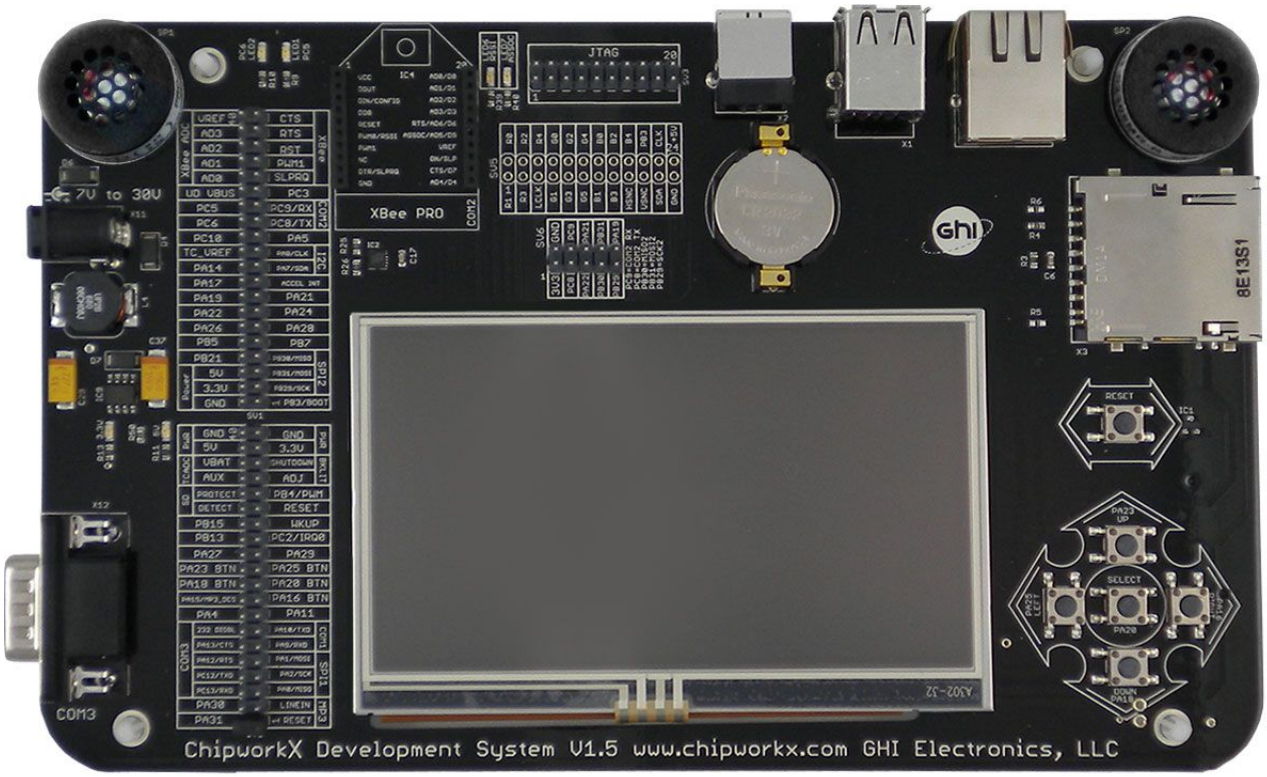
ChipworkX Development System

Rev.1.10 July 21, 2010 Getting Started



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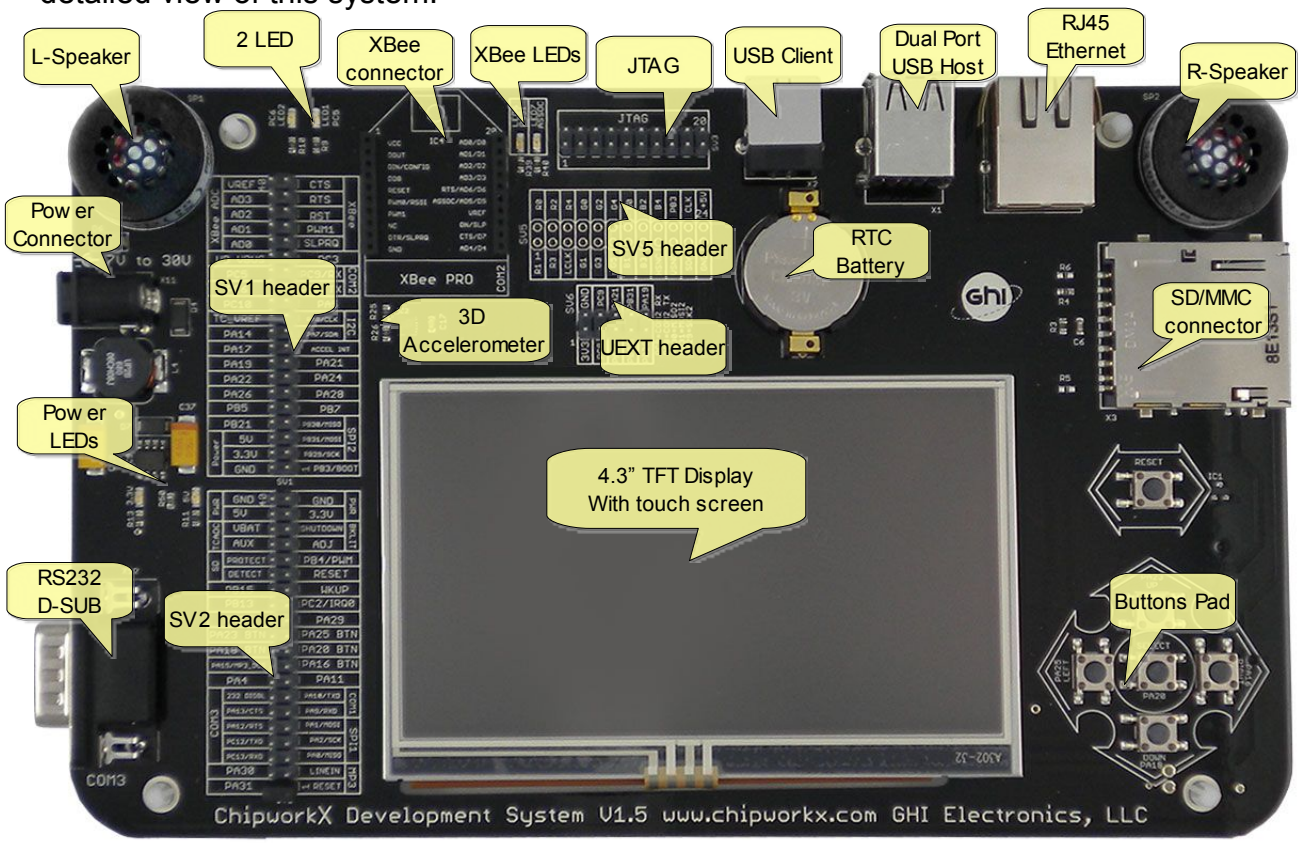
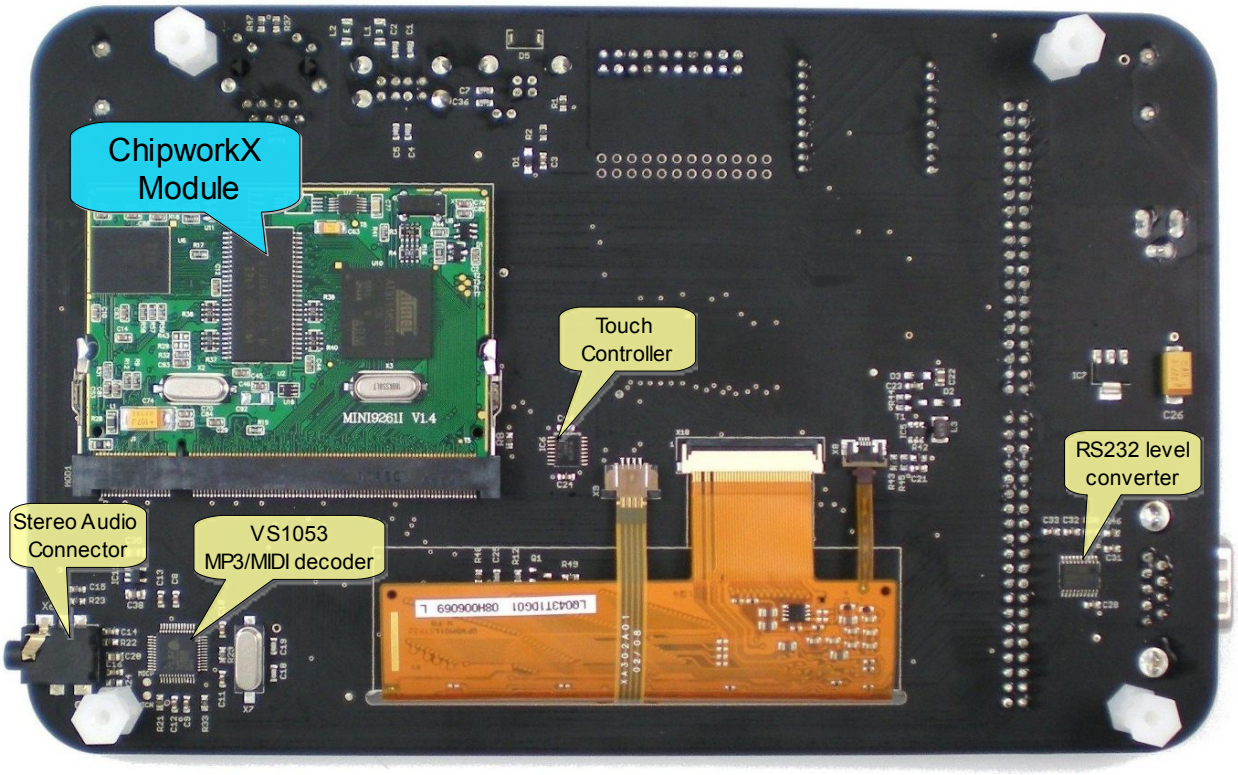
1. Introduction

