link.
2. Start the installer and then follow the instructions in the installation wizard.

The installer file, *ISF1P1KL25Z_Installer.exe*, is also available for download from the **Downloads** tab of the [Xtrinsic ISF website](#)

2.2.1 Installing MQX Lite

ISF v1.1 for the Kinetis KL25Z uses the current version of MQX Lite supplied with CodeWarrior and Processor Expert.

2.3 Incorporating Freescale-Developed Sensor Adapters into ISF

The sensor adapters provided by Freescale are included as part of the ISF installer. During the installation, the user is given the choice to add or not add Freescale-developed sensor adapters. It is recommended that users add the Freescale-developed sensor adapters. Following installation, sensor adapter libraries are located in the *C:\Program Files\Freescale\ISF_Kinetis\ISF_R1p\ISF\Lib\Sensors* folder.

As sensor adapters are newly released or updated, a user may want to add a new or updated sensor adapter to the existing installation. This procedure explains how to obtain and incorporate a sensor adapter into ISF.

NOTE

This procedure applies to any of the sensor adapters (provided by Freescale or written by the user). The Freescale MAG3110 magnetometer sensor adapter is used here for illustration.

1. Obtain the *ISF1P1KL25Z MAG3110 ADAPTER LIB.zip* file from the **Downloads** tab of the [Xtrinsic ISF website](#).
2. Move the downloaded file, *ISF1P1KL25Z MAG3110 ADAPTER LIB.zip*, to the *C:\Program Files\Freescale\ISF_Kinetis* folder.
3. Right-click on the zip file, then select **Extract All**, and then click **Extract**. If prompted by the unzip utility to overwrite existing files, select **Copy and replace**.

Upon completion, the sensor adapter is incorporated into the ISF folder.

3 Using Reference Binary Applications for ISF v1.1 on Kinetis KL25Z

3.1 Overview of Reference Binary Applications for ISF

To demonstrate selected functionality of ISF, a few example reference applications are provided as pre-built binary images ready to run on the Kinetis KL25Z. They can be downloaded and then run using the FRDM-KL25Z and the FRDM-FXS-MULTI-B.

The following reference, or example applications, showcasing several Xtrinsic products in addition to the Kinetis KL25Z, are provided with the installer, and can be located via the Microsoft Windows Start menu

All Programs -> Freescale -> Xtrinsic ISF v1.1 Kinetis KL25Z -> Prebuilt Applications Folder

as well as the **Downloads** tab of the [Xtrinsic ISF website](#) :

- **ISF1P1KL25Z MAG3110 S19**—Binary image as a S19 file using the MAG3110 magnetometer.
- **ISF1P1KL25Z FXAS21000 S19**—Binary image as a S19 file using the FXAS21000 gyroscope.
- **ISF1P1KL25Z FXOS8700 S19**—Binary image as a S19 file using the FXOS87000 accelerometer and magnetometer.
- **ISF1P1KL25Z MPL3115 S19**—Binary image or S19 file using the MPL3115 pressure sensor.

Other examples will be provided as they become available.

NOTE

CodeWarrior projects (that do not include pre-built binaries) with complete source code of these applications are also provided for users already familiar with ISF concepts and API. See [Using Applications and Templates for ISF on FRDM-KL25Z](#) for details.

Using Reference Binary Applications for ISF v1.1 on Kinetis KL25Z

The ISF v1.1 core library for the Kinetis KL25Z is automatically installed by using the automated installer located on the **Overview** page of the [Xtrinsic ISF website](#). Using the ISF installer ensures that all of the items required to run these applications are available. If downloading them individually, ensure that CodeWarrior 10.5 or newer and ISF 1.1 core library for the Kinetis KL25Z are installed properly on the PC. For instructions, see [Installing Necessary Software](#).

NOTE

The term Application board is used in this document to refer to the combined (dual stack) FRDM-KL25Z and the FRDM-FXS-MULTI-B.

3.2 Importing a S19 Binary (Reference Application) onto the Kinetis KL25Z

NOTE

ProjectName_S19 is the generic name used throughout this document to represent one of the specific Kinetis KL25Z S19 binaries provided with the ISF release. Substitute the name of a specific project (for example, ISF1P1KL25Z_MAG3110 S19) when following the instructions provided.

1. Connect the openSDA port on the FRDM-KL25Z board to the development PC.

NOTE

The power switch on the FRDM-FXS-MULTI-B should be OFF.

When the board is attached to the PC, it appears as a Removable Disk named FRDM-KL25Z in Windows Explorer.

