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An **IXYS** Company

ZMOTIONS200ZCOG

ZMOTION® Intrusion Detection Development Kit

User Manual

UM023302-1214

Warning: DO NOT USE IN LIFE SUPPORT SYSTEMS.

Revision History

Each instance in the table below reflects a change to this document from its previous edition. For more details, refer to the corresponding pages and appropriate links in the table below.

Date	Revision Level	Description	Page No.
December 2014	02	Removed reference to CD-ROM; replaced Figure 1; replaced old part numbers with new part numbers; replaced the System Requirements section with a Supported Operating Systems section; replaced references to ZMOTIONL200ZCOG with ZMOTIONS200ZCOG; changed store ID SD00026 to SD00030; removed the Installation section; added the Download and Install the ZDSII Software and Documentation section; modified the ZMOTION_Intrusion_Demo section; modified Table 2 and updated subsequent paragraphs; removed the Installing ZDSII and the USB SmartCable section; moved Board Design Information to Appendix A; added Appendix B.	1, 2, 3, 7, 8, 14, 18
April 2011	01	Original issue	All

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Introduction

Zilog's ZMOTION® Intrusion Detection Development Kit provides a general-purpose platform for evaluating the capabilities and operation of the ZMOTION Intrusion Detection MCU, which features Zilog's passive infrared (PIR) technology. The ZMOTION Family of Motion Detection products includes a series of high-performance microcontrollers with integrated motion detection algorithms. A variety of included lenses and pyroelectric sensors demonstrate the flexibility of the integrated motion detection algorithms to provide the best possible performance for a range of lighting, intrusion detection and security-related control applications.

The Z8FS021 MCU, a prominent member of the ZMOTION Family, combines the programmability and rich peripheral set of Zilog's Flash Z8 Encore! XP® Family of MCUs with built-in motion detection software algorithms to provide the functions necessary for PIR motion detection applications. These motion detection algorithms comprise Zilog's PIR technology and run in the background while control and status of the motion detection engine is accessed through a software Application Programmer Interface (API). As a result, the designer can create his or her own application-specific software while taking advantage of Zilog's ZMOTION Motion Detection Technology.

Within this kit, API settings are provided to match the Engine operation to each of the lens and pyroelectric sensor combinations provided.

To learn more about the ZMOTION MCU, refer to the ZMOTION Intrusion Detection Product Specification (PS0288), available for download at www.zilog.com.

Kit Contents

The ZMOTION Intrusion Detection Development Kit contains the following components:

Hardware

- ZMOTION Intrusion Detection Development Board
- USB SmartCable Debugger
- 1.2" focal flat lens Holder
- Three 1.2" focal flat lenses
  - ZWA12GI12V4
  - ZLR12GI12V3
  - ZVB12GIV1
- Mini-USB serial cable
- Wall mount power supply[1]

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1. Zilog recommends using only the power supply provided in the ZMOTION Intrusion Detection Development Kit.

- Mounting hardware

The contents of the kit are shown in Figure 1.

Figure 1. ZMOTION Intrusion Detection Development Kit Contents

Supported Operating Systems

The ZMOTION Intrusion Detection Development Board supports the following operating systems:

- Microsoft Windows 7 (32-bit/64-bit)
- Microsoft Windows Vista (32-bit/64-bit)
- Microsoft Windows XP

Safeguards

The following precaution must be observed when working with the devices described in this document.

⚠ **Caution:** Always use a grounding strap to prevent damage resulting from electrostatic discharge (ESD).

Download and Install the ZDSII Software and Documentation

Prior to connecting the ZMOTION Development Board to your PC, observe the following procedure.

1. Download ZDS II for Z8 Encore! v5.2.0 (or later) from the Downloadable Software category in the Zilog Store.

2. Run the software installation file and follow the on-screen instructions to install ZDS II.

Download and Install the Code and Documentation

ZMOTION software and documentation is available as a downloadable file from the Zilog Store. Observe the following brief procedure to download and install your ZMOTION software.

1. In the Zilog Store, under Categories, click **Downloadable Software** to present a list of the available software in the Zilog Store. In this list, click **ZMOTIONS200ZCOG Software and Documentation v2.0** (or later). On the Product Details page that appears next, click the blue **Add to Cart** button and complete the checkout process to download the ZMOTION software and documentation files to your hard drive.

▶ **Note:** If you're a first-time visitor to the Zilog Store, you will first be required to register as a Zilog Store user before downloading your software. Returning visitors must log in to purchase or download.

2. When the download is complete, unzip the file to your hard drive, double-click to launch the `ZMOTIONS200ZCOG_<version>.exe` installation file, and follow the onscreen instructions.

▶ **Note:** `<version>` represents the release version of the ZMOTIONS200ZCOG installation.

3. When the installation is complete, the ZMOTION documentation will be located in the following path, by default:

```
C:\Program Files\Zilog\ZMOTIONS200ZCOG_<version>\
ZMOTION Product Documentation
```

ZMOTION Intrusion Detection Development Board

Zilog's ZMOTION Intrusion Detection Development Board is a development and proto-typing platform for the ZMOTION Intrusion Detection silicon and software as well as for lens/pyroelectric sensor/silicon and software bundled solutions. The Board provides the user with a tool to evaluate the many features of ZMOTION PIR technology, as well as the actual performance of each lens and pyro combination.

> **Note:** Attach the Intrusion lens holder to the Board using the primary placement set of holes, which are indicated in Figure 2.