ChipworkX Development System is the official kit from GHI Electronics for the ChipworkX module. This kit exposes the various peripherals and interfaces that make it an ideal starting point for any .NET Micro Framework project. Furthermore, most of ChipworkX module signals such as GPIO, SPI and UART are accessible on a 0.1" header for rapid prototyping.

ChipworkX Development System Brochure and Pin-outs Document provides for a more detailed view of this system.



Front View



Back View

The objective of this guide

This guide will help you in the first steps to use ChipworkX Module through the Development System. From here, we will show you how to connect ChipworkX, make sure it is running, load a simple program, and explain how to update the internal firmware. This guide only covers very basic points about ChipworkX. More details are provided in the user manual.

2. Getting Started

2.1. System Setup

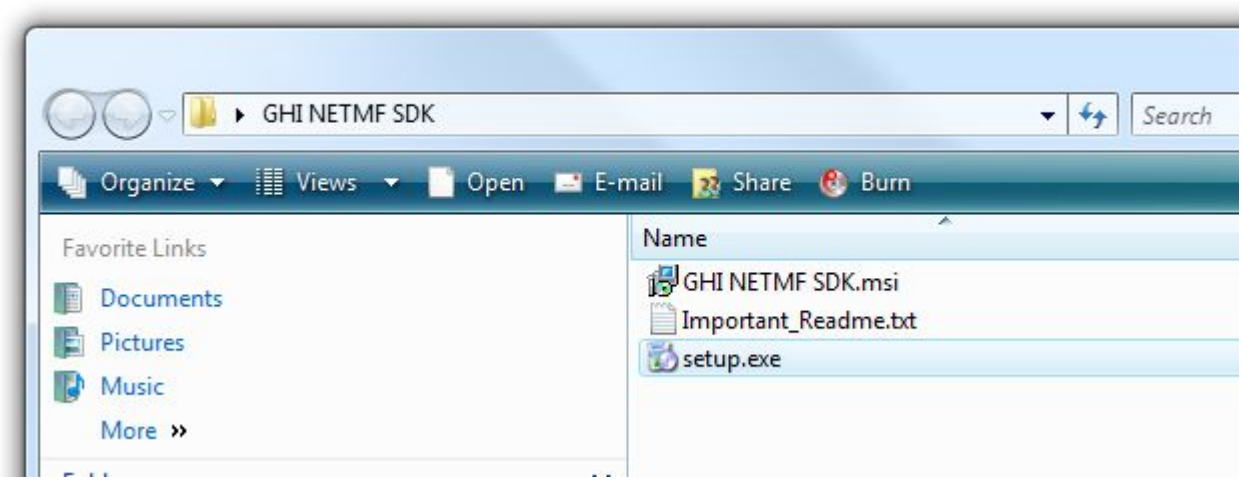
Before we try anything, we want to make sure the PC is setup with needed software. First download and install Visual C# express 2010 with SP1. If you have Visual Studio 2010 installed then you can skip this step.

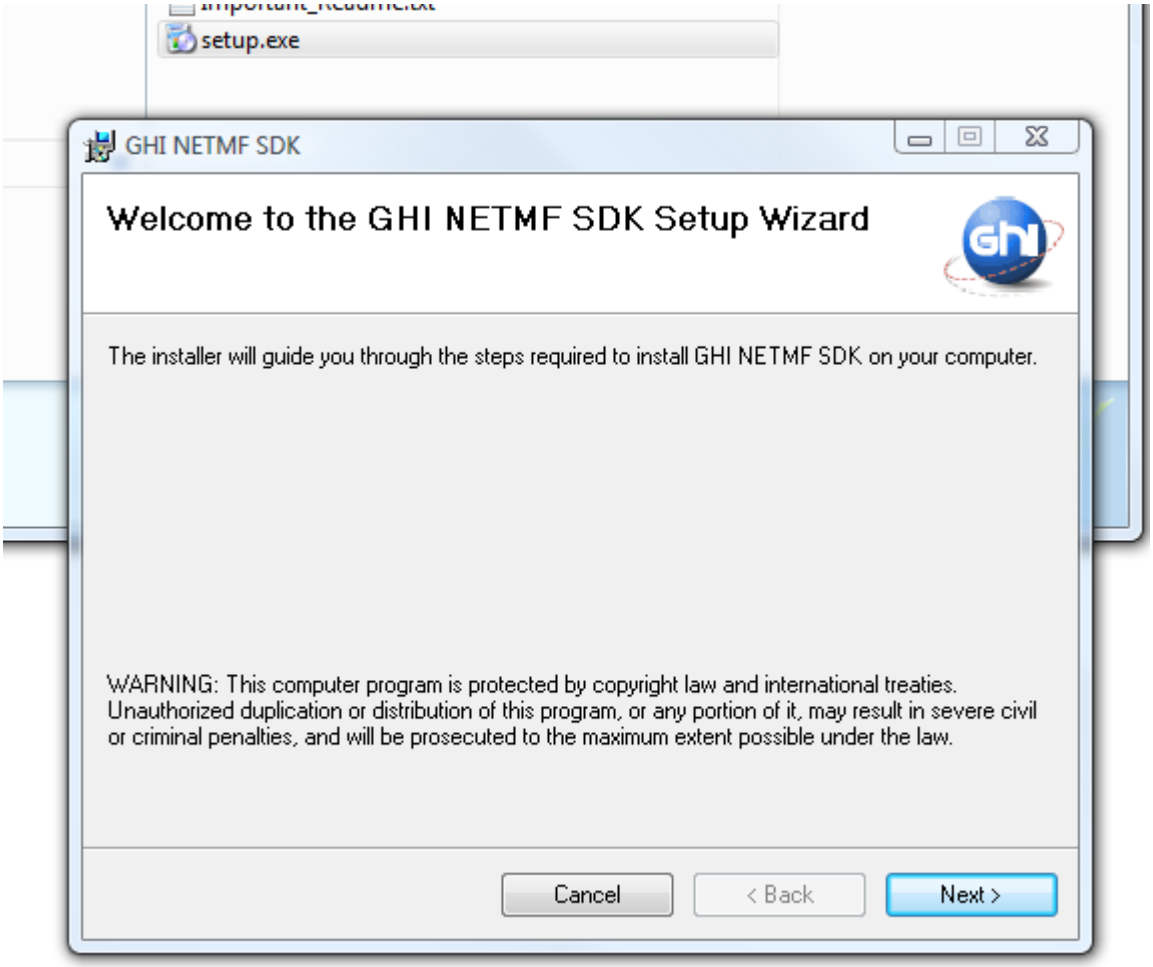
Now, download and install .NET Micro Framework 4.1 SDK (not the porting kit).

if link above didn't work, search for ".NET Micro Framework 4.1 SDK".

Finally, install the GHI NETMF SDK (Software Development Kit) available on GHI Electronics website.

The SDK comes in a zip file, extract it and then run setup.exe to install the SDK.



