

# Z8FMC16100 Series Motor Control Development Kit

## Introduction

This quick start guide describes how to set up Zilog's Z8FMC16100 Series Motor Control Development Kit and use it to evaluate your motor control designs and applications.

The Z8FMC16100 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 32-LQFP Z8FMC16100 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 24V DC, 3A workbench power source.

This document guides you through the following:

- 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) software and documentation required to evaluate the Zilog motor control solution is included within the Z8FMC16100 Series Motor Control Development Kit. For details about kit contents, refer to the *Z8FMC16100 Series Motor Control Development Kit Packing List (PAK0006)*. The sample code used in this development kit is based on the [Sensorless Brushless DC Motor Control with Z8 Encore! MC Microcontrollers Application Note \(AN0226\)](#). The [latest sample code](#) for this project (AN0226-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 (includes Application and Documentation)</li><li>• Super VGA Video Adapter</li><li>• CD-ROM for installation</li><li>• USB High-Speed port (when using USB Smart Cable)</li><li>• Ethernet port (when using Ethernet Smart Cable)</li><li>• RS232 communication port with hardware flow control</li><li>• Internet browser (Internet Explorer or Netscape)</li></ul>	<ul style="list-style-type: none"><li>• Windows XP Professional</li><li>• Pentium IV 1.2GHZ processor</li><li>• 512 MB RAM</li><li>• 50 MB hard disk space (only includes Application)</li><li>• Super VGA Video Adapter</li><li>• CD-ROM for installation</li><li>• USB Full-Speed port (when using USB Smart Cable)</li><li>• RS232 communication port with hardware flow control</li><li>• Internet browser (Internet Explorer or Netscape)</li></ul>



**Caution:** Always use a grounding strap to prevent damage resulting from electrostatic 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

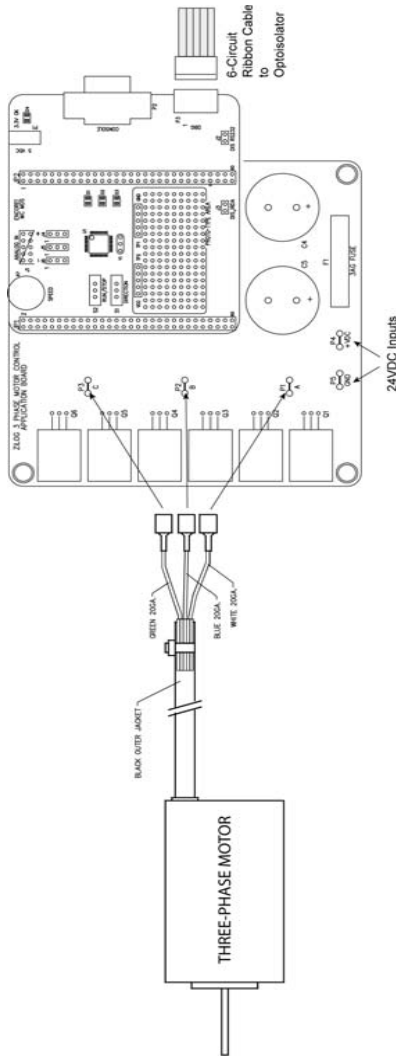
The Z8FMC16100 Series Motor Control Development Kit is shipped with [the sample code](#) from the application note AN0226 preloaded into the Z8FMC16100 chip's internal Flash memory.

This section describes a series of steps for setting up the kit and running the sample code in standalone mode.



- Speed Potentiometer R7 to its mid-point

Refer to the [Z8FMC16100 Series Motor Control Development Kit User Manual \(UM0192\)](#) for detailed jumper descriptions.



**Figure 2. Z8FMC16100 Series Motor Control Development Kit Motor and DBG Connections**

---

### **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 5V DC universal power supply:

- a. Remove the slide-out plate.
- b. Select the AC plug adapter appropriate for your locale and insert it into the slot that remains after removing the slide-out plate.
- c. 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 to the MC MDS Board**

Connect the 5V DC power supply to the MC MDS board at connector P1, then plug the supply into an electrical outlet. The green 3.3V DC LED D4 illuminates when power is applied and LED D3 blinks.

### **Step 5. Set the Adjustable Power Supply to 0V DC and Connect It to the 3-Phase Motor Control Application Board**



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

---

Observe the following steps to adjust and connect the power supply to the application board.

- a. Set your adjustable power supply to 0V DC.
- b. Connect the negative (–) lead of your adjustable power supply to spade lug connector P5 on the 3-Phase Motor Control Application Board.
- c. 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**

The sample code causes Direction SWITCH S1 to change the direction of motor spin. Run/Stop SWITCH S2 is set to turn the motor ON and OFF, and Speed Potentiometer R7 allows you to change the direction of motor spin and motor speed.

