

# IoT Sensing SDK

## Getting started with IoT Sensing SDK (ISSDK) v1.6 middleware

Rev. 1.3 — 25 May 2017

User guide

## 1 Prerequisites

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This document assumes the following knowledge by the user prior to attempting to use the ISSDK v1.6 middleware:

- One of the recommended IDEs has been installed on the development PC (see the release notes)
- A FRDM-K64F-AGM01 sensor kit is connected to the development PC
- User understands the debug environment setup for the Freedom family of development boards using OpenSDA or third-party debugger with their IDE of choice
- Exposure to the Kinetis SDK and MCUXpresso SDK Builder (previously known as Kinetis Expert)

## 2 Overview

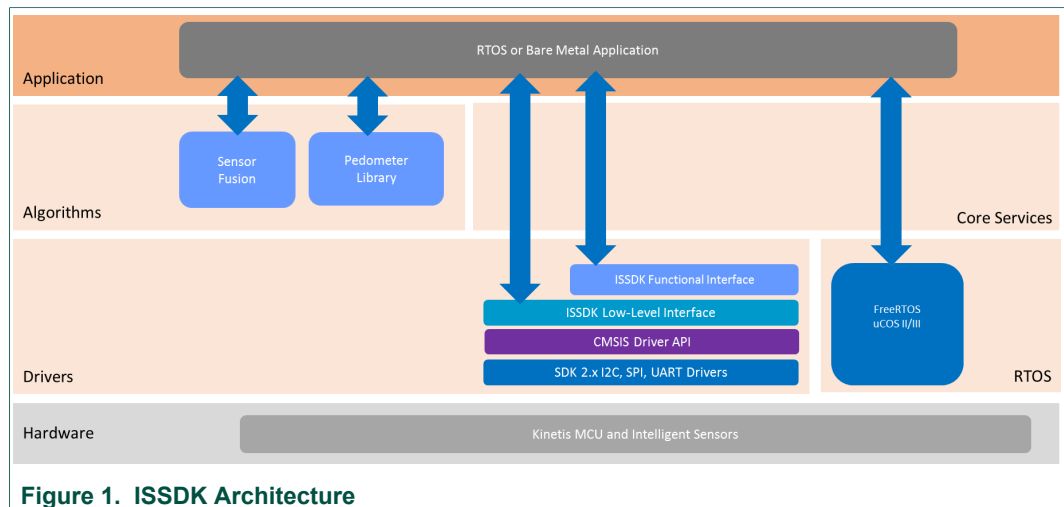
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The IoT Sensing SDK (ISSDK) v1.6 is an optional middleware component included in SDK packages downloaded from MCUXpresso SDK Builder (previously known as Kinetis Expert (KEx)) designed to provide support for Kinetis MCU projects using NXP sensors. ISSDK relies on the SDK 2.2 drivers and project release infrastructure to create a unified user experience. ISSDK v1.6 combines a set of robust sensor drivers and algorithms along with example applications to allow a customer to get started with using NXP sensors quickly. For more information on ISSDK, go to [www.nxp.com/iotsensingsdk](http://www.nxp.com/iotsensingsdk).

### 2.1 ISSDK Architecture

[Figure 1](#) shows the high-level *layer cake* architecture of the ISSDK v1.6 middleware. ISSDK is designed to provide separable layers of functionality that a customer can choose to use or ignore based on their specific needs. In addition, the ISSDK architecture is portable due to the use of open APIs (ARM Ltd.'s CMSIS Driver APIs). ISSDK is designed to allow users to start with as small a production footprint (memory and CPU load) as is practical for their particular application. This is typically done by selecting the Bare Metal option; however, some applications may prefer using one of the RTOSs supplied with SDK 2.2.





In the following sections, this guide focuses on how ISSDK can be deployed via MCUXpresso for a specific Freedom Sensor Toolbox sensor demonstration kit called the FRDM-K64F-AGM01. This kit combines the Kinetis FRDM-K64F development board with a FRDM-STBC-AGM01 sensor shield to provide a stand-alone, low cost sensor development platform.

