µEZ® Software
Quickstart Guide

Future Designs, Inc.
Your Development Partner
996 A Cleaner Way, Huntsville, AL 35805

Table of Contents

Contents

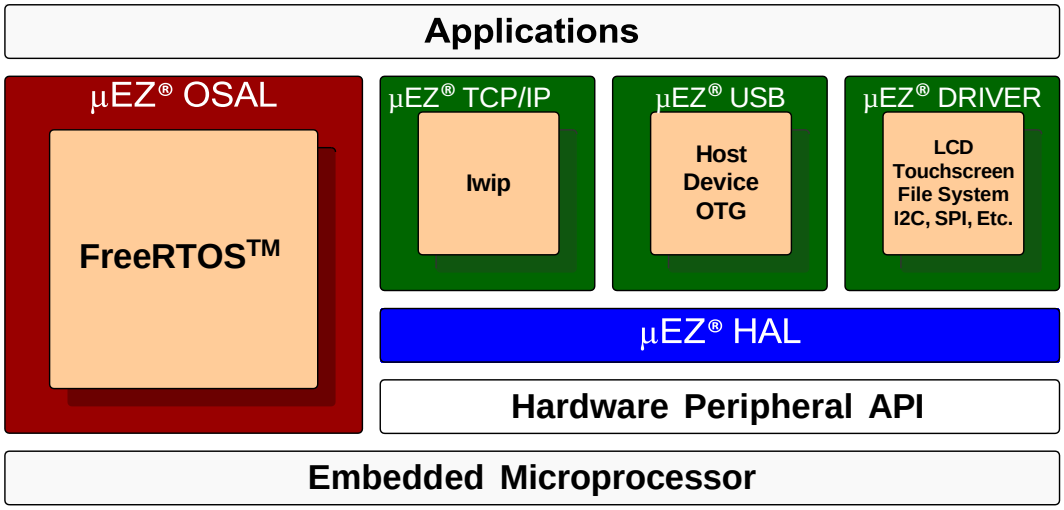
FDI PN: MA00015
Revision: Rev 2.13, 07/11/2023
Published in the United States of America

1. Introduction

µEZ® takes its name from the Muses of Greek mythology. A Muse was a goddess who inspired the creation process for the arts and sciences. Like its ancient Greek namesake, the **µEZ®** platform inspires rapid development by supplying customers with an extensive library of open-source software, drivers, and processor support - all under a common framework. **µEZ®** development works on the premise of "design once, reuse many times". This provides an open-source standard for embedded developers to build upon and support. **µEZ®** allows companies to focus on innovation and on their own value-added applications while minimizing development time and maximizing software reuse.

The diagram below shows a typical embedded application stack. **µEZ®** has three primary categories of components that help simplify embedded application development:

1. **Operating System Abstraction Layer (µEZ® OSAL)**
2. **Sub-system drivers (µEZ® TCP/IP, µEZ® USB, µEZ® Driver)**
3. **Hardware Abstraction Layer (µEZ® HAL)**



The selection of an RTOS can be one of the most daunting aspects of an embedded system development. With **µEZ®** the primary features of common multi-tasking operating systems are abstracted, thus easing the transition to an open source or low-cost RTOS. The **µEZ®** OSAL provides applications access to the following features in an OS-independent fashion:

- Pre-emptive multitasking
- Stack overflow detection
- Unlimited number of tasks
- Queues
- Semaphores (binary, counting, mutex)

The **µEZ®** sub-system drivers utilize the OSAL functions to provide protected access to the processor peripherals. The sub-system driver API functions are typically protocol layer interfaces (TCP/IP, USB, etc) designed as high-level access routines such as open, close, read, write, etc. where possible.

The HAL functions provide single-threaded unprotected access to the processor peripherals. Customers can use the **µEZ®** HAL routines provided by FDI or they can write their own. The HAL routines provide for RTOS/**µEZ®** independence and allow portability within a family of processors.

