

## Introduction

This quick start guide describes how to set up Zilog's ZNEO™ Z16FMC Series Motor Control Development Kit and use it to evaluate your motor control designs and applications.

The Z16FMC Series Motor Control Development Kit features a Motor Control Modular Development System (MC MDS) daughter board mounted on a 3-Phase Motor Control Application Board (see Figure 1). The MC MDS board consists of a 64LQFP Z16FMC chip and a DBG connector to connect the kit to a host development PC via the USB Smart Cable. The 3-Phase Motor Control Application Board provides spade lug connectors for the 3-phase motor and fused spade lug connectors for an adjustable 24 V DC, 3 A work-bench power source.

This document guides you through the following elements:

- Power supply requirements to power the 3-phase motor supplied with the kit
- How to run the kit's preloaded sample code in standalone mode
- How to connect the kit to your development PC
- Running the sample code in Zilog Developer System II (ZDSII) Debug mode

## Kit Contents

All hardware (except an external adjustable power supply) and software/documentation required to evaluate the Zilog® motor control solution is included within the Z16FMC Series Motor Control Development Kit. For details on kit contents, refer to the Z16FMC Series Motor Control Development Kit Packing List (PAK0025). The sample code used in this development kit is based on the Zilog Application Note titled *Sensorless BLDC Motor Control Using the ZNEO Z16FMC MCU (AN0311)*. The latest sample code for this document, AN0311-SC01, can be downloaded at [www.zilog.com](http://www.zilog.com).

## System Requirements

Table 1 lists the system requirements for running ZDSII.

**Table 1. ZDSII System Requirements**

| <b>Recommended Configuration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Minimum Configuration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Windows XP Professional SP3 or later</li> <li>Pentium IV 2.2GHz processor or higher</li> <li>1024MB RAM or higher</li> <li>135 MB hard disk space</li> <li>Super VGA Video Adapter</li> <li>CD-ROM for installation</li> <li>RS232 communication port with hardware flow control</li> <li>USB High-Speed port (when using USB Smart Cable)</li> <li>Ethernet port (when using Ethernet Smart Cable)</li> <li>Internet browser (Internet Explorer or Netscape)</li> </ul> | <ul style="list-style-type: none"> <li>Windows XP Professional SP3</li> <li>Pentium IV 1.2GHz processor</li> <li>512 MB RAM</li> <li>25MB hard disk space (Application only)</li> <li>Super VGA Video Adapter</li> <li>CD-ROM for installation</li> <li>RS232 communication port with hardware flow control</li> <li>USB High-Speed port (when using USB Smart Cable)</li> <li>Ethernet port (when using Ethernet Smart Cable)</li> <li>Internet browser (Internet Explorer or Netscape)</li> </ul> |



**Caution:** Always use a grounding strap to prevent damage resulting from electro-static discharge (ESD).

## External Power Supply Requirements

The 3-phase motor shipped with your development kit requires power from an adjustable external power source. The external power source must provide 0V DC to 24V DC power at 3 A. The adjustable power supply leads must be fitted with spade lugs that connects to spade lugs (P4 and P5) on the 3-Phase Motor Control Application Board (see Figure 1).