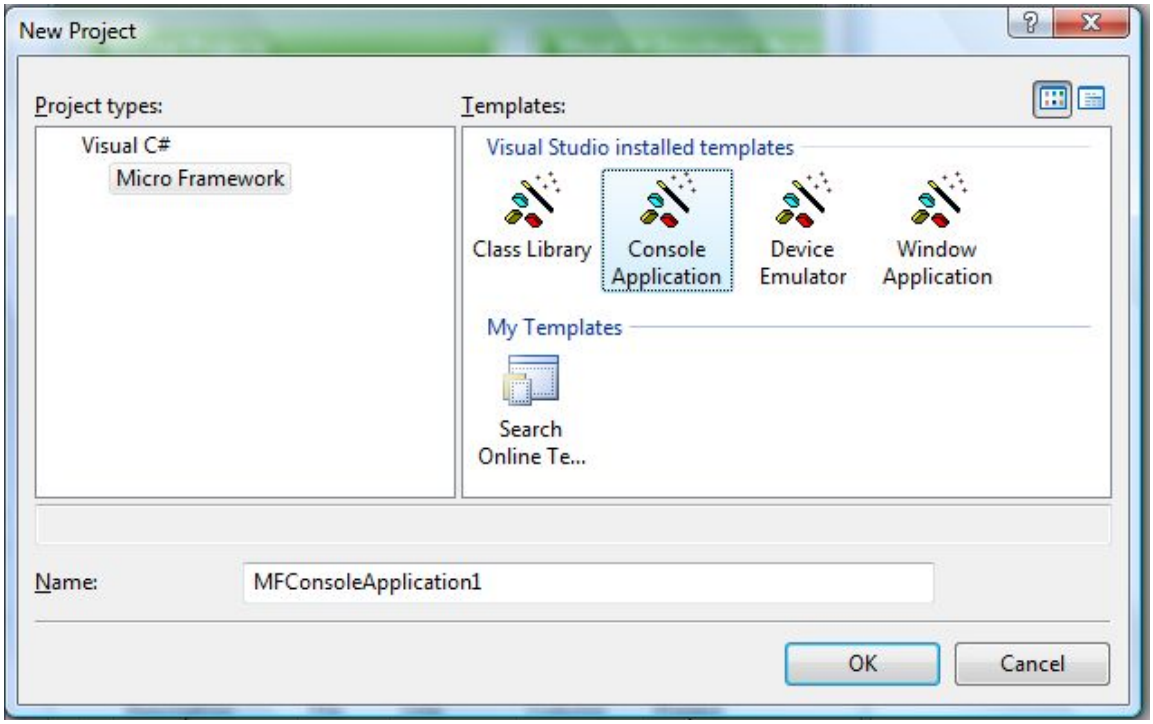


2.2. The Emulator

NETMF includes an emulator that allows running application right on the PC. For our first project, we will use the emulator to run a very simple application.

Create a Project

Open Visual C# express and, from the menu, select file -> New Project. The wizard now should have “Micro Framework” option in the left menu. Click on it, and from the templates, select “Console Application”



Click the “OK” button and you will have a new project that is ready to run. The project has only one C# file, called Program.cs, which contains a few lines of code. The file is shown in “Solution Explorer” window. If this window is not showing then you can open it by clicking “View->Solution Explorer” from the menu.

```
using System;
using Microsoft.SPOT;

namespace MFConsoleApplication1
{
    public class Program
    {
        public static void Main()
        {
            Debug.Print(
                Resources.GetString(Resources.StringResources.String1));
        }

    }
}
```

For simplicity change the code to make it look like the listing below.

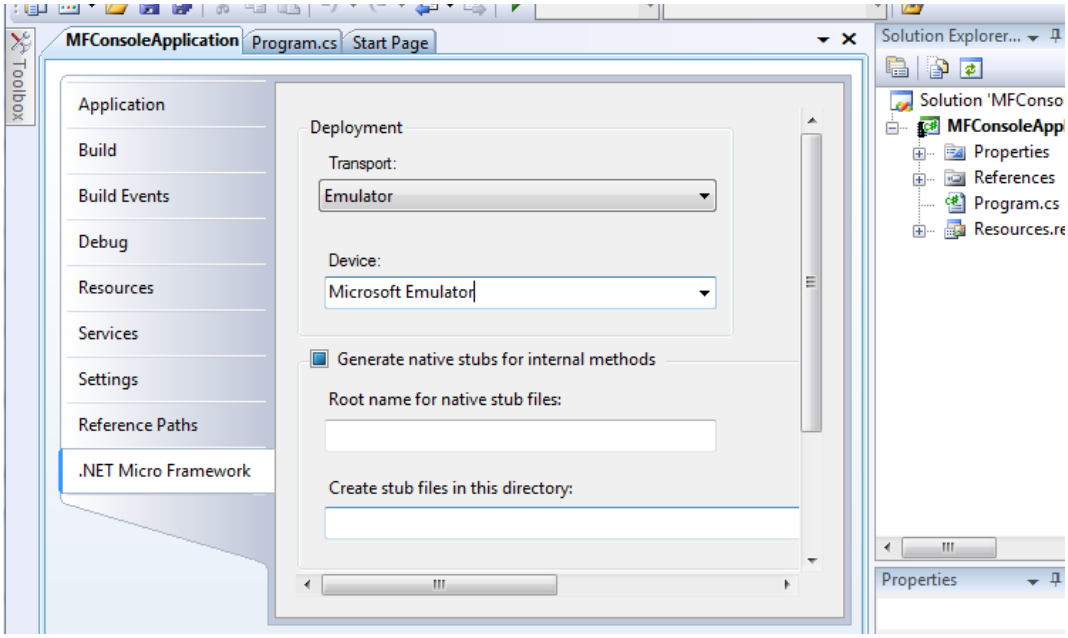
```
using System;
using Microsoft.SPOT;

   public class Program
   {
      public static void Main()
      {
         Debug.Print("Amazing!");
      }

   }
```

Selecting Transport Interface

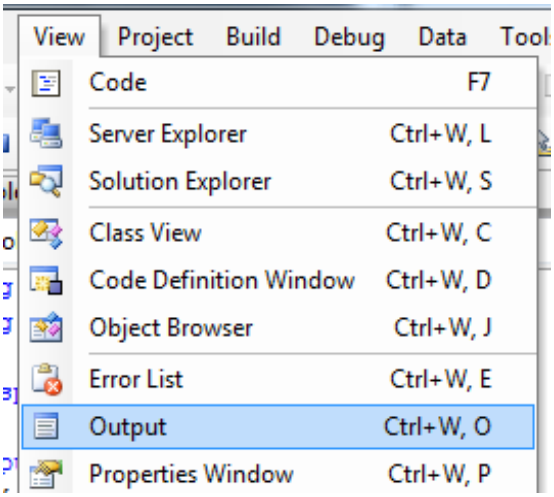
Do not worry if you do not understand the code. We will explain it later. For now, we want to run it on the emulator. Let us make sure you have everything setup properly. Click on “Project->Properties” from the menu. In the new showing window, we want to make sure we select the emulator. On the left side tabs, select “.NET Micro Framework” and make sure the window looks like the image below.

Transport: Emulator

Device: Microsoft Emulator



Make sure the output window is visible, click on “View->Output”

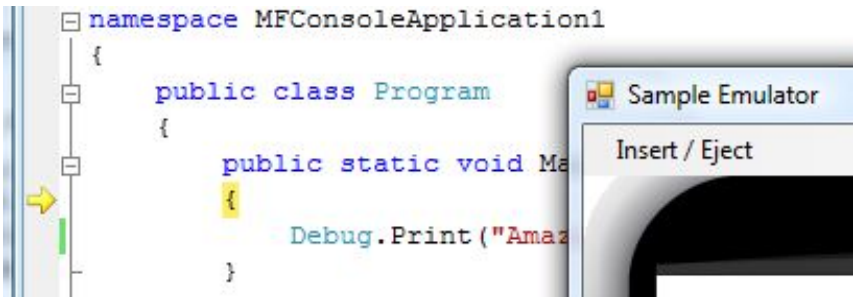


Executing (Deploying) the project

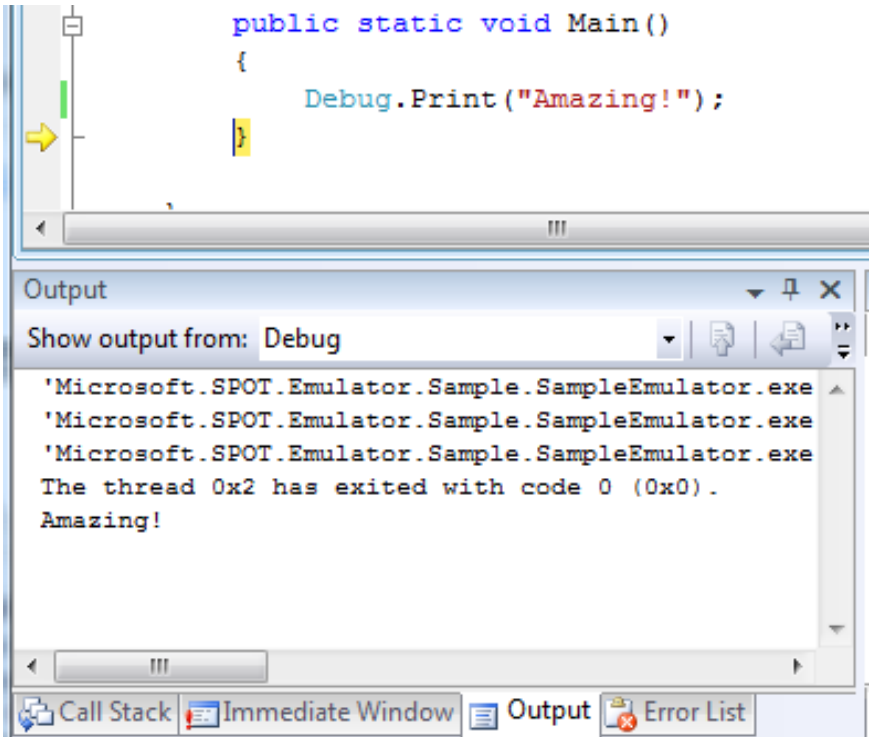
Finally, we are ready to run our first application. Press F5 key on the computer. This is a very useful shortcut and you will be using it a lot to run your applications. After you press F5, the application will be compiled and loaded on the emulator, and in couple seconds everything will stop! That is because our program had finished execution so fast that we didn't see much.

