



Freescale i.MXS Development Kit Quickstart Guide

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1. Introduction

Freescall introduces the i.MXS Development Kit, designed to quickly enable hardware manufacturers to create products on Microsoft's .NET Micro Framework™ and the Windows Vista™ SideShow™ platform. The Microsoft .NET Micro Framework is a platform enabling developers to build applications for very small devices that are constrained by cost, memory, processor, or power.

Windows Vista SideShow is a new platform in the Windows Vista operating system that sits on top of .NET Micro Framework and allows developers to write gadgets for the PC that sends data to an auxiliary display device connected to the PC. The i.MXS Development Kit for SideShow enables manufacturers to build auxiliary displays in a range of peripheral devices such as keyboards, LCD display casings, remote controls, cellular phones, and even user defined applications. These devices can then display information received from a PC running the Windows Vista OS without powering on the PC.

Freescall's i.MXS Development Kit enables hardware manufacturers to build auxiliary displays that comply with the SideShow "Enhanced Display" configuration. The kit features a small form-factor reference board that has a 2.5 inch color LCD panel with QVGA resolution. Freescall's i.MXS applications processor drives the system, providing superb performance and extremely low power consumption, enabling hours of use off a single battery charge. The i.MXS Development Kit includes a USB interface and an expansion connector for add-on modules such as Bluetooth™ technology or the ZigBee™ wireless protocol, creating a comprehensive development platform for a variety of applications. This development kit continues to evolve with more functionality built into the platform.

2. Key Features

i.MXS applications processor, based on the powerful ARM920T™ core	One 8-megabyte (MB) Burst Flash memory device
Clock source crystal: 32 kilohertz	One RS232 transceiver (configured for DCE) supporting on-chip UART1 port
Multi-ICE debug support connector	1 UART port at CMOS level for expansion
I2C and SSI bus connector for connection to external audio CODEC	On-Chip USB 1.1 interface
SMbus interface	On-board 2.5 inch LCD with back-light and QVGA resolution
32-megabyte (MB) SDRAM device	11 separated GPIO for key-button input
LED indicator for power	

3. i.MXS Development Kit CD Contents

The i.MXS Development Kit comes with 3 CDs:

Visual Studio.NET 2005 Evaluation Software

This software is used to develop and debug .NET applications, such as the .NET MicroFramework applications that will run on the i.MXS development kit, as well as the PC-based Gadget applications that run on Windows Vista.

Microsoft .NET MicroFramework SDK 2.0 Software

This CD contains the .NET MicroFramework SDK 2.0 software used to develop applications for resource-limited devices, such as the i.MXS development kit.

Freescale i.MXS Development Kit Content

This CD contains the following items to enable development on the i.MXS kit:

- i.MXS Development Kit Emulation software
- Sample .NET MicroFramework Application
- USB and SideShow Drivers for the i.MXS development board
- i.MXS Development Board Schematics and update documentation
- i.MXS development kit Bill of Materials
- i.MXS DevKit original binary image and flashing instructions
- i.MXS DevKit Flashlite and MFDeploy Client software
- i.MXS Devkit .NET MicroFramework Bootloaders – binary and hex
- i.MXS DevKit Quickstart guide – pdf

NOTE: In the future, these CDs may not all ship in the kits as they are all available for download online. If you do not receive these CDs, the software may be obtained from the following locations (links subject to change):

Visual Studio.NET 2005 Evaluation Software

<http://www.microsoft.com/downloads/details.aspx?familyid=B2C27A7F-D875-47D5-B226-E2578A116E12&displaylang=en>

SP1 patch: <http://msdn2.microsoft.com/en-us/vstudio/bb265237.aspx>

NOTE: to use .NET MicroFramework SDK 2.0 SP1 patch, VS2005 SP1 patch must be applied. This requires 6 GB of space. If you do not have this space, only install the .NET MicroFramework SDK 2.0. Freescale can provide this.