### 3 NXP Freedom Sensor Toolbox Sensor Development Ecosystem

NXP Sensors provide a sensor development ecosystem called the Freedom Sensor Toolbox. This ecosystem is designed to provide solutions for hardware and software that enable customers to evaluate and prototype with sensors quickly and easily. ISSDK v1.6 is deployed on top of the Freedom Sensor Toolbox hardware platforms and is expected to become the embedded software support platform for the ecosystem.

The following figure shows how the Freedom Sensor Toolbox development hardware can be used to explore the ISSDK v1.6 software. In this example, the MCUXpresso IDE is used to compile, load and launch an existing project into the FRDM-K64F-AGM01 kit. The customer may then launch a terminal emulator to examine the debug console output provided for many ISSDK v1.6 projects.

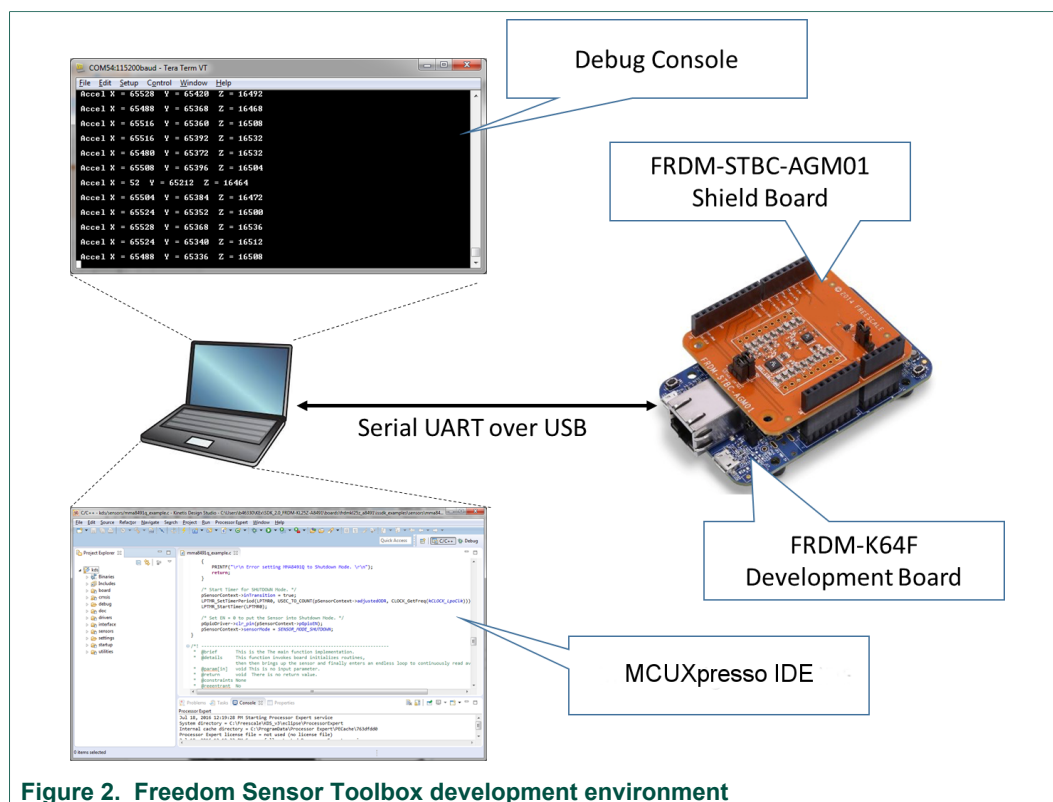


Figure 2. Freedom Sensor Toolbox development environment

More information about the Freedom Sensor Toolbox development ecosystem can be found at <http://nxp.com/sensortoolbox>. The remainder of this document focuses on the steps involved to use the FRDM-K64F-AGM01 development kit with the ISSDK enablement software for it.

## 4 Project deployment

ISSDK v1.6 is fully integrated into the MCUXpresso Web and SDK Builder delivery system. MCUXpresso includes both cloud and locally based tools to collect and build projects from the Kinetis SDK repositories. KSDK 2.2 is built using a hierarchy of deployed Git repositories. Specific project codebases are built through the online tool. A given codebase is specified by its target (device, board, or kit desired), the version of KSDK (2.2 only), the supported IDEs (MCUXpresso IDE (RedEye), Somnium DRT, KDS, IAR, Keil, GCC), and the target Host OS (Windows, Mac, or Linux).