Primary Placement Holes
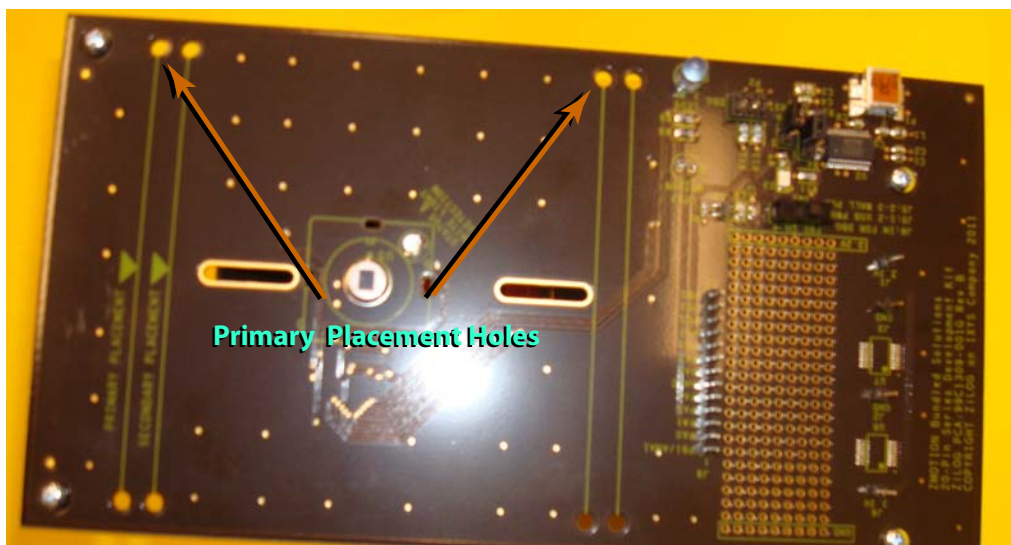
Figure 2. ZMOTION Intrusion Detection Development Board

Features

The ZMOTION Intrusion Detection Development Board features the following elements:

- Z8FS021 ZMOTION Detection MCU (20-pin SSOP)
- Mini-USB power connector and serial interface
- Power-On and Detection LED
- On-chip debugger interface
- Board openings for an assortment of lens holders and clip-on lens attachments

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- Prototyping area
- 2.7 V–3.6 V operating voltage with 5 V tolerant inputs

MCU Features

The Z8FS021 ZMOTION Intrusion Detection MCU combines the programmability and rich peripheral set of Zilog's Flash Z8 Encore! XP Family of MCUs with built-in motion detection software algorithms to provide the functions necessary for PIR motion detection applications.

The Z8FS021 MCU includes the following features:

- High performance eZ8® MCU core
- 2 KB in-circuit programmable Flash memory available for application code
- Single-pin debug with unlimited breakpoints
- Flexible clocking scheme
- Internal precision oscillator running at 5.53 MHz
- External oscillator operating up to 20 MHz
- Sigma Delta ADC
- Up to 6 single-ended channels or 3 differential channels available
- On-chip analog comparator with independent programmable reference voltage
- Full-duplex UART with dedicated BRG
- Two 16-bit timers with input capture, output compare and PWM capability (11 modes total)
- Watchdog timer (WDT) with dedicated internal oscillator
- Up to 20 vectored interrupts
- 6 to 25 I/O pins depending upon package
- 2.7 V to 3.6 V operating voltage with extended operating temperature range –40°C to +105°C
- Zilog PIR technology controlled and monitored via software API registers
- Selection capability from an assortment of lenses and pyroelectric sensors to best fit your application
- API settings provided for each lens and pyroelectric sensor combination
- Directly supports 1 or 2 pyroelectric sensors
- Sensitivity control, range control and directionality detection

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- Extended detection modes for occupancy sensing

- Low power modes

- White light detection and pet immunity

ZMOTION Intrusion Detection Development Kit Lens and Pyroelectric Sensor

The ZMOTION Intrusion Detection Development Kit includes three different types of lenses to fill a wide variety of intrusion detection and security applications. These applications also demonstrate the flexibility, and superior performance of Zilog's PIR motion detection technology.

Please refer to the ZMOTION Lens and Pyroelectric Sensor Product Specification (PS0286) for part-specific details about the individual lenses and pyroelectric sensors. Refer to the ZMOTION Intrusion Detection Development Kit Quick Start Guide (QS0078) for specific installation instructions for the lenses.

Lens Mounting Options

The ZMOTION Development Board supports a lens holder option for each of the 1.2" focal length intrusion lenses, as indicated in Table 1. For lens installation instructions, please refer to the ZMOTION Intrusion Detection Development Kit Quick Start Guide (QS0078).

Table 1. Lens Mounting Options

Lens Mounting	Supported Lenses
Flat Lens Holder 1.2 Focal	ZWA12GI12V4
	ZVB12GIV1
	ZLR12GI12V3

Pyroelectric Sensor Option

The ZMOTION Intrusion Detection Development Kit includes one type of pyroelectric sensor, the Basic Dual Element sensor, part number ZRE200B, which is mounted directly on the Board.

ZMOTION Development Kit Application Software

The ZMOTION application software includes the `ZMOTION_Intrusion_Demo` motion detection project, which is described in this section.

ZMOTION_Intrusion_Demo

The `ZMOTION_Intrusion_Demo` project demonstrates the basic motion detection functionality of the ZMOTION Development Board. The MCU included with the Board is programmed with this project.

Each lens type is supported by an associated lens configuration header file which displays a name format of `API_INIT_xx.h`. Header files for all supported lens types are included in the include project folder of the `ZMOTION_Intrusion_Demo` project. The most up-to-date API settings and header files are included with the ZMOTION Detection Lens and Pyro Sensor Configuration Guide (WP0018), available from the Zilog website.

The `main.c` source file contains the `include` directive to add the `API_INIT_xx` header file to the project. Changes to these header files should not be required, but any modifications you make should be made to a copy of the original header file; *do not modify the original versions*. As new lens types are added to the ZMOTION family, an associated lens configuration file is made available in WP0018.

Table 2 lists additional project features that can be modified or enabled in `main.c` and `main.h`.

Table 2. Additional Project Features

Feature	File	Define/Variable/Modification	Default Values
LED On Time	main.h	LED_ON_TIME	DELAY_1SEC (1 second)
Alarm Output On Time	main.h	ALARM_ON_TIME	DELAY_5SEC (5 second)
White Light Immunity	main.h	WHITE_LIGHT	1 (On)
White Light Threshold	main.h	WHITE_LIGHT_THRESH_DEF	0x1F
White Light Anti-Jam	main.h	WHITE_LIGHT_ANTI_JAM_DEF	0 (Off)
Supported Lens	main.c	#include "API_INIT_09.h"	ZWA12GI12V4

When motion is detected, the LED is turned ON for 1 second (LED_ON_TIME) and the Alarm Output (PB0) is activated for 5 seconds (ALARM_ON_TIME). A serial terminal program such as HyperTerminal or RealTerm can be used to view the detection messages from the ZMOTION Development Board.

