Application Note

AN_325

FT9xx Toolchain Installation Guide

Version 1.04

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This guide documents the tools and methods required for building, programming and debugging the FT9xx series devices from BRT Chip.

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1 FT9xx Toolchain Introduction

The free FT9xx toolchain is a port from the popular GNU toolchain which includes the following components:

- GCC based compiler
- GNU Binary Utilities (binutils) based tools, most notably:
  - as - the assembler
  - ld - the linker
  - and some other useful tools such as objdump, ar, ranlib, addr2line, etc.
- GDB based debugger
- In addition, a plugin for the Eclipse IDE is also provided. This plugin allows the FT9xx toolchain to integrate seamlessly into Eclipse and as a result, greatly simplifies the development works for the FT9xx MCUs.

1.1 Compiler: ft32-elf-gcc

The FT9xx compiler is used similarly to standard GCC. It supports most GCC options such as -Wall, -O1, -O2…

Example: To compile a C file into an object file:

ft32-elf-gcc -c -o file.o file.c

1.2 Assembler: ft32-elf-as

The FT9xx assembler functions in the same way as the standard GNU assembler (GAS). The assembly files should be written using the GAS general syntax.

Example: To compile an assembly file into an object file:

ft32-elf-as -o file.o file.s

1.3 Linker: ft32-elf-ld

Typically running behind ft32-elf-gcc, the FT9xx linker performs two tasks. It first links all object files and libraries into a.out and then convert's a.out into an executable file for FT9xx. Similar to the FT9xx compiler and assembler, the FT9xx linker supports most standard GNU linker options.

Example:

- To link various object files / libraries into an .elf file:

  ft32-elf-gcc -nostartfiles file1.o file2.o -L <libfolder> -l lib1 -l lib2 -o file.elf
- To convert file.elf into a FT9xx binary file, which can be programmed into the chips:

  ft32-elf-ld --oformat binary -o file.bin file.elf

1.4 Debugger: ft32-elf-gdb

The Bridgetek programmer/debugger module is needed for the communication between ft32-elf-gdb and the chip. The communication follows the GDB remote protocol. In addition to the debugger module, two software components are needed:

- GDB Bridge: for converting GDB commands into the debugger module commands
- Bootloader: for receiving & executing the debugger module commands

More information on how to use the FT9xx debugger can be found in section 5.1.3 of this document.

1.5 A useful utility: ft32-elf-objdump

ft32-elf-obj dump displays various information about object files. Its usage is the same as standard GNU objdump.

Example: To disassemble file.elf into a text file

ft32-elf-objdump -d file.elf > disassembly.txt

2 Setting up the FT9xx Toolchain

2.1 Installing the toolchain

The toolchain can be installed by running the setup wizard "FT9xx Toolchain Setup_*version*.exe", which can be downloaded from the Bridgetek website. Please follow the steps in the wizard to complete the installation process. It is recommended to use the default settings for simplicity.

Note: all applications should be closed before the installation or a restart may be required.

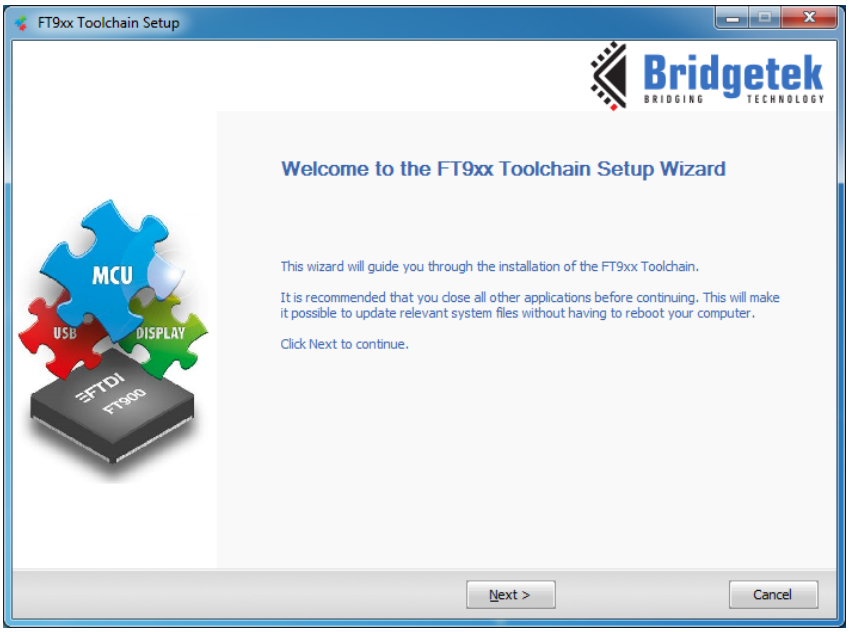


Figure 1 Toolchain Setup Wizard Dialog box

In the License Agreement dialog box, click **I Agree**.

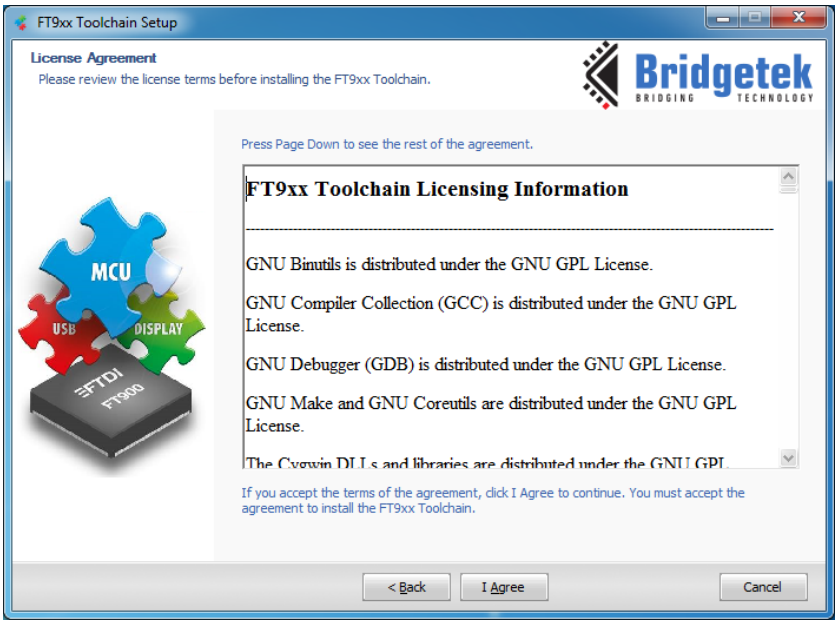


Figure 2 License Agreement Dialog box

Go through the Revision and Release information and click **Next**.

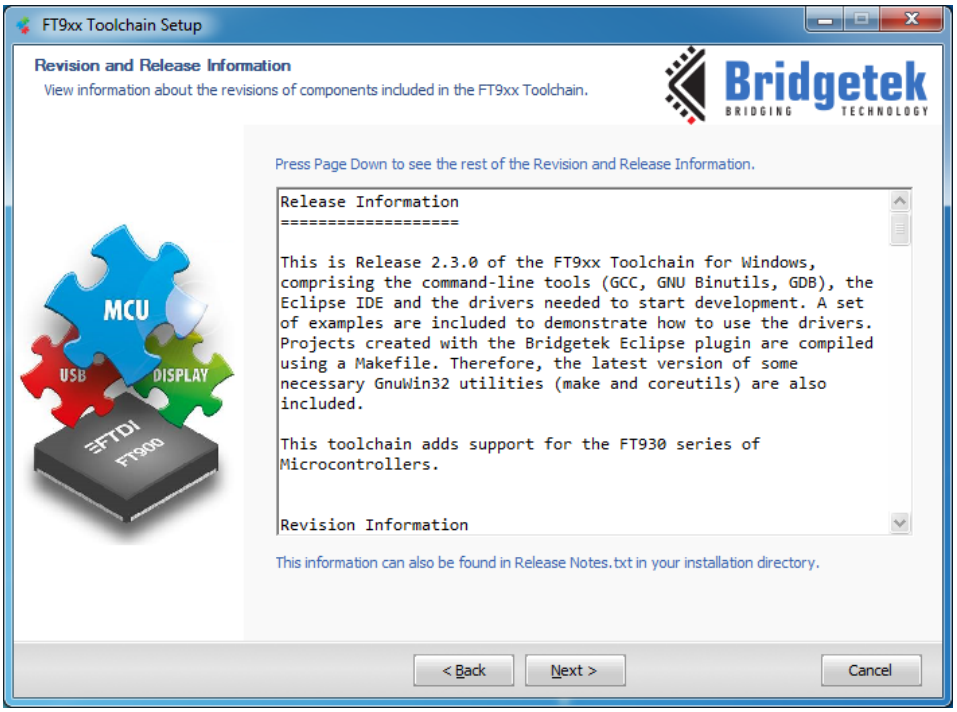


Figure 3 Revision and Release Information Dialog box

Select the Components and click **Next**.

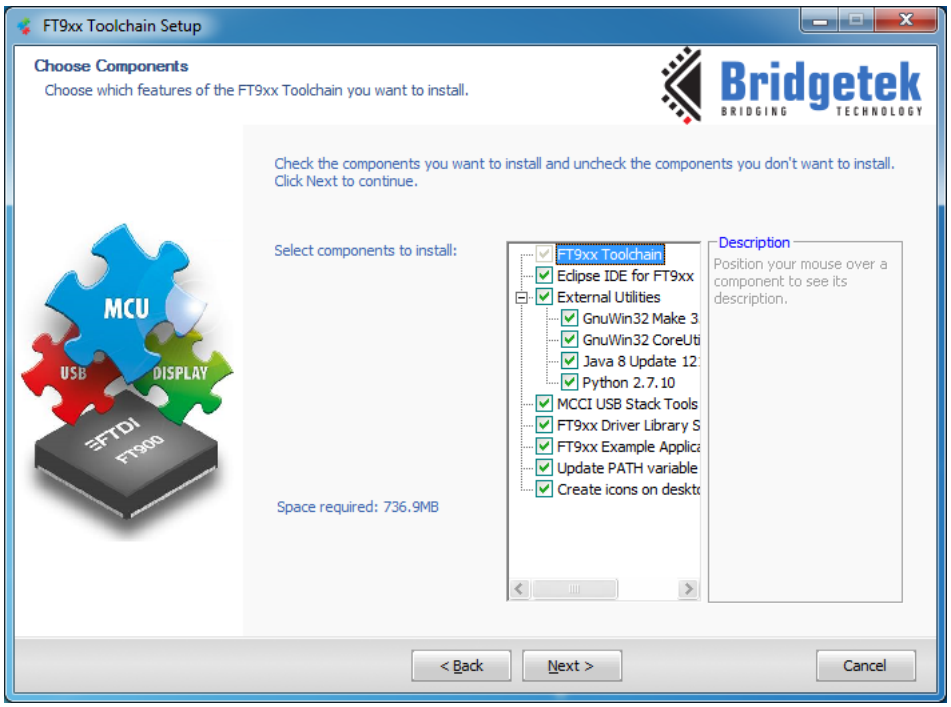


Figure 4 Components Dialog box

Click **Browse** and select a different file path for the FT9xx Toolchain installation. Alternately, continue installing in the specified folder by clicking **Next**.

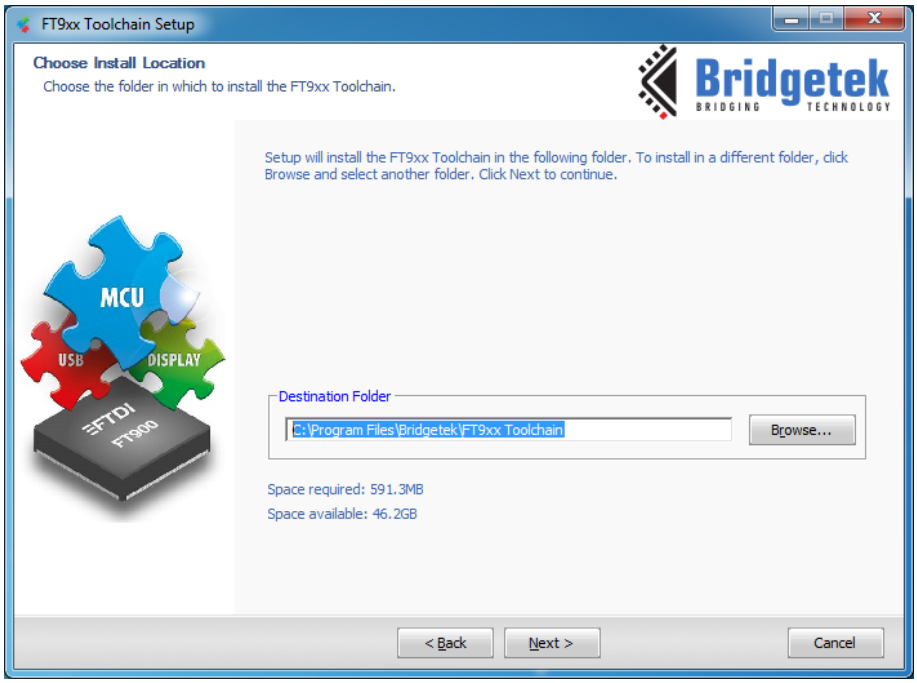


Figure 5 FT9xx Toolchain Install Location Dialog box

Click **Browse** and select a different file path for installing FT9xx examples and documents. Alternately, continue installing in the specified folder, by clicking **Install**.

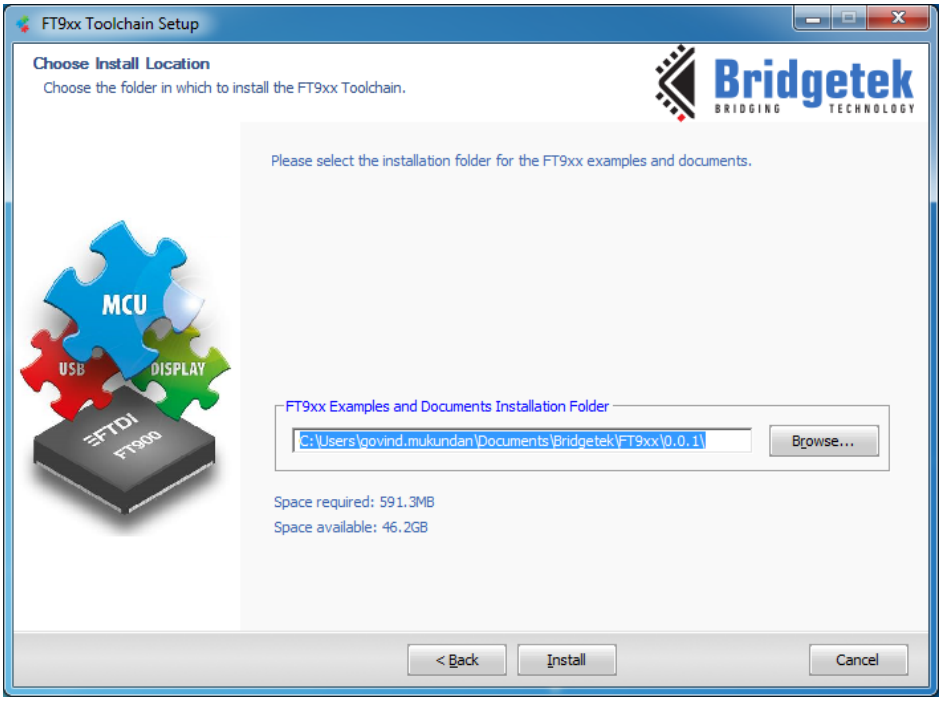


Figure 6 FT9xx Toolchain-Examples & Documents Install Location Dialog box

The FT9xx Toolchain installation progress bar is displayed.