2. In Windows Explorer, copy the S19 file for the application into the FRDM-KL25Z root folder.

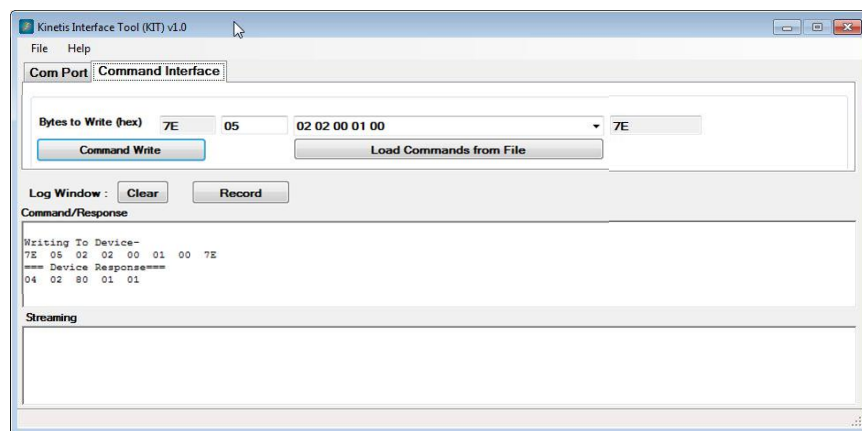
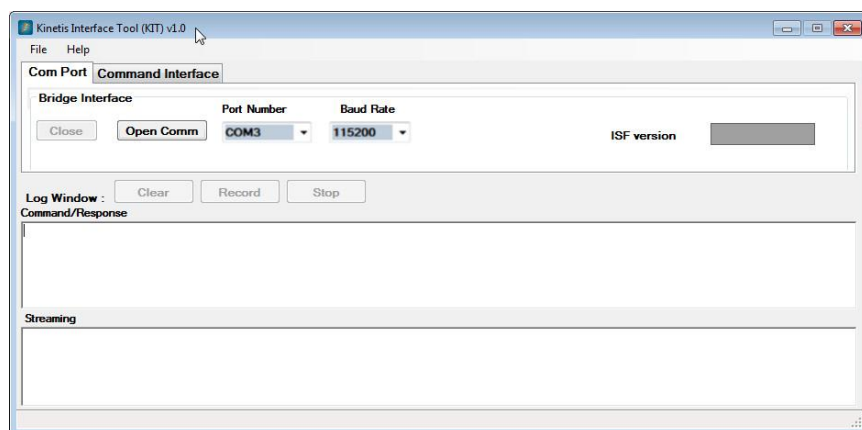
NOTE

.hex and .elf files produced by CodeWarrior can be imported with the same procedure.

3. Power on the Application Board by moving the power switch on the FRDM-FXS-MULTI-B to ON.
4. Verify that the hardware is connected properly; the single LED on the FRDM-FXS-MULTI-B is lit.

3.3 Running a S19 Binary (Reference Application) Project

The application is now running on the Application board. Data and commands can be sent to the application board from the Kinetis Interface Tool and data can be received from the application.



For more information, refer to the <SensorID>_Project_HOST_CMD_README.txt file of the relevant CodeWarrior project. From the Windows Start menu, select

All Programs → Freescale → Xtrinsic ISF v1.1 Kinetis KL25Z → Example Applications Folder.

4 Using Applications and Templates for ISF on FRDM-KL25Z

4.1 Overview of Xtrinsic ISF Applications and Templates

To demonstrate selected functionality of ISF and to enable rapid development of sensor applications using ISF, example embedded applications are provided. These applications include source code which highlight proper usage of the API. They can be downloaded and run using the run the two stack development board configuration with the FRDM-KL25Z and the FRDM-FXS-MULTI-B. (Refer to the [FRDM-KL25Z](#) website for details.)

The following applications are provided with the installer, and can be located via the Microsoft Windows Start menu,

All Programs → Freescale → Xtrinsic ISF v1.1 Kinetis KL25Z → Example Applications

They are also available on the Downloads tab of the [Xtrinsic ISF website](#) :

- **ISF1P1KL25Z DSA SNSR ADAPTER TMPL**—Digital Sensor Abstraction (DSA) Template that can be used as a starting point for developing Sensor Adapters with ISF v1.1 on the Kinetis KL25Z.