### 4.1 MCUXpresso Web & SDK Builder

MCUXpresso Web & SDK Builder is a cloud-based system used to build Kinetis SDK 2.2 packages. ISSDK is an optional component that can be deployed by MCUXpresso in two ways:

- If the customer selects a FRDM sensor kit, such as the FRDM-K64F-AGM01, then the ISSDK sensor drivers and example applications appropriate for that kit are deployed into the package.
- If the customer selects a supported device or FRDM board and checks the box for optional ISSDK support, then all the sensor drivers and example applications are deployed into the package.

It should be noted that in both cases the SDK 2.2 drivers and example applications are also deployed alongside the ISSDK files.

The following figure shows the MCUXpresso environment for deploying ISSDK (see <https://mcuxpresso.nxp.com/en/configuration-settings>). In this example, the customer has selected the FRDM-K64F-AGM01 kit, the MCUXpresso IDE, and Windows host operating system. Notice that ISSDK middleware component has been selected by default because the target is a board/shield kit. When the customer selects the Build SDK Package, the request is sent to the build servers. Requests for packages are served in order and when the package is ready, a notification is returned to the customer. At this point, the customer may download the package (a zip file) and deploy it into their local system.

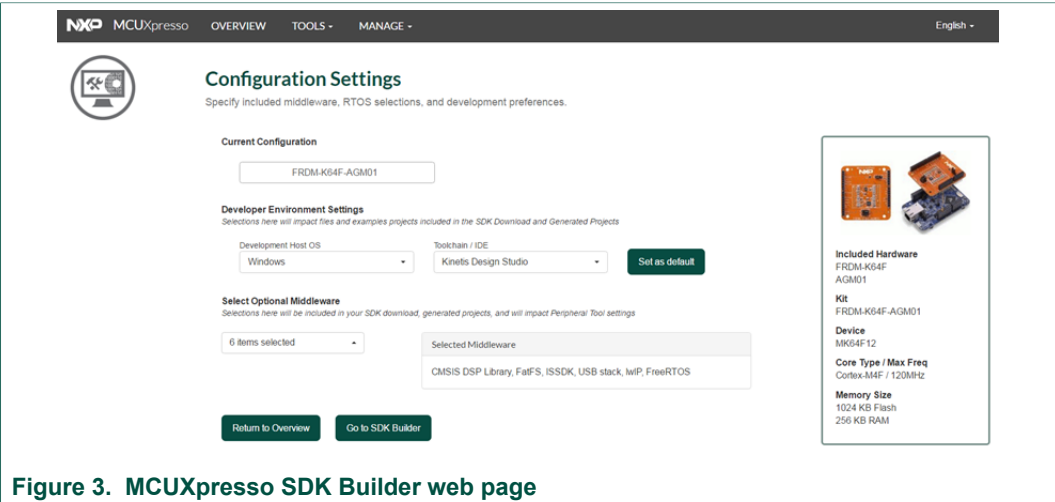


Figure 3. MCUXpresso SDK Builder web page

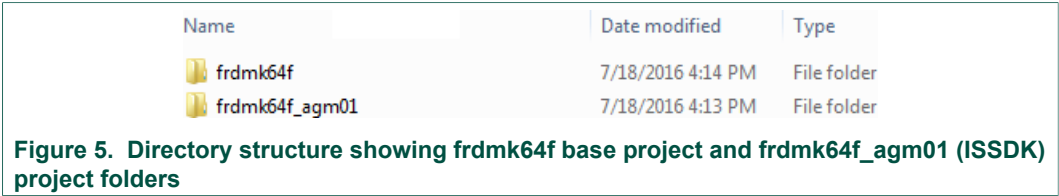
4.2 Deployment directory structure

Once the MCUXpresso package has been downloaded, the user can extract the package on their local machine. Figure 4 displays the MCUXpresso directory structure.