µEZ® is ideally suited for Embedded Systems with standard features such as:

- Processor and Platform BSPs (Board Support Packages)
- Real Time Operating System (RTOS)
- Memory Management
- NAND/NOR Flash
- SDRAM and DDR Memory
- TCP/IP stack
- USB Device/Host Libraries
- Mass Storage Devices
- LCD Displays with Touch Screen
- Input / Output Devices

2. Downloading uEZ®

Start by downloading the latest version of uEZ® from https://sourceforge.net/projects/uez/. Unzip to a working folder. In this document we will use a simple directory structure of /uEZ but the user is free to modify this as desired.

The uEZ® file directory structure should be as follows:

Directory	Description
uEZ/Build	Projects/makefiles for different applications/demos
uEZ/Include	uEZ® system files and Config.h
uEZ/Include/Device	Device Driver class definitions.
uEZ/Include/HAL	Hardware Abstraction Layer (HAL) driver class definitions.
uEZ/Include/Types	Common data types used by both HAL and Device Drivers.
uEZ/Source	Source code
uEZ/Source/Devices/<category>/<manufacturer>/<device>	Device specific code organized by category (I2C, SSP, etc.), manufacturer, and specific device.
uEZ/Source/Library/<category>/<package>	Various support libraries organized by category (graphics, file system, etc.) and package name.
uEZ/Source/Platform/<manufacturer>/<platform>	Platforms/boards code organized by manufacturer and specific platform build.
uEZ/Source/Processor/<manufacturer>/<processor>	Processor specific code in separate directories organized by manufacturer and specific processor.
uEZ/Source/RTOS/<RTOS>/	RTOS source code in separate directories
uEZ/Source/uEZSystem	uEZ® System Core routines
uEZDemos/Build	Demo Project files are stored by type and specific board.
uEZDemos/Source/App	User Application/Shared Demo source code

3. Project Configuration

uEZ® uses a simple one project configuration. Depending on the compiler tools, use one of the following subsections.

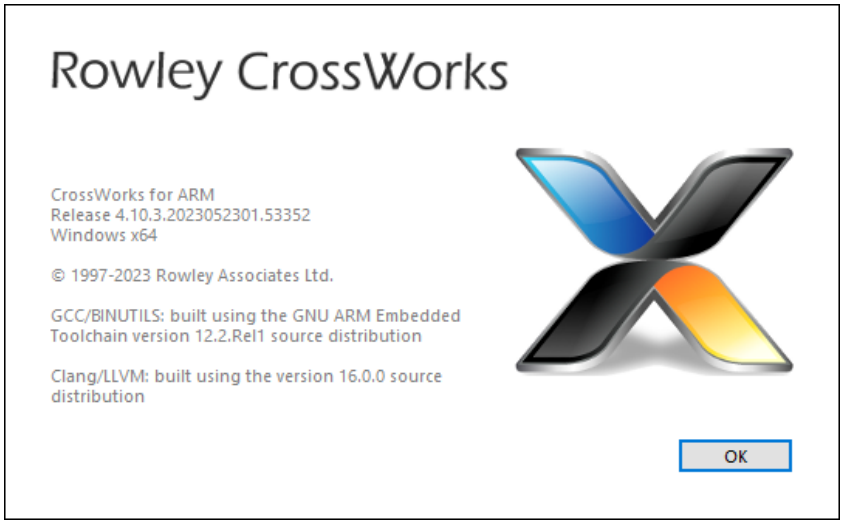
Preparing the uEZ® Source Code

Download the uEZ® v2.13 (or later) source code from http://www.sourceforge.net/projects/uez. Unzip the file to where you will be working. It should create a folder called /UEZ_SRC.

Rowley CrossWorks CrossStudio v4.10.x Project Configuration

Check CrossStudio Version

uEZ® is built using v4.10, or later, of the Rowley CrossWorks CrossStudio for ARM® toolset. To confirm the version number of the tools, go to "Help" → "About" in the main menu and the version number should appear in the middle of the dialog.



