Stellaris® LM3S9B92 Robotic Evaluation Kit

The Stellaris EVALBOT Evaluation Kit provides a low-cost way to start designing simple robotic applications with Stellaris microcontrollers. The EVALBOT Evaluation Board (EVB) functions as a complete evaluation target that also includes a debugger interface that can be used to program and debug the evaluation board. The included USB cable is all that is needed to provide power and communication to the host PC. Three included AA batteries provide power for mobile applications.

Requirements

- You have a PC, with a USB interface, running Microsoft® Windows 2000, Windows XP, Windows Vista, or Windows 7.
- You have an internet connection.

Software Download

Before connecting the EVALBOT to your PC, download and install the supporting software and device drivers for the board. These can be found at http://micrium.com/page/downloads/os-iii_files listed under "µC/OS-III for TI Stellaris."

After downloading the `Micrium-Book-uCOS-III-LM3S9B92.exe` file, run the file and unzip the contents to a directory on your hard disk.

Downloading µC/Probe

µC/Probe is an award-winning Microsoft Windows-based application that allows users to display or change the value (at run time) of virtually any variable or memory location on a connected embedded target.

To gain run-time visibility, µC/Probe is used in all of the examples described in Chapter 3 of the *Micrium uC/OS-III: The Real-Time Kernel* book. There are two versions of µC/Probe:

- The Full Version of µC/Probe is included with all µC/OS-III licenses. This version supports J-Link, RS-232C, TCP/IP, USB, and other interfaces. The full version allows users to display or change an unlimited number of variables.
- The Trial Version is not time-limited, but only allows users to display or change up to five application variables. However, the trial version allows users to monitor any µC/OS-III variables because µC/Probe is µC/OS-III aware.

Both versions are available from Micriµm's website:

www.Micrium.com/Books/Micrium-uCOS-III

Follow the links to download the version you want to use (or both). If you are not already registered on the Micriμm website, you must register in order to download the software. Once you have downloaded the software, run the appropriate μC/Probe setup file:

```
Micrium-uC-Probe-Setup-Full.exe
Micrium-uC-Probe-Setup-Trial.exe
```

Download the IAR Embedded Workbench for ARM

Examples provided with the book were tested using IAR Embedded Workbench for ARM V5.5. You can download the 32K Kickstart version from the IAR website. This version allows you to create applications up to 32 Kbytes in size (excluding μC/OS-III). The file from IAR is about 400 MBytes. If you have a slow Internet connection or are planning to install a new version of Windows, you might want to consider archiving this file on a CD, DVD, or even a USB drive.

You can download IAR tools from (case-sensitive): www.iar.com/MicriumuCOSIII.

1. Click the *Download IAR Embedded Workbench* >> link in the middle of the page. This opens the *Download Evaluation Software* page on the IAR website.
2. Locate the *ARM* processor row and then the *Kickstart edition* column on that same row and click the link for *v5.50 (32K)* (or newer version if that's available). The *KickStart edition of IAR Embedded Workbench* page displays.
3. Click *Continue...* when you are finished reading the page.
4. You must register separately on the IAR website. Registration information is not shared between Micriμm and IAR. Complete the registration form and click *Submit*.
5. Save the file to a convenient location.
6. You will receive a *License number and Key for EWARM-KS32* from IAR.
7. Double click the IAR executable file (`EWARM-KS-WEB-5505.exe`) (or a similar file if newer) and install the files on the disk drive of your choice, in the root directory.

You can use the full version of the IAR Embedded Workbench if you are already a licensee.