boards	3/16/2017 3:54 PM	File folder
CMSIS	3/16/2017 3:54 PM	File folder
devices	3/16/2017 3:54 PM	File folder
docs	3/16/2017 3:54 PM	File folder
middleware	5/10/2017 5:01 PM	File folder
rtos	3/16/2017 3:54 PM	File folder
tools	3/16/2017 3:54 PM	File folder
FRDM-K64F-AGM01_manifest.xml	3/15/2017 10:45 PM	XML Document
LA_OPT_Base_License.htm	3/15/2017 10:45 PM	Chrome HTML Do...
SW-Content-Register.txt	3/15/2017 10:45 PM	TXT File

Figure 4. FRDM-K64F-AGM01 kit SDK package directory structure

The CMSIS, devices, docs, rtos, and tools directories are unchanged from standard KSDK 2.2 deployments. ISSDK v1.6 projects appear as new targets in the boards directory. Figure 5 illustrates the directory where frdmk64f\_agm01 (ISSDK) reference example projects are available (as well as the base projects for the frdmk64f).

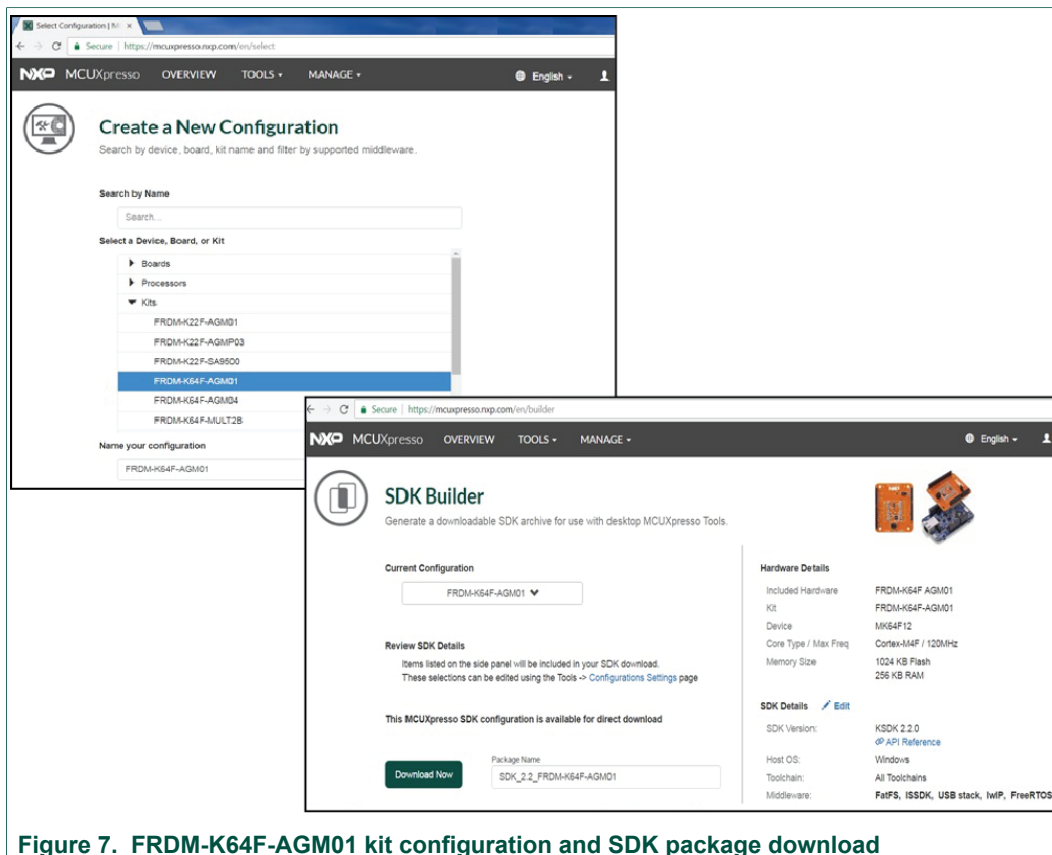


In addition, a new middleware component is created that contains the ISSDK drivers, algorithms and other support files as shown in [Figure 6](#).



## 5 Build and run a sensor driver example

Choose FRDM-K64F-AGM01 kit configuration and download SDK package from MCUXpresso SDK Builder. [Figure 7](#) and [Figure 8](#) illustrate how to get the FRDM-K64F-AGM01 SDK package from MCUXpresso configuration.