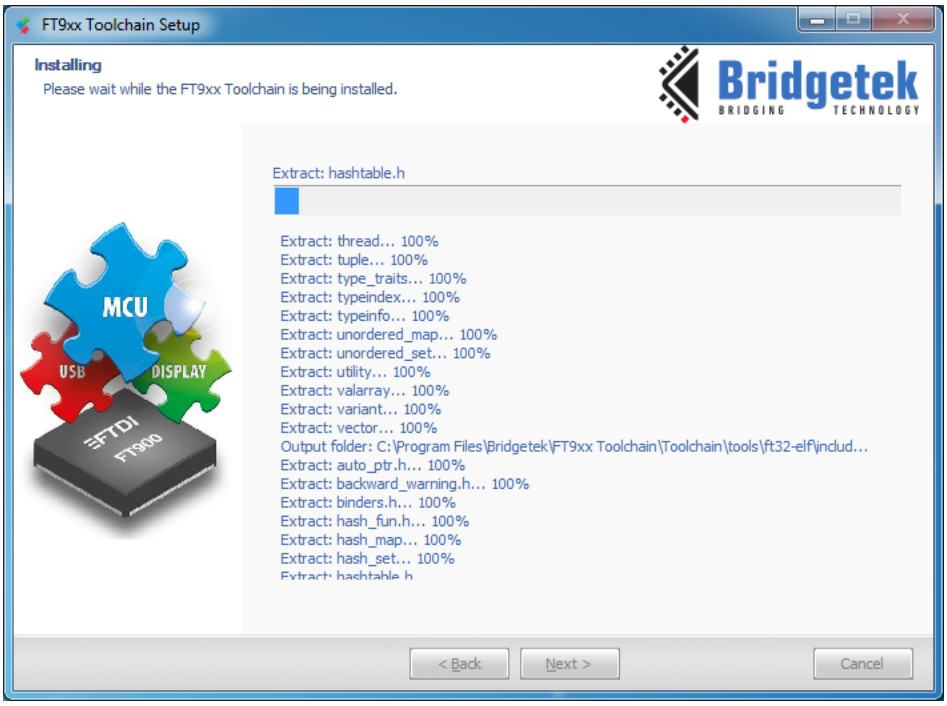


Figure 7 FT9xx Toolchain - Installation Progress Window

If Java is selected for installation, the following message is displayed. Please close any open Java Applications and click OK

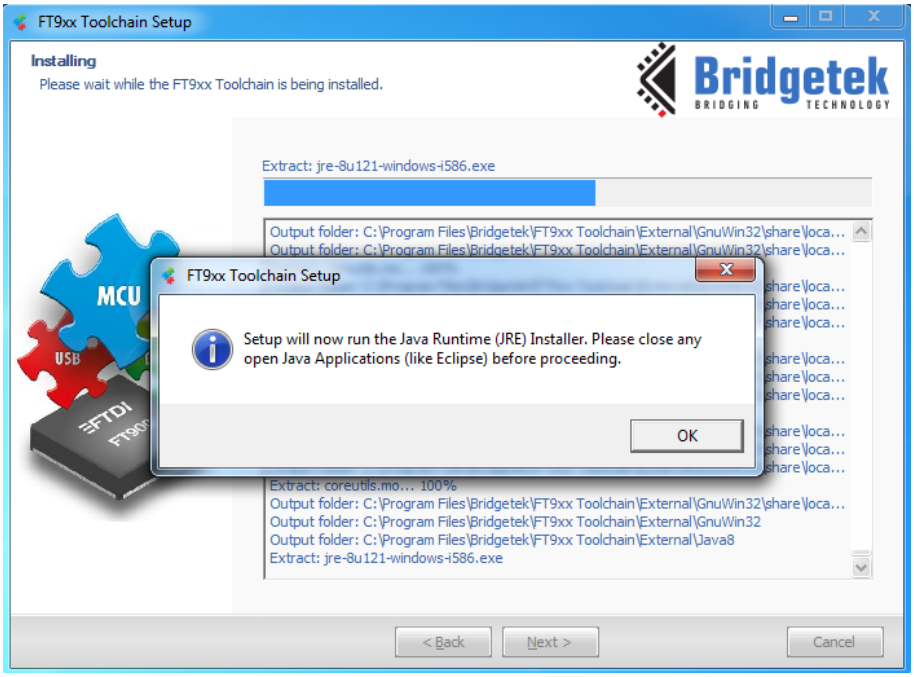


Figure 8: Close any running Java Applications before launching JRE Installer

Setup will then launch the JRE installer and the following window will be displayed

Figure 9 Java Setup Window

Click **Install** and follow the instructions to install Java on the machine.

Figure 10 Java Setup Progress Window

During installation, if a **Python 2.7.10 Setup** dialog box is displayed, select the appropriate option as required and click **Next**.

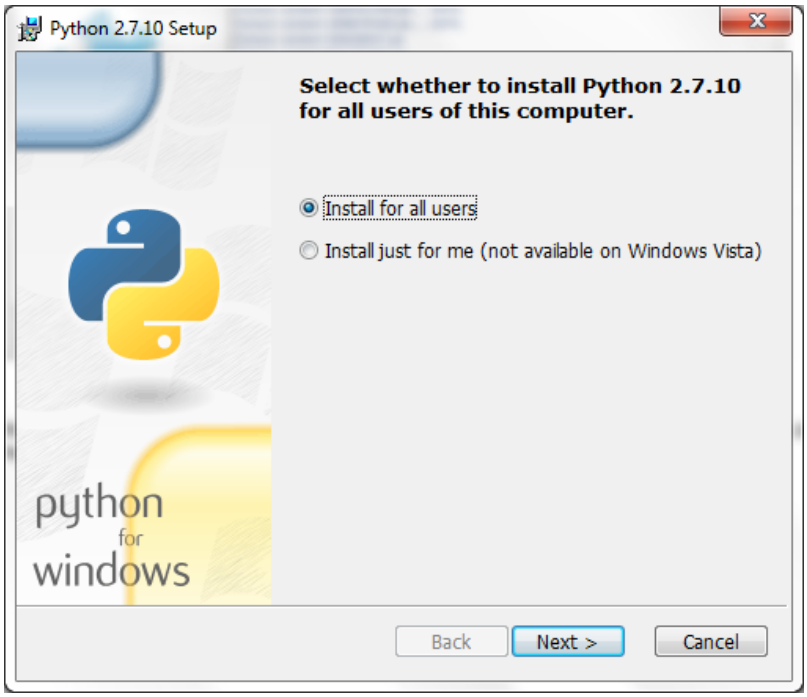


Figure 11 Python Setup Dialog box

Select a different Destination Directory to setup Python. Alternately, continue installing in the specified folder by clicking **Next**.

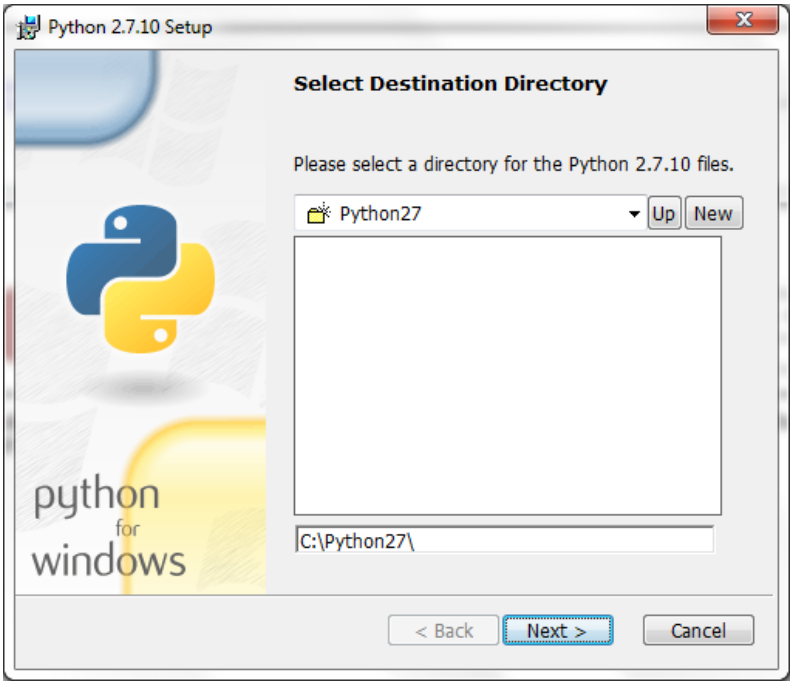


Figure 12 Destination Directory Selection Dialog box for Python Setup

Select the Python features to be installed or continue with the default features and click **Next**.

Figure 13 Python Features Customization Dialog box

Python installation progress bar is displayed.

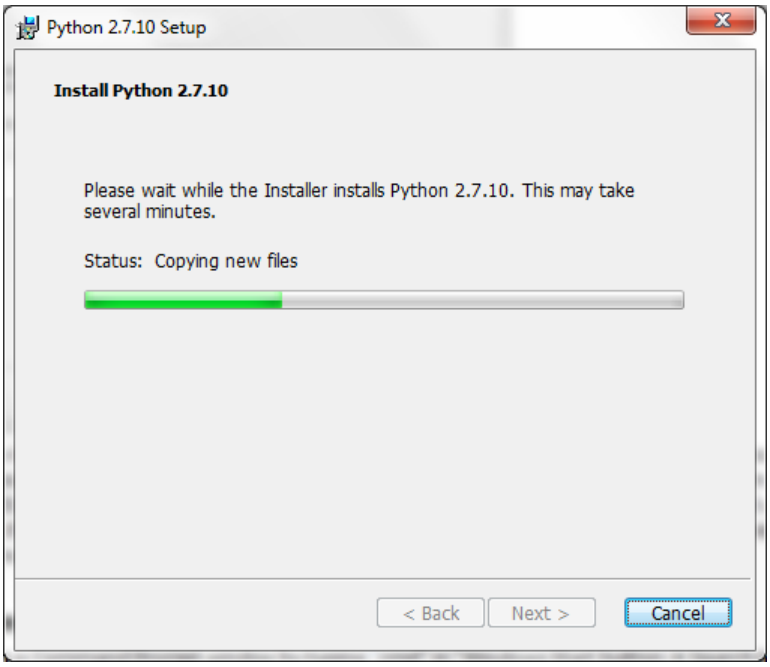


Figure 14 Python Installation Progress Dialog box

Click **Finish** to complete the Python installation.

Figure 15 Python Installation Completion Dialog box

The FT9xx Toolchain installation is continued.

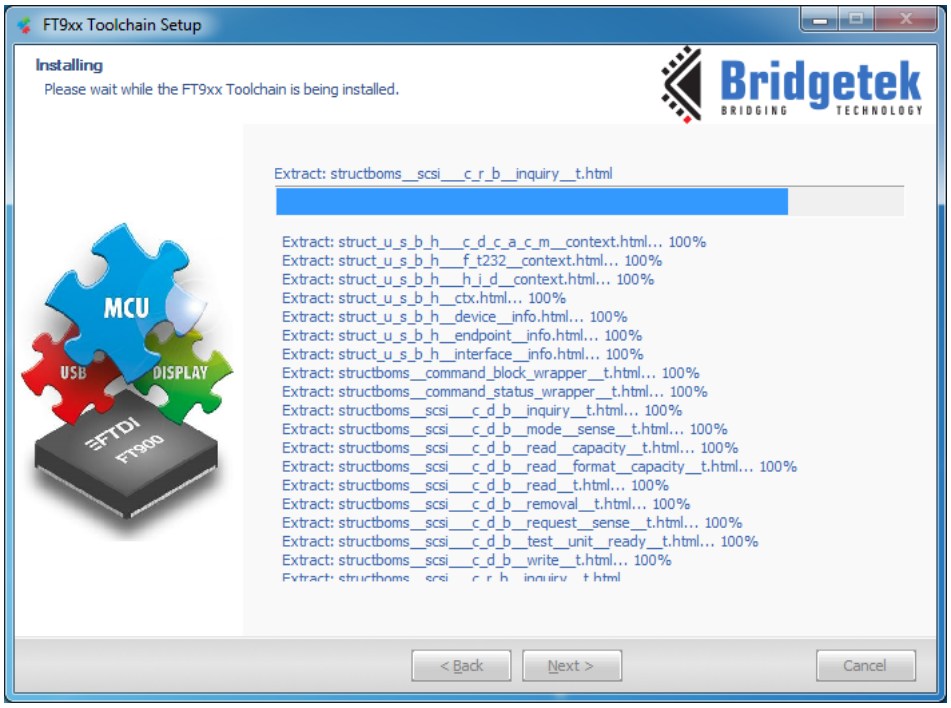


Figure 16 FT9xx Toolchain - Installation Progress Window

Select the **Open AN_325** checkbox to start immediately after closing the Setup Wizard. Else leave it unchecked. Click **Finish** to complete the FT9xx Toolchain Setup.

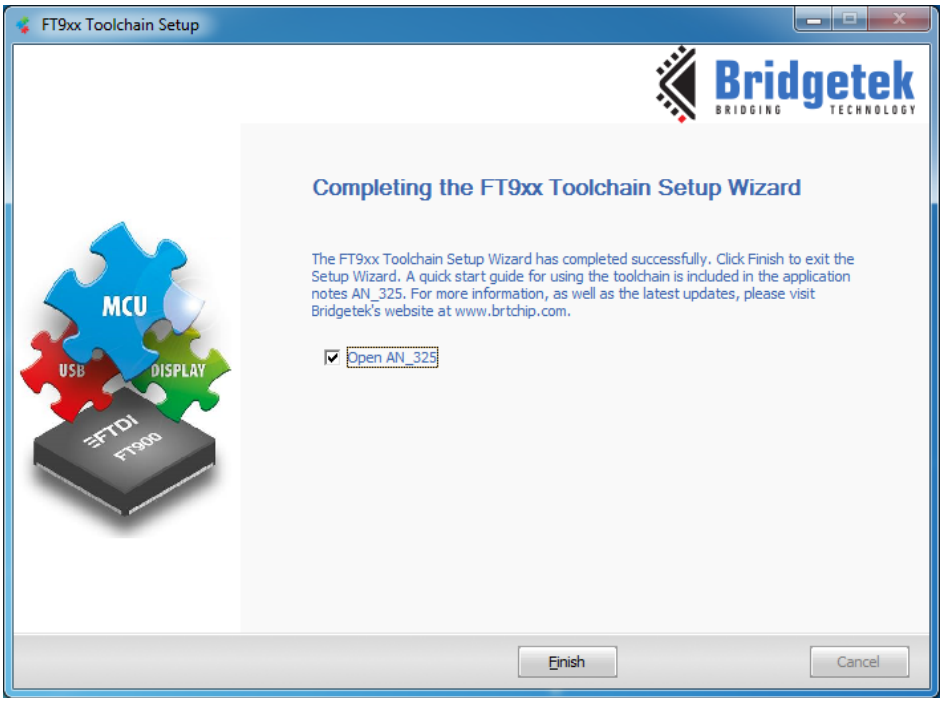


Figure 17 FT9xx Toolchain Setup Completion Dialog box

After the installation, the toolchain can be found in the installation directory. The default location is "C:\Program Files\Bridgetek\FT9XX Toolchain" for 32-bit Windows and "C:\Program Files (x86)\Bridgetek\FT9XX Toolchain" for 64-bit Windows. This directory also contains the external utilities needed. The FT9xx drivers, sample applications and documents (if selected for installation) can be found in "My Documents\Bridgetek\FT9xx".

2.1.1 Installing Java Runtime Environment Manually

The toolchain requires the Windows MSI Installer (msiexec.exe) while installing the Java Runtime Environment (JRE). The MSI installer can only process one installation at a time. Under some conditions, msiexec.exe may have already been started by another Windows process during automatic Windows Update for example. If the installer detects another instance of msiexec.exe running in the background, the user will be prompted to either wait for the background MSI Installer to complete and retry after 5 seconds or to skip the JRE installation entirely. This is shown in Figure 18.