## Running in Standalone Mode

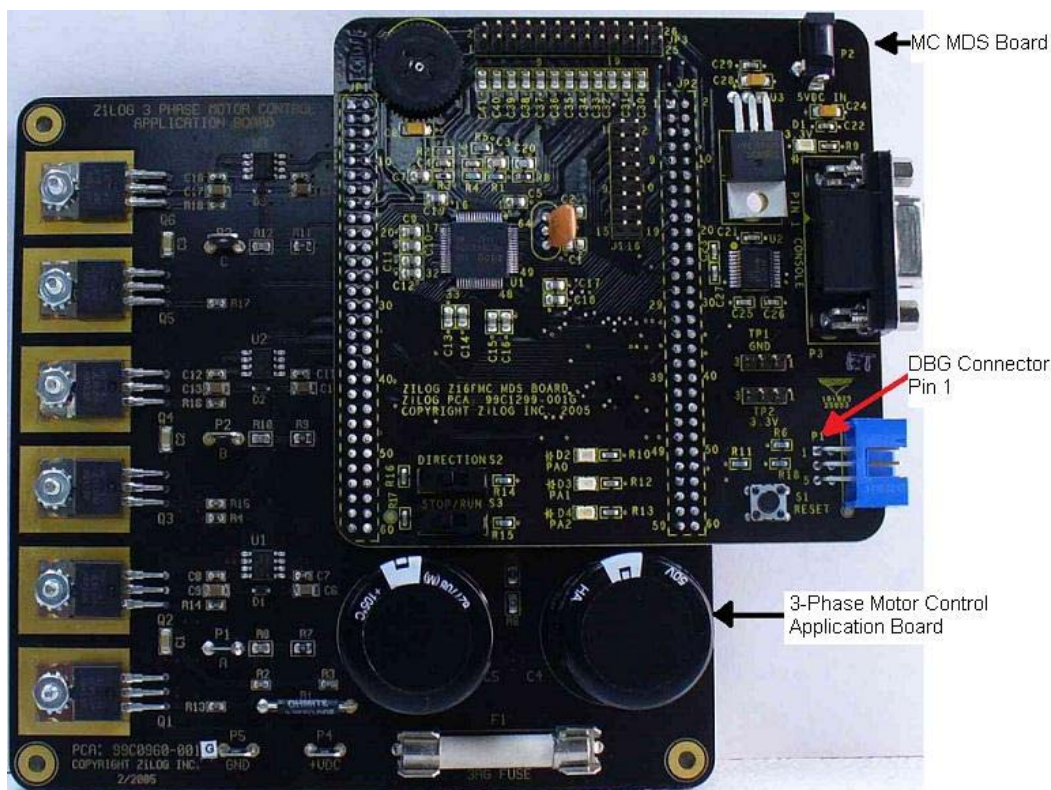
The Z16FMC Series Motor Control Development Kit is shipped with the sample code from the Application Note titled *Sensorless Brushless DC Motor Control with the Z16FMC MCU (AN0311)* preloaded into the Z16FMC chip's internal Flash memory.

Observe the steps in this section to set up the kit and run the sample code in standalone mode.

### Step 1. Connect the 3-Phase Motor to the Board

The 24V DC 3-phase motor included with the kit features three spade connectors that plug into spade lugs P1, P2, and P3 on the 3-Phase Motor Control Application Board. Connect

the motor leads to the spade lugs on the 3-Phase Motor Control Application Board as shown in Figure 2.



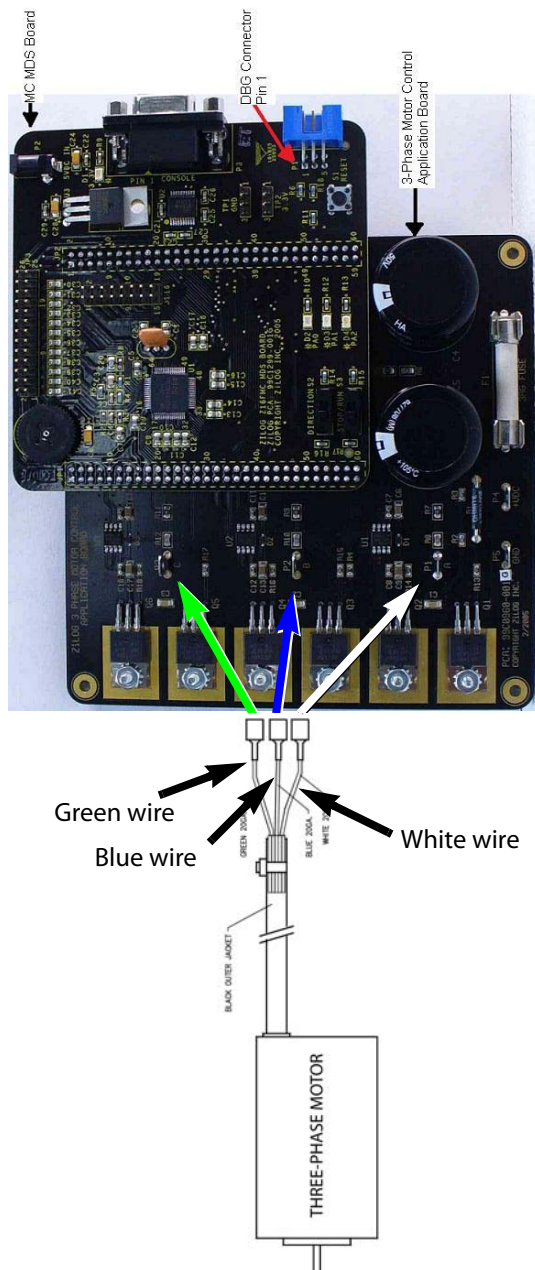
**Figure 1. MC MDS Board Mounted on 3-Phase Motor Control Application Board**

## Step 2. Set Switches

For your initial setup, set the switches on the board as detailed below.

