Software User Guide
UG-461

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*ez*LINX *i*Coupler Isolated Interface Development Environment

FEATURES

Sample PC application
Open source software
Uses Microsoft .NET Framework, Version 4
Integrates with the *ez*LINX hardware platform via an isolated USB
Allows a complete plug and play evaluation and development experience with 8 isolated communication standards
Isolated USB
Isolated CAN
Isolated RS-485/RS-422
Isolated RS-232
Isolated I²C
Isolated SPI
Isolated LVDS

APPLICATIONS

Isolated communication interfaces

SOFTWARE PACKAGE CONTENTS

***ez*LINX sample PC application install**
***ez*LINX USB drivers**

SOFTWARE REQUIREMENTS

Windows XP, Windows Vista, or Windows 7

GENERAL DESCRIPTION

The *ez*LINX™ hardware platform contains an Analog Devices, Inc., ADSP-BF548 processor running the uCLinux™ kernel and the *ez*LINX embedded software. A sample PC application is also provided, interfacing with the *ez*LINX hardware via an isolated USB. The embedded software is written in C, and the sample PC application is written in Microsoft Visual C#; both use Microsoft .NET Framework, Version 4.0.

The *ez*LINX software and hardware allow:

- Simultaneously transmitting and receiving data on multiple isolated interfaces
- Switching between running interfaces
- Viewing data traffic in real time
- Customizing interfaces to suit various applications
- Easy updating of embedded software, or firmware, via an isolated USB
- Quick saving and loading of an entire configuration for all communication standards
- Hardware routing of signals between interfaces

The open source nature of both the sample PC application and the embedded software allows the user to view and edit the source code of the application to optimize the *ez*LINX hardware system for a given application. The source code and sample PC application can be downloaded from the *ez*LINX *i*Coupler Isolated Interface Development Environment wiki page.

*ez*LINX SAMPLE PC APPLICATION MAIN WINDOW

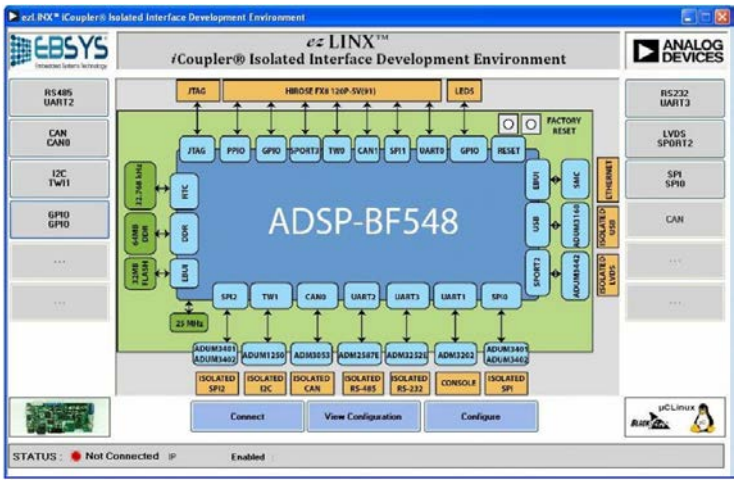

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

12/13—Revision 0: Initial Version

MAIN WINDOW

Upon starting the *ez*LINX sample PC application, the **Main** window opens (see Figure 2).

This window provides a complete overview of the *ez*LINX hardware system and shows how it connects to the ADSP-BF548 processor. The sample PC application allows simultaneous use and evaluation of multiple communication standards.

MAIN WINDOW BUTTONS AND OPTIONS

The application has two sidebars at the left and right of the **Main** window that contain seven active buttons for accessing various transceiver interfaces. These interfaces can be accessed from any window in the application software. The color of each button indicates the status of the corresponding transceiver as follows:

- Light gray indicates that the transceiver is deactivated and disconnected.
- Steel blue indicates that the transceiver is activated and disconnected.
- Royal blue indicates that the transceiver is activated and connected.

The **STATUS** bar along the bottom of the window indicates whether the application is connected to an *ez*LINX hardware platform, the IP address of that hardware platform, and the transceivers on the hardware that are currently enabled. Clicking the word **STATUS** opens the **Transceiver Status** window, where you can view the amount of data sent and received by each interface in the current session. The **Main** window of the application also has three buttons located under the system block diagram: **Connect**, **View Configuration**, and **Configure**.

Connect Button

Clicking **Connect** establishes a connection with the *ez*LINX hardware board using the current IP address configuration.