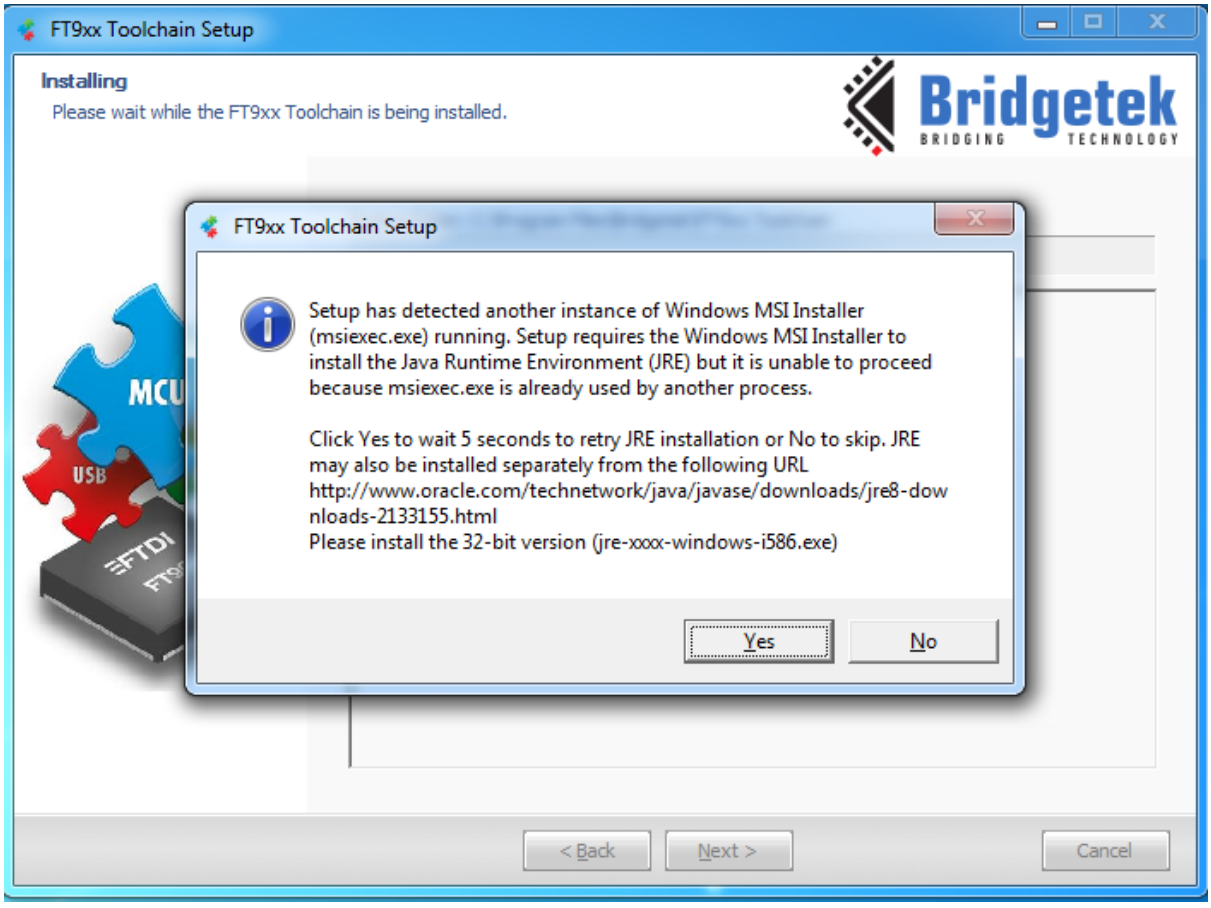


Figure 18: MSI Installer is busy

If the user skips JRE installation, JRE can be installed manually from the Oracle Website (http://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html) or by re-running the FT9xx Toolchain Installer later. Please ensure to install the 32-bit version of JRE (jre-xxx-windows-i586.exe) as the Eclipse installed as part of the FT9xx Toolchain install is 32-bit.

2.2 Verifying the installation

1. Open a Command Prompt window by typing "cmd" in "Windows Start button → Search box".
2. Type "ft32-elf-gcc --version" in the command prompt. It should give the following message:

```
ft32-elf-gcc (GCC) 7.0.0 20161219 (experimental)
Copyright (C) 2016 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

If this message appears, then the toolchain has been successfully setup.

3 Quick Start Guide: From creating to getting your application to run on the FT9xx MCUs

This chapter guides you through the steps to create a new application, compile and program it into the chip. To debug your application, please refer to chapter 4 - "Setting up Eclipse for Debugging". For more information about the tools, as well as the advanced features, refer to chapter 5 - "Advanced Topics".

3.1 Creating a new project

Double click on the icon "Eclipse for FT9xx" to launch the Eclipse IDE.

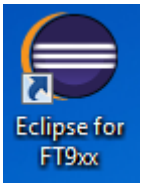


Figure 19 Eclipse for FT9xx Icon

When you run Eclipse for the first time, it will ask you for the location of the workspace. Eclipse will create some files within this directory to manage the projects. Specify a folder of your choice and click OK.

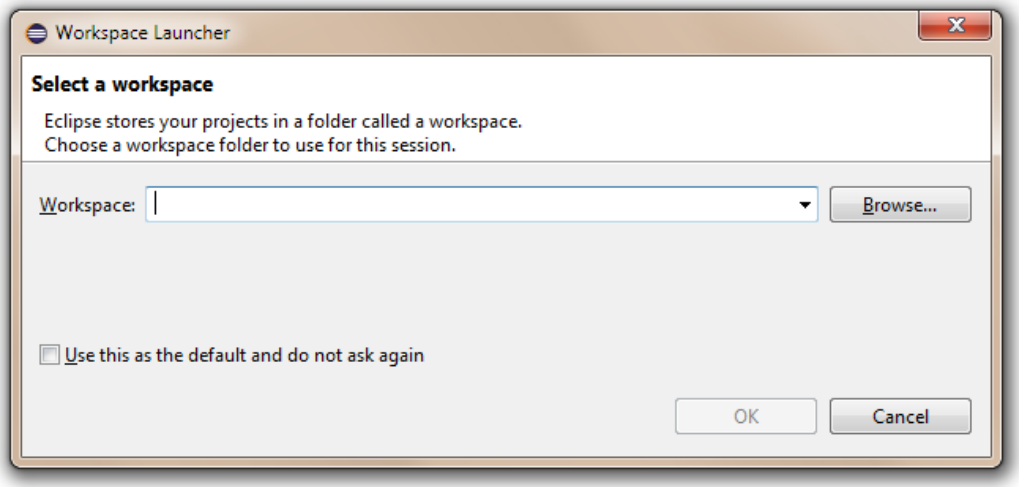


Figure 20 Eclipse Workspace Selection

Note: The following message will be displayed if an existing workspace, which was created by an older version of Eclipse, is specified. As there may be some configurational changes in files related to workspace in the newer version of Eclipse which may cause issues, it is recommended to create a new workspace and imported the existing projects there.

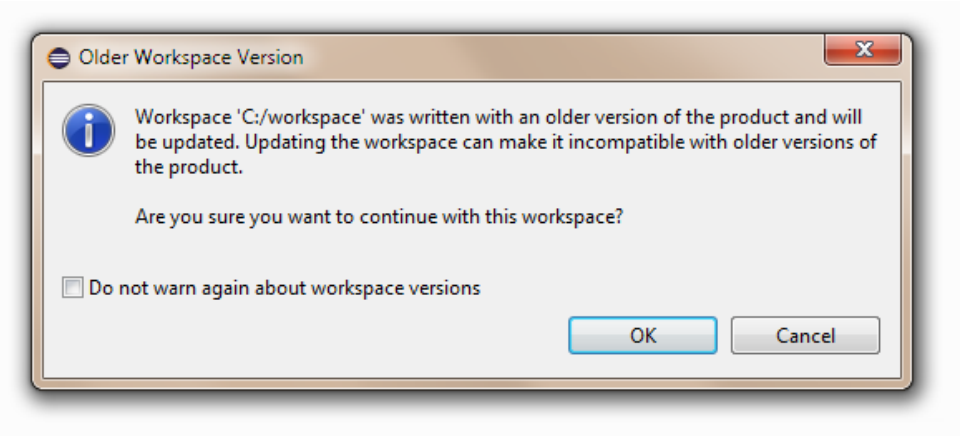


Figure 21 Eclipse Workspace Update

To create a new C project in Eclipse, on the menu bar click "File → New → C Project". The C Project wizard will open.

Give a name to the project, for example "Hello World". By default, the new project will be created inside the workspace you have chosen. If you want to change it, uncheck the box "Use default location" and specify another location. Choose **"Empty Project"** for the project type and **"Bridgetek FT9xx GCC"** for the toolchain. This ensures all the relevant FT9xx include files are part of the project. Click Next.

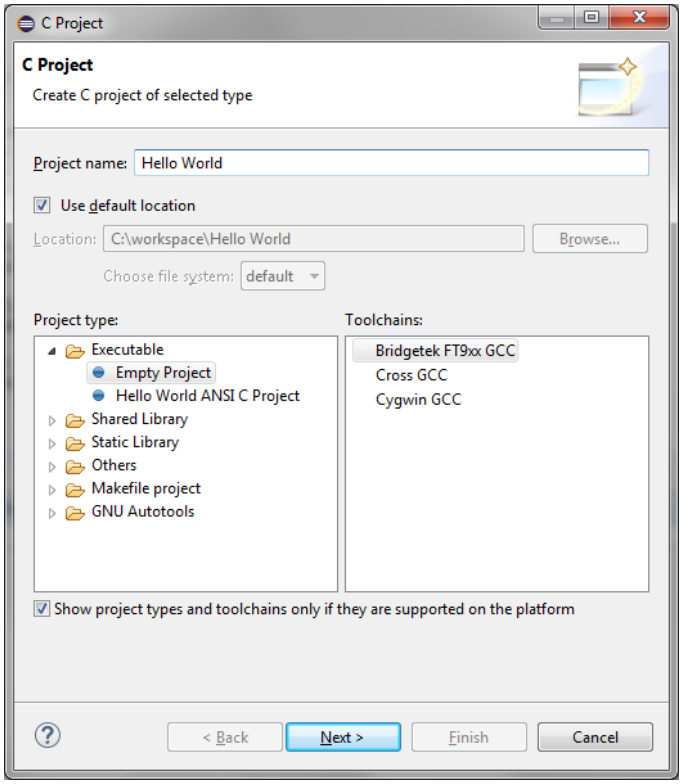


Figure 22 C Project Wizard

In the next window, select FT900 _* configurations if your project is to target FT900 series of MCU or FT930_* to target FT930 series, or both if you wish to target both series and click **Next**.

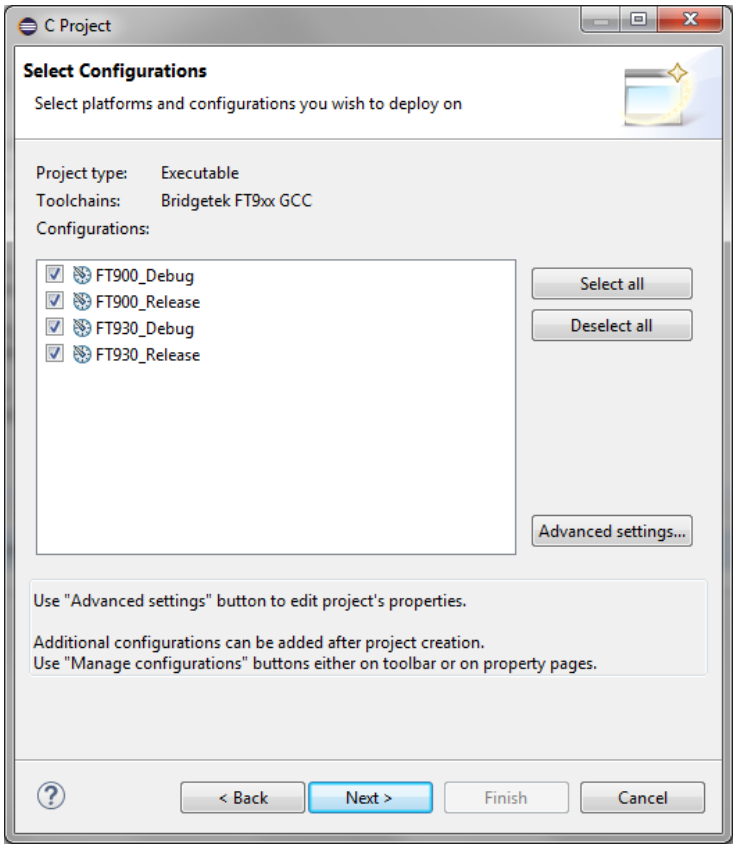


Figure 23 Project Wizard - Build Configurations Selection

The last window is for the toolchain prefix and location. By default, the values will be prefilled as follows.

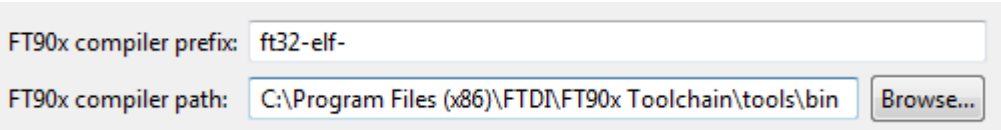


Figure 24 C Project Wizard - Toolchain Details

Click Finish to complete the New Project Wizard. A new FT9xx project will be created in Eclipse.

3.2 Building the project

After the wizard completes, some folders and an empty source file (main.c) will be created.

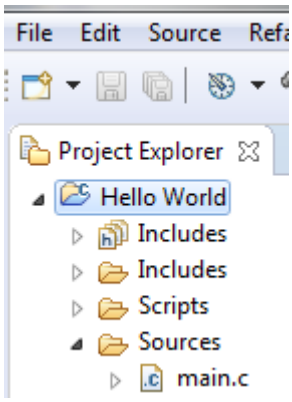


Figure 25 New empty project structure

The main.c contains some default content:

```
#include <stdint.h>
#include <ft900.h>

#if defined(__FT900__)
#define GPIO_UART0_TX     48
#define GPIO_UART0_RX     49
#elif defined(__FT930__)
#define GPIO_UART0_TX     23
#define GPIO_UART0_RX     22
#endif

void main(void){
    /* Enable the UART Device... */
    sys_enable(sys_device_uart0);
    /* Set UART0 GPIO functions to UART0_TXD and UART0_RXD... */
    gpio_function(GPIO_UART0_TX, pad_uart0_txd); /* UART0 TXD */
    gpio_function(GPIO_UART0_RX, pad_uart0_rxd); /* UART0 RXD */
    uart_open(UART0,                    /* Device */
              1,                        /* Prescaler = 1 */
              UART_DIVIDER_19200_BAUD,  /* Divider = 1302 */
              uart_data_bits_8,         /* No. Data Bits */
              uart_parity_none,         /* Parity */
              uart_stop_bits_1);        /* No. Stop Bits */

    /* Print out a welcome message... */
    uart_puts(UART0,
        "---------------------------------------------------------- \r\n"
        "Hello World! \r\n"
        "---------------------------------------------------------- \r\n"
        );
    /* Now keep looping */
    while (1);

}
```

Now select the Build Configuration for either FT90x or FT93x via the project menu:

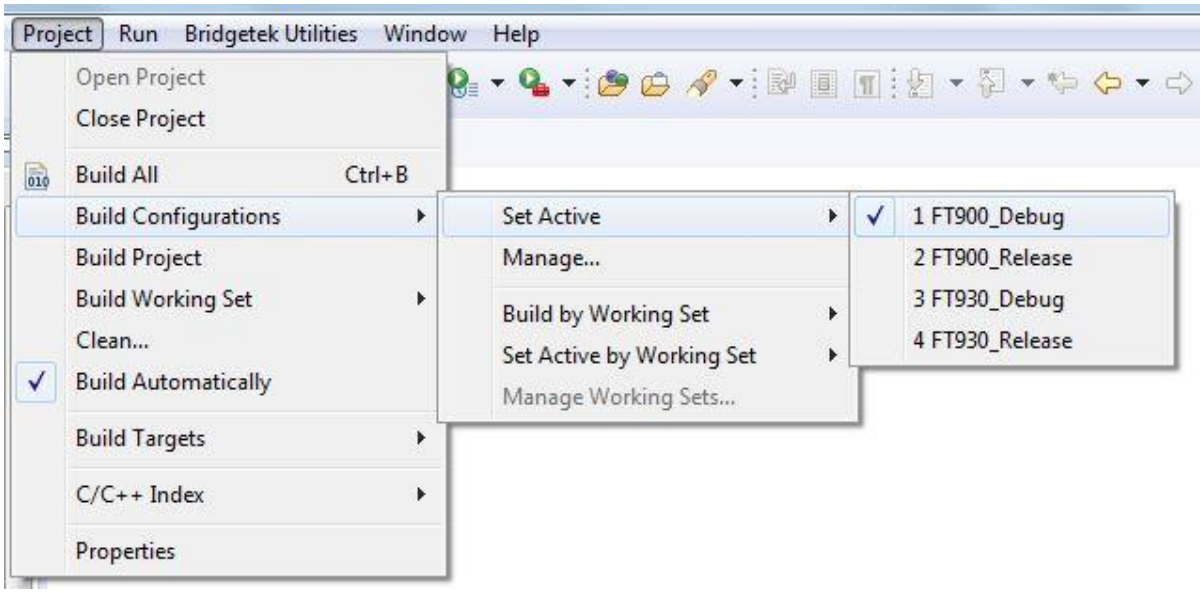


Figure 26 Build Configuration

This can also be done via the Manage Configurations toolbar icon:

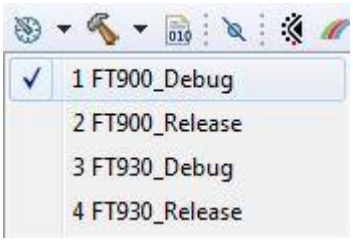


Figure 27 Build Configuration

Now the project can be built by clicking on the menu **Project → Build Project**, but note that there are a few options like right-click on the project → Build Project and the  icon.

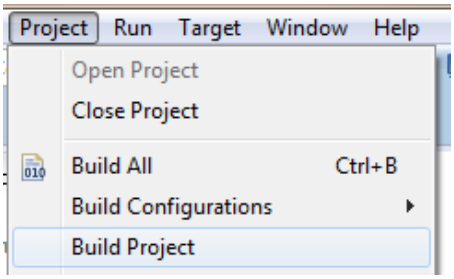


Figure 28 Building the Project

The console window at the bottom of the IDE shows the build status. If the build completes successfully, two files will be created - "Hello World.elf" and "Hello World.bin". The file to be programmed into the chip is "Hello World.bin". The .elf file is used for the debugger, as detailed in the next chapter.