Microsoft .NET MicroFramework SDK 2.0 with SP1 Software

<http://www.microsoft.com/downloads/details.aspx?familyid=32F5DF20-6C95-4FE8-A76C-0ED56A839AD2&displaylang=en>

Freescale i.MXS Development Kit Content

http://www.freescale.com/files/32bit/doc/support_info/iMXS_DevKit_CD_Contents.zip?fpsp=1

4. Powering Up the i.MXS Kit

The i.MXS development kit comes with a binary image pre-loaded onto the board in Flash memory that is intended to demonstrate a possible GUI application running on the i.MXS development kit. This image was created with the Microsoft SideShow SDK, which is built upon the .NET MicroFramework. This SideShow SDK product is available from Microsoft to develop high quality GUIs that interface with PC-based gadgets running on Windows Vista.

NOTE: Usage of the SideShow SDK must be licensed from Microsoft. Thus, the source of this pre-loaded application does not ship with the i.MXS development kit. If a new application is deployed to the i.MXS development kit, the user can reflash the original image using ARM AXD and Multi-ICE per the instructions and binary included on the content CD. If you are interested in the SideShow SDK, you can contact Microsoft directly at winsshdk@microsoft.com.

To view this image, follow the following procedure:

- 1) Ensure that the bootstrap switches 1 and 2 (S11) on the i.MXS board are both set to OFF position. This boots the board from Flash memory at 0x10000000.
- 2) Plug in the power supply that comes with the kit into the power connector (P2) on the board, and turn the power switch on. Note that some boards do not have an ON switch. You should see the LED above this switch light up.
- 3) Next you will see the backlight come on with a black screen. TinyBooter bootloader is loading. After a few seconds, you will see the Freescale logo splash on the LCD and the Windows SideShow GUI will appear, as seen in the picture below. Use the menu buttons below the LCD monitor to interact with the GUI. The bottom right button (S8) on the i.MXS board serves as a back button. The middle button (S5) serves as a 'select' button in this GUI.



5. Installing the USB Driver for the i.MXS Development Kit

The i.MXS development kit requires the user to install USB drivers on the PC host computer. There are two provided USB drivers- those in the 'USB Driver - XP Vista' folder are used for debug and development with Flashlite, MFDDeploy, and Visual Studio tools. The second driver in the 'SideShow Driver - Vista Only' is for use with Vista and is only used to sync gadgets via usb. Please see section 6 for more details.

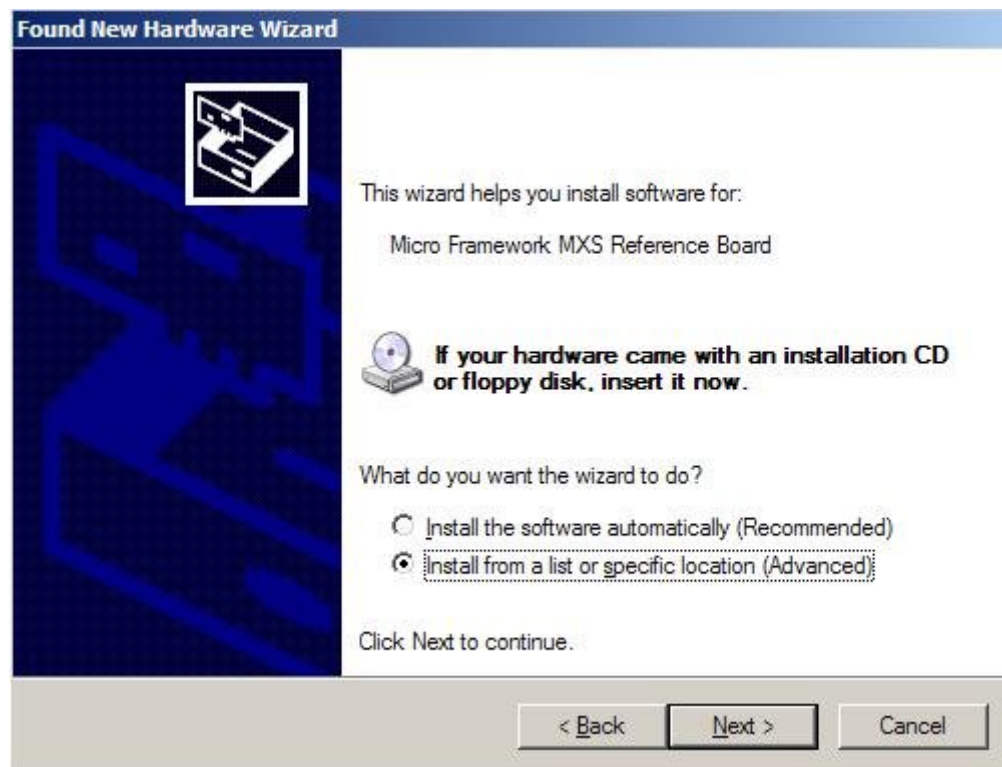
To install the USB development driver, follow these steps:

- 1) Do not connect the board to the USB cable at this time.
- 2) Copy the 'USB and SideShow Drivers' folder in the Freescale i.MXS Development Kit Content CD to the location of your choosing on your PC.
- 3) Verify that the i.MXS development board is set to boot from flash – i.e. the boot switches 1 and 2 are both set to OFF, or are both oriented to the right side.
- 4) Ensure that the board is powered by the power supply and power the board. Connect the USB cable from the i.MXS board to the PC. **Powering the board from only the USB cable can cause damage to the MXS board.**
- 5) You should see a "Found New Hardware" message from your PC, which loads the following installation program:

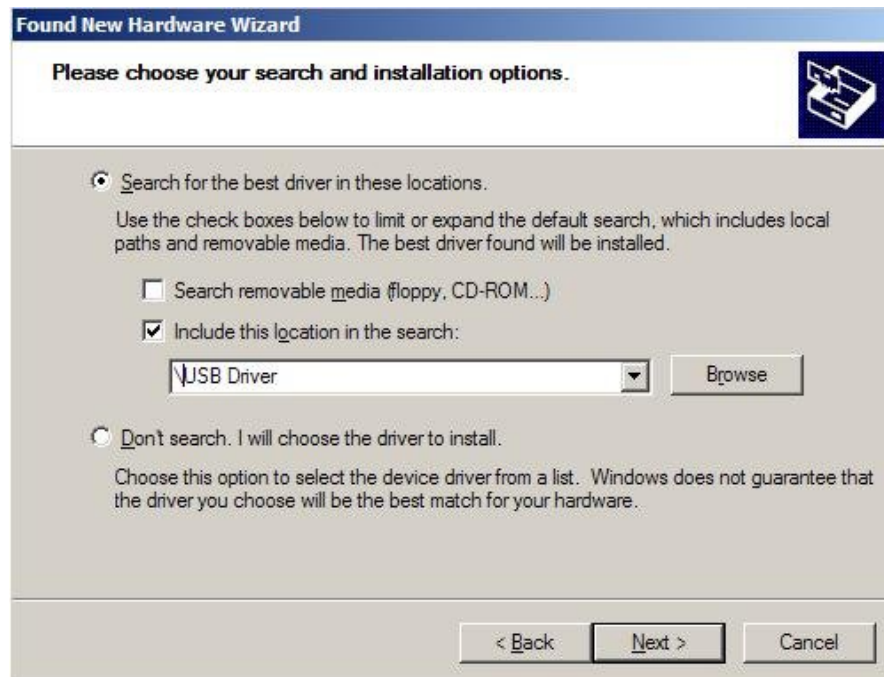


- 6) Click "No, not this time" and press 'Next' to continue.