View Configuration Button

Clicking **View Configuration** opens the **Transceivers Configuration** window (see Figure 48), which allows viewing the global configuration of all transceivers and GPIOs on the *ez*LINX hardware platform.

Configure Button

Clicking **Configure** opens the **Board Configuration** window (see Figure 3 and Figure 4), which allows

- Configuring the IP address of the *ez*LINX hardware platform that the PC application software connects to.
- Changing the IP configuration of the connected *ez*LINX hardware board.
- Applying updates to the embedded software of the *ez*LINX hardware board.

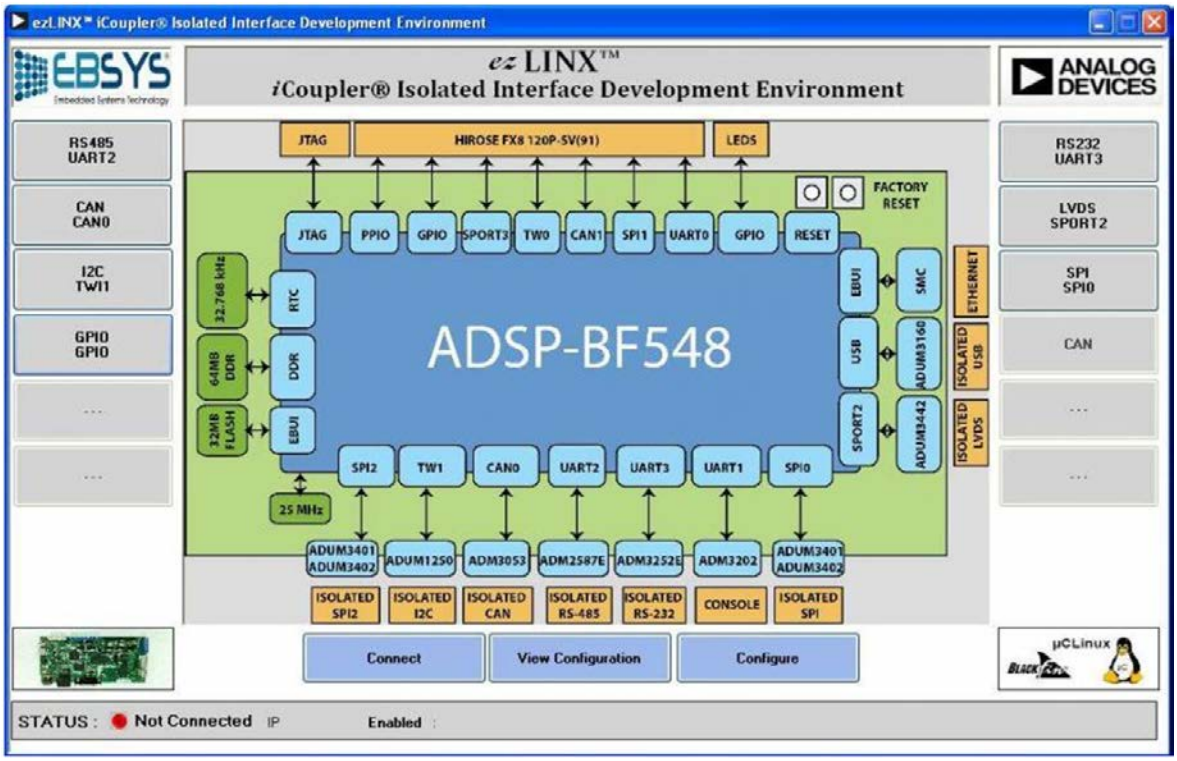

Figure 2. Main Window

BOARD CONFIGURATION WINDOW

There are two ways to open the **Board Configuration** window:

- Click **Configure** (see Figure 3).
- Click the image of the *ez*LINX hardware platform on the bottom left of any window in the application software (see Figure 4).

The **Board Configuration** window is divided into three sections that allow setting the network features, updating the firmware, and the enabling/disabling the transceivers. The buttons near the bottom of the window depend on which method is used to open the **Board Configuration** window. If the window is accessed by clicking **Configure**, the buttons appear as **Use Changes**, **View Configuration**, and **Cancel Changes**. If the window is accessed by clicking the image of the *ez*LINX hardware platform, the buttons appear as **Connect**, **View Configuration**, and **Configure**.