The following messages are transmitted from the ZMOTION Development Board:

*** ZMOTION Intrusion Serial Demo ***

Version 46

Waiting for the pyro sensor to stabilize

Pyro Sensor Stable – Ready to detect motion

M 001 @ 33

M 002 @ 38

M 003 @ 42

E 001 @ 44

In the above output, when power is applied to the Board, it sends a title message and the software version, then waits for the pyroelectric sensor to stabilize, which can take between 10 and 60 seconds. A '.' symbol is transmitted every second while it waits for stability. After the pyroelectric sensor becomes stable, the software is ready to start detecting motion. Each time a motion event is detected, a message is transmitted. For example, in the message M 001 @ 33, the character indicates which part of the ZMOTION Engine detected the motion event. M indicates the event was detected by the Normal Engine and E indicates the Extended Engine detected the motion event. 001 is the count of motion events for each Engine and 33 is the time of the event in seconds since power-on.

Connecting the USB SmartCable

Observe the following steps to connect the USB SmartCable to the ZMOTION Development Board.

⚠️ **Caution:** The power to the development board must be disconnected or turned OFF before connecting or disconnecting the USB Smart Cable.

1. Attach one end of the six-conductor ribbon cable (included) to the USB SmartCable six-pin DBG connector, as shown in Figure 3.
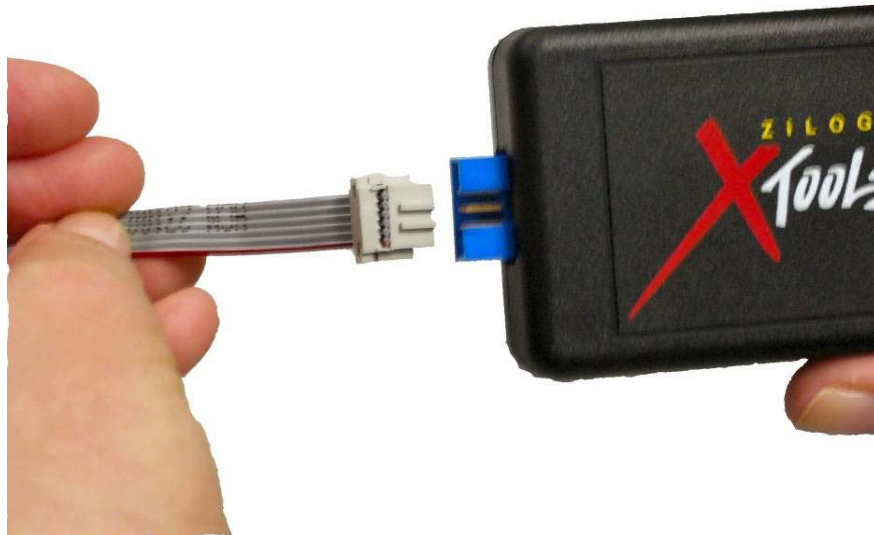

Figure 3. Connecting the Six-Conductor Ribbon Cable to the USB Smart Cable

2. Attach the free end of the ribbon cable to the DBG connector (ZDI Interface) on the development board. Ensure that pin 1 on the ribbon cable (indicated by the dark stripe) is aligned with pin 1 on the target connector (indicated by a 1 on P2 of the board).

Installing the FTDI USB to Serial Driver

Observe the following steps to install the FTDI USB to Serial Driver.

1. Make sure that the USB cable is not plugged into the ZMOTION Development Board.

2. Navigate to the ZMOTIONS200ZCOG Software and Documentation installation directory and double-click the `CDM20802_Setup.exe` file to start the driver installation. The installation process will begin, and will appear similar to the following code statements:

```
32-bit OS detected
<installation path>\dpinstx86.exe
Installation driver
FTDI CDM driver installation process completed.
```

3. When the installation is complete, plug the USB cable into the ZMOTION Development Board.

4. If driver installation was successful, **USB Serial Port (COMx)** should appear in the list displayed in the Device Manager's **Ports (COM & LPT)** interface.

   To open the Device Manager on Windows 7 systems, launch the Start menu, enter `Device Manager` in the **Search program and files** field, and press the Enter key.

   To open the Device Manager on earlier Windows systems, navigate to the following filepath:

   Start → Control Panel → System → Hardware → Device Manager → Ports (COM &LPT).

Downloading and Running the Sample Project

Sample projects are included in the ZMOTIONS200ZCOG Software and Documentation directory. Ensure the folders are not set to **Read Only** by right-clicking the folder and selecting properties. Deselect the **Read Only** attribute and click **OK**. Make sure you apply changes to this and the other subfolders when prompted.

In this example, we reference the `ZMOTION_Intrusion_Demo` project; however, the steps that follow will apply to any additional project.

> **Note:** At this point you should have downloaded ZDSII and the SmartCable USB driver on to your computer. If you haven't yet done so, revisit the beginning of this Download and Install the ZDSII Software and Documentation section before proceeding.

1. Open ZDSII and select **File → Open Project**, then navigate to the project folder labeled `ZMOTION_Intrusion_Demo`.

2. Open the `ZMOTION_Intrusion_Demo.zdsproj` project. When you first receive your kit, this project is already loaded into the ZMOTION MCU. Right-click within the

open grey area below the menu icons and select **Workbook Mode** to turn on the tabs at the bottom of the editor and therefore make it easier to switch between files.