Install downloaded SDK package into MCUXpresso IDE (drag and drop SDK package into “Installed SDKs” view). Start SDK import wizard, import any existing ISSDK example by choosing `frdmk64_agm01` board for your project, build the imported project and load the image to FRDM-K64FAGM01 kit. This creates a standalone project in your workspace. Refer to [Figure 8](#).

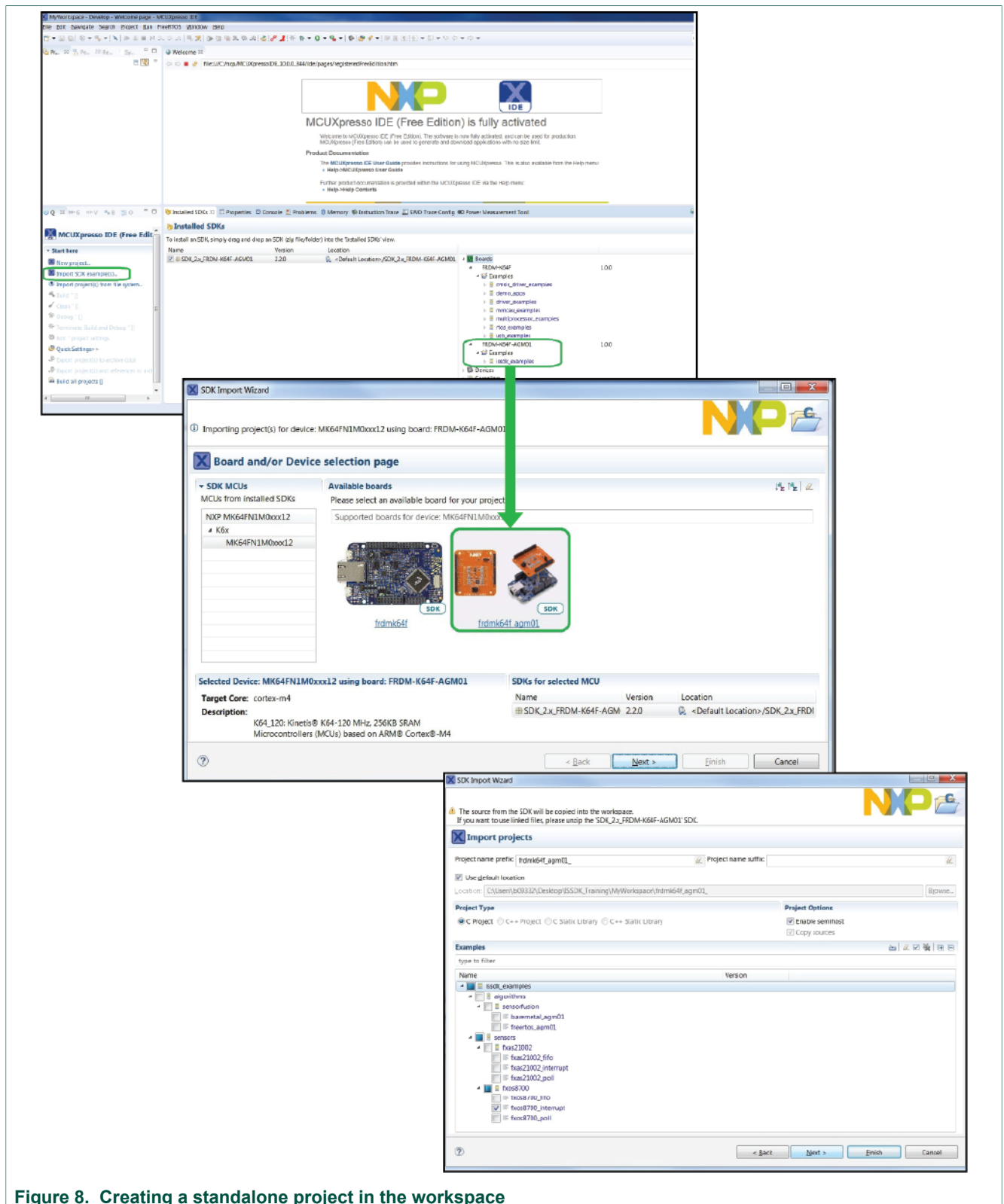


Figure 8. Creating a standalone project in the workspace

Notice that the code is ready to start in the file `fxos8700_interrupt.c`, which is the main application for this example.