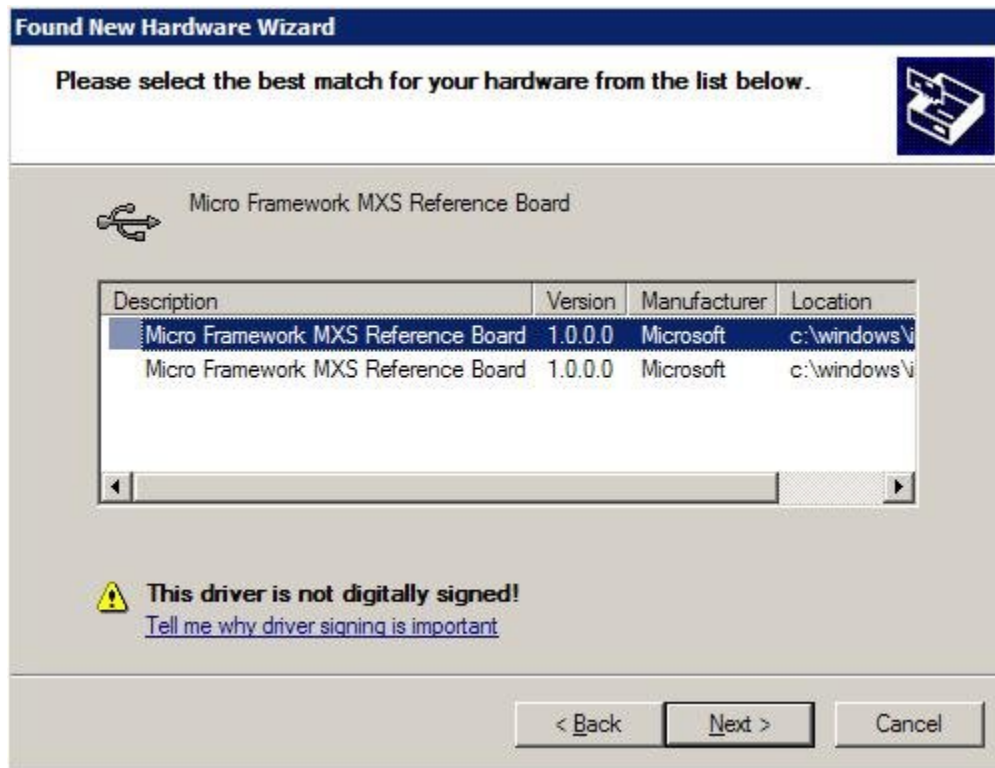
7) At the next menu, select 'Install from a list or specific location' and press 'Next'.



8) In the next menu, check 'Include this location in the search:' and navigate to the 'USB Driver - XP Vista' folder in the 'USB and SideShow Drivers' folder created in Step 2. This folder should contain the file named 'MFUSB.inf'. Press Next.



9) You may see the following screen below asking for further guidance in installing the USB driver:



Select the option which has the location pointing to the 'MFUSB' file, or, if not listed, press 'Next'. If it prompts for the MFUSB.sys file, point it to the x86 folder in the USB and SideShow Drivers\USB Driver - XP Vista folder.

10) At this point, the USB driver should install, and you should see a 'Found New Hardware' message from your PC. Click 'Finish' when prompted.

11) Finally, the USB driver must be enabled so that Visual Studio can detect the device for Deployment. Navigate to the "USB Driver - XP Vista" folder in the "USB and SideShow Drivers" folder of the content cd and double-click the spotusb.reg file. **Now the device will be detected by Visual Studio.**