3. Click the **Rebuild All** icon to build the project. The build output should not indicate any errors. If you receive errors, try reloading the projects from the original Application CD and ensure that the folders are not set to **Read Only**. See Figure 4 for an example; Figure 5 indicates the location of the **Rebuild All** icon in the ZDS II menu bar.
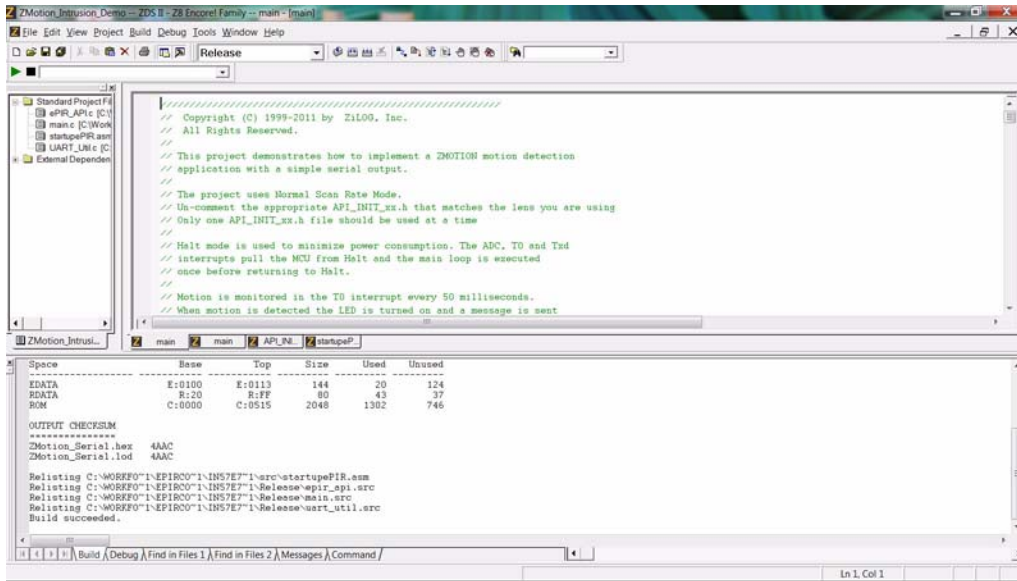

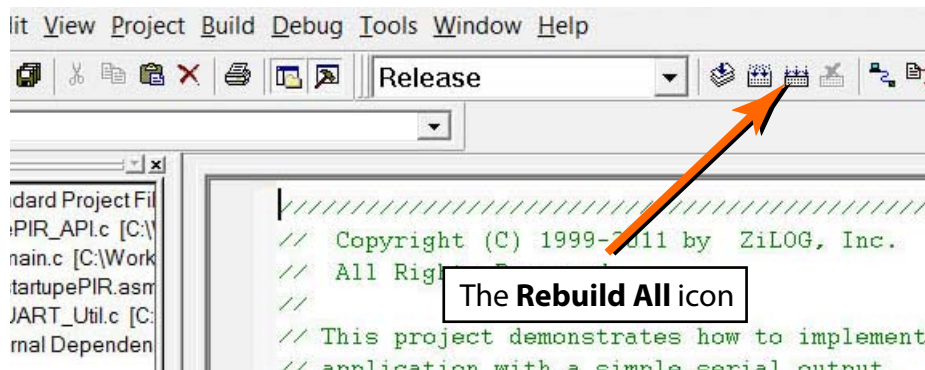**Figure 4. Building the ZMOTION_Intrusion_Demo project in ZDSII**

Figure 5. The Location of the Rebuild All Icon

4. Make sure that the ZMOTION Development Board is powered OFF, then connect the USB SmartCable (Debugger) to P2, as described above.

5. Apply power to the Development Board by plugging in the USB cable and setting SW1 to the ON position. Next, click the **Reset** icon in ZDSII. Figure 6 indicates the location of both the **Reset** and **Go** icons in the ZDSII menu bar.
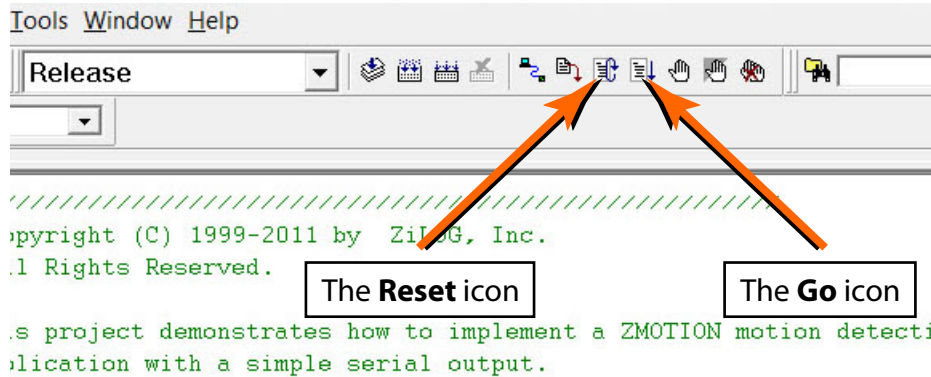
Figure 6. The Location of the Rest and Go Icons

6. An information notice may appear, indicating that the silicon is not the latest version. This occurrence is normal and is not an issue. Click **OK** to continue. You should see a message in the Debug Output Window indicating that the load was successful, as shown in Figure 7.
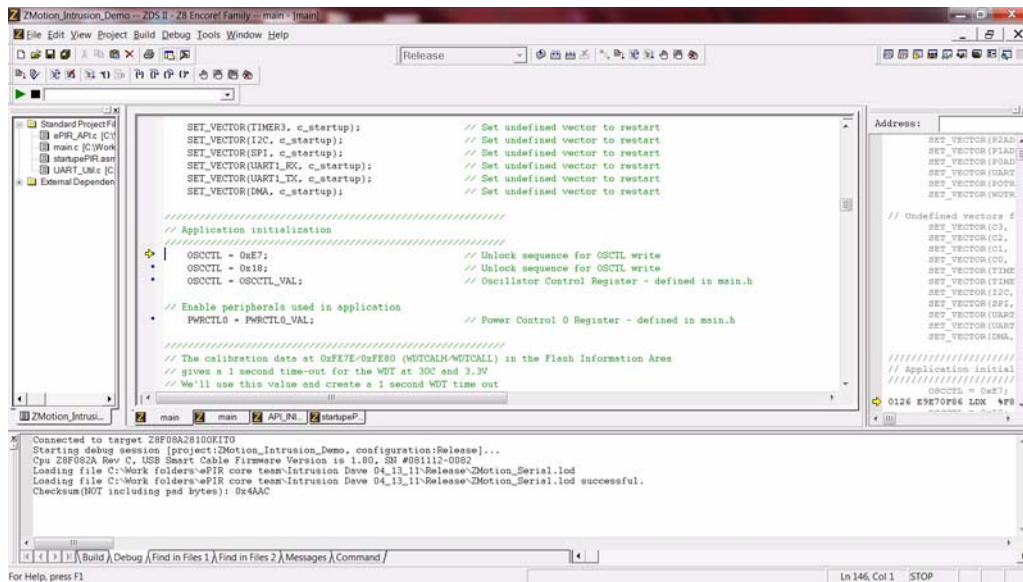