Check Installed Packages

In addition, packages for your target processor(s) should be installed. Go to **Tools->Show Installed Packages** and see which packages have been installed. For example,

Package	Version	Status
NXP LPC1000 CPU Support Package	1.32	Installed
NXP LPC4300 CPU Support Package	3.7	Installed

If doing development with the NXP LPC1788/LPC4088, the following packages should be installed:

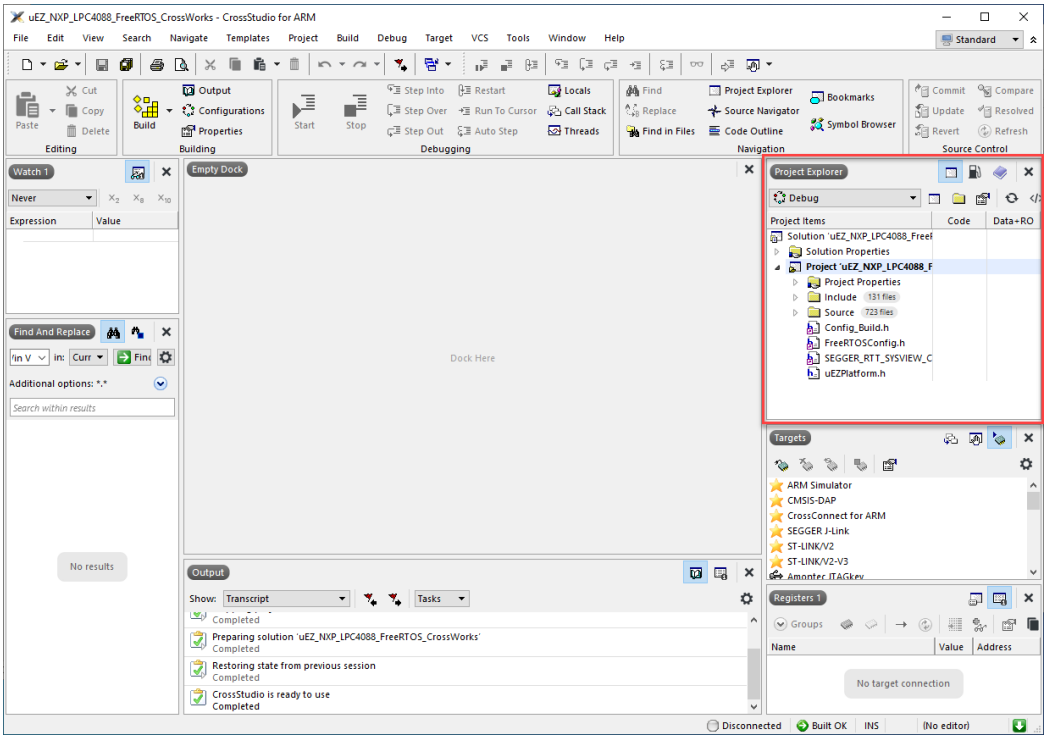
ARM CPU Support Package
NXP LPC1000 CPU Support Package

If the packages are not installed, go to "**Tools**" → "**Download Packages from Web**", download the missing packages, and then use "**Tools**" → "**Install Package…**" to install them.

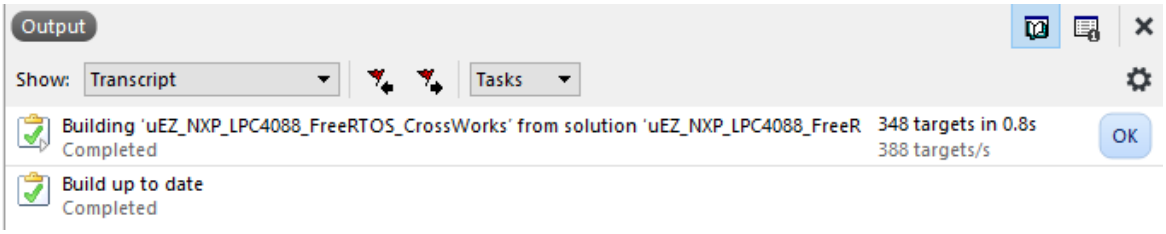
Opening and Compiling uEZ®

Before the uEZ project can be downloaded and debugged, the uEZ Library needs to be built.