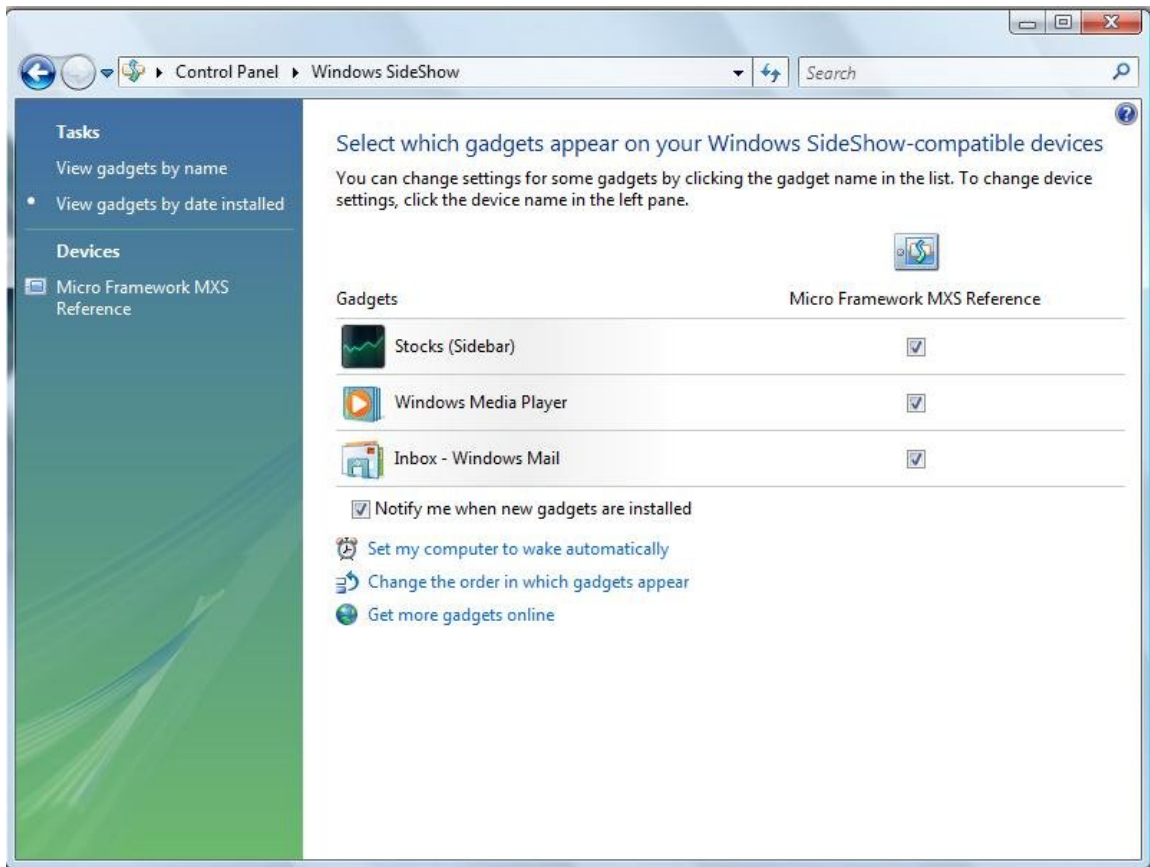
Now, when the i.MXS development kit is connected via USB to the PC, the device will be recognized. In the future, it may ask for a reinstallment of the driver. Follow the above steps. If you already have installed previous versions of i.MXS devkit USB drivers, it may say that hardware may not work properly, but you will still successfully be able to deploy applications and connect to the i.MXS board. This driver is also compatible with Microsoft Windows Vista™.

6. Running Windows Vista™ SideShow Gadgets on the i.MXS Development Kit

The i.MXS Development Kit ships with a pre-loaded Windows SideShow image on the board. This image allows you to run Windows Vista SideShow gadgets on the i.MXS development kit. This requires Windows Vista.

To operate these SideShow gadgets on your i.MXS board, follow these steps:

- 1) Do not connect the board to the USB cable at this time.
- 2) Verify that the i.MXS development board is set to boot from flash – i.e. the boot switches 1 and 2 are both set to OFF, or are both oriented to the right side.
- 3) Ensure that the board is powered by the power supply and power the board. Connect the USB cable from the i.MXS board to the Vista computer. **Powering the board from only the USB cable can cause damage to the MXS board.**
- 4) If you are not prompted to install the driver for the device, go to Device Manager (right click 'My Computer' and select 'Properties') and uninstall the i.MXS USB driver if installed by right-clicking on it. Then re-plug the usb cable to the Vista computer.
- 5) Follow the prompts to install the driver for the new device. Point the installer wizard to the 'SideShow Driver - Vista Only' folder located in the 'USB and SideShow Drivers' folder. The SideShow driver for the i.MXS board should install successfully. If the i.MXS board is NOT running a SideShow image, such as the originally loaded image, this driver will not install.
- 6) Go to Settings -> Control Panel -> Windows SideShow. You should see the following menu if the driver installed successfully and the i.MXS board is running a SideShow image.



- 7) Make sure boxes on the right are checked according to which gadgets you wish to run on your i.MXS board. Once the items are checked, you should see an icon for that gadget on the i.MXS board and you should be able to run the gadget. The Windows Media Player SideShow, for example, can control which songs are played on the Vista PC from the i.MXS device. To download and install more SideShow gadgets, click the 'Get more gadgets online' link, or create your own with the .NET MicroFramework and Microsoft SideShow SDK.