Figure 7. ZDSII's Debug Output Window for the ZMOTION_Basic project

7. Click the **Go** icon to start the application running. The Red LED (LED2) will be ON initially until the pyroelectric sensor stabilizes – a period that can take up to 30 seconds. After it has stabilized, (LED2) turns OFF, to turn ON only when motion is detected.

8. To test this procedure, wave your hand over the lens and notice (LED2) turning ON for approximately 1 second.

Making Changes to the ZMOTION_Intrusion_Demo Project

To change the duration of the LED on time, observe the following procedure.

1. Change the following line in the `main.c` file:

```
unsigned int cMDDelayTime = DELAY_1SEC;      // LED ON time
```

2. Change the line as follows to select a five-second LED on time:

```
unsigned int cMDDelayTime = DELAY_5SEC;      // LED ON time
```

> **Note:** **LED on time** definitions are provided in the `main.h` file for values from 200 ms to 30 minutes.

3. Click the **Rebuild** icon to build the project. The build output should not indicate any errors. Click the **Go** icon to download the modified project and start the application running. Generate motion and notice that the LED now stays on for 5 seconds.

4. To change the lens used by the project, edit the `include` line at the top of the `main.c` file to include the appropriate `API_INIT` file. The project initially uses `API_INIT_09.h` to support the ZWA12GI12V4 (board clip-in) lens (see the code sample below). To use a different lens, edit out the comment characters (//) in the `main.c` file that correspond to the new lens, and comment out the lens that is no longer in use.

```
replace with:
// This file must match the lens and PIR sensor used in the application
//#include "API_INIT_00.h"        // Generic settings: non-lens-specific
//#include "API_INIT_01.h"        // API configuration file for AA 0.9 GI V1 Lens
//#include "API_INIT_02.h"        // API configuration file for CM 0.77 GI V3 Lens
//#include "API_INIT_03.h"        // API configuration file for CM 0.77 GI V5 Lens
//#include "API_INIT_04.h"        // API configuration file for CWM 0.5 GI V1 Lens
//#include "API_INIT_05.h"        // API configuration file for NCL-9(26) Lens
//#include "API_INIT_06.h"        // API configuration file for NCL-10IL Lens
//#include "API_INIT_07.h"        // API configuration file for NCL-3B Lens
//#include "API_INIT_08.h"        // API configuration file for NCL-11 Lens
#include "API_INIT_09.h"          // API configuration file for WA1.2 GI 12 V4 Lens
//#include "API_INIT_10.h"        // API configuration file for LR1.2 GI 12 V3 Lens
//#include "API_INIT_11.h"        // API configuration file for VB1.2 GI V1 Lens
```

The `API_INIT` file must match the lens and pyroelectric sensor being used on the Development Board. Use the Lens Selection Guide in the ZMOTION Lens and Pyroelectric Sensor Product Specification (PS0286) to determine which API_INT file is required for each lens and Pyroelectric Sensor combination.

Appendix A. Board Design Information

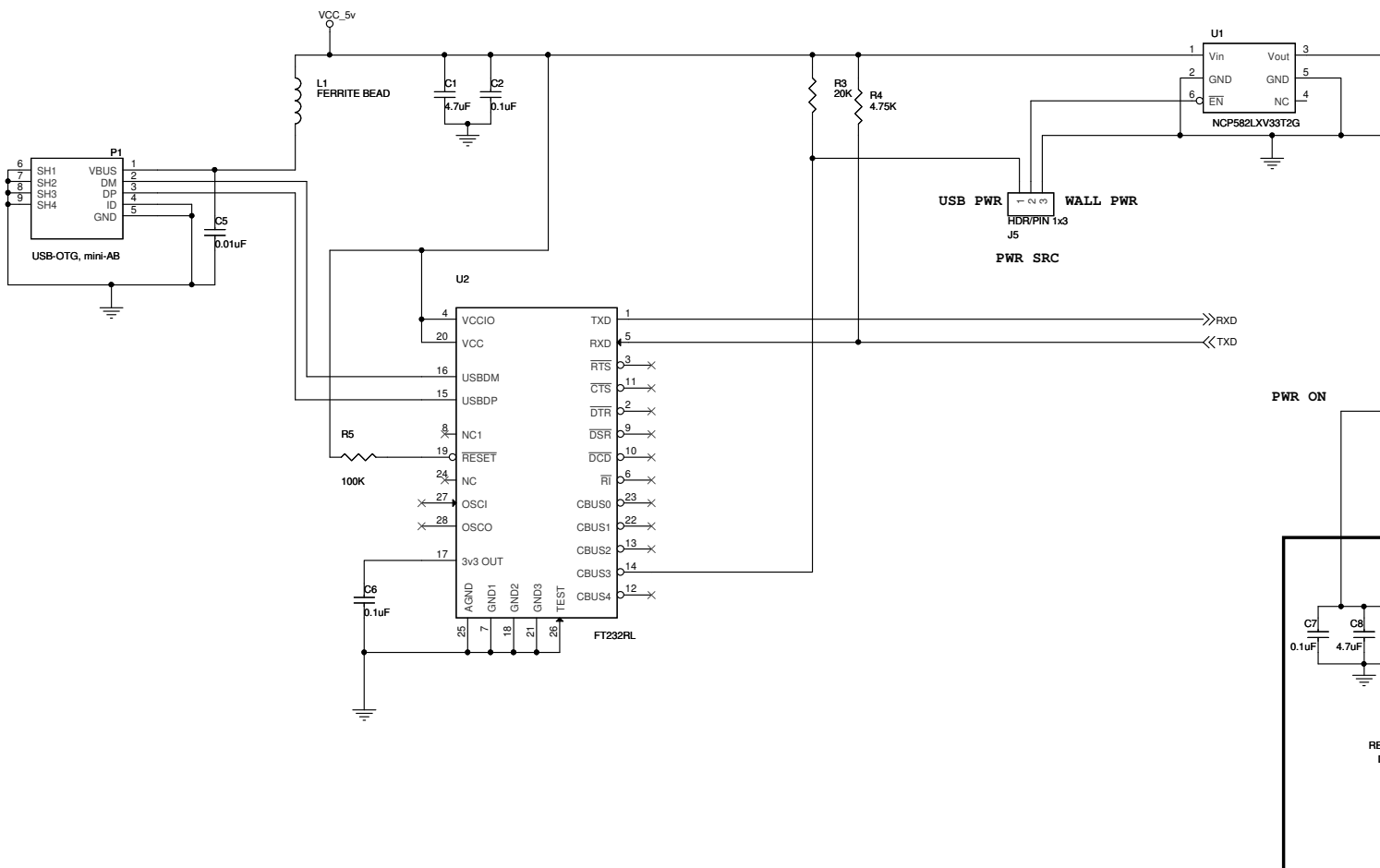Figure 8 displays the schematics for the ZMOTION Development Board.