We want to “debug” the code now. Debugging means that you are able to step in the code and see what it is doing. This is one of the greatest values of NETMF.

This time use F11 instead of F5, this will “step” in the application instead of just running it. This will deploy the application on the emulator and stop at the very first line of the code. This is indicated by the yellow arrow.



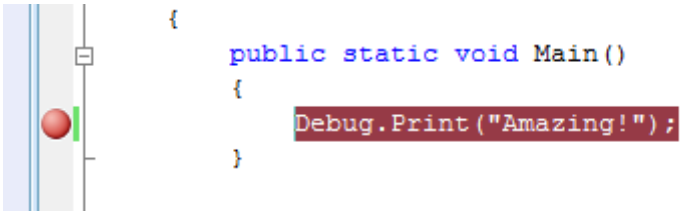
C# applications always start from a method called Main, and this is where the arrow had stopped. Press F11 again and the debugger will run the next line of code, which is the line you changed before. You probably have guessed it right, this line will print “Amazing!” to the debug window. The debug window is the output window on Visual C# express. Make sure Output window is visible like explained earlier and press F11 one more time. Once you step on that line, you will see the word Amazing! Showing in the output window.



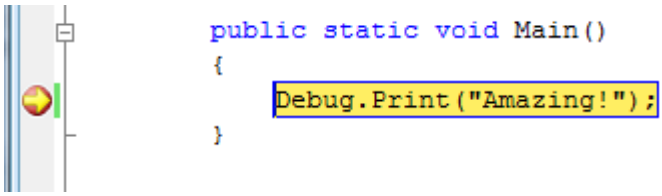
The Program that you've just deployed is called "Managed Code" in .NET Micro Framework Terminology.

Debugging Breakpoints

Breakpoints are another useful feature when debugging code. While the application is running, the debugger checks if execution has reached a breakpoint. If so, the execution will pause. Click the bar right to the left of the line that prints “Amazing!”. This will show a red dot which is the breakpoint.

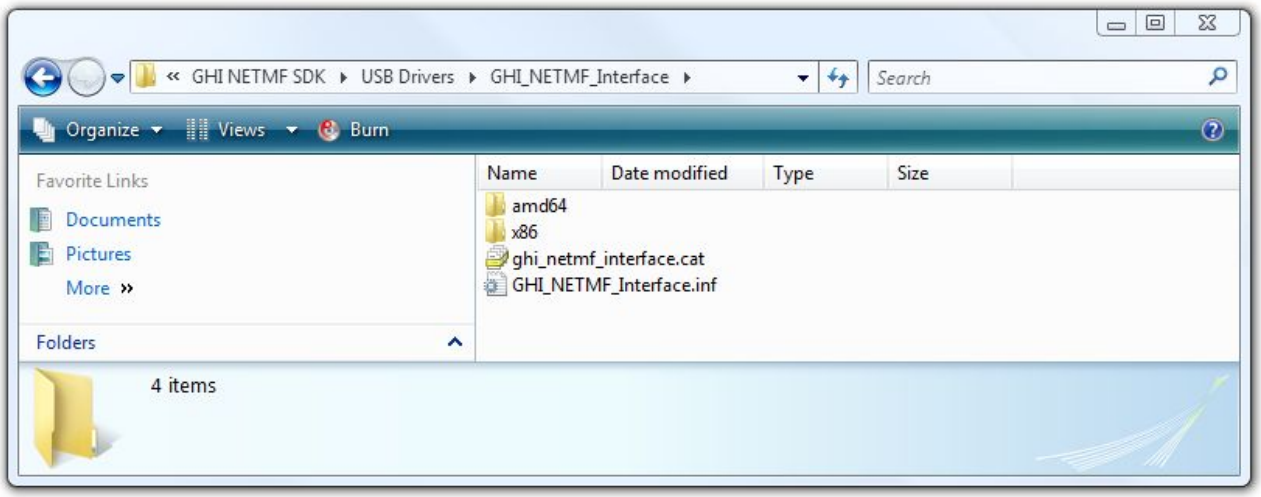


Now press F5 to run the software and when the application reaches the breakpoint the debugger will pause it as showing in the image below.



Now, you can step in the code using F11 or continue execution using F5.

2.3. Running on Hardware



We are now ready to connect ChipworkX Development System to the PC. Connect The development system using the USB cable. No power is needed as ChipworkX Development System uses USB for power. If this is the first time you plug the system to your PC then windows will ask for drivers. Direct windows to the GHI NETMF interface driver available in GHI NETMF SDK under USB Drivers Folder.

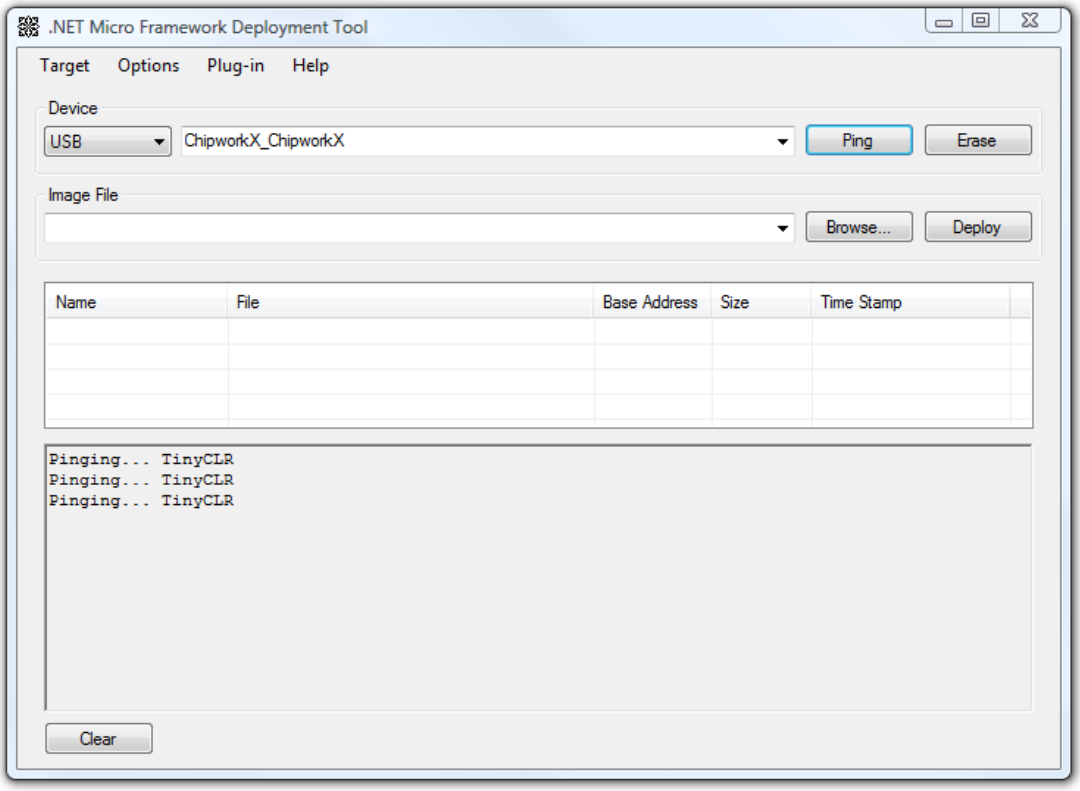
Important Note: The development system with the many peripherals, such as the TFT display, requires relatively high power. So make sure that you connect to a direct USB port

at your PC or to a powered USB hub, or the board might not function correctly due to the insufficient supplied power. If you can not provide a USB port with good power or you are not sure, you can connect external power directly to the development system.

MFDeploy can Ping!

Before we use the hardware, let us make sure it is properly connected. The NETMF (.NET Micro Framework) SDK comes with a software from Microsoft called MFDeploy. There are many good uses for MFDeploy but for now we only need it to “ping” the device. Basically, “ping” means MFDeploy will say “Hi” to the device and then checks if the device will respond with “Hi”. This is to make sure the device is connected properly and communication has no issues.