Open the library project file in the \uEZ\Build directory. For example, when working on the uEZGUI-4088-43WQN, open "\uEZ\Build\Generic\NXP\LPC4088\FreeRTOS\CrossWorks\uEZ_NXP_LPC4088_FreeRTOS_CrossWorks.hzp". The Project Explorer should appear at the right showing all the files in the project.



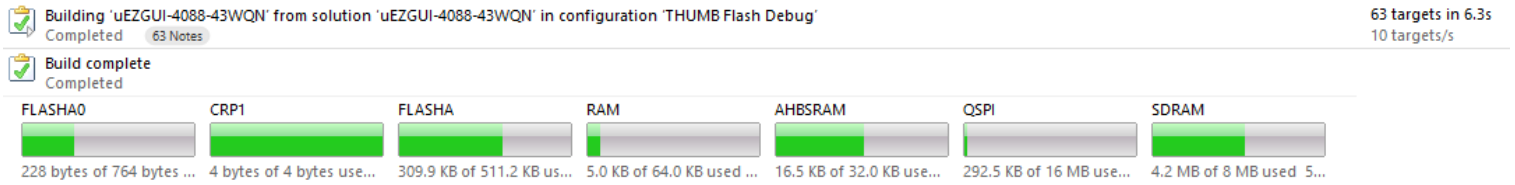
To compile the code for the first time, select "**Build**" → "**Build uEZ_NXP_LPC4088_FreeRTOS_CrossWorks**" from the toolbar menu, or press <**F7**>. When complete, the output should report "Build Complete" or "Build up to date" when done.



Close the uEZ Library project.

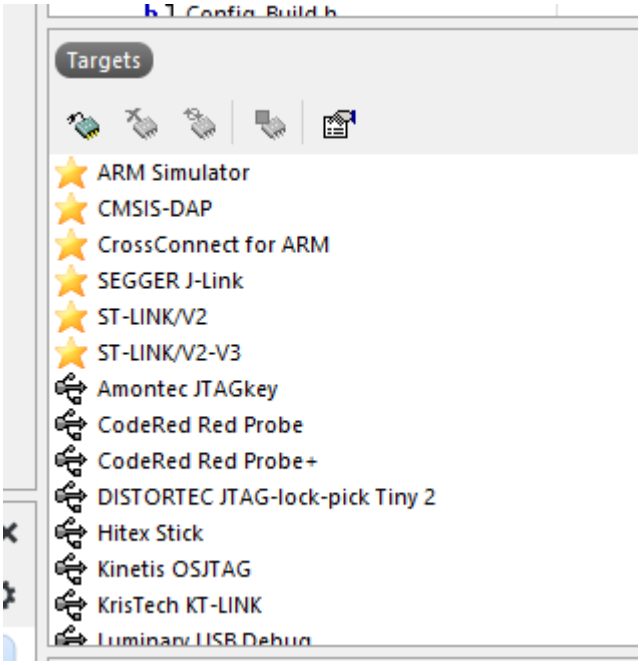
The uEZ distribution comes with a uEZ GUI Demonstration Application project file: "\uEZDemos\Build\FDI\uEZGUI\uEZGUI-4088-43WQN\CrossWorks\uEZGUI-4088-43WQN.hzp".

Open the "**uEZGUI-4088-43WQN.hzp**" project and compile just as with the uEZ Library. Select "**Build**" → "**Build uEZGUI-4088-43WQN**" from the toolbar menu, or press <**F7**>. When complete, the output should report "Build Complete" or "Build up to date" when finished and report the memory usage for this project.