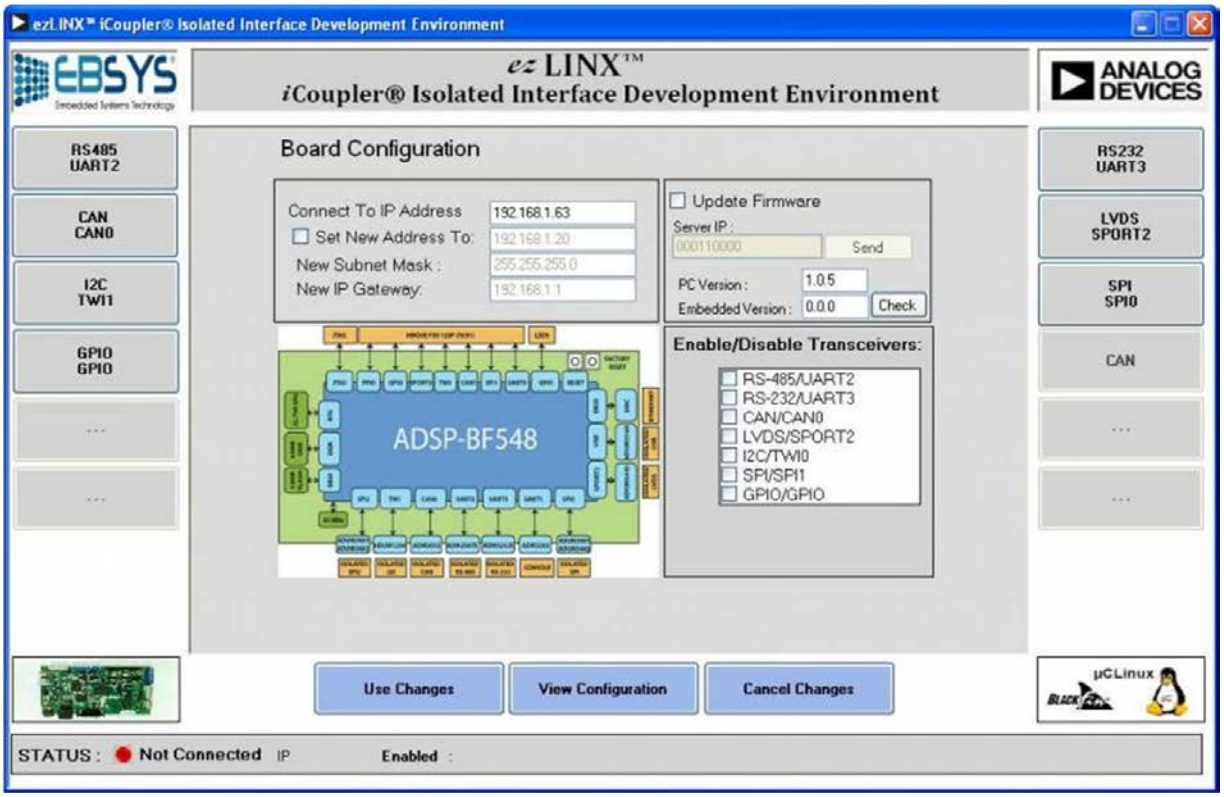

Figure 3. Board Configuration Window Accessed by Clicking Configure

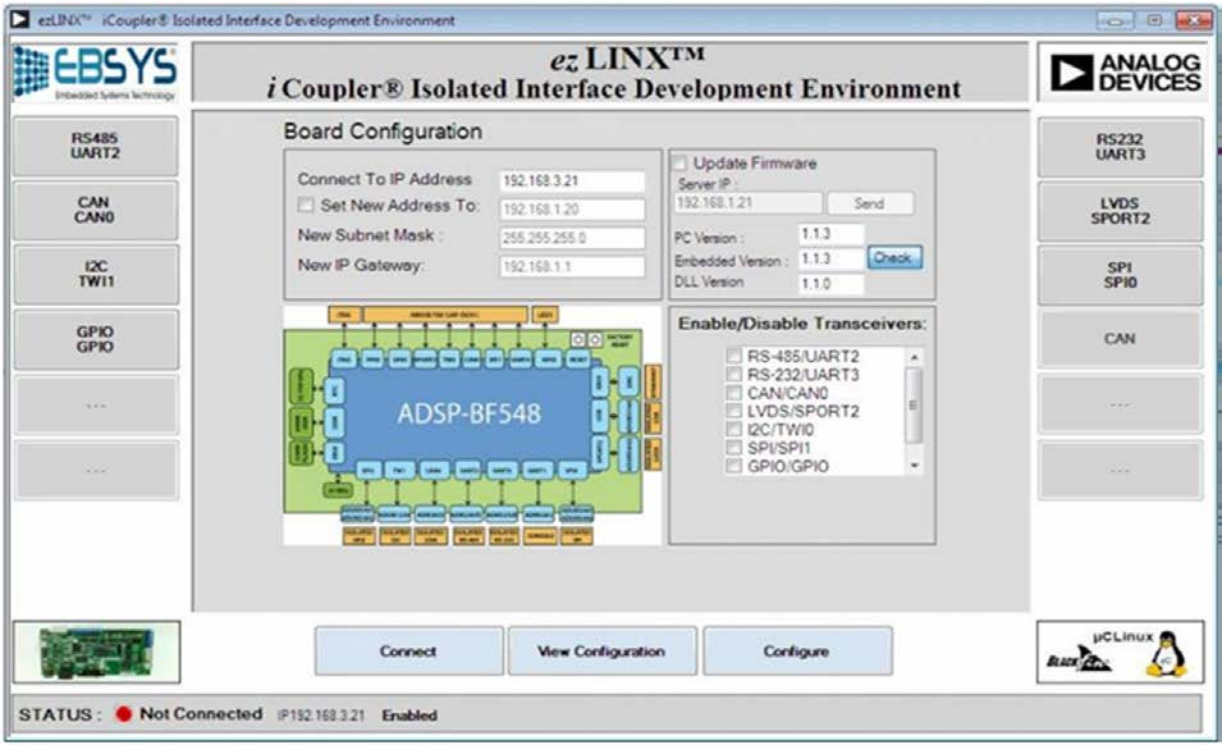

Figure 4. Board Configuration Window Accessed by Clicking the Image of the ezLINX Hardware Platform

SETTING THE NETWORK FEATURES

The upper left section of the **Board Configuration** window (shown in Figure 5) is used to modify the network features of the *ez*LINX hardware platform.

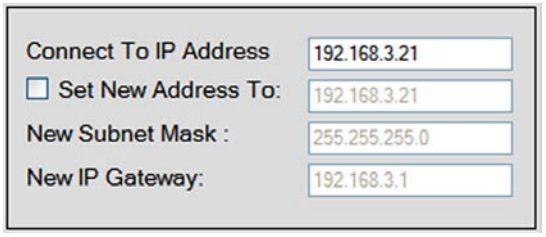

Figure 5. Network Features Box

The boxes in this section can be used as follows:

- **Connect To IP Address** box: Specify the IP address of the *ez*LINX hardware platform that the PC application software connects to when **Connect** is clicked. The default address is 192.168.3.21.
- **Set New Address To** box: Specify a new IP address to configure the connected *ez*LINX hardware platform. You must select the **Set New Address To** box and connect an *ez*LINX hardware platform before setting a new address or using the **New Subnet Mask** and **New IP Gateway** functions.
- **New Subnet Mask** box: Specify a new subnet mask to configure the connected *ez*LINX hardware platform.