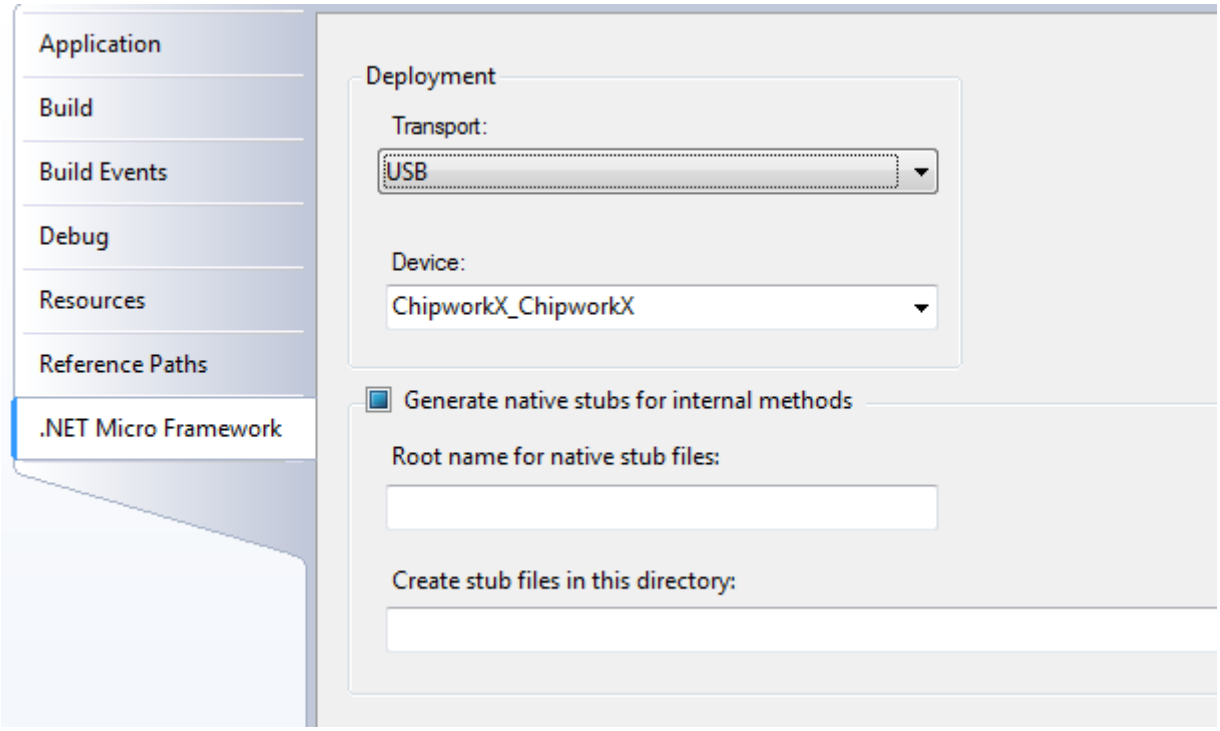
Open MFDeploy and connect ChipworkX using the included USB cable to your PC. If this is the first time you plug in ChipworkX, Windows will ask for drivers. Supply the driver from the SDK folder and wait until windows is finished.



Deploying to Hardware

Now that we checked the hardware is working using MFDeploy, we need to go back to

Visual C# express. From the project properties, select USB for transport and ChipworkX for the device. Make sure your setup looks similar to the image below.



Allow a couple seconds to ensure the hardware has completed the boot up process then press F5, we will now send our simple application to ChipworkX and it will run right inside the real hardware. Switching from emulator to real hardware is that simple!

Try the steps we tried with the emulator, like setting breakpoints and using F11 to step in the code. Note that “Debug.Print” will still forward the debug messages from the hardware to the output window on Visual C# express.

You have to keep in mind that only one software can talk to ChipworkX interface at the same time. In another word, you can not Ping the hardware through MFDeploy if it is already connected through Visual Studio.

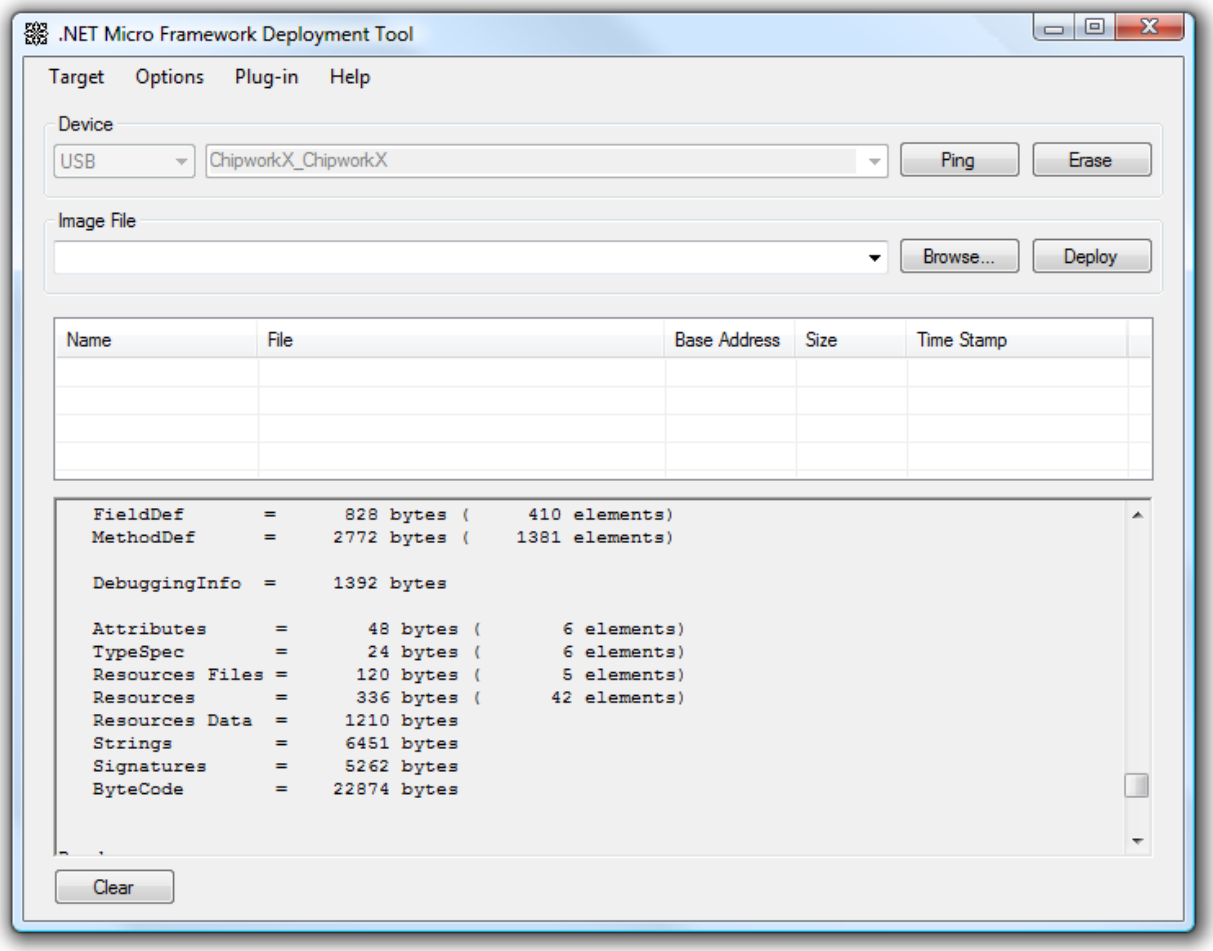
Connect MFDeploy to show debugging messages

After Deploying the application through Visual Studio. The application still works on ChipworkX even if is Visual Studio was disconnected and it will run every time you reset or recycle power on ChipworkX.

User can still view the boot up and debugging messages by connecting MFDeploy to USB. Simply after you connect USB cable and you can ping ChipworkX in MFDeploy, click Target->Connect.

After this you can even reset the board and see all the boot up sequence messages and any debugging messages including the strings printed out in the code using Debug.Print(). In our previous example,"Amazing!". When done, you can disconnect using Target->Disconnect.

Important Note: If you did not see the debugging messages, press the Ping button and the debug messages will be displayed after.