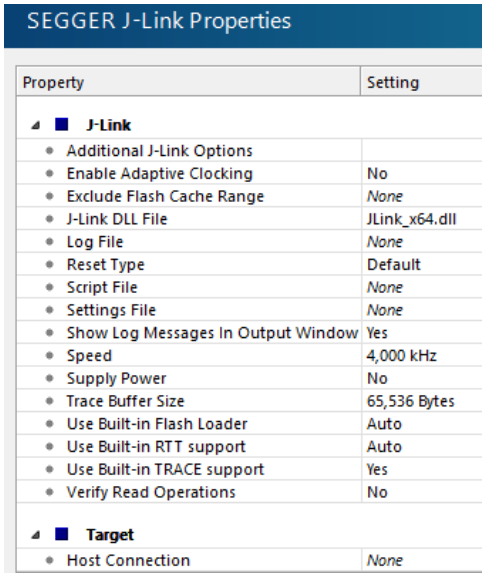


Downloading and Debugging uEZ® on the Target

1) Plug the J-Link device into the PC and install any drivers as directed. The Segger J-Link drivers can be found at http://www.segger.com/cms/jlink-software.html with additional information at http://www.segger.com/cms/development-tools.html.
2) Plug the J-Link's JTAG cable into the target (e.g., uEZGUI-4088-43WQN's J5 connector).
3) Power on the target board.
4) Select "**View**" from the toolbar and choose "**Targets**". The following list will appear on the right:



5) Right click on "Segger J-Link" and select Properties,



6) If this is the first time you are programming with the J-Link on the Rowley Platform…

a) Click on "**J-Link DLL File**".

b) Press the "…" button and find the file JLinkARM.dll (usually installed in C:/Program Files/SEGGER/")

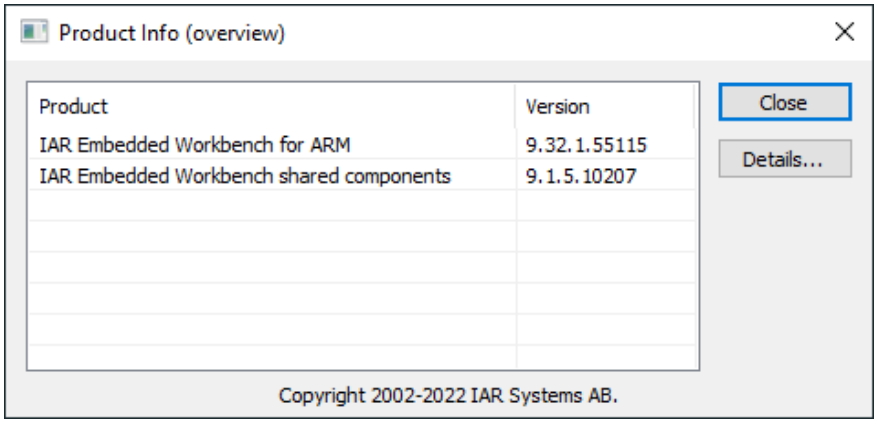
c) If programming a blank LPC4088 part, select a Speed of 100 kHz. If the LPC4088 has already been programmed, select a Speed of 4000 kHz.

7) Right click on "Segger J-Link", and click "Connect Segger J-Link".
8) Press <**F5**> to download the application to the target and start debugging. When the application starts, it will pause at main(). Press <**F5**> again to continue executing the code.
9) To stop at any line of code, right click the line and select Toggle Breakpoint. Execution will stop automatically at the breakpoint. Press <**F5**> again to continue debugging.
10) When done debugging, select "**Debug**" → "**Stop**" from the toolbar, or the <**Stop**> button from the **Debugging** Menu. The debugger will return to standard editor mode.
11) From this point on, the process is simply a matter of editing code, compiling the code (**Build->Build uEZ** or pressing F7), and then running the debugger.

IAR Systems Embedded Workbench v9.32.1 Project Configuration

Check IAR Version

uEZ® is built using 9.32.1, or later, of the IAR Embedded Workbench Toolset and C/C++ Compiler. To confirm the version number of the tools, go to "Help" → "About" → "Product Info" in the toolbar and the version number should appear in the middle of the dialog.



Opening and Compiling uEZ®

Before the uEZ project can be downloaded and debugged, the uEZ Library needs to be built.