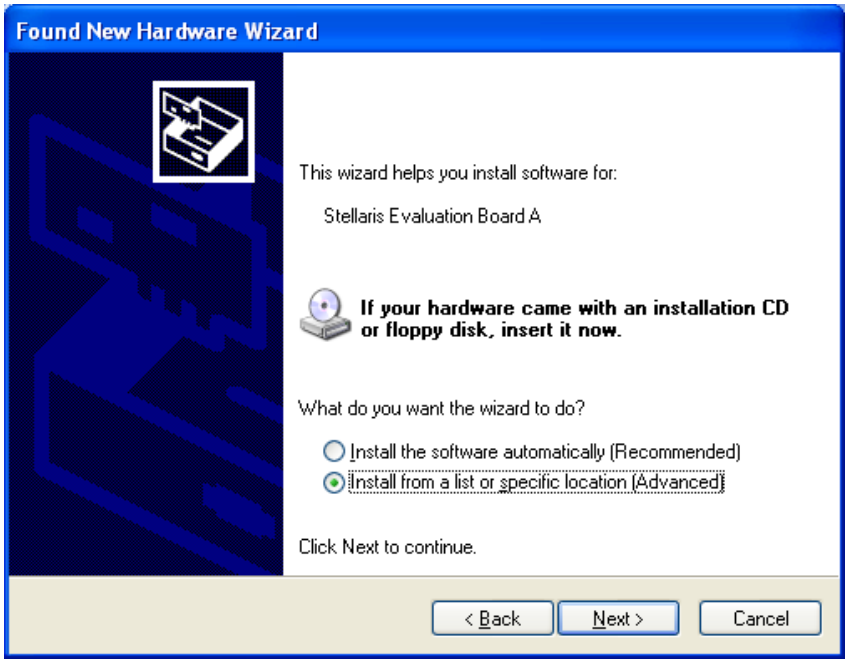
Board Set-Up

If you have already assembled the EVALBOT, you will have seen it driving around using battery power. The board can also be powered via a USB connection. This configuration would typically be used when downloading or debugging software on the board. To connect the EVB to a PC, use the USB-miniB to USB-A cable supplied in the kit. Connect the miniB (smaller) end of the USB cable to the connector labeled "ICDI." Connect the other end (Type A) to a free USB port on your host PC. The USB is capable of sourcing up to 500 mA for each attached device, which is sufficient for the evaluation board. If connecting the board through a USB hub, it must be a powered hub. Once the board is connected to the PC, press the ON/RESET button next to the display on the EVALBOT.

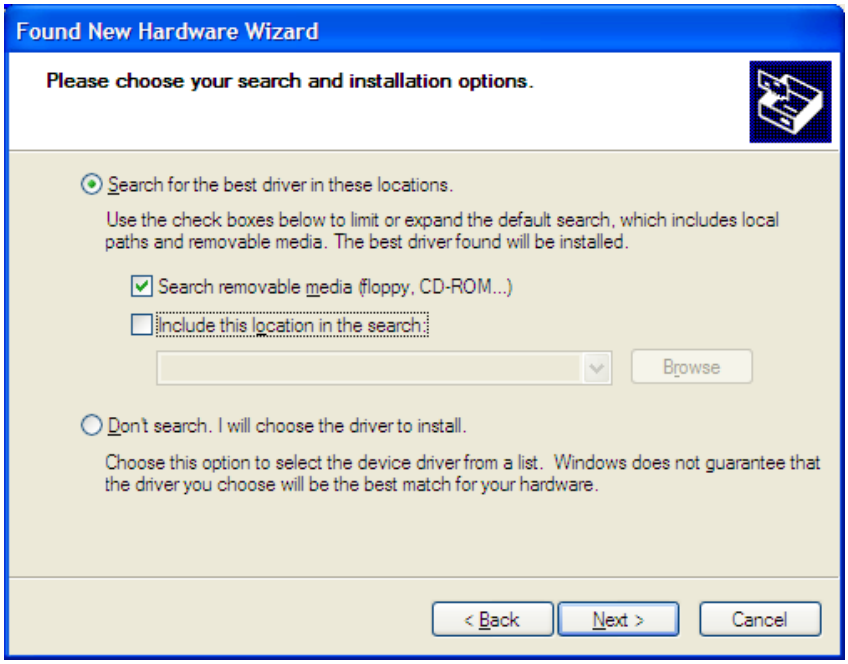
Important Note: The next step explains how to install the FTDI drivers for the board. Some customers with previous installations of the FTDI drivers may experience trouble when installing newer (2.02.04 and later) versions of the driver. The problem only seems to affect users of Windows XP, and not Windows Vista. If you have any problems with the driver installation, visit http://www.ti.com/lm_ftdi_driver for information.

When you plug in the EVB for the first time, Windows starts the Found New Hardware Wizard and asks if Windows can connect to Windows Update to search for software. Select "No, not this time" and then click Next.