- Set Direction Switch S2 to the far right position
- Set Switch S3 to the far right/RUN position
- Set Speed Potentiometer R7 to its midpoint

Refer to the *Z16FMC Motor Control Development Kit User Manual (UM0234)* for detailed jumper descriptions.



**Figure 2. Z16FMC Series Development Kit Motor and DBG Connections**

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## Step 3. Configure the 5V DC Universal Power Supply

The universal power supply kit features different plug adapters in one box and the power supply in another. The power supply ships with a slide-out plate that must be removed to insert the location-specific plug adapter.

Observe the following steps to configure the 5 V DC universal power supply:

1. Remove the slide-out plate.
2. Select the AC plug adapter appropriate for your locale and insert it into the slot that remains after removing the slide-out plate.
3. Slide the new plug adapter into the slot until it snaps into place.

For convenience, you can leave the adapter slot cover in place and plug in a standard computer equipment AC power cord (purchased separately) between the AC cord receptacle on the end of the power supply and an electrical outlet.

## Step 4. Connect the 5V DC Universal Power Supply

Connect the 5 V DC power supply to the MC MDS board at connector P2, then plug the supply into an electrical outlet. The green 3.3 V DC LED D1 illuminates when power is applied.

## Step 5. Connect the Adjustable Power Supply



**Caution:** To avoid damage to the development kit, check the power supply connection polarities as you follow the instructions below.

1. Set your adjustable power supply to 0 V DC.
2. Connect the negative (–) lead of your adjustable power supply to spade lug connector P5 on the 3-Phase Motor Control Application Board.
3. Connect the positive (+) lead of your adjustable power supply to spade lug connector P4 on the 3-Phase Motor Control Application Board.

## Step 6. Apply Power to the Motor

1. Slowly increase the adjustable power supply to 24 V DC. The 3-phase motor begins to spin.

The sample code has preprogrammed Direction SWITCH S2 to change the direction of motor spin. Run/Stop SWITCH S3 is set to turn the motor ON and OFF. Speed potentiometer R7 allows you to change the direction of motor spin and motor speed.

2. Experiment with the switches to see how simple it is to control the motor using the Z16FMC MCU installed on the kit's MC MDS board.

## **Step 7. Power Down the Motor**

After seeing how the sample code operates, turn the adjustable power supply to 0V DC and unplug the 5V DC universal power supply from the MC MDS board.

## **Executing the Sample Code**

The steps below outline the basic script for executing the sample code in debug mode using ZDSII. Each of these steps is further described in this section.

1. Stop the preloaded sample code and turn power to the 3-phase motor and MC MDS board off.
2. Install the ZDSII–ZNEO Series Software.
3. Install the USB Smart Cable driver software and USB Smart Cable.
4. Connect the USB Smart Cable to the MC MDS board.
5. Download and run the sample code in Debug mode using ZDSII.

## **Step 1. Stop the Preloaded Sample Code**

If you have not already done so, apply the adjustable power supply to 0V DC and unplug the 5V DC universal power supply from the MC MDS board.

## **Step 2. Install the ZDSII–ZNEO Series Software**

Observe the following steps to install the ZDSII software tool.

1. Insert the ZDSII CD into your computer's CD-ROM drive. DemoShield launches automatically. If it does not automatically launch, go to the root of the CD-ROM and double-click the `launch.exe` file.
2. DemoShield provides several installation choices. To install ZDSII right away, select **Install Zilog Developer Studio**. You can install other software and accompanying documentation later.

3. Follow the instructions on the screen to complete the installation.

## **Step 3. Install the Opto-Isolated USB Smart Cable**

The opto-isolated USB Smart Cable connects the development kit to a high-speed or full-speed USB port on your ZDSII host system. Its internal optoisolator electrically isolates the development kit circuitry from the USB Smart Cable.