Open the library project file in the \uEZ\Build directory. For example, when working on the uEZGUI-4088-43WQN, open "\uEZ\Build\Generic\NXP\LPC4088\FreeRTOS\IAR\uEZ_NXP_LPC4088_FreeRTOS_IAR.eww". The Project Explorer should appear at the left, showing all the project files.

To compile the code for the first time, select "**Project**" → "**Make**" from the toolbar, or press <**F7**>. When complete, the output should report "Total number of errors: 0" and "Build succeeded".

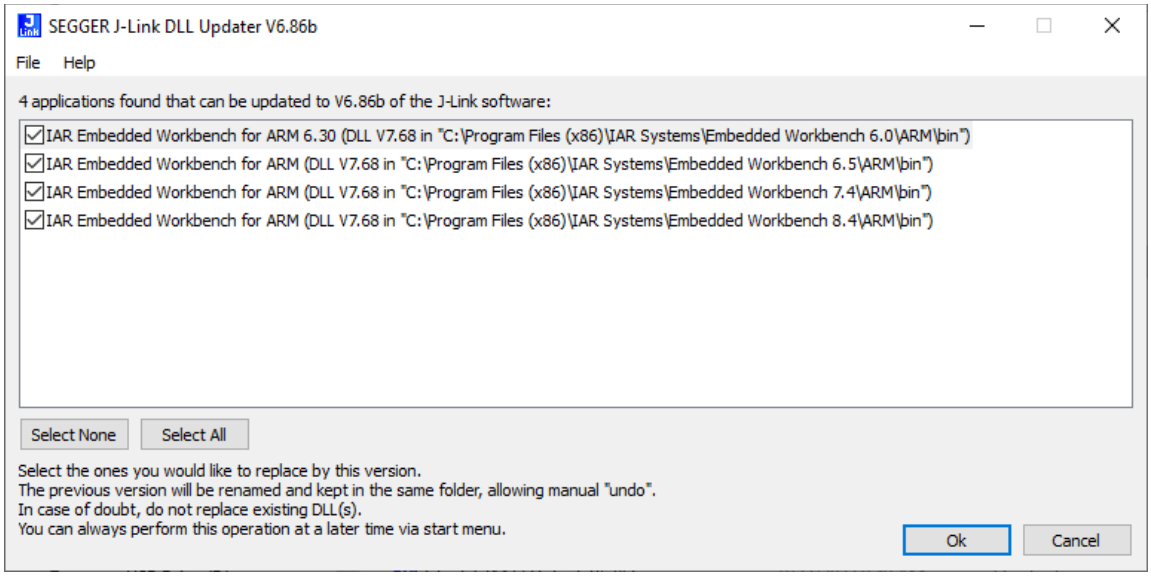
With the uEZ Library built, close "uEZ_NXP_LPC4088_FreeRTOS_IAR.eww". Now open the uEZ GUI Demo project: "\uEZDemos\Build\FDI\uEZGUI\uEZGUI-4088-43WQN\IAR\uEZGUI-4088-43WQN.eww".

As in the uEZ Library project, select "**Project**" → "**Make**" from the toolbar, or press <**F7**>. When complete, the output