Checking ChipworkX firmware and TinyBooter Version

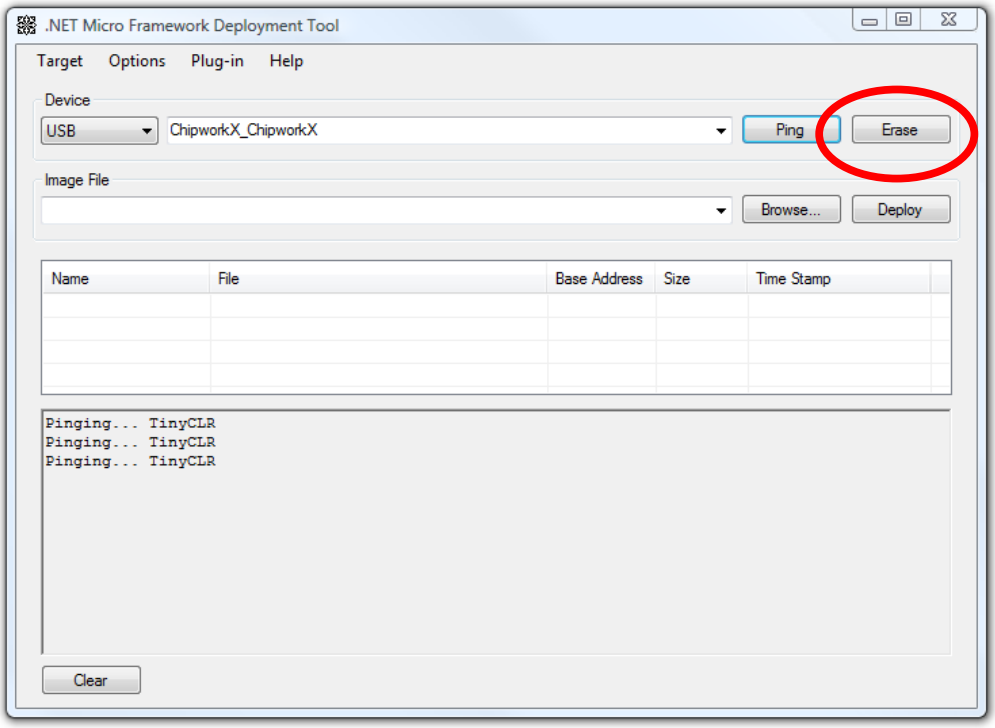
At this point and before proceeding, it is important to check if you need to update your ChipworkX firmware. When you download a new SDK, it comes with new firmware that needs to be sent to ChipworkX. Please see system update section at the end.

2.4. Deleting The Deployed Project

User can always over-deploy the current application (project) on ChipworkX by deploying the newer application from Visual C#. but in some cases user might need only to delete the current application. this can be accomplished using MFDeploy tool explained before:

Open MFDeploy, choose USB and ChipworkX from device list and ensure you get positive response when pinging

Then click the erase button:



Emergency user application code deletion

In some cases, user needs to delete the application because it is locking up the device or blocking the USB debugging interface. but Visual C# or MFDeploy tool does not help here and can not communicate with the device.

In this case you should access The Tinybooter mode (by pressing and holding Up and Down buttons on system bootup, you will see "Tinybooter on the screen", release the buttons the Erase the application code using MFDeploy as explained earlier.

3. Assemblies With ChipworkX Project

3.1. What are Assemblies?

Hardware/Software features are accessed through Managed code using C# Classes with their members such as methods, properties and variables. On ChipworkX you may neeed assemblies from 2 sources:

Standard Assemblies

.NET Micro Framework SDK includes pre-compiled assemblies that contain the managed code of various classes for hardware features such as Debug Class that you've just used in the example to print the string "Amazing!" using the Print Method. Users do not see the source code of these classes but can use these classes by simply adding the relevant assemblies to the Visual C# project.

.NET Micro Framework library examples:

- Microsoft.SPOT.Hardware
- Microsoft.SPOT.Native
- System.IO

Classes are described is in .NET Micro Framework SDK documentation which also includes information about the required assemblies.

GHI NETMF assemblies

ChipworkX hardware adds more functionality on top of the .NET Micro Framework. For example, hardware peripherals such as CAN, Analog converters, PWM,...etc are not directly supported in .NET Micro Framework. However, they can be easily used with ChipworkX.

The assembly provides access to hardware peripherals, storage solutions, USB connectivity, and many other features. The assembly files and their documentation are included with GHI NETMF SDK. These assembly files must be added to your Visual Studio project in order to be able to use the extra features.

ChipworkX uses the same assemblies available for EMX and USBizi. This also means, you can switch from ChipworkX to USBizi to EMX without the need to change any line of code!

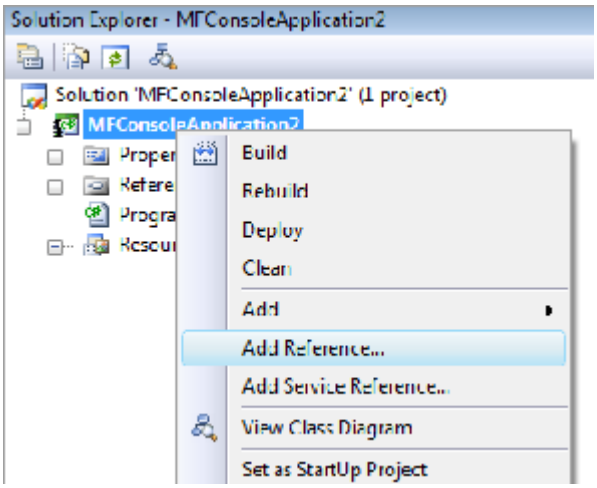
GHI NETMF library examples:

- GHIElectronics.NETMF.Hardware
- GHIElectronics.NETMF.System
- GHIElectronics.NETMF.Net

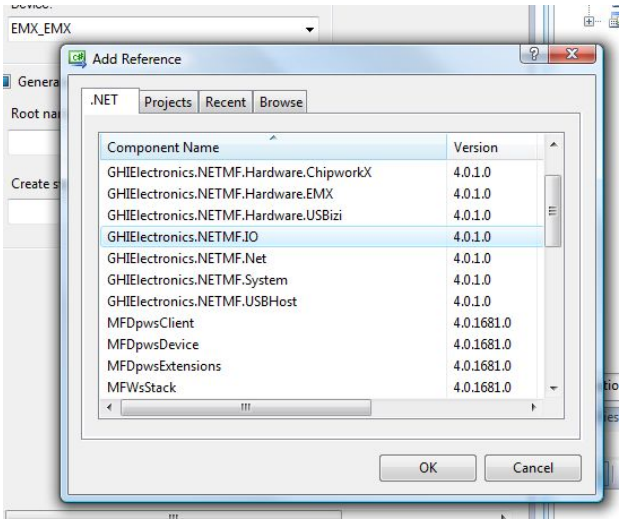
Adding Assemblies to Visual C# Project

Adding a library is pretty simple.

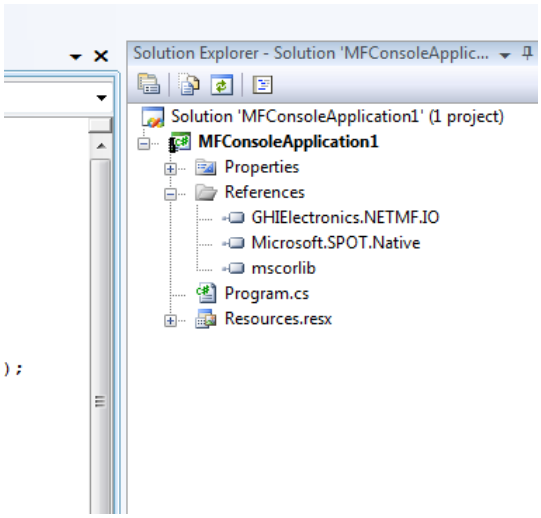
1. Go to the Menu and select “project --> Add Reference...“



2. Choose the library that you need then click OK.



3. We can now see the new Assembly reference with the References in the solution explorer.



4. TinyBooter And Firmware Update

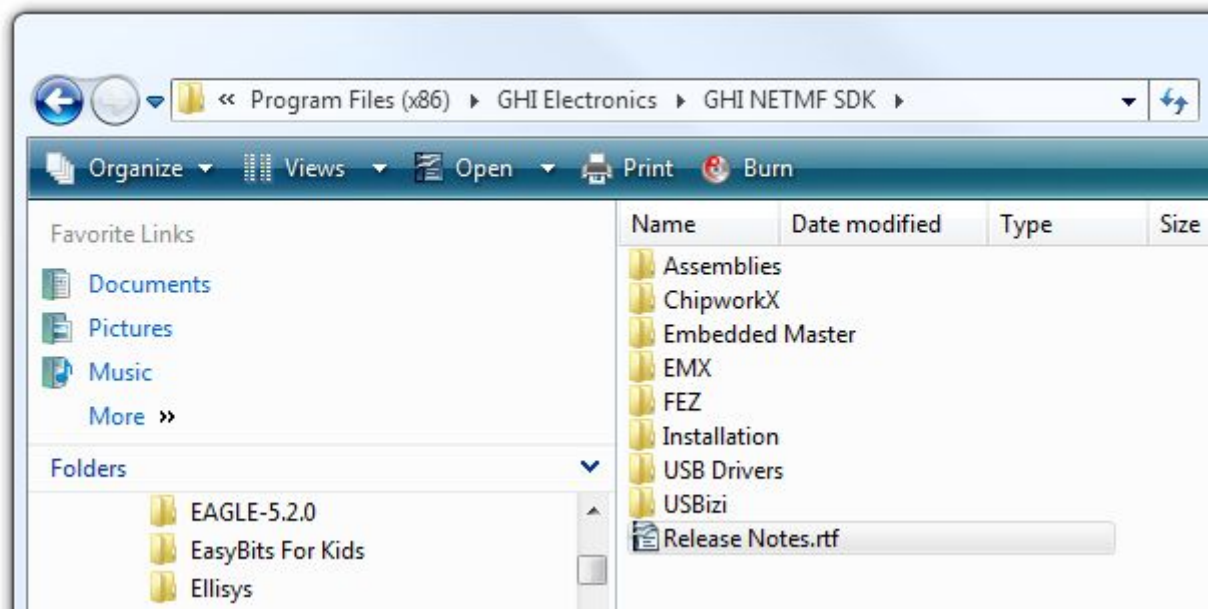
ChipworkX includes three pieces of embedded software, bootstrap loader, TinyBooter and ChipworkX firmware.