```
Problems  Tasks  Console  Properties
CDT Build Console [Hello World]
15:52:13 **** Incremental Build of configuration FT930_Release for project Hello World ****
make all
'Building file: ../Sources/main.c'
'Invoking: FT9xx GCC Compiler'
ft32-elf-gcc -D__FT930__ -I"C:/Program Files/Bridgetek/FT9xx Toolchain/Toolchain/hardware/include" -Os -Wall -c -fmessage-leng
'Finished building: ../Sources/main.c'
' '
'Building target: Hello World.elf'
'Invoking: FT9xx GCC Linker'
ft32-elf-gcc -L"C:/Program Files/Bridgetek/FT9xx Toolchain/Toolchain/hardware/lib/Release" -Wl,--gc-sections -Wl,--entry=_star
'Finished building target: Hello World.elf'
' '
'Invoking: FT9xx Flash File Generator'
ft32-elf-objcopy --output-target binary "Hello World.elf"  "Hello World.bin"
'Finished building: Hello World.bin'
' '
```

Figure 29 Build Status

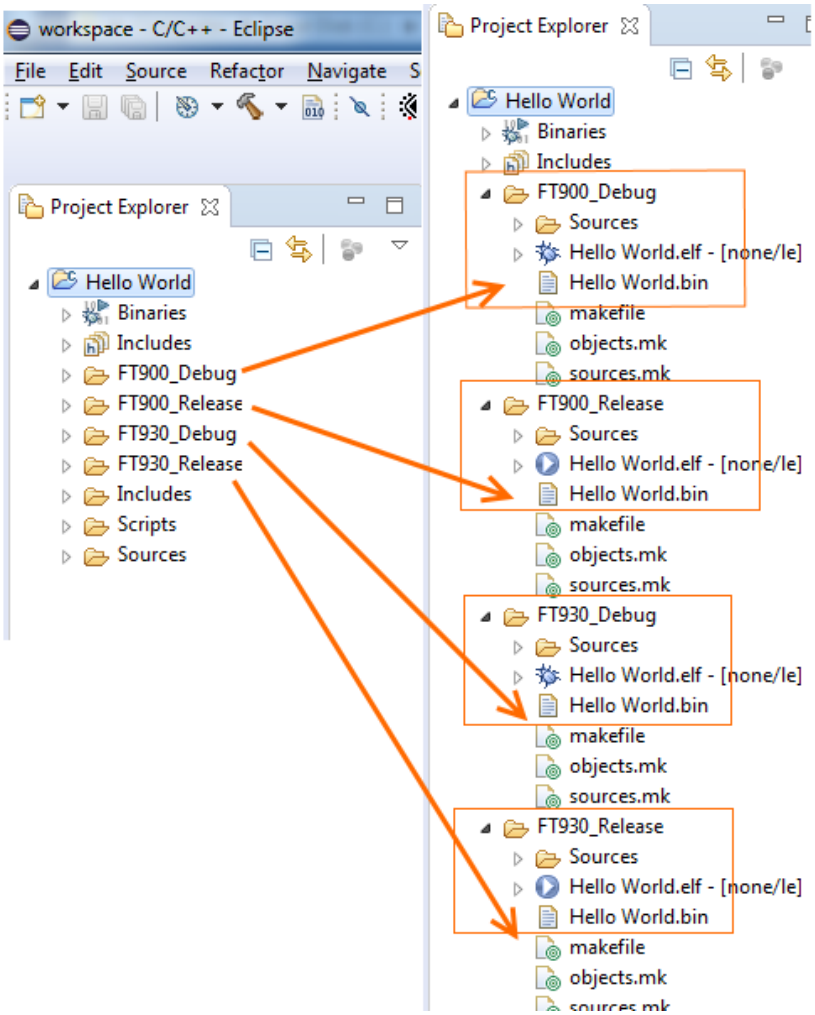


Figure 30 List of Files after building (if all 4 configurations were selected)

For syntax highlighting to work correctly as configurations are switched, the C/C++ Indexer must be configured to "work with the active build configuration". Refer to section 6.3.3 for more details on how to do this.

3.3 Programming the binary file into the chip

The FT9xx Programmer is provided together with the toolchain. There are a couple of options available.

3.3.1 GUI Version

To run it, double click on the icon "FT9xx Programming Utility" created on your desktop, if selected during install, otherwise it can be found in:

C:\Program Files (x86)\Bridgetek\FT9xx Toolchain\Toolchain\programmer\dist

Figure 31 FT900 Programming Utility Icon

You can also open the programming utility from Eclipse by selecting it in the Bridgetek Utilities menu or the toolbar icon as highlighted in Figure 32:

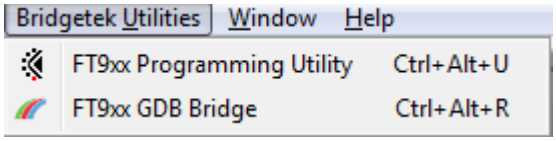


Figure 32 Bridgetek Utilities Menu

After the splash message the following screen will appear.

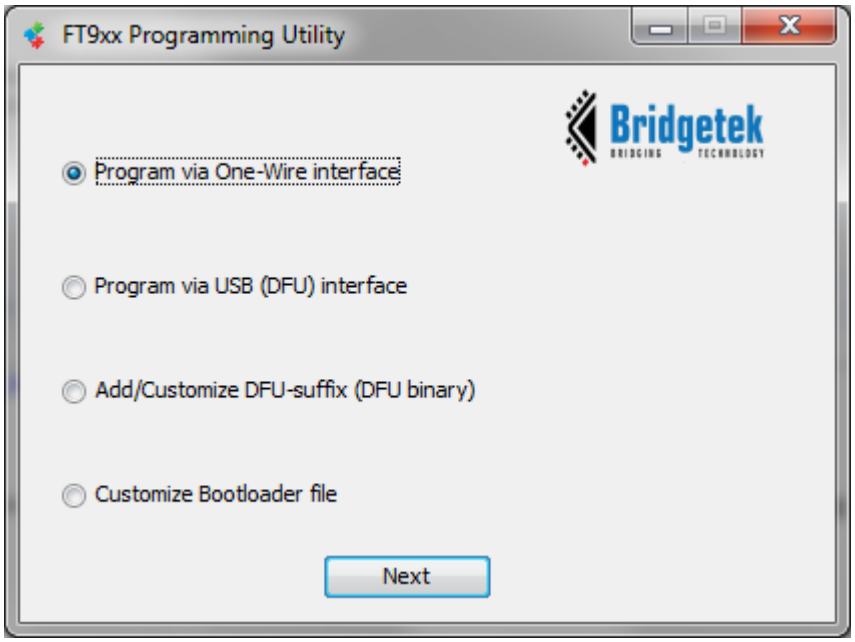


Figure 33: FT9xx Programmer - Work with One-Wire

Select the "Work with One-Wire" option and click Next. The next screen shows a list of supported devices that you might wish to program.

When a valid FT900 and Programmer module are detected, the information will be displayed in the list. Select the device you wish to program and click Next to launch the programmer window.

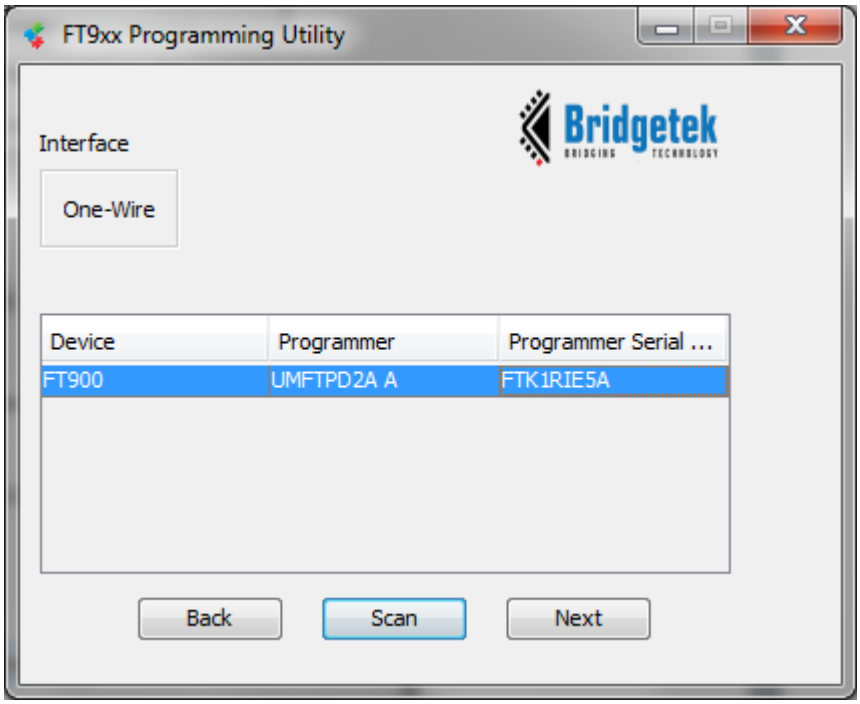


Figure 34: FT9xx Programmer - Device Selection

In the programmer window, leave everything as default. Specify the location of the binary file and click Start. If the Verify check box is selected, an icon will show up next to the status bar to indicate whether the flash memory has been properly programmer.

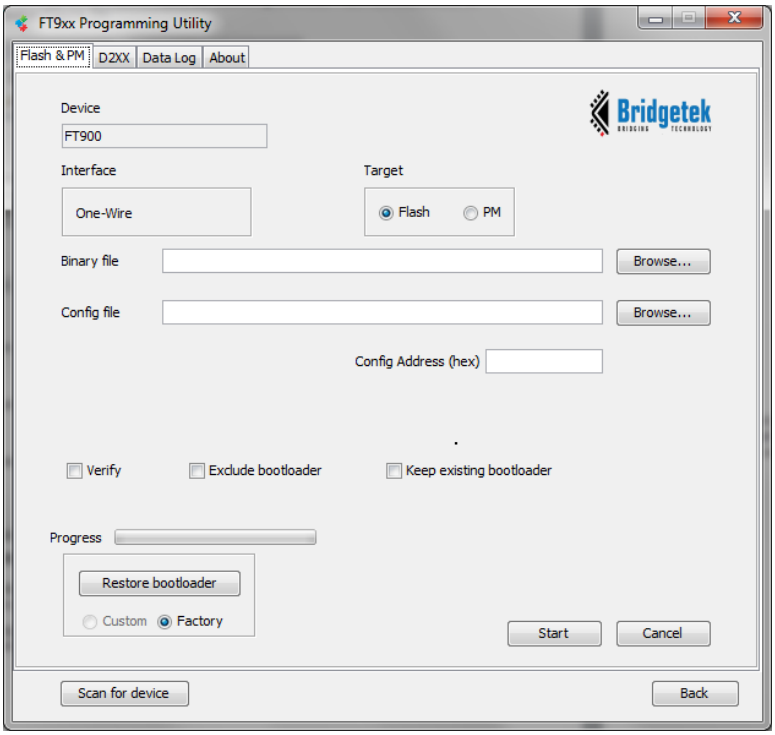


Figure 35 FT9xx Programmer – Flash and PM Screen

More information on the utility can be found in the 'About' tab, then click on Help.

3.3.2 Command Line Version

FT900Prog.exe is available to run at a command prompt. Enter FT900Prog.exe to see the options available. See section 5.1.2 for more details.

This can also be run within Eclipse as an External Tool. See Figure 36 for settings found in Run → External Tools → External Tools Configurations. The argument string is:

```
-f "${project_loc}\${config_name:${project_name}}\${project_name}.bin" -O -v
```

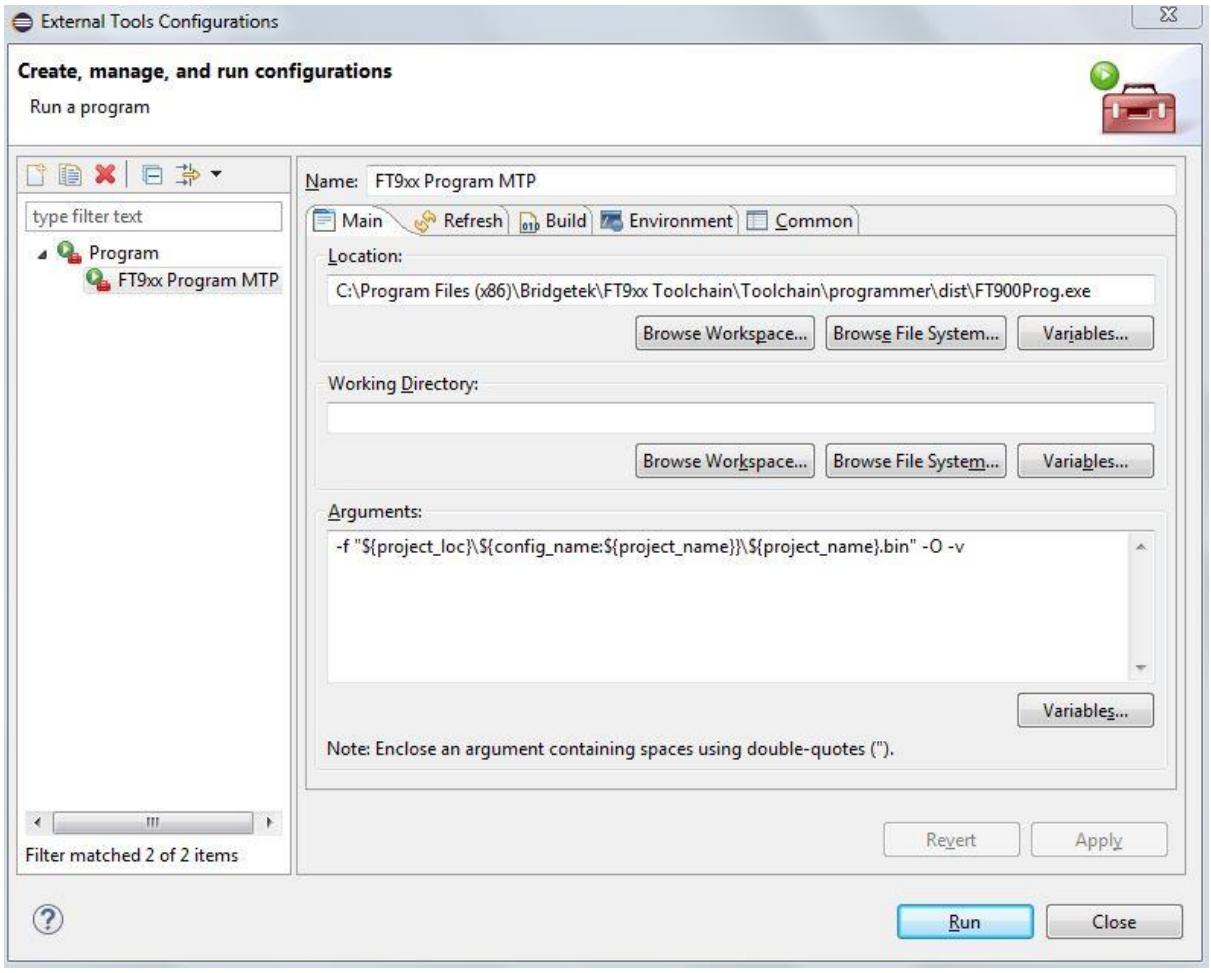


Figure 36 FT9xx Programmer in Eclipse

3.4 "Hello World" in action, and more…

The "Hello World" example above will send a message to a serial terminal via the FT9xx UART0 port. Open a terminal on your computer, for example Tera Term or HyperTerminal. Apply the following settings:

- Baud Rate: 19200
- Parity Bit: None
- Data Bit: 8
- Stop Bit: 1
- Flow Control: None

Now when you reset the MCU, the message will be printed to the terminal.

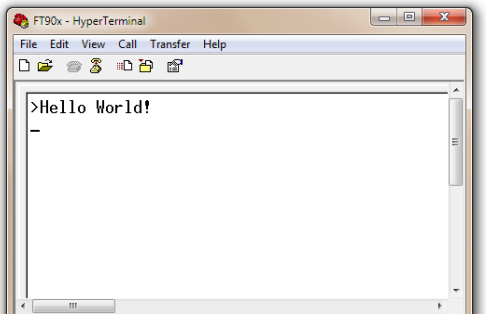


Figure 37 Hello World

Congratulations! You have just completed your first project for FT9xx. The FT9xx toolchain comes with plenty of examples, which demonstrate a variety of features. If you have selected to install them in the Toolchain Installation Wizard, by default they can be found in:

"My Documents\Bridgetek\FT9xx*version*\Examples"

The Eclipse project has already been setup for these examples, as suggested by the presence of two files - ".cproject" and ".project". Instead of creating a new project, you can simply import these projects into the workspace. To do this:

1. On the Menu bar, choose "File → Import"
2. In the Import window, choose "General → Existing Projects into Workspace" and click "Next".
3. In the next window, set the root directory to "My Documents\Bridgetek\FT9xx*version*\Examples". The projects will be detected by Eclipse.
4. Select which projects you wish to import and click Finish to complete the importing process. This is an example of how Eclipse would look like with the sample applications. Refer to AN_360 for more details about these applications.

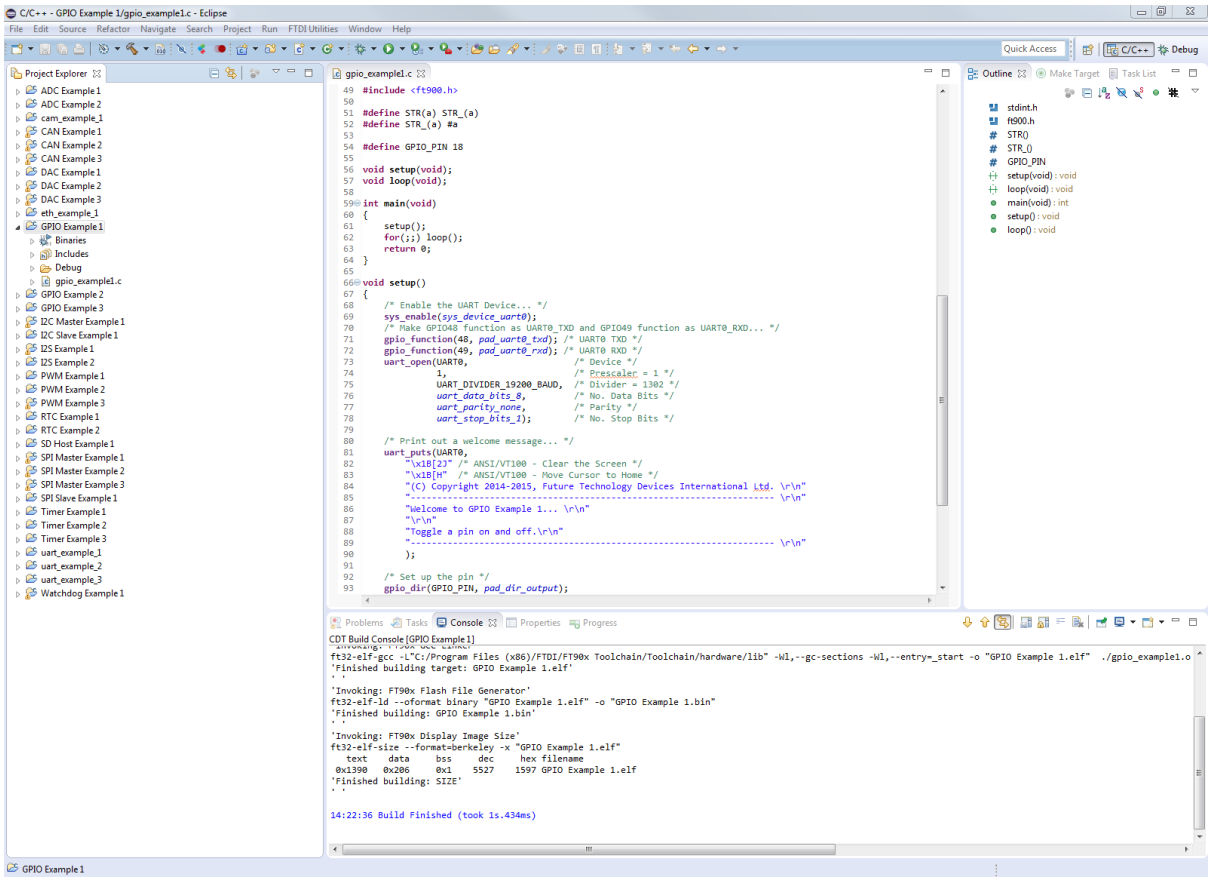


Figure 38 FT9xx Examples

4 Setting up Eclipse for Debugging

Eclipse comes with an intuitive GUI for debugging applications. To enable this feature, eclipse requires additional information about our debugger. The steps are presented below.

4.1 Build the application using the Debug configuration

The application should be built using the Debug configuration so that the debug information is available. It is the default build configuration but can be verified in the Project menu.

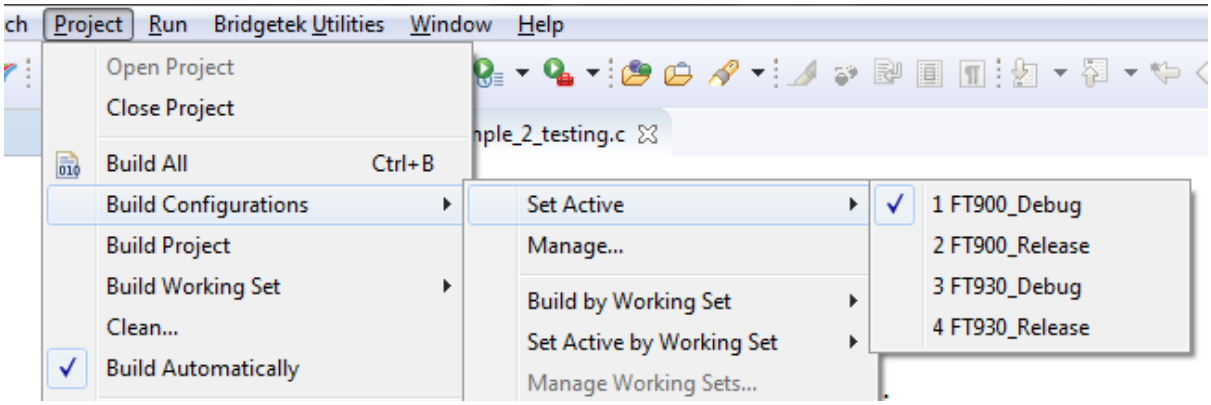


Figure 39 Build Configuration

Please note for FT93x: As of toolchain v2.3.0 it is recommended to disable the `-mcompress` option when using GDB as single stepping does not work properly with `-mcompress`. The option can be disabled in the project settings. See section 6.3.2.1 for more details.

4.2 Create a new debug configuration

A debug configuration is used by Eclipse to launch the debug GUI and only needs to be created once for the FT9xx Debugger. To create it:

1. On the Menu bar, select **Run → Debug Configurations...**
2. In the Debug Configurations window, double click on "C/C++ Remote Application"
3. Press the 'New' button to create a new debug configuration
4. In the next window, a Debugging Launcher will need to be specified. Click on "Select others…" at the bottom of the window.

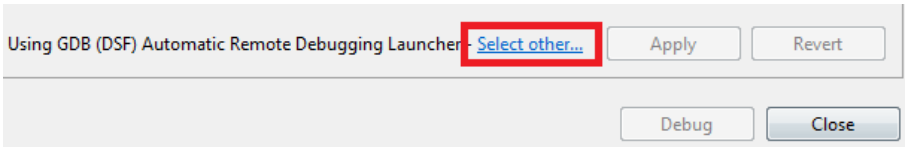


Figure 40 Choosing a Debugging Launcher (1)

5. In the "Select Preferred Launcher" window, check "Use configuration specific settings". Then choose "GDB (DSF) **Manual** Remote Debugging Launcher". Click OK.

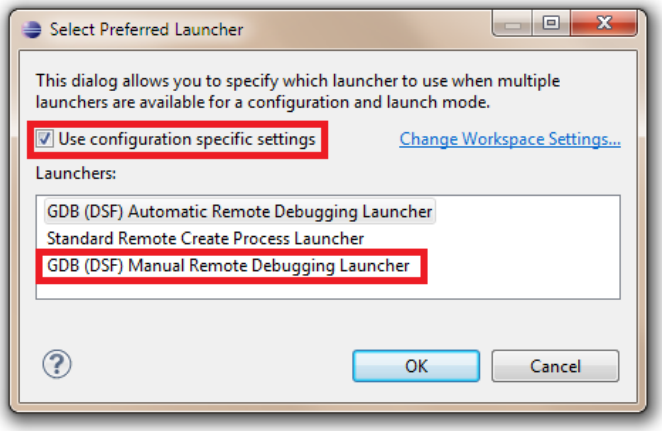


Figure 41 Choosing a Debugging Launcher (2)

6. Now provide the details for the configuration. Specify the **name** of the Debug configuration, for example "FT9xx Remote Debug". Use this configuration to debug FT9xx projects from now on.
7. Under Main tab, specify the **project** and the **.elf file** for **Application**. The "Browse…" button next to the project field will list all active projects. The .elf file can be found easily after the project has been selected, by clicking on **"Search Project..."** button.

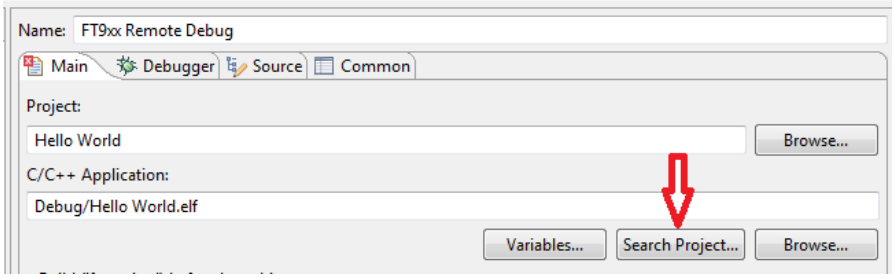


Figure 42 Eclipse Debugging Application Settings

8. Under the Debugger tab, the user needs to provide some Debugger Options. Specify the path to ft32-elf-gdb.exe (or simply "ft32-elf-gdb.exe") in the **Main sub-tab** and make sure the **"GDB command file"** field is **empty**. ft32-elf-gdb.exe can be located in the toolchain installation folder, under "tools\bin".

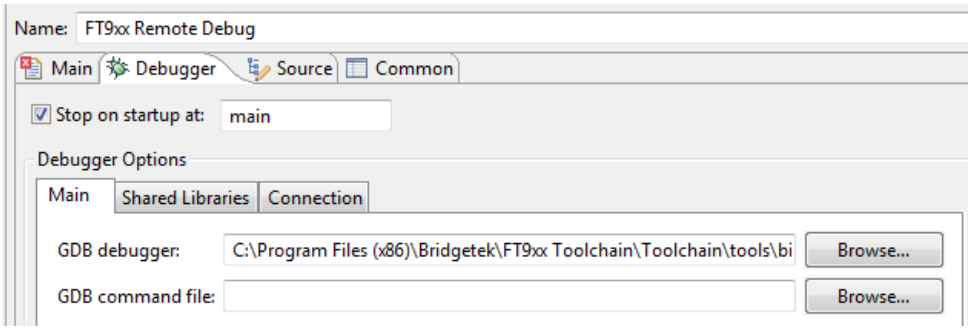


Figure 43 Eclipse GDB Settings