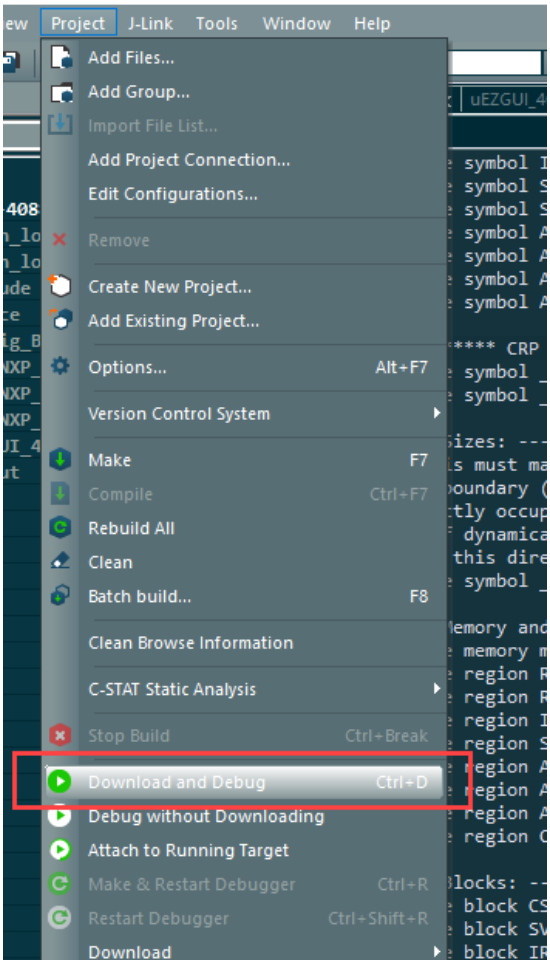
should report “Total number of errors: 0” and “Build succeeded”.

Downloading and Debugging uEZ® on the Target

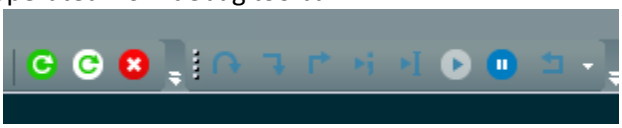
1) Plug the J-Link device into the PC and install any drivers as directed. The Segger J-Link drivers can be found at http://www.segger.com/cms/jlink-software.html with additional information at http://www.segger.com/cms/development-tools.html.
2) Plug the J-Link’s JTAG cable into the target (e.g., uEZGUI-4088-43WQN’s J5 connector).
3) Power on the target board.
4) The project is preconfigured for the Segger J-Link. If the J-link software is installed after IAR, the .dll will automatically be updated. Otherwise run the SEGGER J-Link Updater from SEGGER/J-Link ARM vx.xx in the start menu.



5) Select “**Project**” → “**Download**” and Debug from the toolbar, click the green “Download and Debug” button on the toolbar, or press <**Ctrl**> + <**D**> to start debugging.



6) Debugging control can be operated from debug toolbar.



7) Debugging will pause at main(). Press <**F5**> or the white circle with a blue arrow inside it to continue code execution.

8) When finished debugging press the red X in the debug toolbar.

4. Questions and Support

For all questions, bug reports and general technical support, go to https://sourceforge.net/projects/uez/ and use the Sourceforge.net tools or email FDI directly at support@teamfdi.com . A support forum is also provided at https://www.teamfdi.com/forum/ .

Marketing updates and details on technical support are available at https://www.teamfdi.com/uez.

Can we use another RTOS?

All **µEZ®** components are made to connect through the **µEZ®** OSAL (Operating System Abstraction Layer) to the RTOS ensuring compatibility with many different RTOS's. Currently all **µEZ®** development by FDI is being focused on the FreeRTOS™ platform since it satisfies the low cost tool requirement because it is "free". RTOS products from other vendors can also be used with **µEZ®**. FreeRTOS™ allows a migration path to SafeRTOS for those customers that need it. See Wittenstein's page for more details. https://www.wittenstein-us.com/Embedded-RTOS/SAFERTOS.html

Which compiler suites do you support?

Currently, most **µEZ®** development by FDI has been done on the following tool suites: Rowley Crossworks for ARM, and IAR EWARM. ARM® RealView, GNU, Keil uVision, and Renesas C/C++ with HEW, KPIT GNU and other compilers can also be used with **µEZ®**.

What debug tools are available?

Since **µEZ®** uses the debug tools that are provided in the customers compiler suite, it can be used with any of the tools listed above.

Which processors are supported?

Even though **µEZ®** is processor independent, all of our initial development has been focused on various members of the ARM Family. We currently support the NXP LPC17xx family, the NXP LPC40xx family, the NXP LPC43xx family, the Renesas RX6XN, and processors like Cortex™-M3/M4, and other variations of ARM v7®.