Observe the following steps to gradually apply power to the motor.

- a. Slowly increase the adjustable power supply to 24 V DC. The 3-phase motor begins to spin.
- b. Experiment with the switches to see how simple it is to control the motor using the Z8FMC16100 MCU installed on the kit's MC MDS board.

## **Step 7. Power Down the Motor and Development Kit**

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

## **Executing Sample Code in Debug Mode using ZDSII**

Observe the following steps to execute the sample code in debug mode using ZDSII.

1. Stop the preloaded sample code and turn power to the 3-phase motor and MC MDS board off.
2. Install ZDSII – Z8FMC16100 Series Motor Control 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 0 V DC and unplug the 5 V DC universal power supply from the MC MDS board.

### **Step 2. Install the ZDSII – Z8FMC16100 Series Motor Control Series Software**

Observe the following steps to install the ZDSII software tool.

- a. Insert the ZDS II CD into your computer's CD-ROM drive. DemoShield launches automatically. If DemoShield does not launch automatically, open the Windows

Explorer, browse to your CD-ROM drive, and double-click the launch.exe file to launch the installer.

- b. DemoShield provides several installation options. Select Install Zilog Developer Studio to install now. You can install other software and accompanying documentation later.
- c. Follow the on-screen instructions to complete the installation.

### **Step 3. Install the USB Smart Cable Driver Software and USB Smart Cable**

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

The 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 USB Smart Cable for your operating system, as described below. 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.

#### **32- and 64-Bit Windows 7**

Observe the following steps to install the USB Smart Cable and associated driver software for Windows 7 systems.

- a. Connect the USB Smart Cable to the host PC. The **Found New Hardware** dialog box is displayed.
- b. 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.
- c. Select **I don't have the disc. Show me other options**.
- d. Select **Browse my computer for driver software (advanced)**.
- e. Browse to one of the following driver directories based on the Win 7 OS you use.
  - For 32-bit Windows 7 systems:
    - <ZDS II Installation Directory>\device drivers\USB\x32
    - <ZDS II Installation CD>\device drivers\USB\x32

- For 64-bit Windows 7 systems:
  - <ZDS II Installation Directory>\device drivers\USB\x64
  - <ZDS II Installation CD>\device drivers\USB\x64
- f. Click **Next**. The **Windows Security** dialog box is displayed.
- g. Select **Install this driver software anyway**.
- h. When the software has been installed successfully, click **Close**.

## 32- and 64-Bit Windows Vista

Observe the following steps to install the USB Smart Cable and associated driver software for Windows Vista systems.

- a. Connect the USB Smart Cable to the host PC. The **Found New Hardware** dialog box is displayed.
- b. 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.
- c. Select **I don't have the disc. Show me other options**.
- d. Select **Browse my computer for driver software (advanced)**.
- e. Browse to one of the following driver directories based on the Vista OS you use.
  - For 32-bit Vista systems:
    - <ZDS II Installation Directory>\device drivers\USB\x32
    - <ZDS II Installation CD>\device drivers\USB\x32
  - For 64-bit Vista systems:
    - <ZDS II Installation Directory>\device drivers\USB\x64
    - <ZDS II Installation CD>\device drivers\USB\x64
- f. Click **Next**. The **Windows Security** dialog box is displayed.
- g. Select **Install this driver software anyway**.
- h. When the software has been installed successfully, click **Close**.

## Windows XP

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

- a. 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<sup>®</sup> Update.



- 
- b. Select **Install from a list or specific location (Advanced)** and click **Next**.

---

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

---

- c. Select **Search for the best driver in these locations** and **Include this location in search**:
- d. Browse to the following directory and click **Next**:  
`<ZDS installation>\device drivers\USB\x32`
- e. Find the appropriate driver, and click **Next**.
- f. Click **Finish** to complete the installation.

## Windows 2000

Observe the following steps to install the USB Smart Cable for Windows 2000 systems.

- a. 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.
- b. Click **Next** in the **Found New Hardware** Wizard after it has been activated.
- c. Select **Search for a suitable driver for my device (Recommended)** and click **Next**.
- d. Select **Specify a location** and click **Next**.
- e. Browse to the following directory and click **OK**:  
`<ZDS installation>\device drivers\USB\x32`
- f. Find the appropriate driver, and click **Next**.
- g. Click **Finish** to complete the installation.

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

Observe the following steps to Connect the USB Smart Cable to the MC MDS Board.

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

## **Step 5. Download and Run the Sample Code in Debug Mode**

Observe the following steps to open the `motordemo.zdsproj` sample project (see the [AN0226-SC01.zip](#) file, downloadable from [zilog.com](http://zilog.com)) and run the sample code in Debug mode using ZDSII.