Using Applications and Templates for ISF on FRDM-KL25Z

- **ISF1P1KL25Z MAG3110 PROJ**—CodeWarrior Project with source using the Xtrinsic MAG3110 magnetometer from the Kinetis KL25Z.
- **ISF1P1KL25Z FXAS21000 PROJ**—Code Warrior Project with source using the Xtrinsic FXAS21000 gyroscope from the Kinetis KL25Z.
- **ISF1P1KL25Z FXOS8700 PROJ**—CodeWarrior Project with source using the Xtrinsic FXOS8700 accelerometer and magnetometer from the Kinetis KL25Z.
- **ISF1P1KL25Z MPL3115 PROJ**—CodeWarrior Project with source using the Xtrinsic MPL3115 pressure sensor from the Kinetis KL25Z.

NOTE

Ready to run ("out of the box") versions with pre-built binaries of some of these applications are also provided with ISF. See [Overview of Reference Binary Applications for ISF](#).

The ISF v1.1 core library for the Kinetis KL25Z is automatically installed by using the automated installer located on the **Overview** page of the [Xtrinsic ISF website](#). Using the ISF installer ensures that all of the items required to run these applications are available. If downloading them individually, ensure that CodeWarrior 10.5 or newer and ISF 1.1 core library for the Kinetis KL25Z are installed properly on the PC. For instructions, see [Installing Necessary Software](#).

NOTE

The term Application board is used in this document to refer to the combined (dual stack) FRDM-KL25Z and the FRDM-FXS-MULTI-B.

NOTE

Most of the supplied Freescale applications include documentation file(s) in the project's \Doc folder that provide details about the application.

4.2 Importing an Application project into CodeWarrior

NOTE

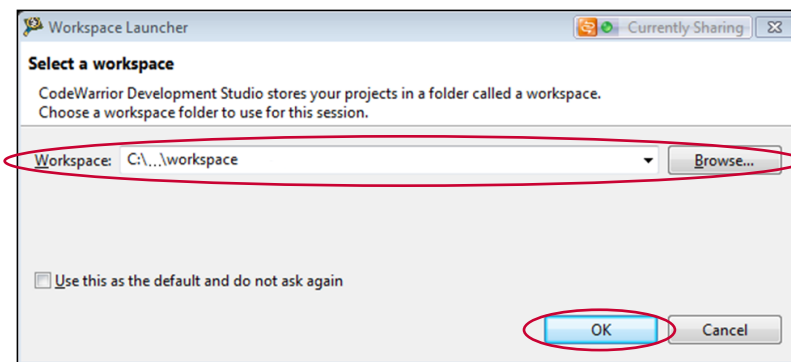
ProjectName is the generic name used throughout this document to represent one of the specific Kinetis KL25Z Application projects provided with the ISF 1.1 Kinetis KL25Z release. Substitute the name of a specific project (for example, ISF1P1KL25Z FXAS21000 PROJ) when following the instructions provided.