Start the program execution. The blue LED begins to flash on the FRDM-K64F board. Next, start a terminal emulation program with the serial port set as shown in [Figure 9](#).

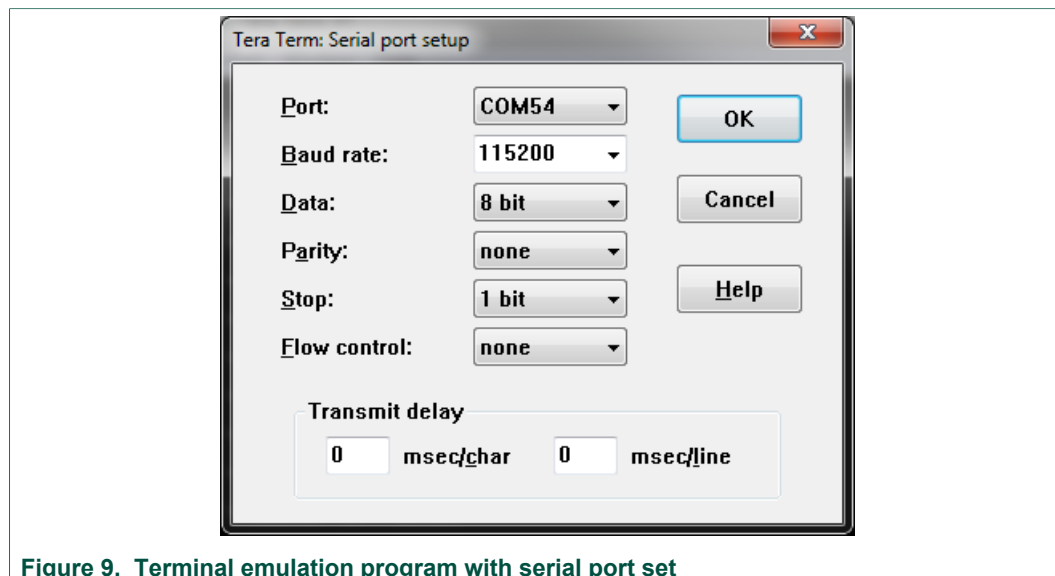


Figure 9. Terminal emulation program with serial port set

[Figure 10](#) displays the the debug console window and output.