7. Upgrading to the TinyBooter Production Bootloader

The i.MXS DevKit ships with the development bootloader, Flashlite, loaded. This can be used to load unsigned firmware to the board if the user has access to the Porting Kit (low-level driver firmware kit). The Flashlite bootloader communicates with the PC via the Flashlite Client tool, included on the content CD. For more information on receiving the low-level driver porting kit, please contact Microsoft at netmbiz@microsoft.com

Some users may wish to try the TinyBooter bootloader, which is production-ready. The user should be aware that TinyBooter will only load signed firmware images. If you are using the porting kit, you will not be able to load unsigned firmware images or bootloader images with TinyBooter.

To load TinyBooter on the i.MXS Devkit:

- 1) Power on the i.MXS Devkit. When you see the “Zen Boot” Flashlite bootloader come up, immediately press the S2 ‘Up’ button until the ‘*’ cursor rests next to the word “Flashlite”.
- 2) Connect USB from i.MXS Devkit to your PC. **Make sure that the board is powered by the 5V supply to prevent USB damage.**
- 3) Double-click the ‘FlashLiteClient.exe’ executable in the ‘Flashlite Client Software’ folder on the content CD.
- 4) Pull down the COM Port drop down menu to the Sideshow USB device. If you only see COM1 and COM3, please reinstall your USB driver. Check Device Manager for any USB issues.
- 5) Browse to the Bootloaders folder on the content CD and select “TinyBooterDecompressor.hex” file. The BIN file is the binary version of the bootloader. Flashlite Client only takes HEX files, however.
- 6) Press “Reload” to refresh
- 7) Press ‘Start’ and wait for flash completion.
- 8) When you restart your board, you should see only the backlight come on before the Freescale logo splash screen. Make sure to close the Flashlite client so that it does not interfere with Visual Studio deployment.

Now TinyBooter is loaded. The user can now use the MFDeploy Client to interface to this bootloader. It can be found on the content CD in the ‘MFDeploy Client Software’ folder.

8. Deploying a Sample Application to the i.MXS Development Kit

With the i.MXS board USB driver installed, it is now possible to build and deploy an application to the board. For this purpose, a sample .NET MicroFramework Application has been provided with the i.MXS development kit for users to get the hang of debugging and deploying an application to the i.MXS kit.

For those wishing to develop for the i.MXS without the i.MXS development hardware, an i.MXS Development Board Emulator has been created. Please see the following two sections of this guide for more information on using this emulator for development.

The sample application provided in this kit performs the following actions:

- Draws a colored circle to the LCD at a randomized location when a button is pressed.
- Outputs a string describing the circle via the COM1 UART connector on P3.

NOTE: Deploying a new application to the i.MXS board will erase the currently loaded SideShow image on the board. **This image is not reloadable for reasons described in the note of Section 4.** If you wish to keep the originally loaded image on the i.MXS board, do not proceed.

To deploy this application to the i.MXS development board, follow these steps:

1) Verify that the i.MXS board is set to boot from flash. Switches 1 and 2 should be set to OFF. The reason for this is that Visual Studio must talk to the tiny bootloader to deploy the application, and the tiny bootloader loads from flash.

2) Ensure that the board is powered by the power supply. **Powering the board from only the USB cable can cause damage to the MXS board.** Connect the i.MXS board to the PC with the USB cable. The PC should recognize the i.MXS device.

NOTE: The computer might report that the "USB device was not recognized". However, it quickly should resolve this and recognize the device. This can be verified if the USB chime sound is heard. To further verify, the device should be listed in the 'Universal Serial Bus controllers' list in the Device Manager of the PC. This can be reached from Start-> Settings -> Control Panel -> System -> click the Hardware tab -> click the Device Manager button.

3) Place the contents of the 'Sample Application' folder in a directory of your choosing. The most common residence of Visual Studio projects is in the 'Visual Studio 2005\Projects' folder that was installed in 'My Documents' when Visual Studio.NET 2005 was installed.