The opto-isolated USB Smart Cable is enclosed in a black box that connects to the host PC via a USB cable (included in kit). The USB Smart Cable housing is connected to the development kit via a six-circuit ribbon cable.

Install the opto-isolated USB Smart Cable as described below for the appropriate operating system. Do not connect power to either the MC MDS board or application board before connecting a USB Smart Cable to the host PC and development board.

### **Windows Vista**

Observe the following steps to install the opto-isolated USB Smart Cable for 32-bit Windows Vista systems.

1. Connect the opto-isolated USB Smart Cable to the host PC. The **Found New Hardware** dialog box is displayed.
2. Select **Locate and install driver software (recommended)**. The **User Account Control** window is displayed; click **Continue**. The **Driver Software Installation** window is displayed, followed by the **Found New Hardware-USB Smart Cable** dialog box.
3. Select **I don't have the disc. Show me other options**.
4. Select **Browse my computer for driver software (advanced)**.
5. Browse to one of the following driver directories:

```
<ZDS II Installation Directory>\device drivers\USB\x32  
<ZDS II Installation CD>\device drivers\USB\x32
```

6. Click **Next**. The **Windows Security** dialog box is displayed.
7. Select **Install this driver software anyway**.
8. When the software has been installed successfully, click **Close**.



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## Windows XP

Observe the following steps to install the USB Smart Cable for Windows XP systems.

1. Connect the Zilog USB device to the Host PC. The **Found New Hardware** Wizard should activate automatically after connecting the Zilog USB device for the first time; Select **No, not at this time** if asked to connect to Windows® Update.
2. Select **Install from a list or specific location (Advanced)** and click **Next**.

► **Note:** If the Windows Logo testing dialog appears, select **Continue Anyway**.

3. Select **Search for the best driver in these locations** and **Include this location in search:**.
4. Browse to the following directory and click **Next**:

```
<ZDS installation>\device drivers\USB\X32
```

5. Click **Next** after the appropriate driver information is found.
6. Click **Finish** to complete the installation.

## Step 4. Connect the Opto-Isolated USB Smart Cable to the MC MDS Board

Attach one end of the six-conductor ribbon cable (included) to the opto-isolated USB Smart Cable's six-pin DBG connector. Pin 1 of the ribbon cable is indicated by a dark stripe (see Figure 3).

Attach the free end of the ribbon cable to the DBG connector on the MC MDS board.





**Figure 3. Connecting the Six-Conductor Ribbon Cable to the Opto-Isolated USB Smart Cable**

## Step 5. Download and Run the Sample Code

Observe the following steps to open the `Z16FMC_motordemo.zdsproj` sample project and run the sample code in Debug mode.

► **Note:** Ensure that the console port (P3) is connected on the serial port of your host PC. Set the terminal to 57600, 8-N-1.

1. Ensure that the switches and jumpers on the MC MDS board are set as described in [Step 2. Set Switches](#) on page 3.
2. Connect and apply power to the development kit as described in [Running in Standalone Mode](#) on page 2 through 6.



**Caution:** Do not apply power to the MC MDS board or application board unless the USB Smart Cable is connected both to the host PC and to the development board's DBG port.