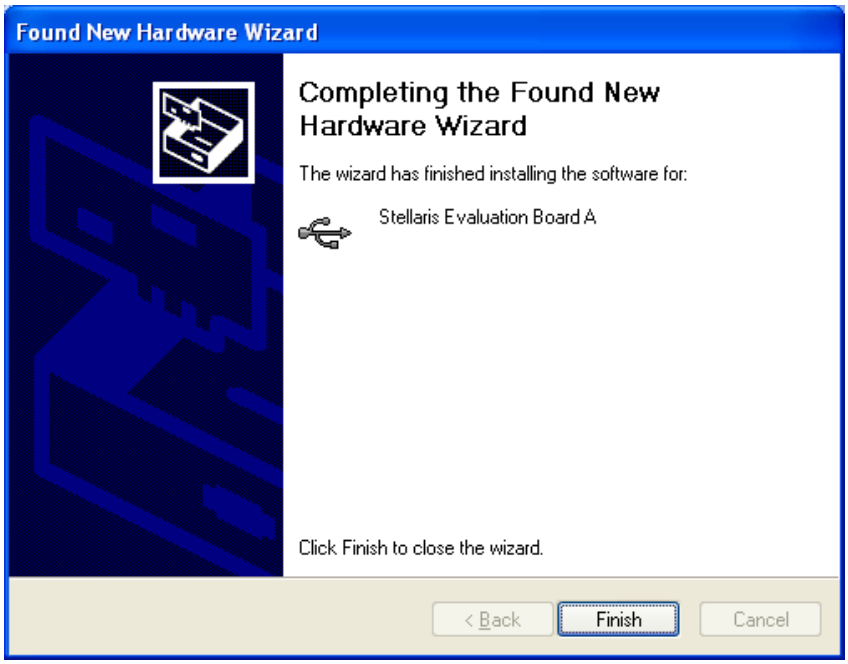
Next, the Found New Hardware Wizard asks from where to install the software. Select "Install from a list or specific location (Advanced)" and click Next.



Select "Search for the best driver in these locations," and check the "Include this location in the search" option. Click the Browse button and navigate to the `FTDI-Stellaris` directory that was created when you unzipped the downloaded software package. If you unzipped the software into the root of your C: drive, for example, this would be `C:\Stellaris_FTDI-2_06_00`. Click Next.



Windows finishes installing the drivers for “Stellaris Evaluation Board A.” When the driver install is finished, the Found New Hardware Wizard window appears like the one below. Click Finish to close the dialog box.



You have just installed the drivers for “Stellaris Evaluation Board A.” The USB device built into the EVB is a composite USB device. After you click Finish, Windows automatically installs a driver for the “Stellaris Evaluation Board B” part of the composite USB device. Follow the same instructions as above to install the drivers for this device.

The Found New Hardware Wizard appears one last time. This is to install the drivers for the “Stellaris Virtual COM Port.” Again, follow the same instructions to install the drivers for this device.

Now all of the FTDI drivers for the EVALBOT Evaluation Board have been installed. These drivers give the debugger access to the JTAG/SWD interface and the host PC access to the Virtual COM Port.

With the drivers installed, Windows automatically detects any new Stellaris boards that you attach, and installs the drivers for you.

Quickstart Application

The EVALBOT Evaluation Board comes preprogrammed with a quickstart application. Once you have powered the board by pressing the "ON/RESET" button, this application runs automatically. Press either SWITCH 1 or SWITCH 2 to start the robot’s preprogrammed quickstart application. Press SWITCH 1 or SWITCH 2 again to pause the operation. Press the OFF button to turn off the robot. The quickstart application provides autonomous control of

the EVALBOT evaluation board using the motors and bump sensors on the board. This project demonstrates how µC/OS-III, in conjunction with the EVALBOT evaluation board, can be used to create an autonomous motor control application. The robot drives forward until either the robot bumps into something or a bounded random time value expires. If either of these events occurs, the robot turns in a random direction and then continues driving forward.

The bump sensors on the front of the EVALBOT board are used to detect the robot bumping into something while driving forward. If the left bump sensor is triggered, the robot turns to the right and then continues driving forward. Conversely, if the right bump sensor is triggered, the robot turns to the left and then continues driving forward.

In addition to the bump sensors, a timer expiration event causes the robot to change directions while driving forward. A timer is configured to expire in a bounded random amount of time when the robot begins to drive forward. If the timer expires prior to bumping into something, the robot randomly chooses to turn to the left or right, and then continues driving forward.

Note: The robot typically drives in a straight line, however, it is also programmed to occasionally drive in a curve.

Software Development Tools

The next step is to install and run the software development tools. Additional tools may be available through the http://www.ti.com/stellaris web site, but may not run with the Micrium software.

References

The following references are available for download at http://www.ti.com/stellaris:

- *Stellaris LM3S9B92 Microcontroller Data Sheet*
- *StellarisWare® Peripheral Driver Library User's Manual*
- *Stellaris Robotic Evaluation Board Documentation Addendum*
- *Stellaris Robotic Evaluation Board (EVALBOT) Product Brief*

Texas Instruments
108 Wild Basin Rd., Suite 350
Austin, TX 78746
http://www.ti.com/evalbot

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265