1. Launch **CodeWarrior**.

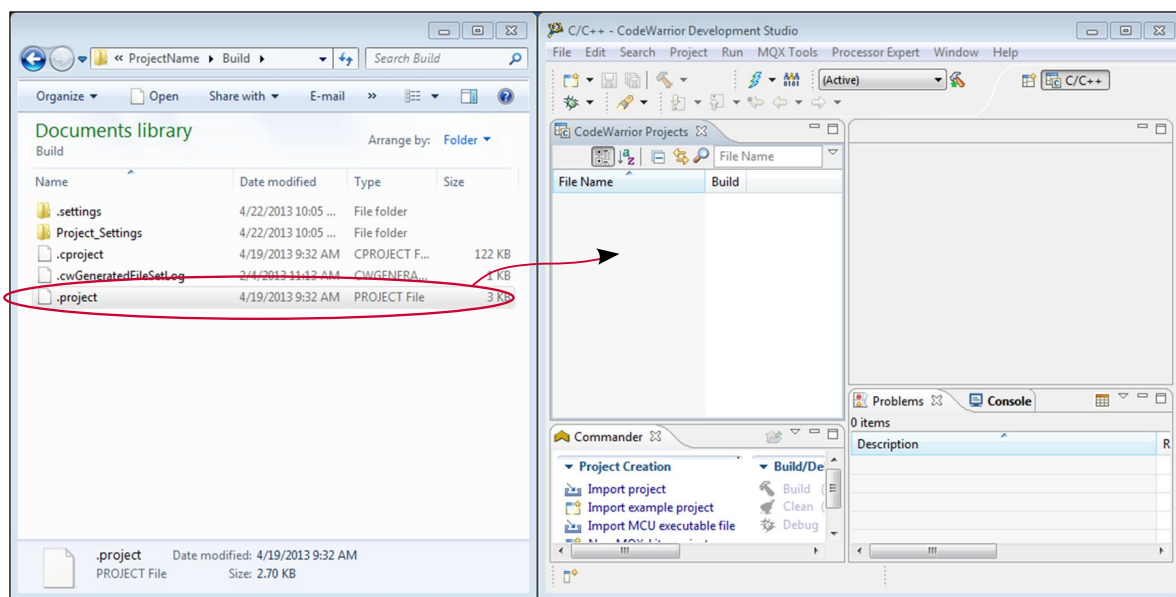
NOTE

If the **Select a workspace** window does not appear when **CodeWarrior** starts, open the **Select a workspace** window as follows: In the **Workbench** screen, from the **File** menu, select **Switch Workspace**, and then select **Other**.

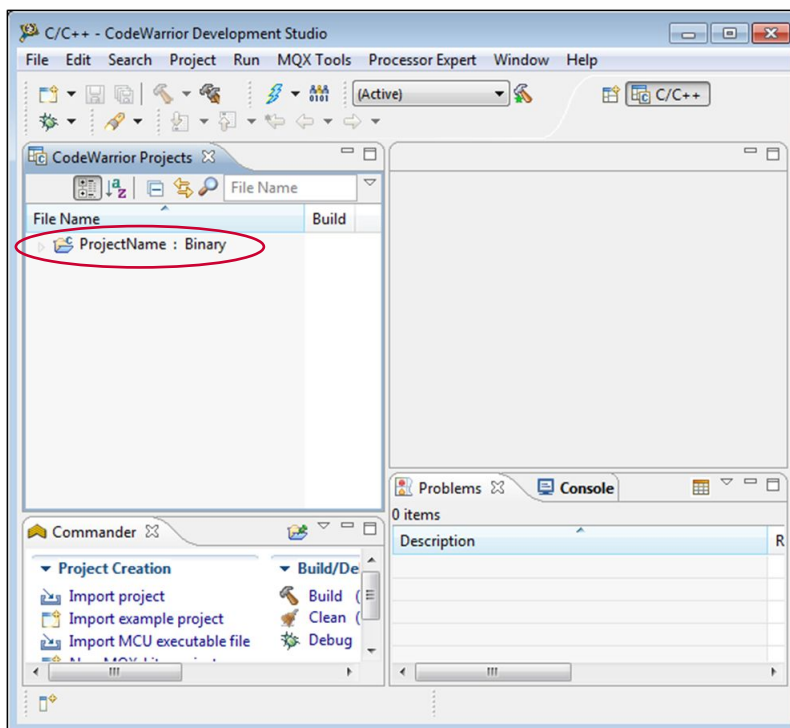
- a. Create a clean workspace.
 1. In the **Select a workspace** window, click **Browse**.
 2. Create a new folder named *workspace* in a location of your choosing. This is referred to as the **workspace** folder.
 3. Select the **workspace** folder, and then click **Open**.
 4. In the **Select a workspace** window, click **OK**.



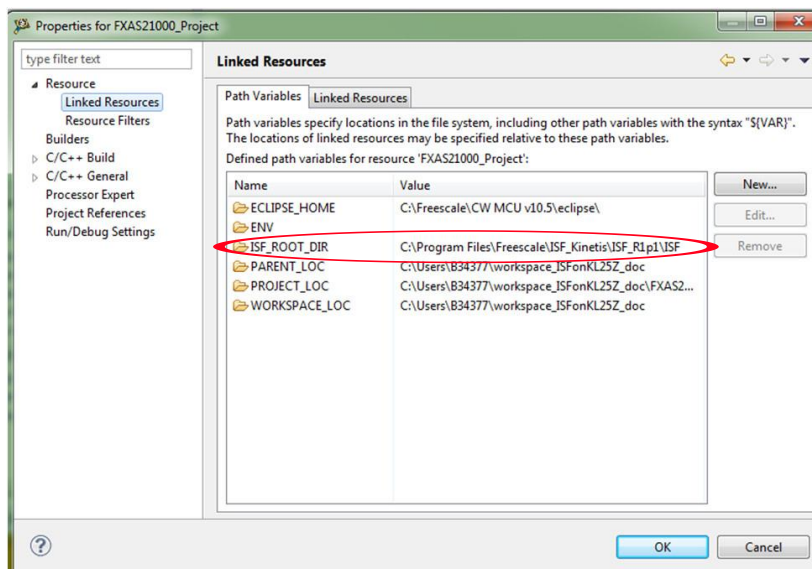
2. Locate the project of interest in the ISF installation directory: *C:\Program Files\Freescale\ISF_Kinetis\ISF_Rlp\Example Applications*. Copy the project folder into the CodeWarrior workspace folder (this will leave the installation folder unchanged). Once in the workspace directory, locate the .project file within the Build directory. Alternatively, obtain the *ProjectName.zip* file, which is available on the [Xtrinsic ISF website](#), on the **Downloads** page, listed under **Applications Specific-Apps**.
3. In **Windows Explorer**, locate the .project file in the **ProjectName/Build** folder. Select the .project file (not the .cproject file), and then drag the file onto the **CodeWarrior Projects** workspace.