Important note: Always make sure the firmware and TinyBooter loaded on the device match the firmware and TinyBooter versions associated with the GHI NETMF SDK ChipworkX firmware. Ideally, whenever you install a new SDK on your PC, you will also update the firmware on your device and update the assemblies you have added to your application.
the next sections explains how to check the firmware version number and how to updating the firmware is explained here.

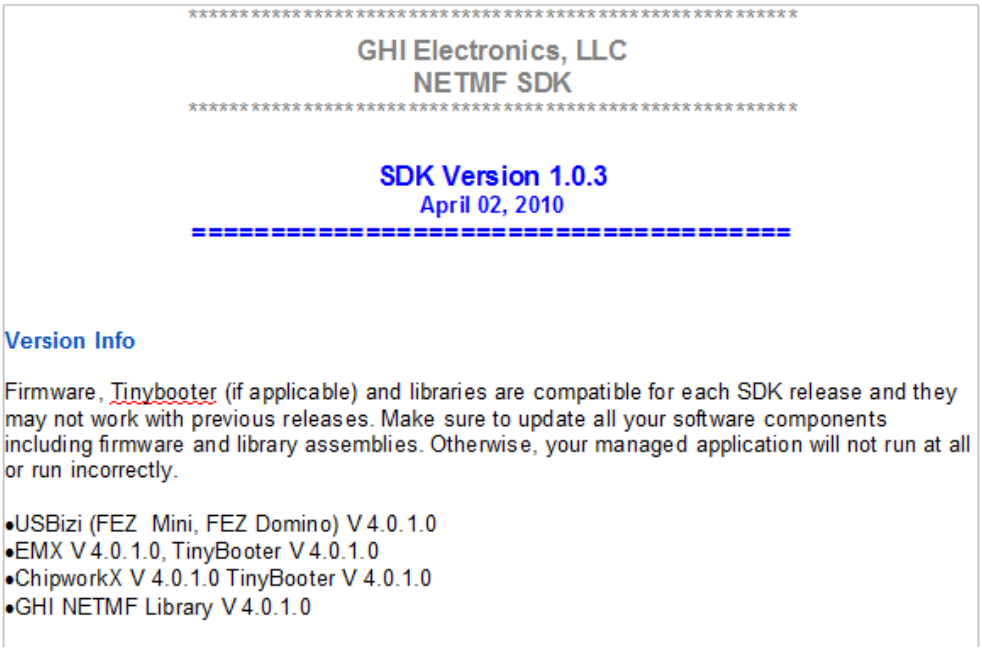
4.1. Checking the Firmware Version

Before updating the firmware, you can check the version number and make sure it needs to be updated or if you have the latest installed. Make sure you have the latest SDK and firmware installed.

Then go to wwww.ghielectronics.com (ChipworkX downloads), the current GHI NETMF SDK version is shown in the download link. You can download and install the SDK. When done, the version release notes and changes are shown automatically. These are also available in the SDK installation folder.



After you have the SDK installed, you can see the Release Notes file, for example ChipworkX firmware version number is 4.0.1.0 and Tinybooter version number is 4.0.1.0 in this SDK.



GHI Electronics, LLC
NETMF SDK

SDK Version 1.0.3
April 02, 2010

Version Info

Firmware, Tinybooter (if applicable) and libraries are compatible for each SDK release and they may not work with previous releases. Make sure to update all your software components including firmware and library assemblies. Otherwise, your managed application will not run at all or run incorrectly.

- USBizi (FEZ Mini, FEZ Domino) V 4.0.1.0
- EMX V 4.0.1.0, TinyBooter V 4.0.1.0
- ChipworkX V 4.0.1.0 TinyBooter V 4.0.1.0
- GHI NETMF Library V 4.0.1.0

The easiest way to verify the version numbers on ChipworkX Development System is to

read them on ChipworkX's display.

On system boot up ChipworkX firmware version number is printed out on second line of the screen.

To read TinyBooter version number, all you have to do is to access TinyBooter (Press and hold Up and Down buttons on system boot up then release the buttons when you see "TinyBooter Mode" on ChipworkX's display. The version number is right after that line.

4.2. TinyBooter Update using bootstrap loader

The user can update Tinybooter using “Tinybooter Updater” included with GHI NETMF SDK under ChipworkX\Firmware folder. This updater tool consists of Atmel sam-ba tool with the required script and the BIN file that has to be loaded to serial DataFlash chip. It also includes the Tinybooter Updater driver that defines USB port as a virtual Serial Port used to upload the new BIN file.

The following instructions explain how to successfully accomplish this:

Erasing Process:

1. Power up ChipworkX hardware.
2. Press and hold **Up, Select and Down** buttons, **keep holding** and reset the system.
3. Release the buttons when prompted to do so then you will see instructions about how to proceed.
4. Press **Up** three times to proceed with the erasing process, or press **Down** to abort.

Emergency Bootstrap access

Use this method of access whenever something wrong happens during TinyBooter update process, like uploading the wrong bin file and ChipworkX tinybooter is not accessible at all.

1. Disconnect power.
2. Remove the jumper placed on ChipworkX Module.

3. Connect power.
4. Place the jumper back.
5. Connect USB cable.
6. Follow the same next steps for updating the TinyBooter.

Installing TinyBooter Updater USB Driver:

1. After erasing serial DataFlash and NOR Flash successfully following the previous steps.
2. Power up ChipworkX hardware.
3. Connect USB cable to your PC, then Windows will ask for driver INF file.
4. The driver file is located in the following path:

   %GHI NETMF SDK%\ChipworkX\Firmware\TinyBooter Updater\USB Tinybooter Updater Driver\

5. **Important Note (for Windows 7 users only):** Windows 7 installs the driver automatically but it mistakenly considers it a GPS camera device. Although the name is wrong the driver is OK and you may proceed with the steps.
6. After Windows is done installing the driver, you will see a new serial port (COM port) in your system. It will take the first available COM port number, e.g. COM5.
7. This port is used by TinyBooter Updater script to upload the new *tinybooter.bin* file to serial DataFlash, or it can be used to access the processor using Atmel tool SAM-BA (*sam-ba_cdc_2.9.xp_vista.exe)* to manually upload bin files to serial DataFlash.

Updating TinyBooter:

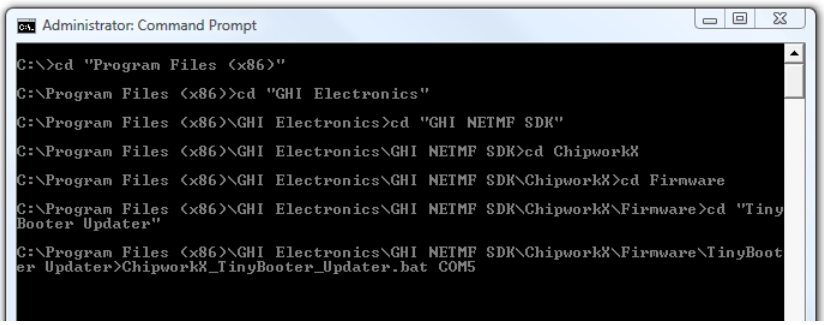
1. After installing TinyBooter Updater USB Driver and recognizing the new COM port number, open command prompt and go to the following folder