4) Double-click on the file named 'MXS_Sample_Project.sln' to bring up this sample application project in Visual Studio.

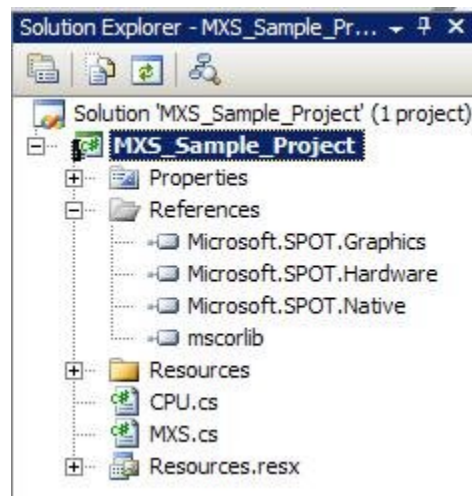
5) If you cannot view the Solution Explorer, go to the View tab and select 'Solution Explorer'. Now you should see the project on the right-hand side of the window. Source for this application resides in the 'MXS.cs' file.

6) Build the application by going to the Build tab and selecting 'Build Solution'. You should get a build succeeded message in the output.

If you do not successfully build, take the following steps:

- Verify that you have the .NET MicroFramework SDK 2.0 installed. You can verify this from Add and Remove Programs in Windows. Old versions of .NET Micro Framework SDK **must** be removed before installing the 2.0 SDK.

- In the Solution Explorer, open the References folder. You should see the following references:



- Right-click on each of these and remove.
 - Right-click on the References folder and select "Add Reference".
 - Click the Browse tab and navigate to the Assemblies directory of the .NET MicroFramework, which is generally located at this path:
C:\Program Files\Microsoft .NET Micro Framework\v2.0.3036\Assemblies
 - Click the ctrl key and select the following files to add as a reference:
 - Microsoft.SPOT.Graphics.dll
 - Microsoft.SPOT.Hardware.dll
 - Microsoft.SPOT.Native.dll
 - mscorlib.dll
 - Build the project again. It should report that the project built successfully.
- Right-click on the project ("MXS_Sample_Project") in the Solution Explorer window and select Properties.
 - Click the MicroFramework tab at the bottom of the page. For 'Transport', select the 'USB' option from the dropdown menu. For 'Device', select the only option in the dropdown menu, which should be something similar to 'iMXS_a7e70ea2'.

NOTE: If you do not see <none> in the "Device" dropdown menu, close down Visual Studio and detach and re-attach the i.MXS board from USB. Verify that the computer recognizes the device as described in step 2. Re-open the sample application and begin from step 7.
 - Click on the green 'Start Debugging' arrow or press F5. You should see messages in the output tab about deployment beginning. Your board should then restart and you should see the words 'Press any button below!' appear on the LCD.

NOTE: If deployment errors are encountered on this step, it may be because a previous debug session was not closed properly. This can happen if an emulator was run previously and closed incorrectly. This can be solved by deploying the emulator again and selecting Debug -> Stop Debugging from the menu to end the process.

10) To stop this application from running, go to the 'Debug' tab and select 'Stop Debugging'. Because deploying the application writes it to flash, the next time the i.MXS board is powered up, this application will load.

This sample application can be debugged with breakpoints. To do this, set the breakpoints at the code location you would like to stop at and press F5.

To view the serial port portion of this sample application, connect the i.MXS via a serial cable to the PC and open Hyperterminal to 115200 baud on COM1. When this application is running, press a button on the i.MXS board and you will see a descriptive message appear on the Hyperterminal. View the output tab in Visual studio to see debug prints from the application running.

Note that serial port communication is only possible using 'COM1' in the sample application code (MXSSample.cs line 51). This is because the i.MXS board only has one RS232 port, P3, on the board, which is set up to use COM1.

9. Installing the i.MXS Emulator

An i.MXS Development Board Emulator has been created for those customers who do not have an i.MXS board in hand to develop and debug applications.