9. Under the Connection sub-tab, choose the connection type to be **TCP**. Enter **"localhost"** for the **host name** and **9998** for the **port number**.

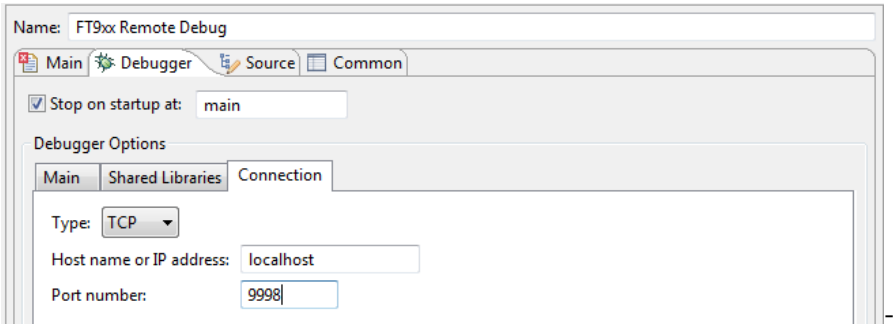


Figure 44 Eclipse TCP Port Settings

10. Click "Apply" and close the window.

A debug configuration for FT9xx has now been created. To use the same configuration for other projects, simply open it and select the right project and application, as presented in step 6 above.

4.3 Running the GDB Bridge

The GDB Bridge is needed for ft32-elf-gdb to talk to the MCU. To run it, simply double click on the desktop icon "GDB Bridge".

Figure 45 GDB Bridge Icon

You can also launch the GDB Bridge from Eclipse by selecting it in the Bridgetek Utilities menu or the toolbar icon as highlighted in **Figure 46** Bridgetek Utilities Menu

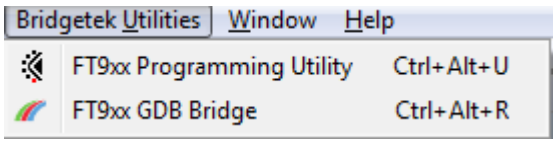


Figure 46 Bridgetek Utilities Menu

The following window should appear:

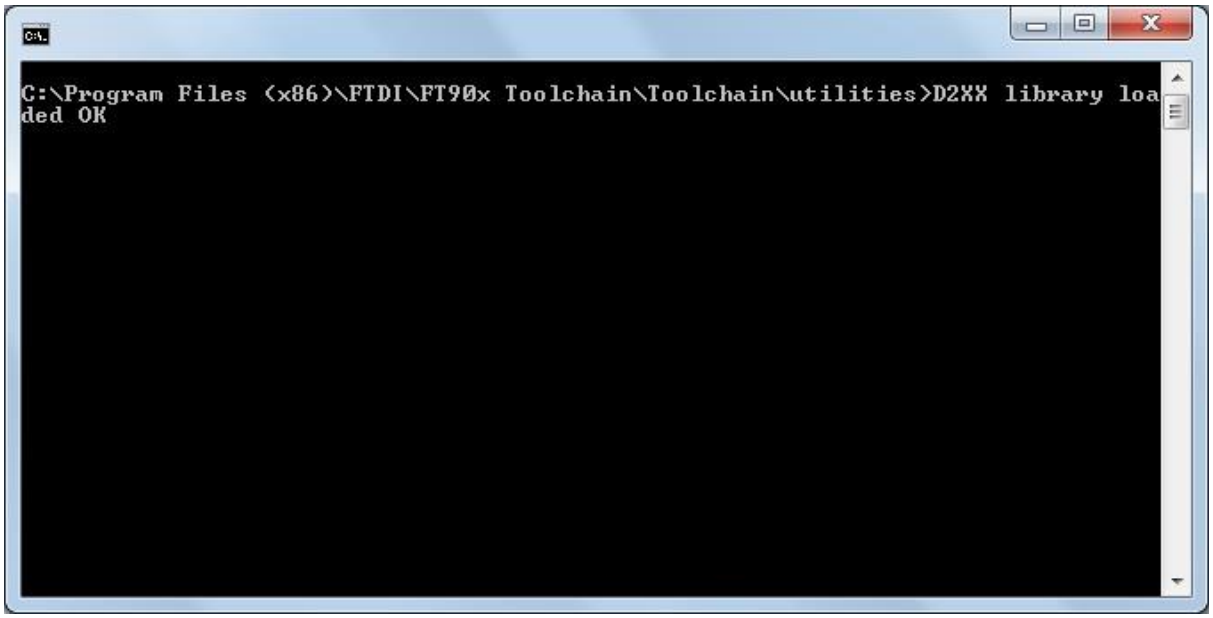


Figure 47 GDB Bridge in action

Now the tools are ready to debug the application in Eclipse.

Note: User must close this debug GDB script when debugging is finished, otherwise it may not be possible to program the device for example.

4.4 Debugging the application in Eclipse

1. Open the debug configuration that was created (FT9xx Remote Debug) and click Debug. Note that this will appear in the Debug button on the toolbar after running once.

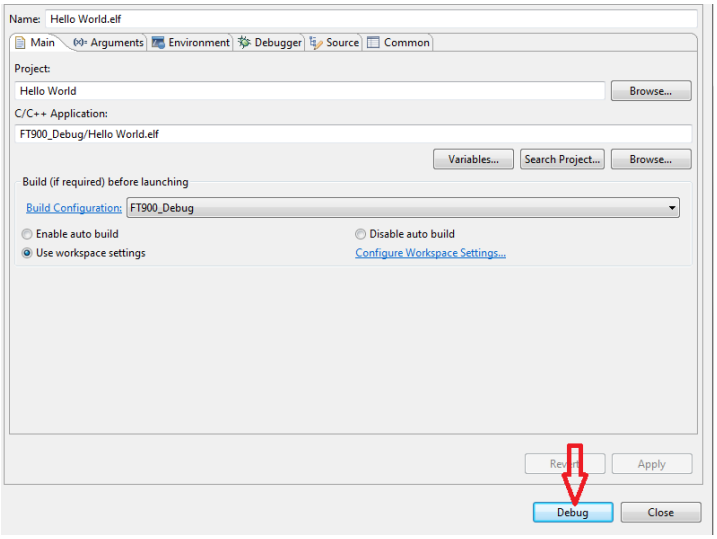


Figure 48 Eclipse Run Remote Debugging

2. The Debug perspective will be opened. The execution will stop at the first line in main(), as shown below. Various debug commands (step into/over, resume, halt, stop, etc.) can now be accessed from the toolbar via buttons. Function variables, setting breakpoints and viewing

physical memory in the memory tab, along with some other debug features are also available now.

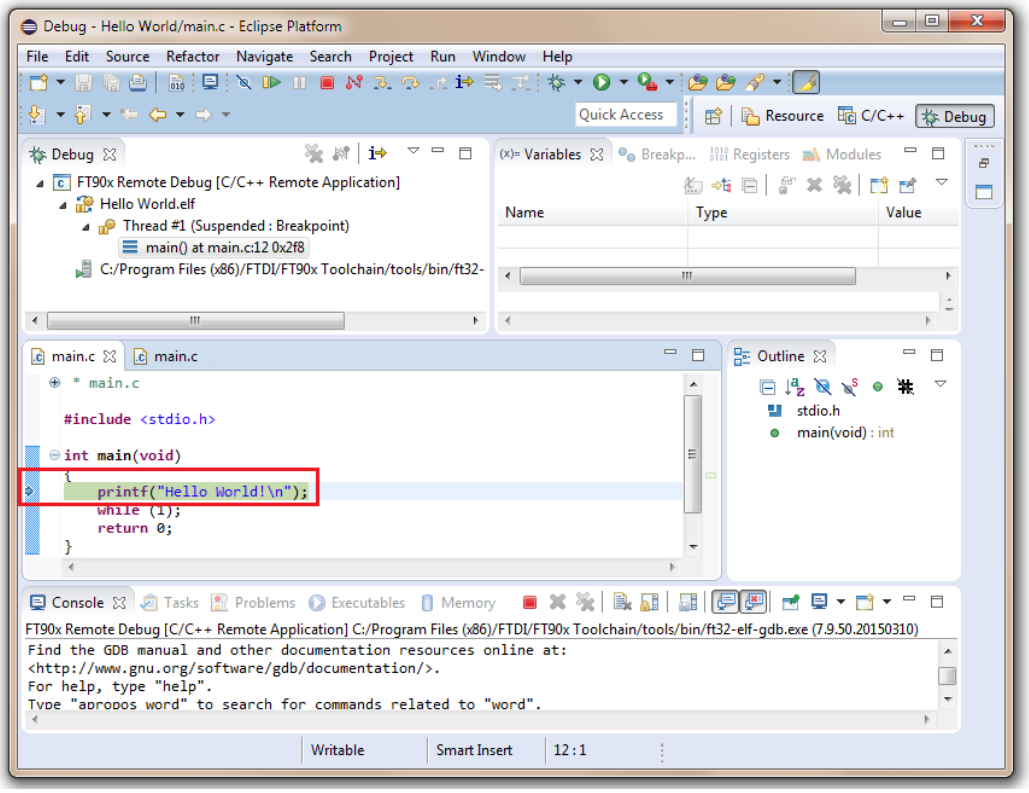


Figure 49 Eclipse Debug Environment

Note: If there is an error message about missing source file as below, locate the source file that contains the main() function using the "Locate file…" button.

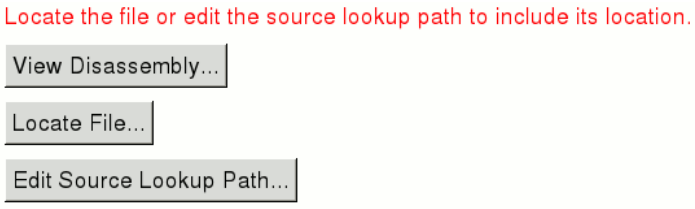


Figure 50 Eclipse Missing Source File

4.4.1 Watch variables in Eclipse Debug Perspective

If the watch variables fail to update or display incorrect values, check that the following flags exist for the debug build (they are present by default in all projects created with Bridgetek eclipse plugin)

-fvar-tracking -fvar tracking-assignments

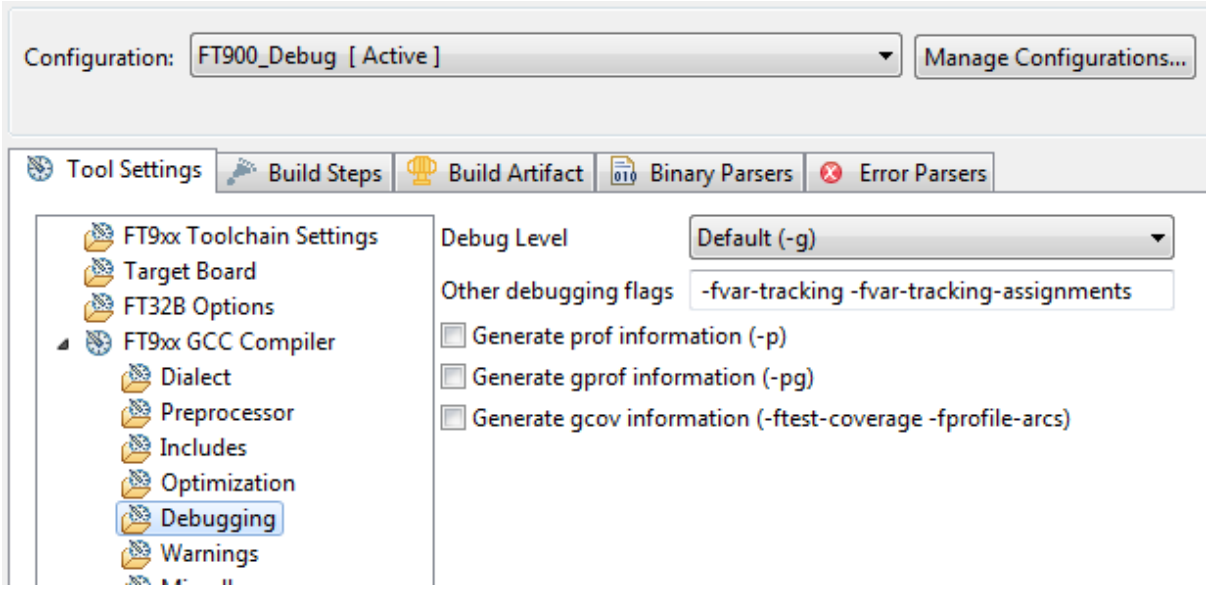


Figure 51 Debug flags

4.4.2 Og Compiler Option when debugging

When compiling a project with no optimization (or –O0) some useful debugging information may not be generated at all, leading to possible unexpected results while debugging. To avoid this, it is recommended to turn on –Og option when no other optimization flags are used. The Bridgetek eclipse plugin does this automatically.

Note that if multiple optimization options are used, only the last option will be effective.

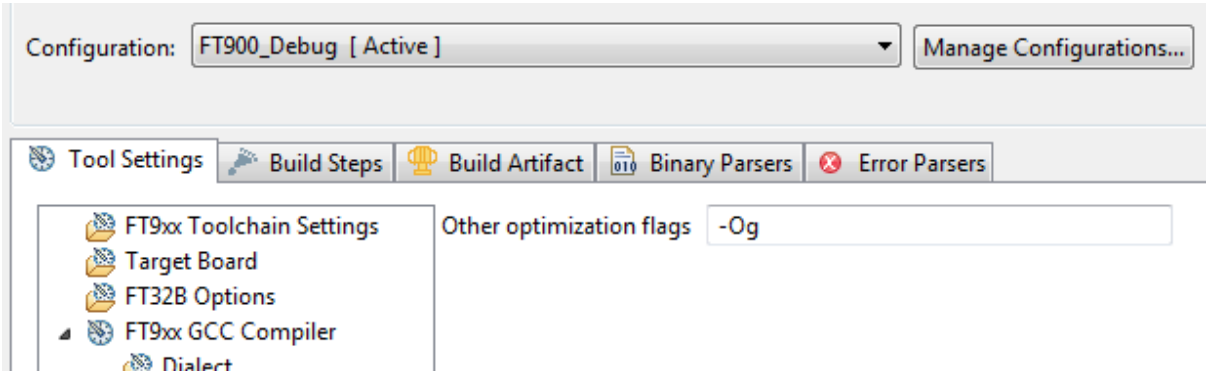


Figure 52 Og compiler optimization option

More information can be found in the GCC documentation - https://gcc.gnu.org/onlinedocs/gcc/Debugging-Options.html and https://gcc.gnu.org/onlinedocs/gcc/Optimize-Options.html

4.5 Eclipse features supported by ft32-elf-gdb

At the moment, not all features of the Eclipse debug perspective are supported by ft32-elf-gdb. The current list of supported features is:

- Breakpoint creation.
- Single stepping/stepping in/stepping out of functions
- Watch variables
- Assembly instruction stepping

5 Bridgetek Projects

Besides the empty project used as the example in Chapter 3, there are several project types specific to Bridgetek. They can be found under "Others" in the project type selection window. Currently, there are two project types:

- D2XX Project
- Data Log (DLOG) Project

For more details about these project types, refer to "AN_360 FT900 Example Applications", which is included in the toolchain installation.

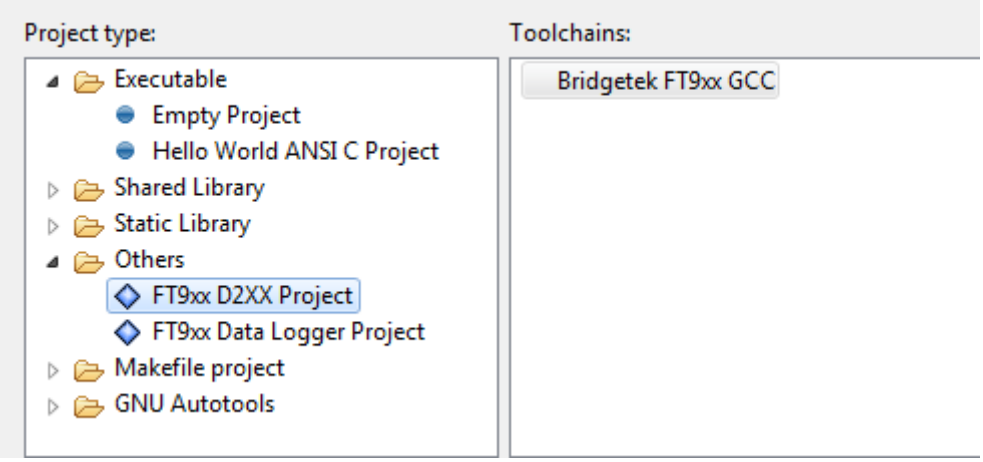
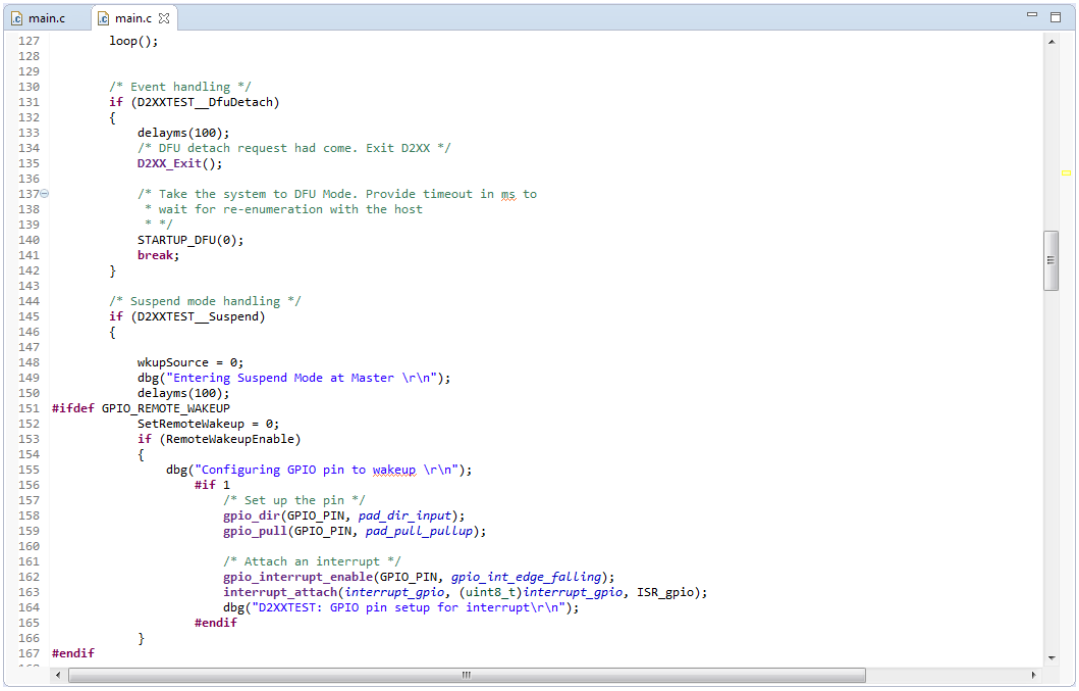


Figure 53 Bridgetek Project Types

The procedure to create a new project is similar to the empty project. When the wizard completes, a template source file will be generated. Below is the template generated for the D2XX project.