3. Run the ZDSII software. By default, the Zilog Developer Studio II program is located in the **Start** menu under:

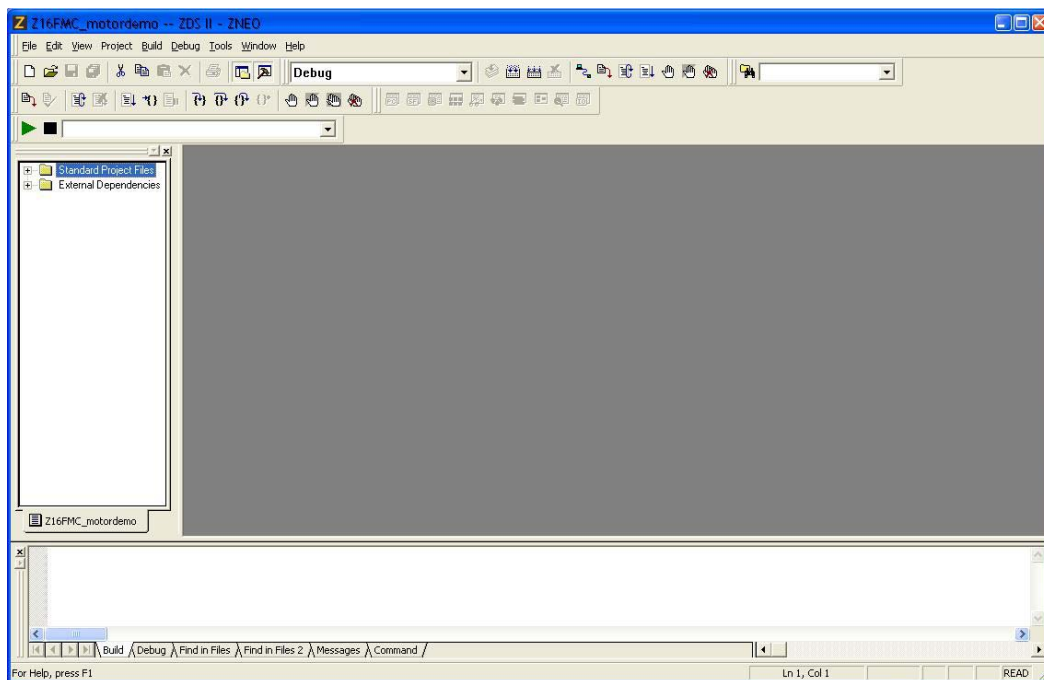
```
Programs ® ZiLOG ZDSII_ZNEO_<version_number> →  
ZDSII_ZNEO_<version_number>
```

4. Select **Open Project** from the **File** menu. The **Open Project** dialog box appears.
5. Browse to the `Samples` folder for the `Z16FMC_motordemo.zdsproj` file, located by default in the following filepath:

```
c:\Program Files\ZiLOG\ZDSII_ZNEO_<version_number>\  
samples\Z16FMC\Z16FMC_Series
```

6. Select the `Z16FMC_motordemo.zdsproj` file and click **Open**. The initial ZDSII program screen opens (see Figure 4). To view the project source files, double-click the **Project Files** folder on left side of the IDE interface. Double-click an individual file to open the file in the ZDSII file editor.

► **Note:** The following figure is offered for reference only; it is possible that you have a newer version of the software.



**Figure 4. Zilog Developer Studio II Opening Screen**

7. Select the correct debug tool using **Project** → **Settings** → **Debugger** → **Debug Tool**. For example, Select USBSmartCable when using the USB Smart Cable.
8. Click **F1** for additional info on how to setup the debugger.
9. Click **OK**.
10. Click the **Rebuild All** icon to build the project. Wait for the build to complete as indicated by the **Build Complete** confirmation in the **Status** window at the bottom of the screen.
11. Click the **Reset** icon to connect and download the code to the development board.

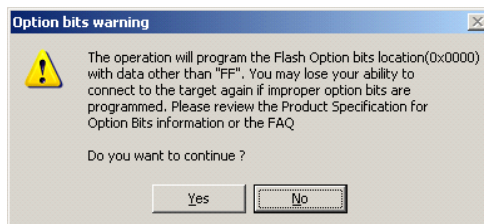


Rebuild  
All Icon



Reset  
Icon

When the **Option Bits Warning** dialog box shown in Figure 5 appears, click **Yes** to continue.