At this time, the following functionality is supported in this i.MXS Emulator:

- LCD emulation
- Button emulation
- Memory emulation
 - 8 MB Flash
 - 6 MB SDRAM*

***NOTE:** The actual i.MXS board has 32 MB SDRAM. Emulation requires 6MB of physical memory on the PC to emulate 1 MB of SDRAM. As this would require a very high amount of memory to run the emulator, the size of SDRAM in emulation has been scaled down to 6 MB.

To install the emulator, follow the following procedure:

1) Install Visual Studio.NET 2005.

2) Install the .NET MicroFramework SDK 2.0. Old versions of .NET Micro Framework SDK **must** be removed before installing the 2.0 SDK. Old versions can be uninstalled using 'Add or Remove Programs' from the Windows Control Panel.

.. **NOTE:** This version of the i.MXS Emulator is only compatible with the 2.0 MicroFramework and not work with any future or previous releases.

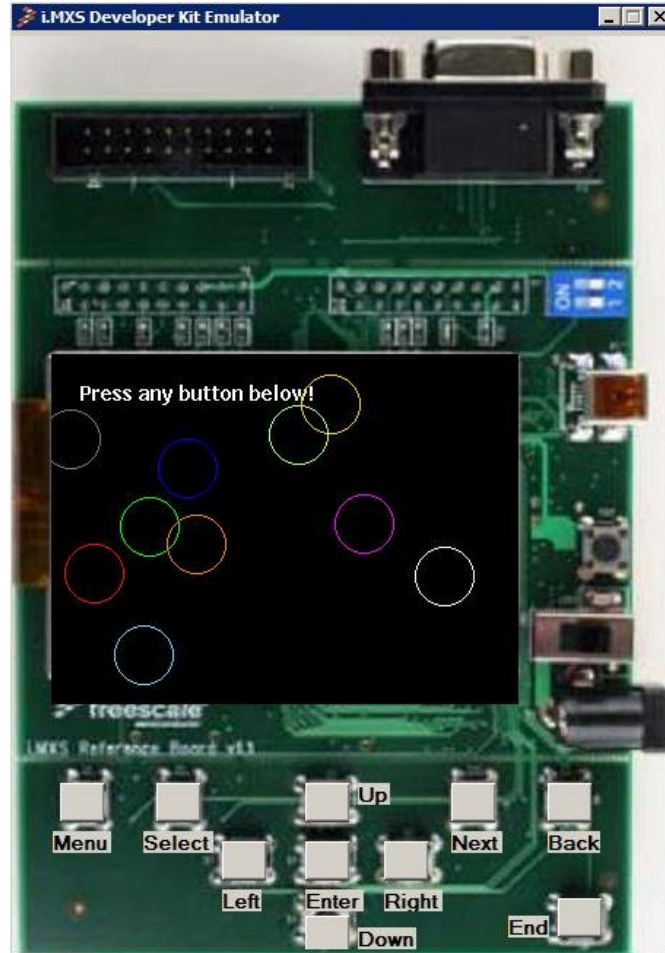
3) On the Freescale i.MXS Development Kit Content CD, open the folder 'i.MXS DevKit Emulator Installer' and double-click the 'MXSEmulator2_0.exe' executable. This will install the i.MXS DevKit Emulator.

10. Running a Sample Application on the i.MXS Emulator

A sample .NET MicroFramework Application has been provided with the i.MXS development kit for users to learn how to debug and deploy an application to an emulator or the i.MXS kit.

To run the sample application with the i.MXS Emulator, follow these steps:

- 1) Install the i.MXS Emulator per the instructions in section 7.
- 2) Complete steps 3-7 in Section 6, 'Deploying a sample application to the i.MXS development board'. If the sample application has already been copied, there is no need to complete step 3.
- 3) Click the MicroFramework tab at the bottom of the Properties page. For 'Transport', select the 'Emulator' option from the dropdown menu. For 'Device', select 'i.MXS DevKit Emulator'.
- 4) Click the 'Start Debugging' green arrow and the i.MXS emulator will deploy running the sample application. You should see:



- 5) To stop the emulator, go to the 'Debug' tab and select 'Stop Debugging'.

11. Questions

For additional questions and information, please see the i.MXS Development Kit website at www.freescale.com/imx. For technical inquiries, please contact support@freescale.com.