```
127         loop();
128
129
130         /* Event handling */
131         if (D2XXTEST__DfuDetach)
132         {
133             delayms(100);
134             /* DFU detach request had come. Exit D2XX */
135             D2XX_Exit();
136
137             /* Take the system to DFU Mode. Provide timeout in ms to
138              * wait for re-enumeration with the host
139              * */
140             STARTUP_DFU(0);
141             break;
142         }
143
144         /* Suspend mode handling */
145         if (D2XXTEST__Suspend)
146         {
147
148             wkupSource = 0;
149             dbg("Entering Suspend Mode at Master \r\n");
150             delayms(100);
151 #ifdef GPIO_REMOTE_WAKEUP
152             SetRemoteWakeup = 0;
153             if (RemoteWakeupEnable)
154             {
155                 dbg("Configuring GPIO pin to wakeup \r\n");
156                     #if 1
157                         /* Set up the pin */
158                         gpio_dir(GPIO_PIN, pad_dir_input);
159                         gpio_pull(GPIO_PIN, pad_pull_pullup);
160
161                         /* Attach an interrupt */
162                         gpio_interrupt_enable(GPIO_PIN, gpio_int_edge_falling);
163                         interrupt_attach(interrupt_gpio, (uint8_t)interrupt_gpio, ISR_gpio);
164                         dbg("D2XXTEST: GPIO pin setup for interrupt\r\n");
165                     #endif
166             }
167 #endif
```

Figure 54 D2XX Project Template

The template can be compiled as it is but additional code is needed to customize it according to the user's need.

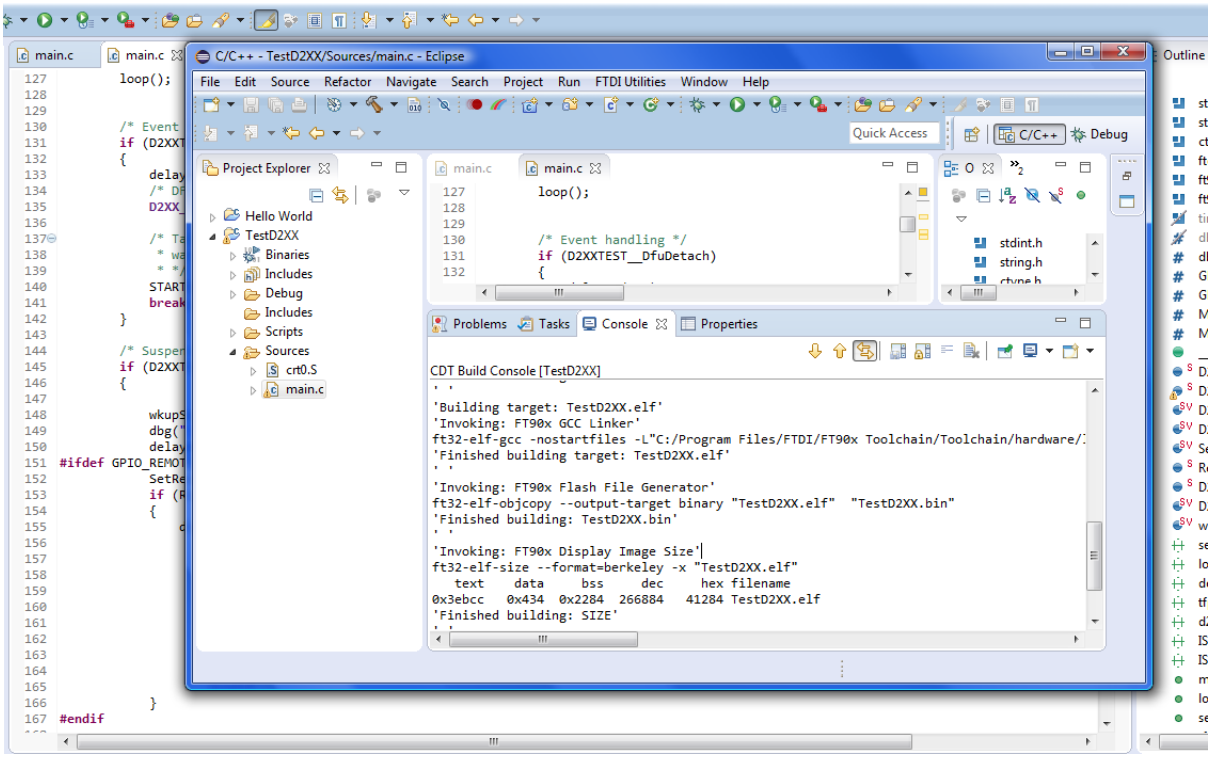


Figure 55 Compiling D2XX Template Code

6 Advanced Topics

6.1 Running the toolchain from the command prompt

6.1.1 Compiling the sample applications using a Makefile

The FT9xx GNU toolchain can be used to compile source code from a command prompt in the same way the official GNU Toolchain is used, often with the help of a Makefile or a batch file.

The sample applications are available in "My Documents\Bridgetek\FT9xx\Examples\ if you have installed them using the installation wizard.

NOTE: makefiles are not included with the toolchain installer.

6.1.2 Programming a binary file into the chip

The programmer can be found in the folder "programmer\dist" in the program installation directory (C:\Program Files (x86)\Bridgetek\FT9xx Toolchain). The command line programmer is FT900Prog.exe. The toolchain is provided with a default bootloader. The bootloader is located at the top 4 KB of the flash memory (address 0x3F000 to 0x3FFFF). At boot, the FT9xx resets and executes instruction at 0x00000, jumping into the bootloader. The bootloader then performs the initializations needed and jumps to location 0x8c, which is the start of the user program. The bootloader is also needed to support debugging with the FT9xx port of GDB.

1. Run the tool FT900Prog.exe without any arguments, the options and usage will be printed. They will also be printed if the specified options are not valid. The most common usage is programming a binary file through the one-wire interface with the supplied bootloader. To do this, the command is:

   FT900Prog.exe -f <.bin file with path if needed> -O
   in which the options are:

   -f: programming the binary file into the **f**lash. The path to the binary file must follow.
   -O: using the **o**ne-wire interface.

   If you want to **v**erify the content of the flash memory after programming, specify "-v" in the command:

   FT900Prog.exe -f <.bin file with path if needed> -O –v

2. If the bootloader is not required, option "-x" can be specified, in which case the program will start executing from address zero and the command is:

   FT900Prog.exe -f <.bin file with path if needed> -O -x

   The supports for GDB debugging will not be available however.

6.1.3 Debugging the sample applications with ft32-elf-gdb

1. The applications must to be compiled with -g option (i.e. ft32-elf-gcc -g …). An .elf file will be created which includes the debug information, for example GPIO/gpio_example1.elf. Note that this file is not used for programming the chip.

   Note: If the output file name for the linker is not specified in the Makefile (i.e. option -o is missing), a.out will be created instead of an .elf file. They are the same and these steps can be applied to a.out as well.

2. Flash the .bin file into the chip. Refer to section 5.1.2 above.

3. Open a command line window, run:
   "python <Installation directory>\Toolchain\utilities\gdb_bridge.py live"

   Note: An alternative is to double click on the shortcut "GDB Bridge" created after the installation.

   The correct response should be:

Figure 56 FT9xx Debugging Status

   Note 1: If there is an error message about permission being denied, the command line window may need to be opened with administrator rights by right-clicking and selecting 'Run as administrator'.

   Note 2: It is also possible to run the GDB Bridge using the shortcut created after the installation.

   Note 3: If the path to gdb_bridge.py contains spaces, enclose it with double quotes ("").

4. Open another command line window, go to the folder that includes the .elf file, run "ft32-elf-gdb <.elf file>", for example "ft32-elf-gdb gpio_example1.elf".

5. After ft32-elf-gdb starts, type in "target remote localhost:9998" to establish a connection to the MCU.

6. Use standard GDB commands to debug the program. Note that the command to start execution should be "continue", not "run".

6.2 Installing Eclipse and the FT9xx plugin manually

When running the installer, it is possible to choose not to install Eclipse as part of the installation. This might be useful if the user have already installed Eclipse for other purposes. This section details how to set it up for use with the FT9xx.

6.2.1 Eclipse Installation

1. Go to Eclipse website, download "Eclipse IDE for C/C++ Developers". At the time of this writing, Eclipse Mars is the latest release and is the recommended version.

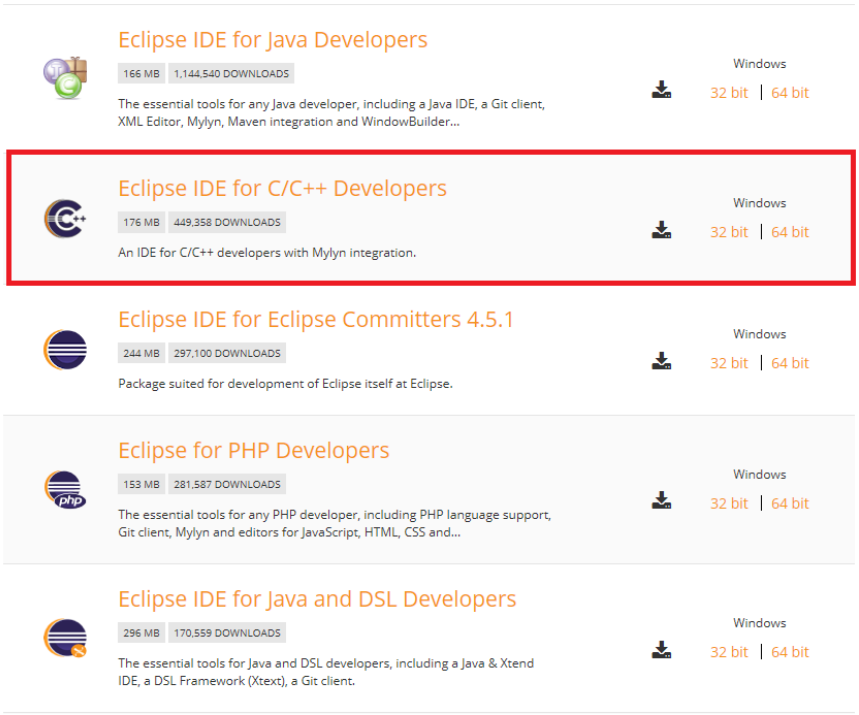


Figure 57 Eclipse Versions

2. When Eclipse is run for the first time, it will ask for the workspace location.