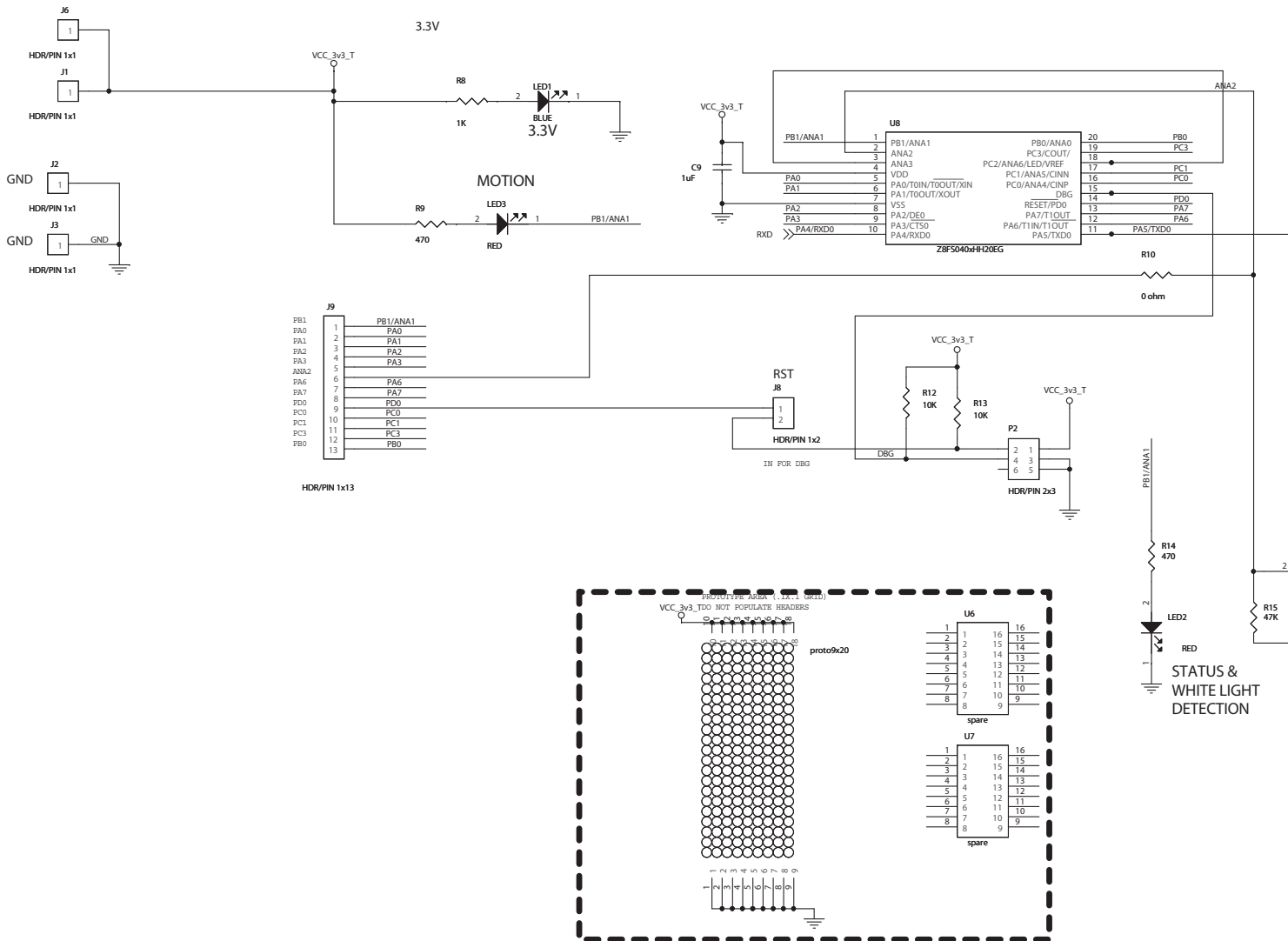**Figure 8. ZMOTION Development Board Schematic Diagram, #1 of 2**