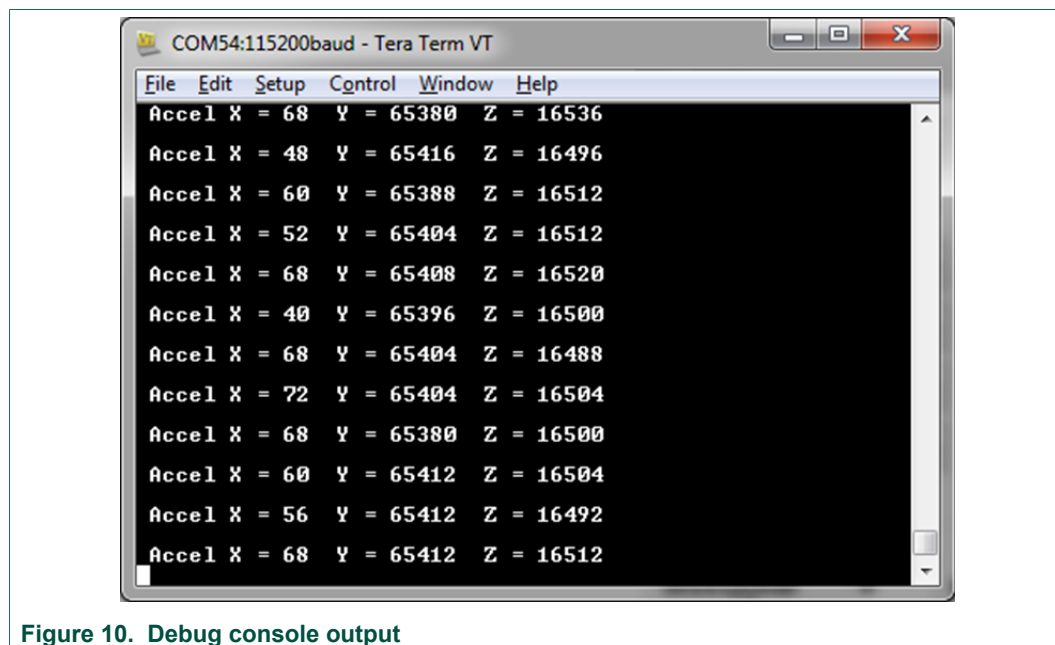


Figure 10. Debug console output

In this example, each data ready interrupt from the FXOS8700 triggers the application to read the raw X-, Y-, Z-axis accelerometer values. These raw values are then converted to 16-bit unsigned integers and output in real time to the debug console.

## 6 Build and run sensor fusion

Start SDK import wizard and import ISSDK sensor fusion example by choosing frdmk64\_agm01 board for your project. This creates a standalone project in your workspace. Refer to [Figure 11](#).



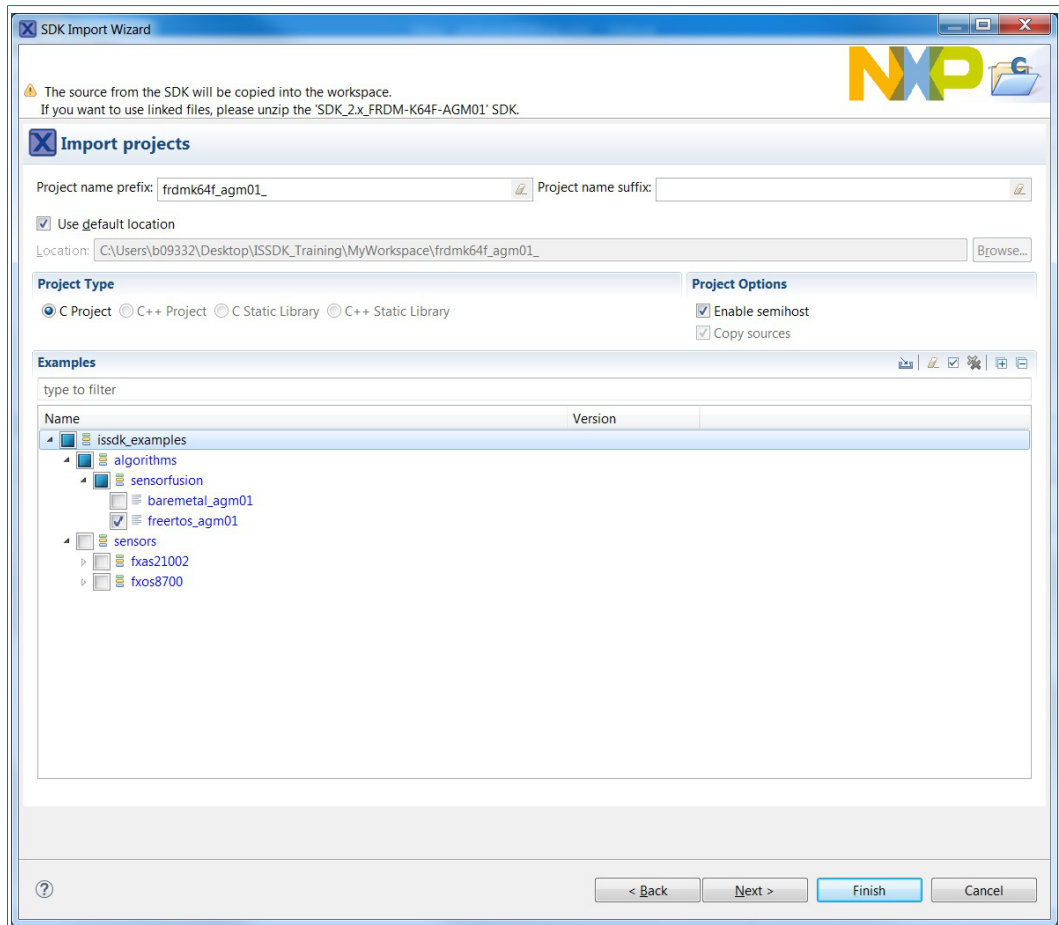


Figure 11. SDK Import Wizard for Sensor Fusion Project

Build sensor fusion project in MCUXpresso IDE and load the image to FRDM-K64F-AGM01 kit. Refer to [Figure 12](#).