   %GHI NETMF SDK%\ChipworkX\Firmware\TinyBooter Updater

2. Run the following command to run the script:

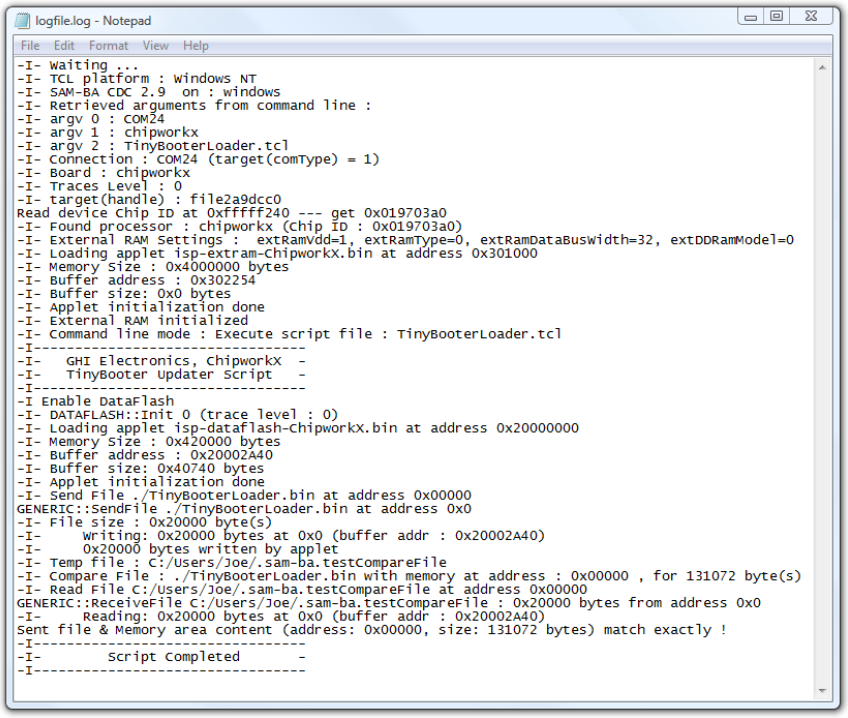
   ChipworkX_TinyBooter_Updater.bat COMx

   where x is the number of newly created Serial Port. See example below:



3. When you run the batch file, if you get an Access Denied message from Windows. Try to run the batch file as an Administrator, or copy the batch file to your desktop and run it from there.
4. The script will run to upload the new TinyBooter bin file to serial DataFlash. This process takes several seconds to complete.
5. When it is done, *logfile.log* will be created and opened using notepad automatically. It contains information about the updating process. Make sure the end of the file says "Sent file & memory area content (....) match exactly!"

   The following is an example *logfile.log* of a successful update:



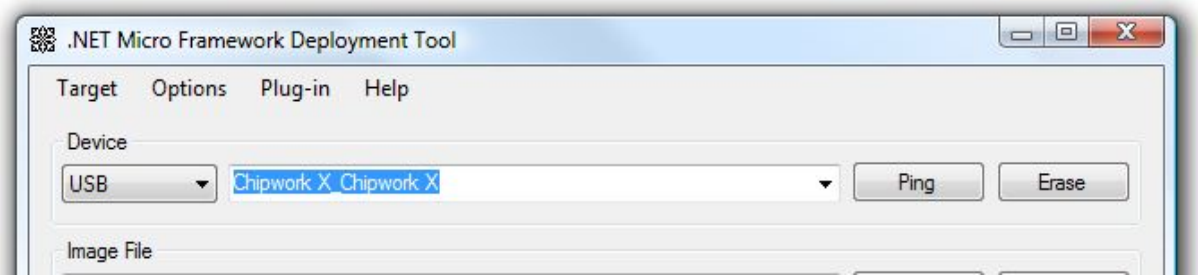
6. Reset the system and then Tinybooter will execute. Make sure to update TinyCLR firmware.
7. The system is now ready to deploy new managed applications.

4.3. ChipworkX Firmware Update Through TinyBooter

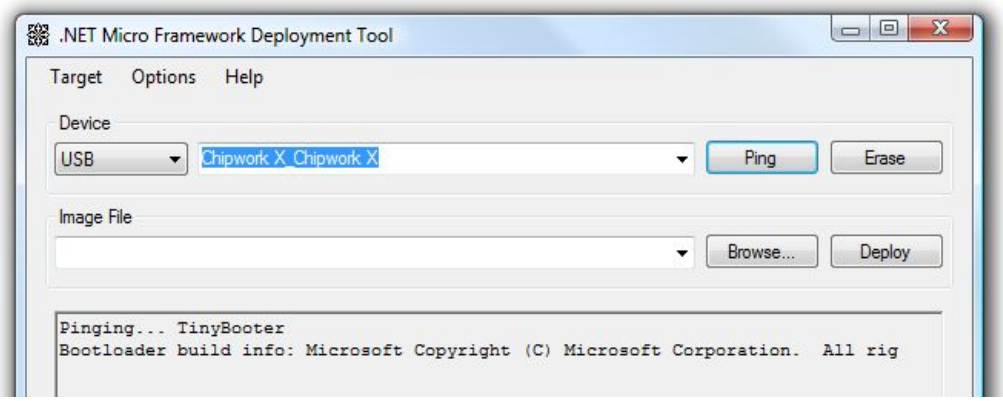
In the following steps, we will update ChipworkX firmware with Tinybooter and MFDeploy help:

1. First, install the latest GHI NETMF SDK (which includes the latest ChipworkX firmware and TinyBooter binary files). You probably already did when you updated the TinyBooter in the previous section.

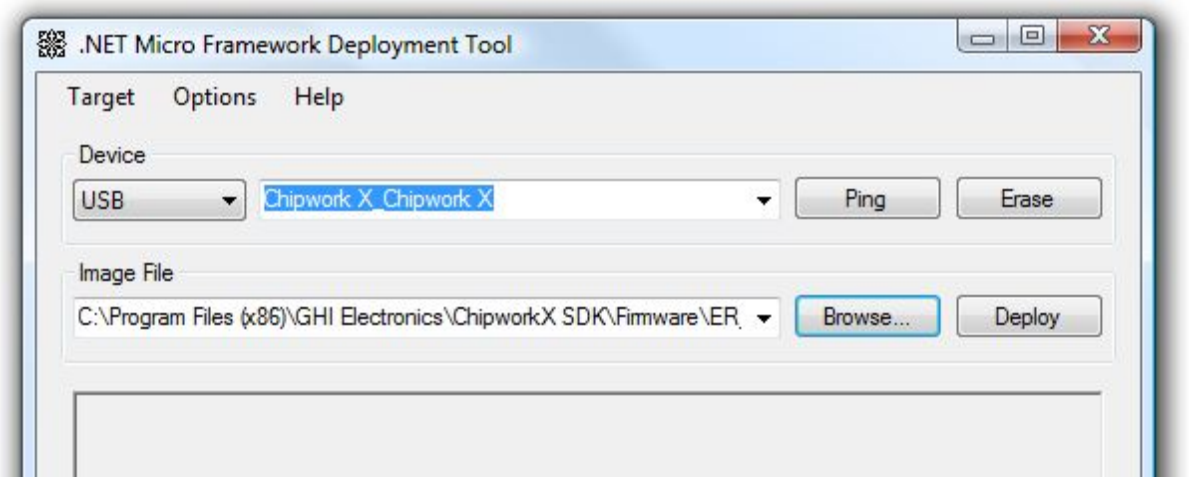
2. Insure there is no need to update the TinyBooter or you already did.
3. Press and hold the Up and Down buttons then press and release reset to access TinyBooter mode. You will see on the ChipworkX's TFT display.
4. Run MFDeploy and select USB from the Device list, you should see ChipworkX_ChipworkX in the dropdown.



5. Check the communication between MFDeploy and TinyBooter by pinging the device. Press Ping and you should see this message:



6. Now we can lead MFDeploy to the new ChipworkX firmware files. Click Browse and direct MFDeploy to the firmware HEX files. These can be found under ChipworkX\firmware folder in the SDK. The other files with “sig” extension must exist in the same folder as the HEX files. Select **ALL** of the HEX files at once and start deploying the firmware by pressing Deploy.



7. Loading the files takes about a minute. On completion the firmware will execute. Double check the version number to make sure the correct firmware is loaded.
8. Loading new firmware will not erase the deployed managed application. If you need to erase the managed application click Erase.

5. What Is Next?

There are many documents and resources that helps you out with ChipworkX and .NET Micro Framework:

- ChipworkX User Manual
- ChipworkX downloads page on www.ghielectronics.com
- GHI blog is always a good place to visit
  http://tinyclr.blogspot.com/
- The Micro Framework Project website is an excellent resource
  http://www.microframeworkprojects.com/
- A good and free eBook to continue learning about C# is available at
  http://www.programmersheaven.com/2/CSharpBook
- Jens Kuhner excellent book on .NET Micro Framework
  http://www.apress.com/book/view/9781430223870
- USB complete is an excellent book on USB
  http://www.lvr.com/usbc.htm
- .NET Micro Framework's main page on Microsoft's website
  http://www.microsoft.com/netmf
- .NET Micro Framework Community
  http://www.netmf.com/

Legal Notice

Licensing

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