Upon completion, the project (ProjectName) should be in the **CodeWarrior Projects** workspace.



4. It is good practice to verify that the ISF libraries are properly loaded.
 - a. In **CodeWarrior**, right-click on the *ProjectName* project, and then select **Properties**.
 - b. Expand **Resource**, and then select **Linked Resources**.
 - c. On the **Path Variables** tab, verify that **ISF_ROOT_DIR** has a value of *C:\Program Files\Freescale\ISF_Kinetis\ISF_R1p\ISF*, and then click **OK**.



Tip

In **CodeWarrior**, in the **CodeWarrior Projects** workspace, expanding the **ProjectName** directory, and then expanding the **Source** directory reveals *ProjectName.c* (for example, *MPL3115_Project.c*), the User Application that is compiled with the ISF library.

Double-clicking ProjectName.c brings it up in the upper right corner for viewing.
Advanced users may modify the code at their own risk if they so choose.

4.3 Compiling, Building and Running an Application project in CodeWarrior

Compile the **ProjectName** (listed in [Overview of Xtrinsic ISF Applications and Templates](#)) project. In **CodeWarrior**, right-click the project directory and select **Clean Project**, then right-click the **project** directory, and then select **Build Project**.

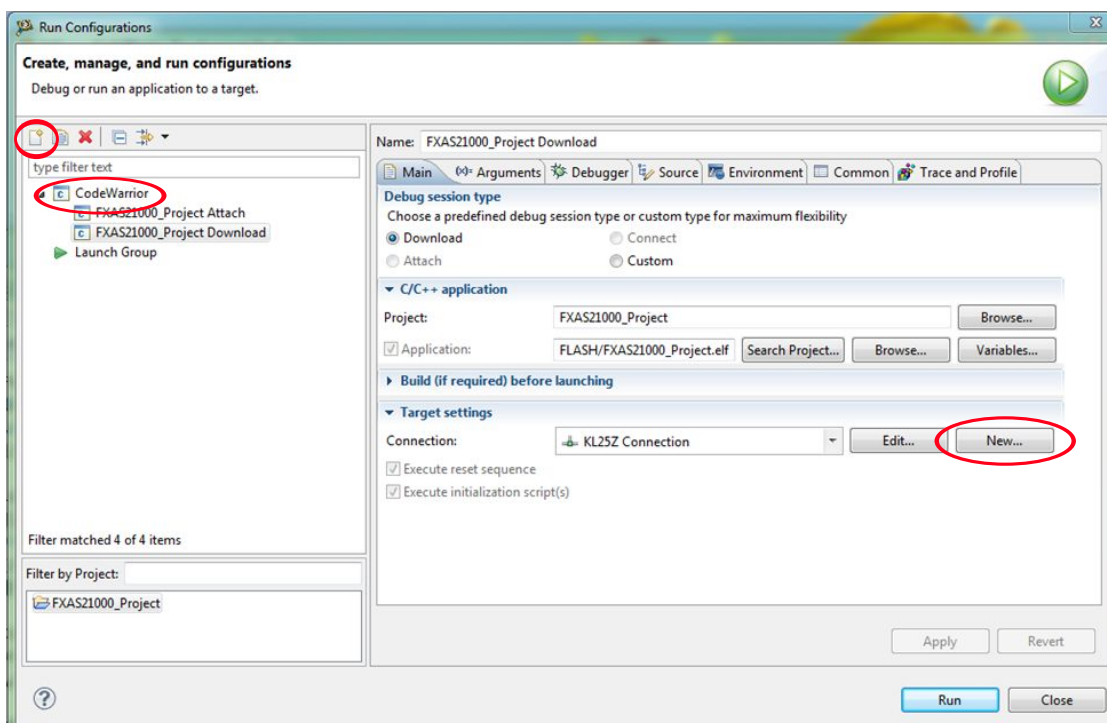
Verify that no compilation problems are indicated in the bottom right status reporting area of the **CodeWarrior** interface.