Figure 9. ZMOTION Development Board Schematic Diagram, #2 of 2

Figures 10 and 11 display top- and bottom-view mechanical drawings, respectively, of the ZMOTION Develop
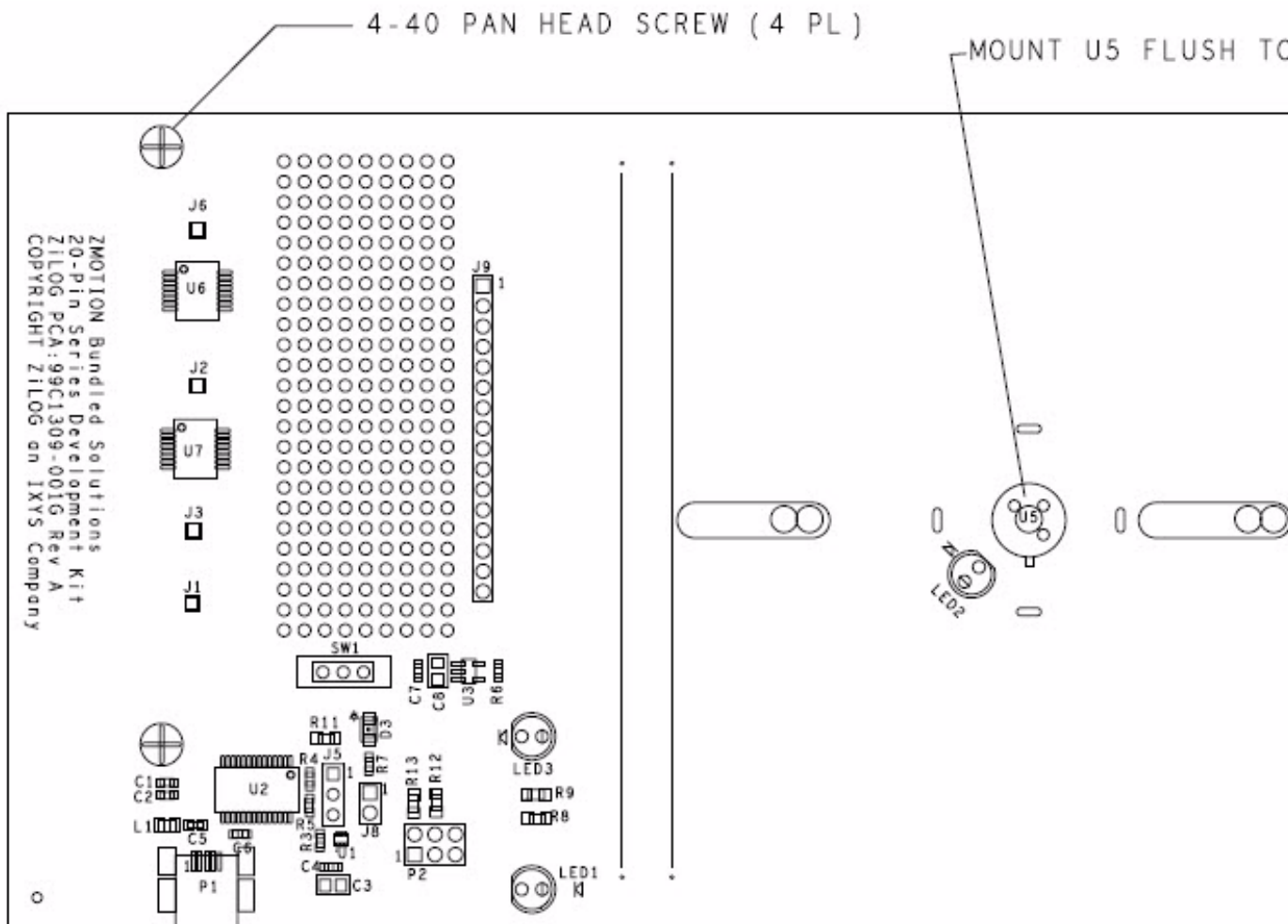

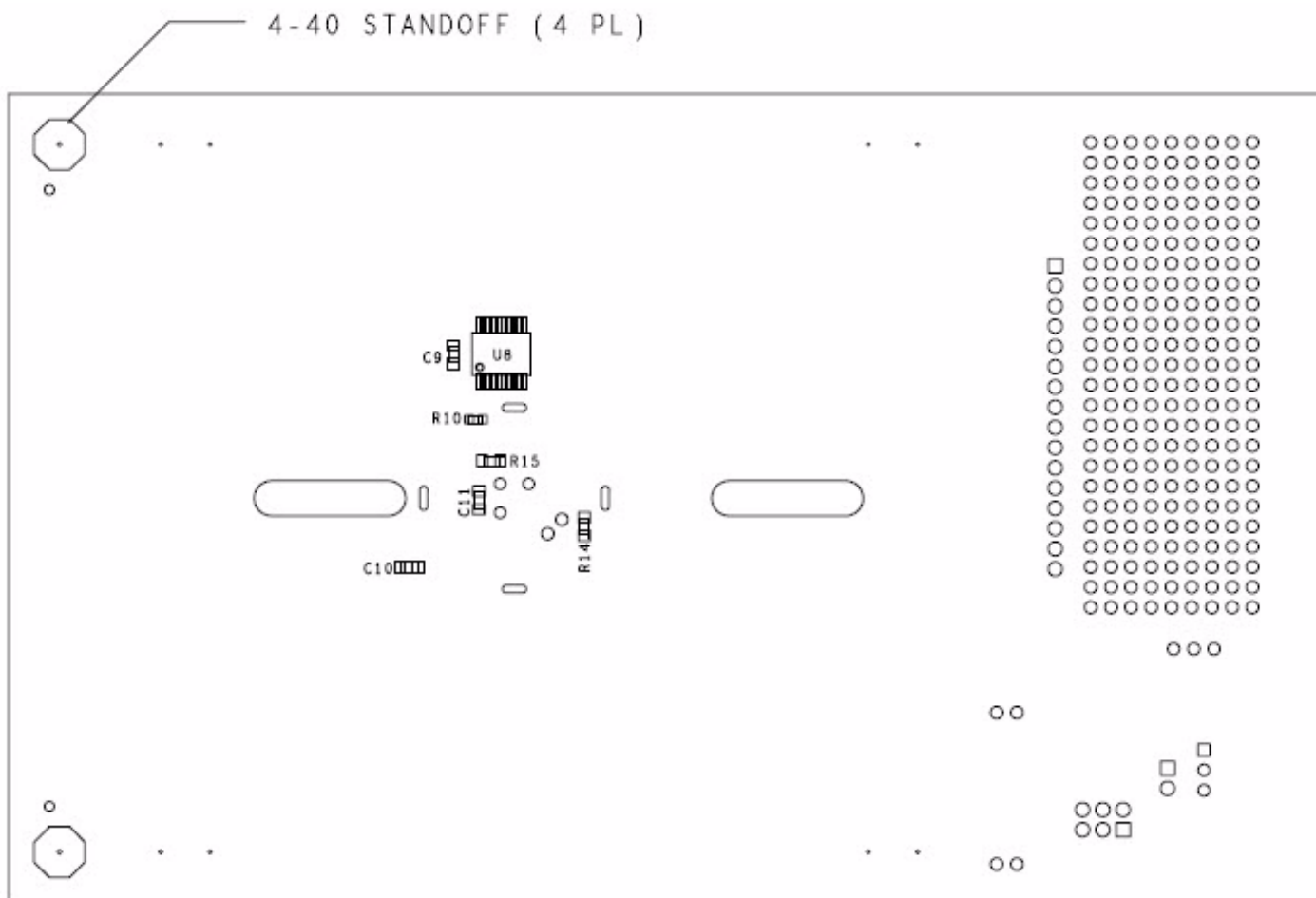**Figure 10. ZMOTION Development Board Mechanical Diagram, Top View**