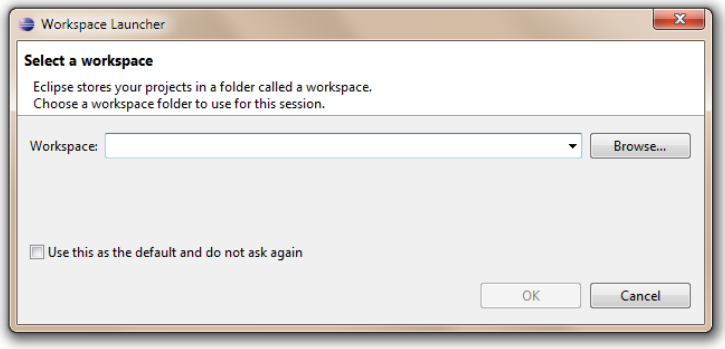


Figure 58 Eclipse Workspace Location

A workspace is a directory on the hard drive where Eclipse stores the projects defined to it. More specifically, a workspace is a logical collection of projects. When you specify this directory name to Eclipse, Eclipse will create some files within this directory to manage the projects. The projects controlled by this workspace may or may not reside in this directory. Specify a directory name and click OK.

Note: To run Eclipse, it is required to download and install the Java Run Time Environment (JRE) or Java Developer Kit (JDK). Eclipse should display a warning if this is not installed. Oracle provides these tools for free.

6.2.2 FT9xx Eclipse Plugin Installation

To assist with completing the configuration of Eclipse for FT9xx coding an extra plug-in is provided as part of the download. To install the plug-in the following steps are required:

1. From the Eclipse toolbar select Help -> Install New Software which will pop up the window as below.

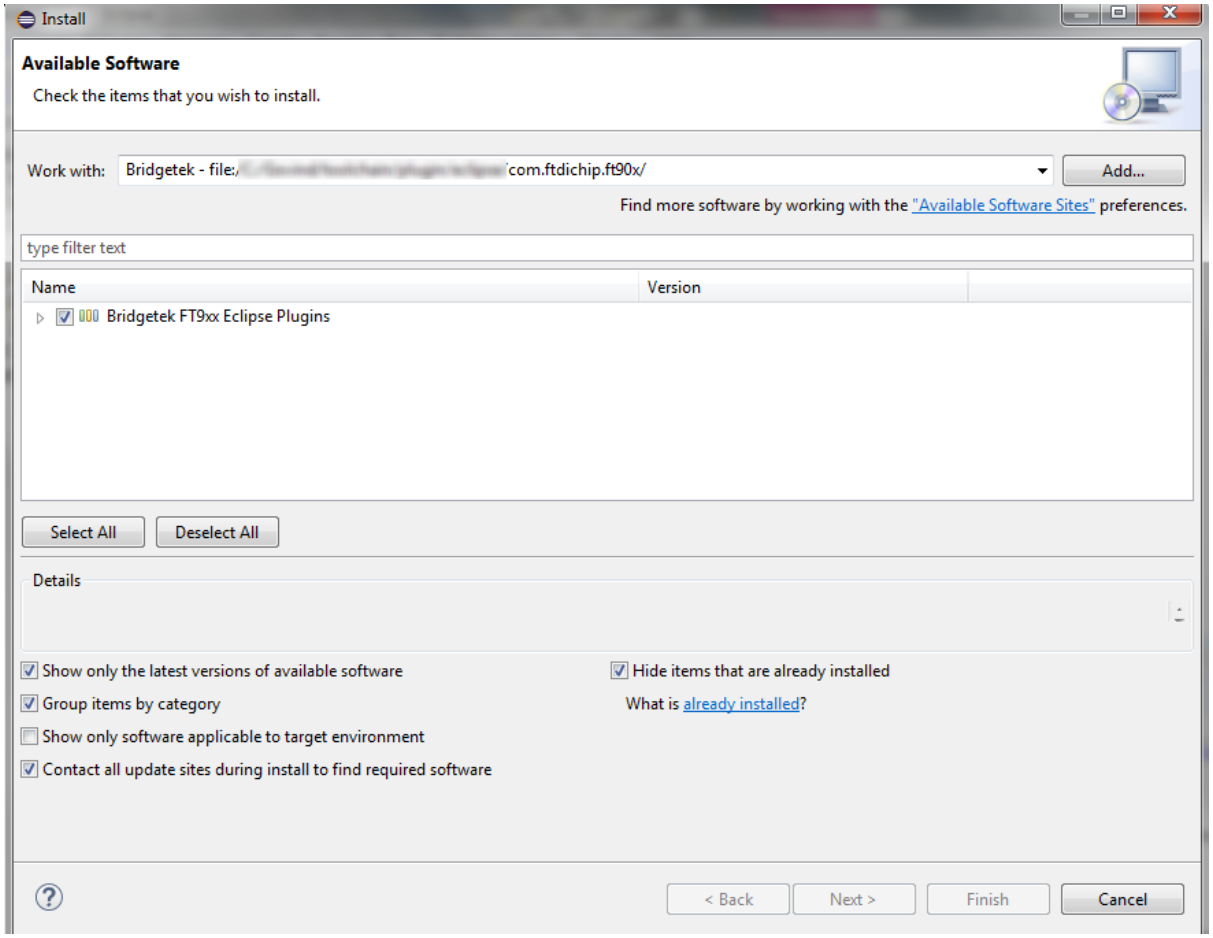


Figure 59 Eclipse Plugin Setup Wizard

2. Select the ADD button, and browse to the LOCAL location of the folder 'com.ftdichip.ft90x' which can be found in "Toolchain\eclipse plugins" in the toolchain installation directory.

3. Press "SELECT ALL" followed by NEXT to install the plugin

4. Close the window when complete.

6.3 Common project settings in Eclipse

6.3.1 Include paths

Eclipse uses its built-in indexer to resolve dependencies between files. In order for the indexer to work correctly, paths that contain the header files in the project need to be added as follows:

1. Right-click on the project and select **Properties**

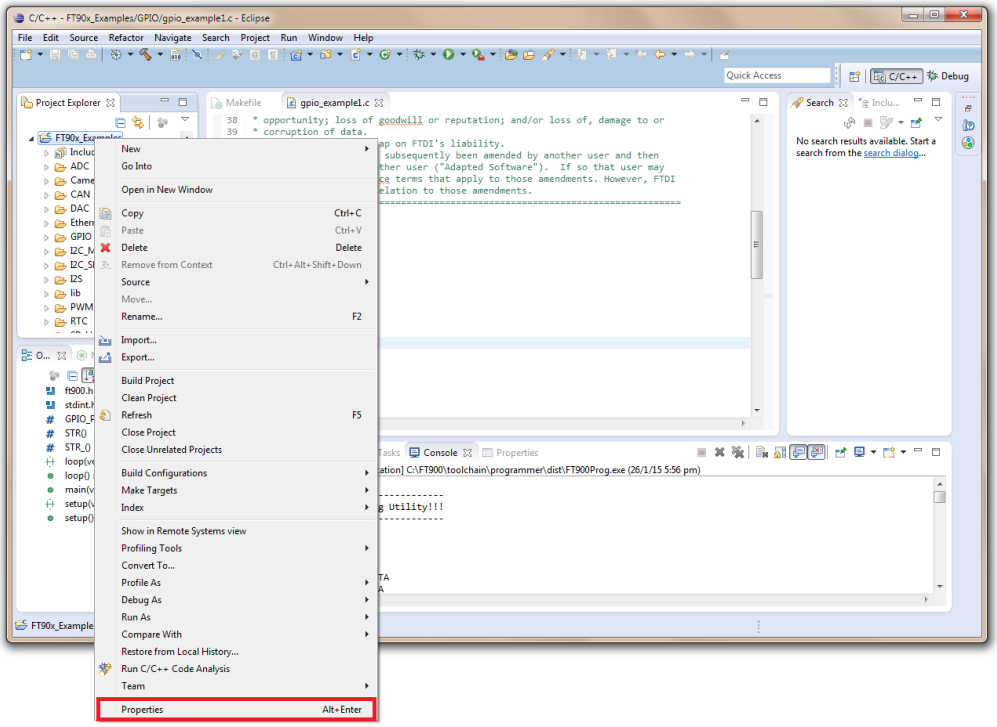


Figure 60 Eclipse Project Properties

2. In the Properties window, **select C/C++ General > Paths and Symbols**

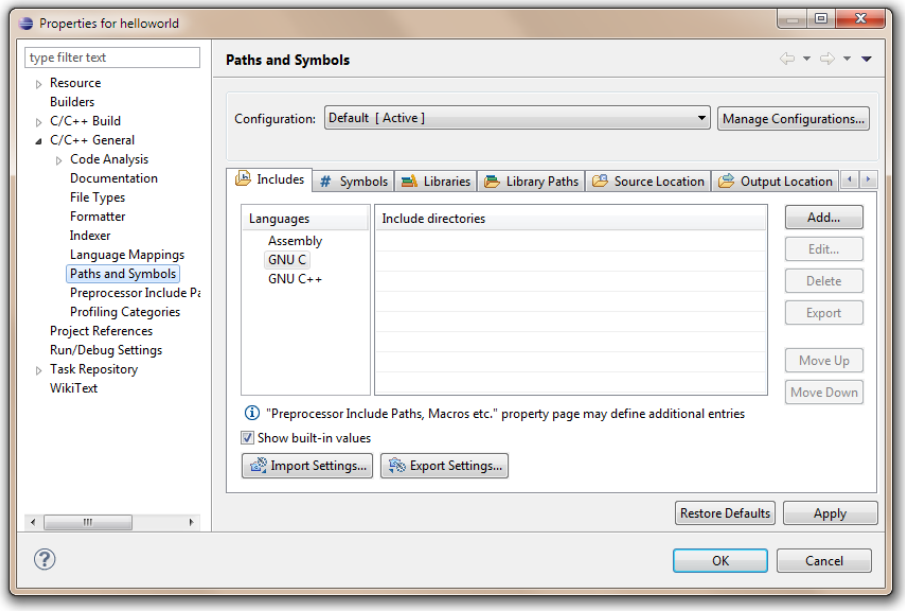


Figure 61 Eclipse Paths and Symbols

3. Under the **Includes** tab, choose **"GNU C"** under **Languages**, then click **"Add..."** on the right side of the window

4. In the **"Add directory path"** window, specify the path to the folder that contains the header files. If the same path is used for some C++ files, check the box **"Add to all languages"**, then click **OK**.

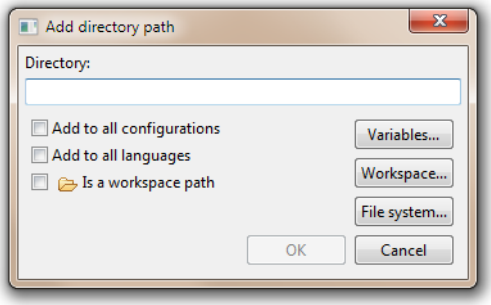


Figure 62 Eclipse Add Directory Path

Note: The paths should be added one at a time. The use of semicolon is not supported.

6.3.2 Toolchain settings

The FT9xx toolchain supports most GNU toolchain options. To specify an option that is not included by default, for example to create a map file, do it as follows:

1. Right click on the project and select Properties

2. In the Properties window, select C/C++ Build > Settings. The toolchain settings can be adjusted in the Settings window.

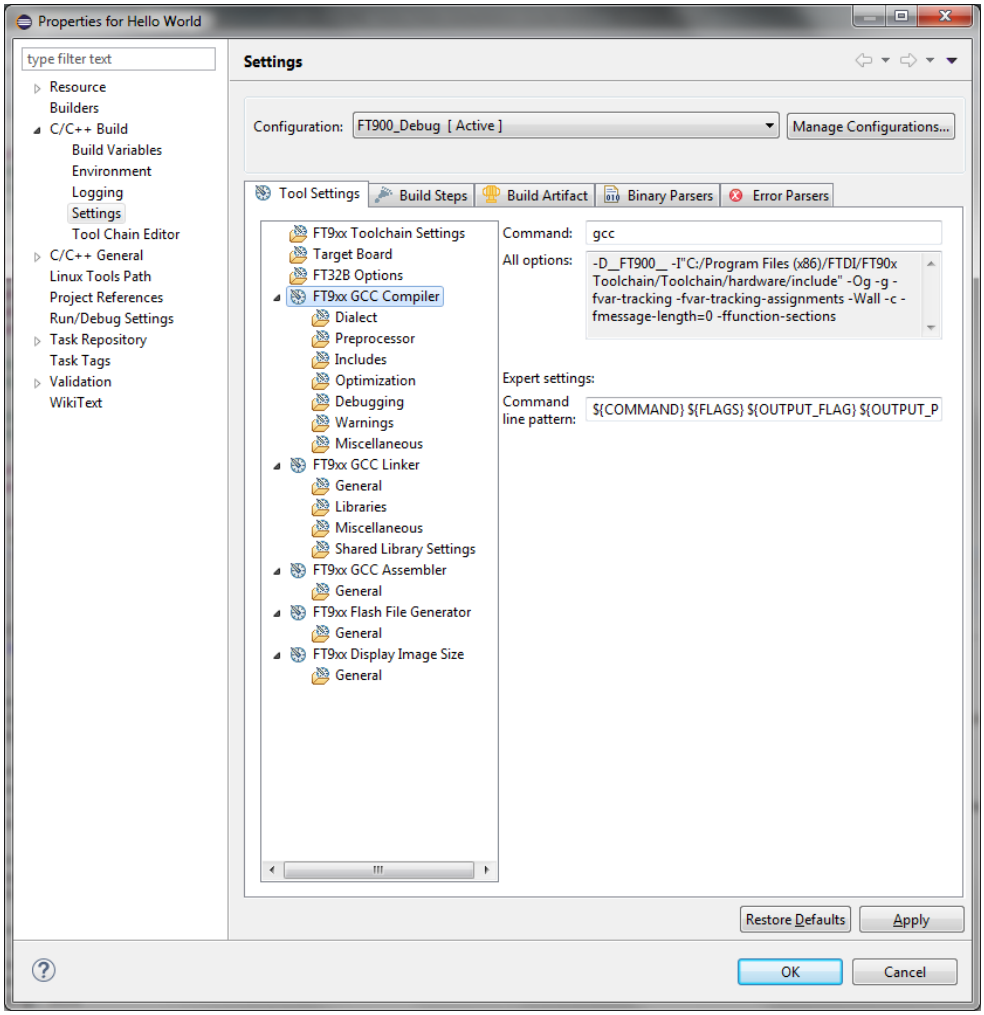


Figure 63 Eclipse Toolchain Settings

6.3.2.1 FT32B options (only for FT93x)

The FT93x target has two special compiler options `-mft32b` and `-mcompress`. `-mft32b` enables the FT32B instruction set and `-mcompress` enables code compression, which can typically result in a code size reduction of about 20 – 30%. These options can be updated in the toolchain settings as shown in ***Figure 64***. Note that this option is only available in the FT930_* configurations.

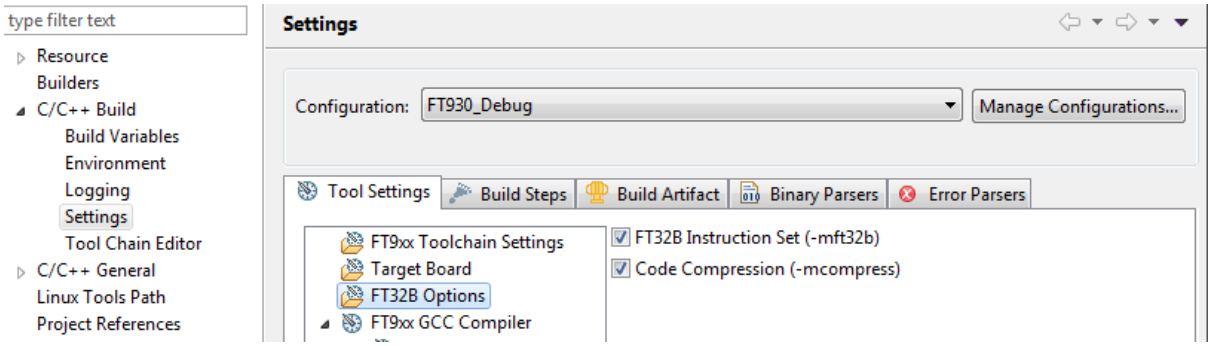


Figure 64: FT32B options (for FT93x)

6.3.3 C/C++ Indexer Settings

For eclipse syntax highlighting to work correctly as you switch configurations, the Indexer has to be configured to work with the *active build configuration* as shown in Figure 65. This is a workspace specific setting and can be accessed in eclipse via `Window | Preferences | C/C++ | Indexer`

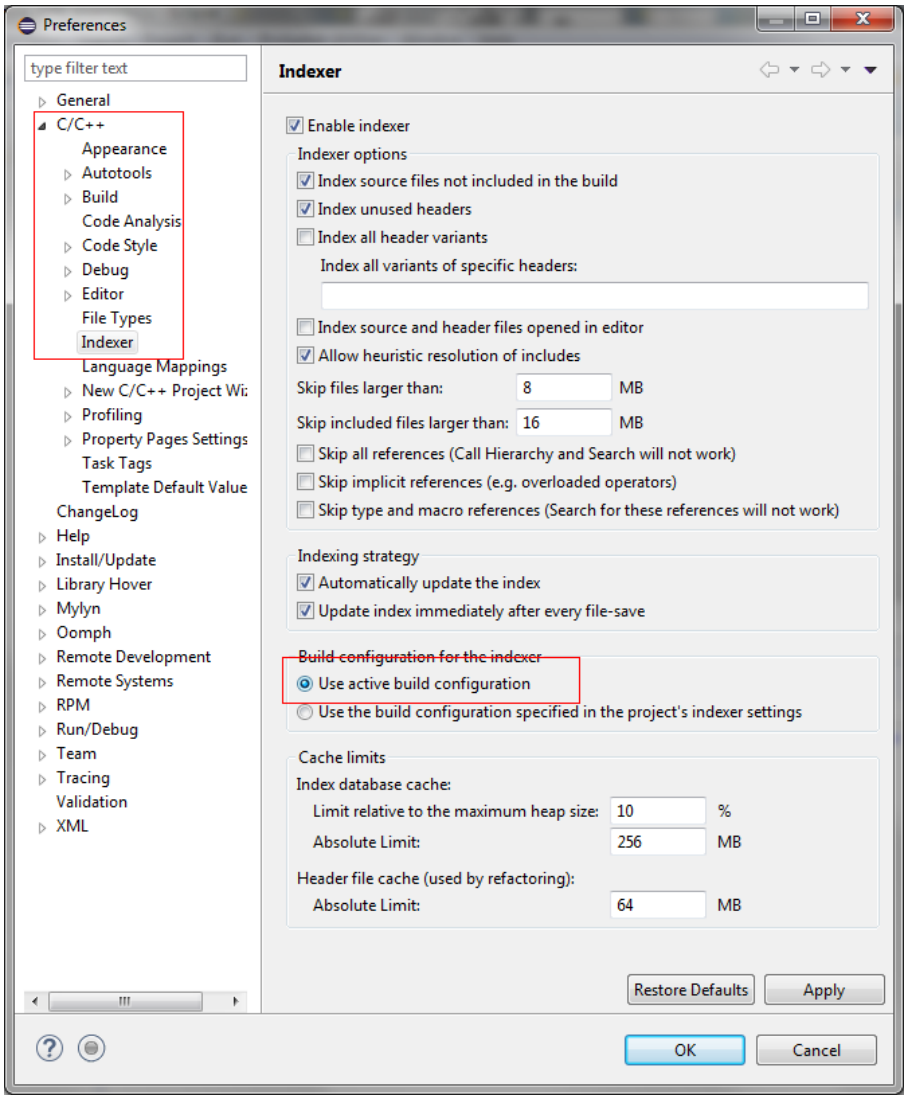


Figure 65: Configure eclipse indexer to use the active build configuration

7 Troubleshooting

This section documents the problems you may encounter when using the FT9xx toolchain.

7.1 Makefile error

If using a makefile to build an application, some makefile errors may be reported, for example:

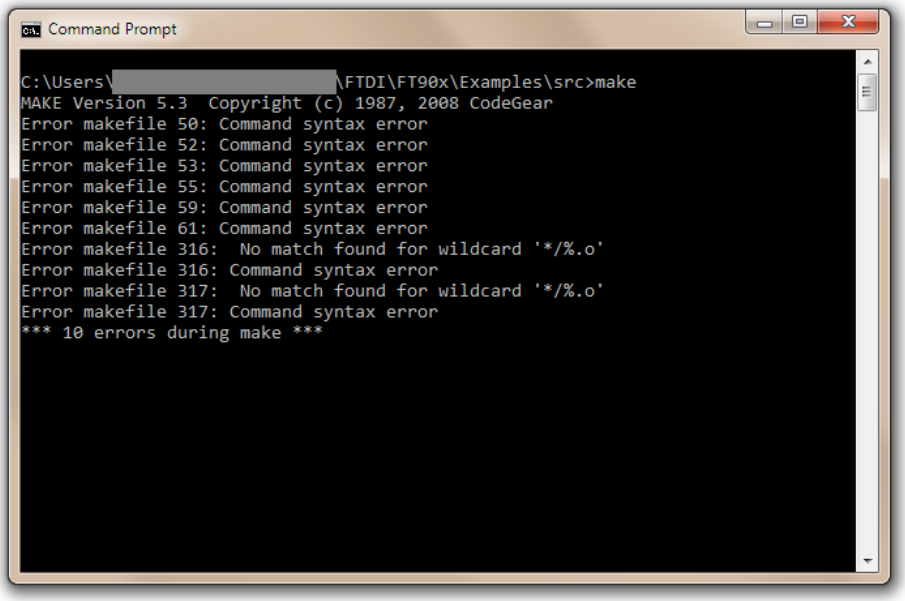


Figure 66: Makefile Error

This is usually because some existing toolchain on the system may be using its own "make" utility which is also referred to in the PATH variable. The FT9xx examples need to be built by the GnuWin32 "make" utility, which can be installed during the toolchain installation. To solve this problem, adjust the PATH variable so that the correct "make" utility is called by the toolchain. Note that it may be necessary to adjust PATH again for the other toolchain. Type "where make" in a command prompt to find out which "make" utilities are present on the system.

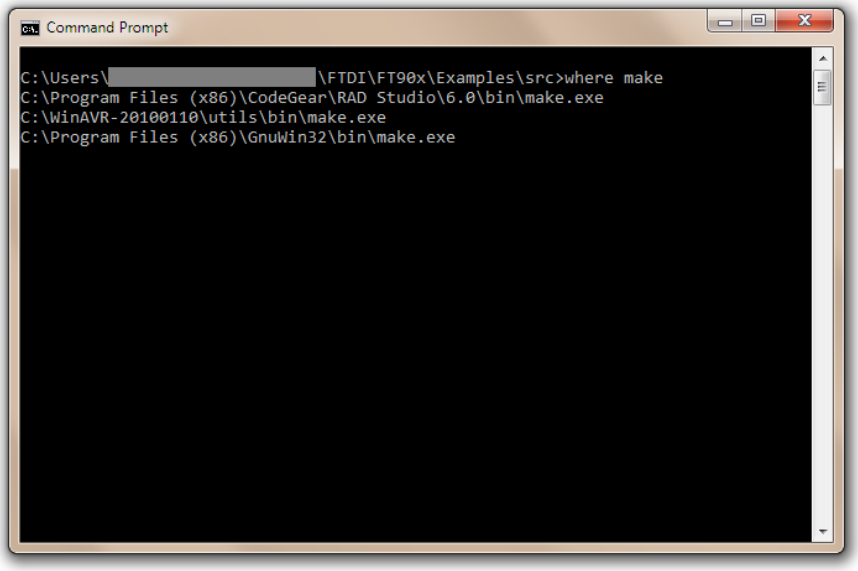


Figure 67 "make" **Locations**

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Appendix A – References

Document References

http://brtchip.com/m-ft9/

TN_160 Eclipse Projects

Acronyms and Abbreviations

Terms	Description
CMD	Command-line interface
DLL	Dynamic-link Library
DLOG	Data Log (Project)
GAS	GNU Assembler
GCC	GNU Compiler Collection
GDB	GNU Project Debugger
GNU	GNU (Gnu's Not Unix) Operating System
GUI	Graphical User Interface
IDE	Integrated Development Environment
JDK	Java Development Kit
JRE	Java Runtime Environment
MCU	Microcontroller Unit
PATH	PATH Environment Variable
TCP	Transmission Control Protocol

Appendix B – List of Tables & Figures

List of Figures

Appendix C – Revision History

Document Title: AN_325 FT9xx Toolchain Installation Guide
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Revision	Changes	Date
1.0	Initial release	2014-05-02
1.01	Expanded screenshots of Installation Wizard in Section 2	2015-08-21
1.02	Updated Version for Toolchain 2.1.0	2016-02-22
1.03	Added section 2.1.1 to document the handling of another instance of MSI installer running in the background while installing JRE (results in JRE install error 1618) Debugger related information moved to section 4.4. from Troubleshooting Updated screenshots for programmer	2016-09-19
1.04	Updated release Migration of the product from FTDI to Bridgetek name – logo changed, copyright changed, contact information changed	2017-03-08