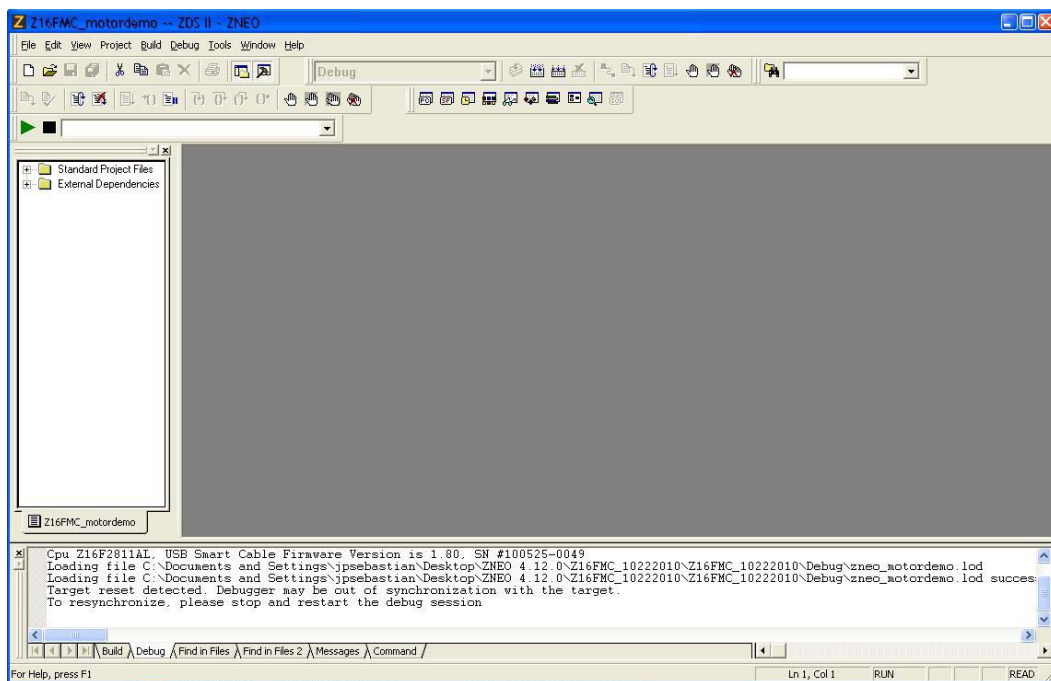
**Figure 5. Option Bits Warning Dialog Box**

12. Click **Go** to start the program.

The screen changes as illustrated in Figure 6 on page 12.



Go  
Icon



**Figure 6. Zilog Developer Studio II Active Screen**


13. Slowly increase the adjustable 24V DC power source from 0V DC to 24V DC. The 3-phase motor should start running. If the motor does not run, start over from [Step 3](#) on page 9.
14. Use the Direction switch S2 to change the direction in which the motor spins. Use SPEED potentiometer R7 to adjust the motor RPM.

For more information about this demonstration software, refer to the Zilog Application Note titled *Sensorless BLDC Motor Control Using the ZNEO Z16FMC MCU (AN0311)*. For more information about using Zilog Developer Studio II and building projects with your Z16FMC Series Motor Control Development Kit, refer to the *Zilog Developer Studio II–ZNEO User Manual (UM0171)*.

## Troubleshooting Tips

If you experience trouble running the sample code with the Z16FMC Series Motor Control Development Kit, check the following before contacting Zilog Technical Support for assistance:

- Verify that you are using ZDSII version 4.12.0 or later.
- Ensure that you are using the unmodified sample project code as described in [Executing the Sample Code](#) on page 6.
- Verify that you have properly connected the opto-isolated USB Smart Cable to the host PC and the MC MDS board as described in [Step 3. Install the Opto-Isolated USB Smart Cable](#) on page 7. Ensure that pin 1 of the cable is properly aligned with DBG connector pin 1 of the MC MDS board.
- After you have connected the 5V DC power supply to the MC MDS board, green 3.3V DC LED D1 must be on. If it is not illuminated, verify that power is properly connected to the board as described in [Step 4. Connect the 5V DC Universal Power Supply](#) on page 5.
- In ZDSII, navigate to **Project** → **Settings** → **Debugger** → **Setup** and verify that the serial number for the USB Optoisolator Smart Cable interface is present and selected. If the serial number is missing, reinstall the opto-isolated USB Smart Cable driver software.
- In ZDSII, verify that **Z16FMC28200KITG** is selected as the target.
- In ZDSII, navigate to **Project** → **Settings** → **Debugger** and verify that your Debug Tool selection is **USB Smart Cable**.

- 
- In ZDSII, click the **Rebuild All**  button. Verify that the project rebuilds with no errors.
  - Verify that the development board is not currently running any code – the motor should not be spinning.
  - Try reloading the sample project as described in [Executing the Sample Code](#) on page 6.

If you perform these steps and cannot get the sample code to run, contact Zilog Technical Support at [support.zilog.com](http://support.zilog.com).



**Warning:** *DO NOT USE IN LIFE SUPPORT*

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