The preferred way of running the application is via downloading the hex or S19 file using the CodeWarrior OpenSDA debugger connection on the FRDM-KL25Z as described in [Using Reference Binary Applications for ISF v1.1 on Kinetis KL25Z](#). However, in order to debug the application using the CodeWarrior debugger, it is necessary to know how to load firmware within CodeWarrior. This procedure is described below.

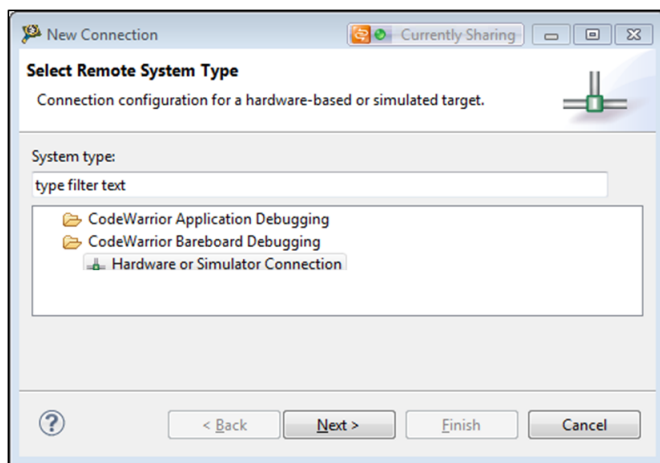
1. Connect the Application board. Plug in the Application board using the OpenSDA connection port via USB to the PC host.

If the light on the FRDM-FXS-MULTI-B is not lit, use the mini-switch on the board to turn it on.

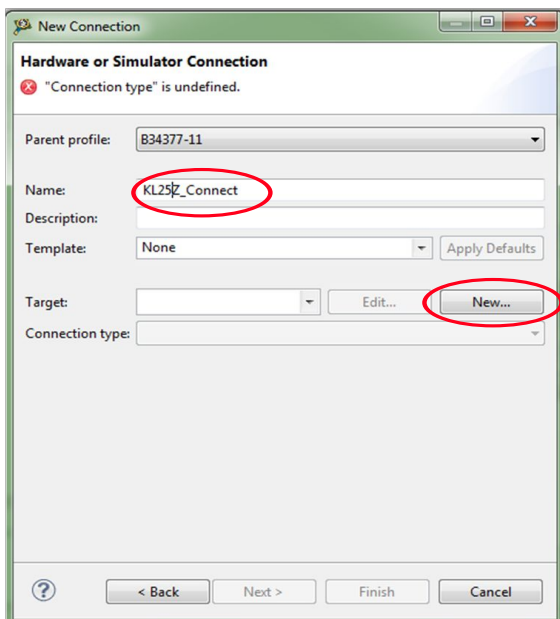
2. In **CodeWarrior**, right-click the project (ProjectName), then select **Run As**, and then select **Run Configurations**.
3. In the **Create, manage, and run configurations** window, select **CodeWarrior Download**, and then click the **New launch configuration** icon. This displays a **ProjectName Binary** window, which is pre-populated with some project-related information. Under Target settings, select **KL25Z Connection** in the pull down menu.



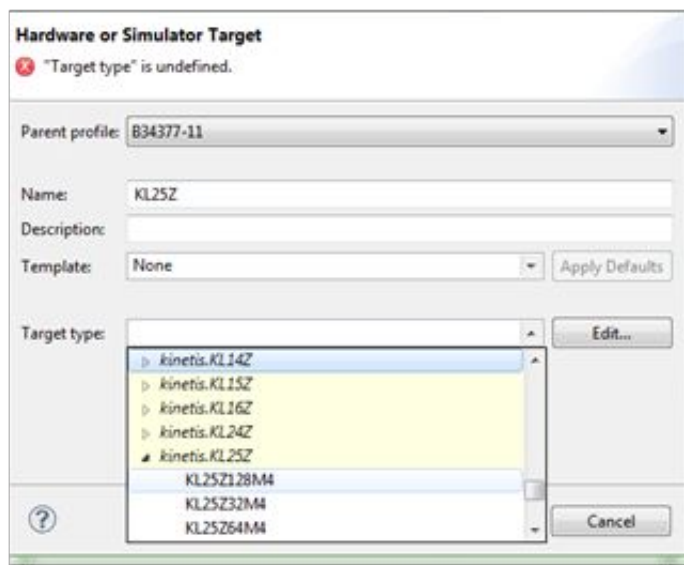
4. Upon selecting **New**, a **Select Remote System Type** window appears. In the **Select Remote System Type** window, expand **CodeWarrior Bareboard Debugging**, then select **Hardware or Simulator Connection**, and then click **Next**.