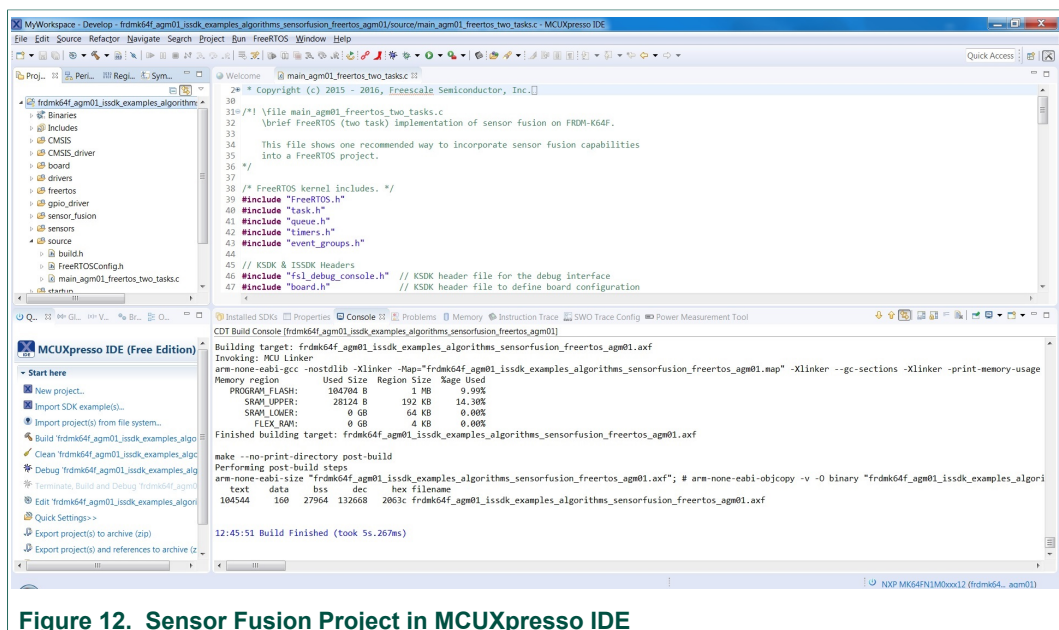


Figure 12. Sensor Fusion Project in MCUXpresso IDE

Notice that the code is ready to start in the file *main\_agm01\_freertos\_two\_tasks.c*, which is the main application for this example.

Start the program execution. The green LED begins to flash on the FRDM-K64F board.

You can now install the Sensor Fusion GUI application in order to visualize the operation of the Sensor Fusion application. Go to <http://nxp.com/sensorfusion>, download the latest Sensor Fusion for Windows GUI and install it. Launch the Sensor Fusion GUI. Select the Port from the pull-down menu. The GUI main screen should resemble [Figure 13](#).



This completes the exercise to run the ISSDK 1.6 Sensor Fusion project.

## 7 Revision history

Table 1. Revision history

Revision number	Date	Description
1.3	20170525	Updates for ISSDK v1.6
1.2	20170306	Updates for ISSDK v1.5
1.1	20161123	Updates for ISSDK v1.1
1.0	20160803	Initial public release

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## Contents

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1	<b>Prerequisites .....</b>	<b>1</b>
2	<b>Overview .....</b>	<b>1</b>
2.1	ISSDK Architecture .....	1
3	<b>NXP Freedom Sensor Toolbox Sensor Development Ecosystem .....</b>	<b>2</b>
4	<b>Project deployment .....</b>	<b>3</b>
4.1	MCUXpresso Web & SDK Builder .....	3
4.2	Deployment directory structure .....	4
5	<b>Build and run a sensor driver example .....</b>	<b>5</b>
6	<b>Build and run sensor fusion .....</b>	<b>8</b>
7	<b>Revision history .....</b>	<b>11</b>
8	<b>Legal information .....</b>	<b>12</b>

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