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

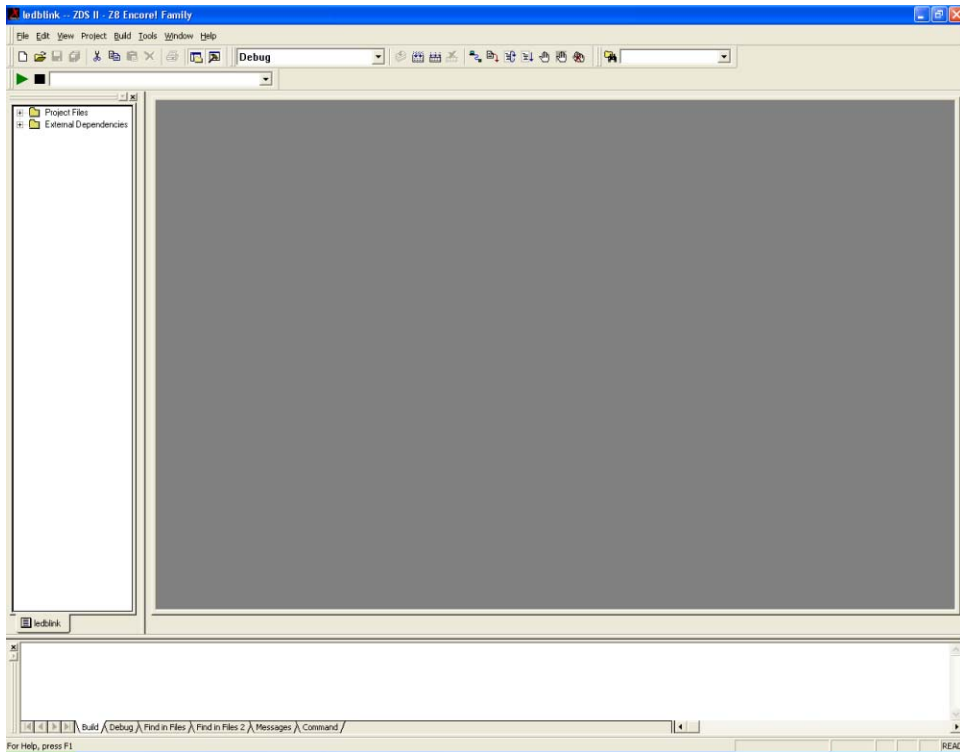
- c. Run the ZDSII software. By default, the Zilog Developer Studio II program is located in the **Start** menu under:

```
Programs → ZiLOG ZDSII_Z8Encore!_<version_number> →  
ZDSII_Z8Encore!_<version_number>
```

- d. Select **Open Project** from the **File** menu. The **Open Project** dialog box appears.

- e. Browse to the **Samples** folder for the `motordemo.zdsproj` file, located by default in the following filepath:  

```
c:\Program Files\ZiLOG\ZDSII_Z8Encore!_<version_number>\  
samples\Z8FMC16\Z8FMC16_MotorDemo\src
```
- f. Select the `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 the individual file to open the file in the ZDSII file editor.



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

- ▶ **Note:** The above figure is for reference only. You may have a newer version of the software.

- g. Select the correct debug tool using **Project ← Settings ← Debugger ← Debug Tool**. For example, Select **USBSmartCable** when using the USB Smart Cable.

► **Note:** Click **F1** for additional information about how to set up the debugger.

- h. Click **OK**.

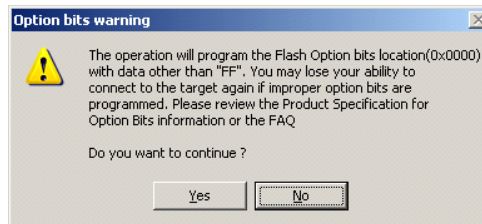
- i. Click the **Rebuild All** icon to build the project. Wait for the build to complete as indicated by the **Build Complete** confirmation in the **Status** window at the bottom of the screen.



- j. Click the **Reset** icon to connect and download the code to the development board.



When the **Option Bits Warning** dialog box appears (see Figure 5), click **Yes** to continue.