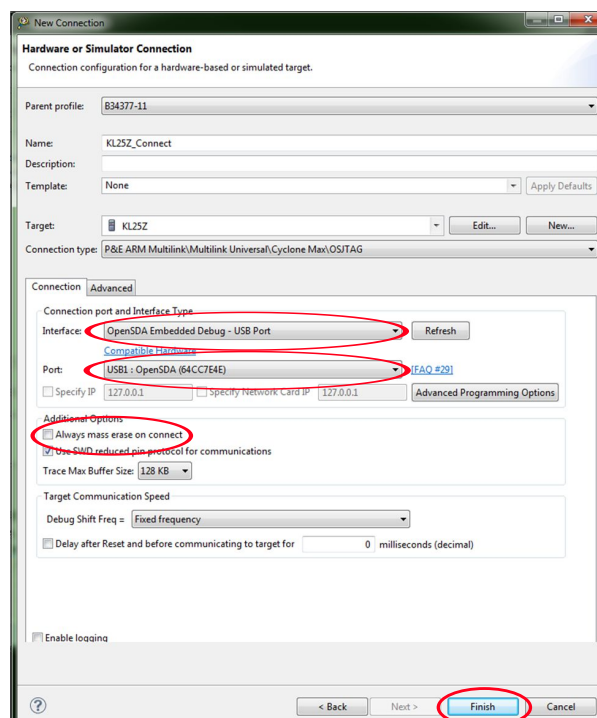
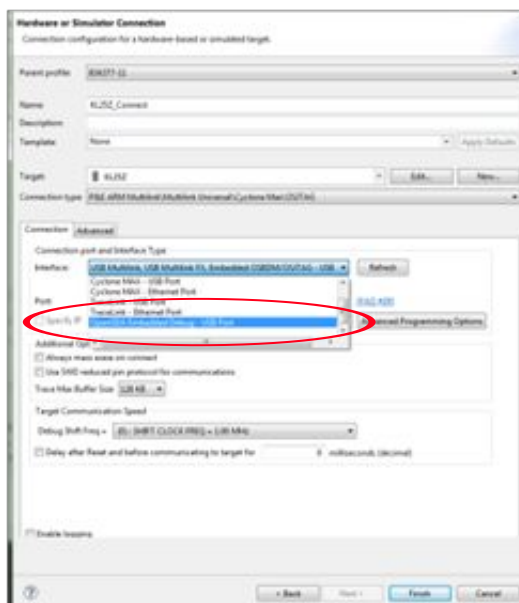
5. In the **Hardware or Simulator Connection** window, enter **KL25Z_Connect** into the **Name** field, and then click **New**, located to the right of the **Target** field.



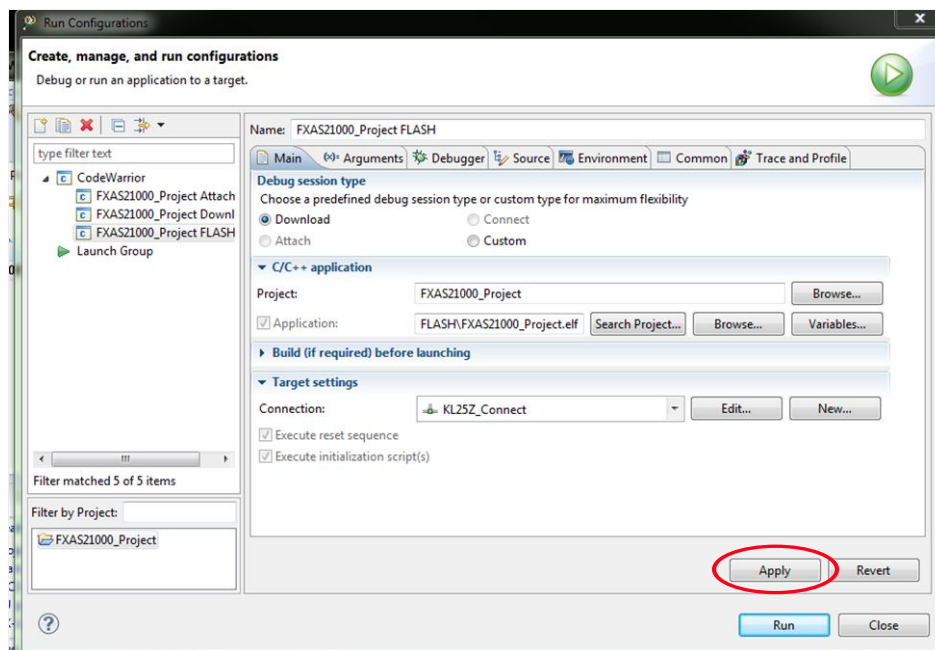
6. In the **Hardware or Simulator Target** window, enter **KL25Z** into the **Name** field. In the **Target type** menu, expand **kinetis.KL25Z**, then select **KL25Z128M4**, and then click **Finish**.