Figure 11. ZMOTION Development Board Mechanical Diagram, Bottom View

Appendix B. Installing the USB SmartCable Driver

The USB SmartCable can be installed on PCs that run on Windows 7 (32- and 64-bit), Windows Vista (32- and 64-bit) and Windows XP operating systems. The procedures in this section will guide you through the USB SmartCable installation process.

Windows 7 32/64 Systems

Observe the following steps to install the USB SmartCable on a Windows 7 system.

1. Connect the USB SmartCable to a USB port on your development PC. When the PC detects the new hardware, it will display the Installing device driver software dialog.

2. Windows automatically searches for the driver; this process can take a few moments. Because there is no option to terminate this search process, wait for the search to complete. If the driver was previously installed, Windows will automatically install the USB SmartCable driver. If this is the case, skip ahead to Step 9. If Windows cannot find the driver, close the search dialog and proceed to the next step.

3. In the **Search programs and files** field in the Windows Start menu, enter Device Manager. The Device Manager will appear in a list of search results.

4. From this list of results, click **Device Manager** to open the Device Manager dialog, which presents a list of devices that operate on your PC. Find and toggle Other devices to view a sublist of additional devices, and right-click your mouse on **USB SmartCable**.

5. In the submenu that appears, click **Update Driver Software...**

6. In the Update Driver Software – USB SmartCable dialog that appears, click the **Browse my computer for driver software** option.

7. Click the **Browse...** button to browse to one of the following driver directories, depending on the configuration of your PC.

   On 32-bit Windows 7 systems, navigate to:

   <ZDS II Installation Directory>\device drivers\USB\x32 ƒn

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

   On 64-bit Windows 7 systems, navigate to:

   <ZDS II Installation Directory>\device drivers\USB\x64ƒn

   <ZDS II Installation CD>\device drivers\USB\x64

8. Click **Next** to install the driver. On 32-bit Windows systems, a security dialog will appear; select **Install this driver software anyway**.

9. After the Wizard finishes the installation, click **Close**.

Windows Vista 32/64 Systems

Observe the following steps to install the USB SmartCable on a Windows Vista system.

1. Connect the USB SmartCable to a USB port on the development PC.

2. After the PC detects the new hardware, it will display the Found New Hardware Wizard dialog box. Click **Locate and install driver software (recommended)**.

3. Depending on your development PC's User Account Control settings, Windows may ask for permission to continue the installation. Click **Continue**.

4. When the *Insert the Disc* dialog appears, select I don't have the disc. Show me other options. Click the **Next** button to display the *Windows couldn't find driver* dialog.

5. Select **Browse my computer for driver software (advanced)** to display the Browse For Driver dialog, which prompts you to key in or browse for the location of the driver's `.inf` file. Depending on the type of computer you use (32- bit or 64-bit), use the **Browse...** button to navigate to one of the following paths, then click the **Next** button.

   On 32-bit Vista systems, navigate to:

   <ZDS II Installation>\device drivers\USB\x32ƒn

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

   On 64-bit Vista systems, navigate to:

   <ZDS II Installation>\device drivers\USB\x64ƒn

   <ZDS II Installation CD>\device drivers\USB\x64

6. When the Windows Security dialog prompts you whether to install or not to install, click **Install this driver software anyway** and wait until the installation is completed (Windows may prompt you more than once).

7. When the software has been installed successfully, click **Close**.

Windows XP Systems

Observe the following steps to install the USB SmartCable on a Windows XP system.

1. Connect the USB SmartCable to a USB port on the development PC. When the PC detects the new hardware, it will display the Found New Hardware Wizard dialog.

2. In the Wizard, select **Install from a list or specific location (Advanced)**, then click **Next**.

▶ **Note:** If the Windows Hardware Installation dialog appears, click Continue Anyway.

3. In the **Please choose your search and installations** dialog, select **Search for the best driver in these locations and include this location in search**.

4. Use the **Browse...** button to navigate to one of the following paths:

<ZDS II Installation>\device drivers\USB\x32ƒn

<ZDS II Installation CD>\Device Drivers\USB\x32

5. Click **Next** to locate the appropriate driver.

6. Click **Next** a second time, then click **Finish** to complete the installation.

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LV-24-33 V6 44-PIN TQFP MCU CARD EMPTY LV-24-33 V6 64-PIN TQFP MCU CARD EMPTY LV-24-33 V6 80-PIN TQFP 1 MCU
CARD EMPTY 32X32 RGB LED MATRIX PANEL - 6MM PITCH 3.3 - 5 VTRANSLATOR READY FOR XMEGA CASING (WHITE)
RELAY4 BOARD ETHERNET CONNECTOR RFID CARD 125KHZ - TAG RFID READER RFM12B-DEMO MAROON 3G CLICK
(FOR EUROPE AND AUSTRALIA) MAX232 MAX3232 BOARD ARTY S7-50 TINKERKIT HALL SENSOR TOUCHPANEL
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