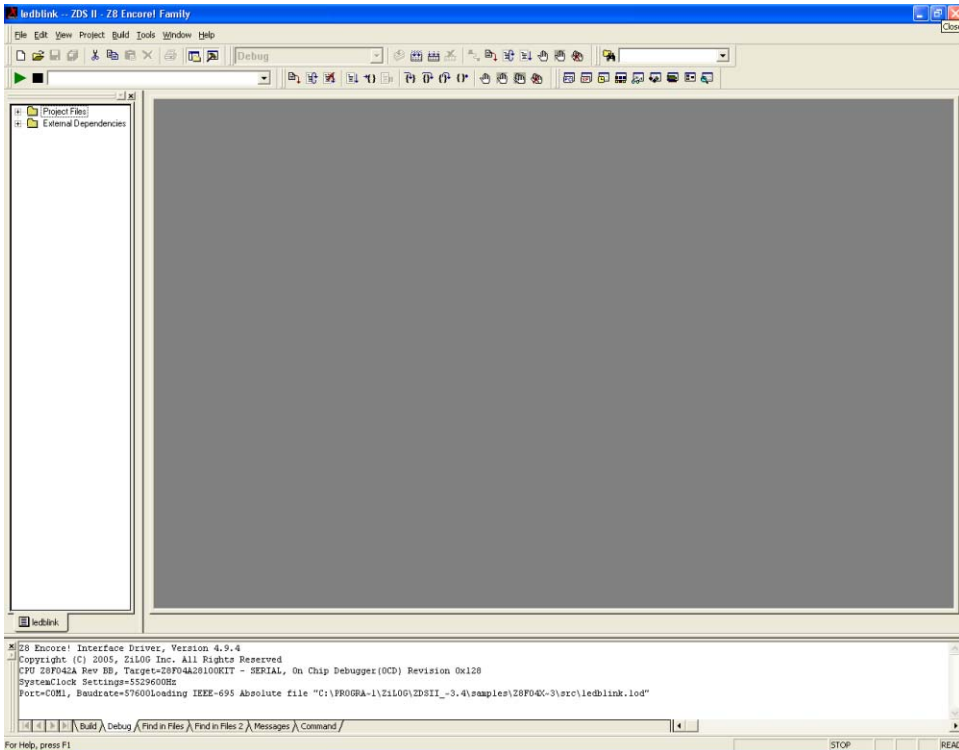


**Figure 5. Option Bits Warning Dialog Box**

- k. Click **Go** to start the program.



The screen changes, as illustrated in Figure 6.



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


- l. Slowly increase the adjustable 24 V DC power source from 0 V DC to 24 V DC. The 3-phase motor should start running. If the motor does not run, start over from Step c on page 10.
- m. Use the Direction Switch S1 to change the direction in which the motor spins. Use Speed Potentiometer R7 to adjust the motor RPM.

For more information about using Zilog Developer Studio II and building projects for your Z8FMC16100 Series Motor Control Development Kit, refer to the [Zilog Developer Studio II – Z8 Encore! User Manual \(UM0130\)](#).

---

## Troubleshooting Tips

If you experience trouble running the sample code with the Z8FMC16100 Series Motor Control Development kit, determine if any of the following items can resolve the issue before contacting [Zilog Technical Support](#) for assistance.

- Verify that you are using ZDSII version 5.0.0 or later.
- Ensure that you are using the unmodified sample project code as described in [Executing Sample Code in Debug Mode using ZDSII](#) on page 6.
- Verify that you have properly connected the USB Opto-Isolator Smart Cable to the host PC and the MC MDS board as described in [Step 3. Install the USB Smart Cable Driver Software and 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, the green 3.3V DC LED D4 must be illuminated. 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 to the MC MDS Board](#) on page 5.
- In ZDSII, navigate to **Project** ← **Settings** ← **Debugger** ← **Communication** and verify that the serial number for the USB Opto-Isolator Smart Cable interface is present and selected. If the serial number is missing, reinstall the USB Opto-Isolator Smart Cable driver software.
- In ZDSII, verify that **Z8FMC16100KITG - USB** is selected as the target.
- 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 Sample Code in Debug Mode using ZDSII](#) on page 6.

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



**Caution:** DO NOT USE THIS PRODUCT IN LIFE SUPPORT SYSTEMS.

---

## **LIFE SUPPORT POLICY**

ZILOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF ZILOG CORPORATION.

### **As used herein**

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

### **Document Disclaimer**

©2011 Zilog, Inc. All rights reserved. Information in this publication concerning the devices, applications, or technology described is intended to suggest possible uses and may be superseded. ZILOG, INC. DOES NOT ASSUME LIABILITY FOR OR PROVIDE A REPRESENTATION OF ACCURACY OF THE INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED IN THIS DOCUMENT. ZILOG ALSO DOES NOT ASSUME LIABILITY FOR INTELLECTUAL PROPERTY INFRINGEMENT RELATED IN ANY MANNER TO USE OF INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED HEREIN OR OTHERWISE. The information contained within this document has been verified according to the general principles of electrical and mechanical engineering.

Z8, Z8 Encore!, Z8 Encore! XP, Z8 Encore! MC, Crimzon, eZ80, and ZNEO are trademarks or registered trademarks of Zilog, Inc. All other product or service names are the property of their respective owners.