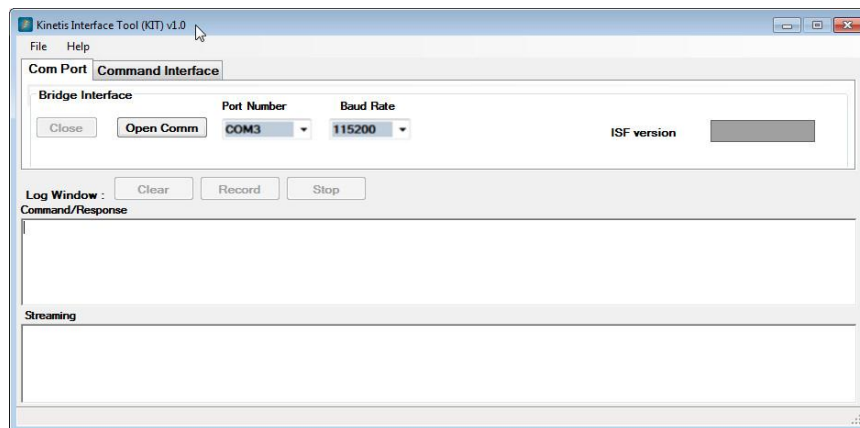
7. In the **Hardware or Simulator Connection** window, from the choices available in the **Connection type** menu, select the **P&E ARM Multilink\Multilink Universal\Cyclone Max\OSJTAG** (exact wording may be different), and then click **Finish**.

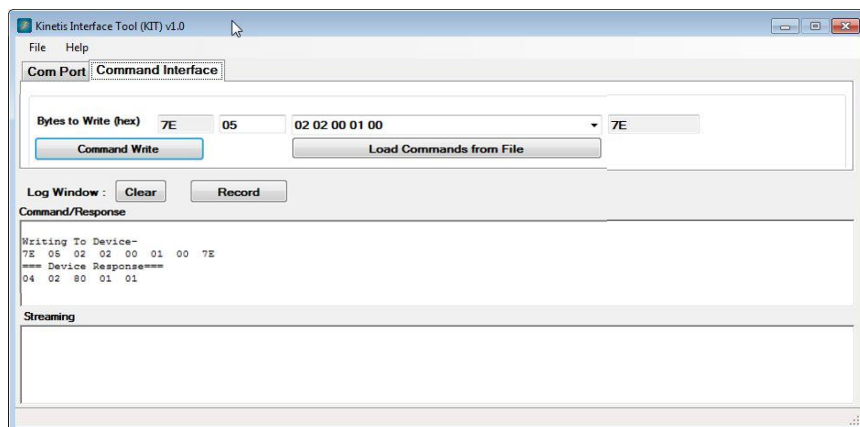


8. In the **Create, manage, and run configurations** window, click **Apply**. The connection type is now saved. Do not close this window.



9. Reset the Application board. Unplug the USB cable from the Application board. Reconnect the USB cable.
10. In **CodeWarrior**, in the **Create, manage, and run configurations** window, click **Run**. In the lower right corner of **CodeWarrior**, launching information will appear indicating that the image is being moved onto the board. Wait for all of these notifications to disappear, indicating the process is complete.
11. The application is now running on the Application board. Data and commands can be sent to the application board from the Kinetis Interface Tool and data can be received from the application.





For more information, refer to the `<SensorID>_Project_HOST_CMD_README.txt` file of the project and reference documents available in the **Documentation** tab of the [Xtrinsic ISF website](#).

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