- **New IP Gateway** box: Specify a new IP gateway to configure the connected *ez*LINX hardware platform.

CHECKING/UPDATING THE FIRMWARE

The upper right section of the **Board Configuration** window (shown in Figure 6) is used to easily load newer firmware versions and check the current version of both the firmware (via the **Embedded Version** box in Figure 6) and the PC application software (via the **PC Version** box in Figure 6).

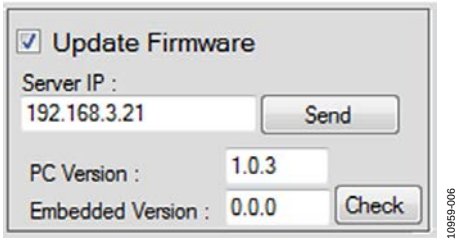

Figure 6. Firmware Upgrade Box

The boxes in this section can be used as follows:

- **Server IP** box: Specify the IP address of the server containing the new version of the embedded software. Click **Send** to load the newer version of the software to the connected *ez*LINX hardware platform. For more information about performing a firmware update, see the Updating the Firmware section of this user guide.
- **PC Version** box: This box shows the current version of the PC application software.
- **Embedded Version** box: This box shows the version of the embedded software on the *ez*LINX hardware platform. Click **Check** to request which version is currently on the hardware platform.

ENABLING/DISABLING THE TRANSCEIVERS

The lower right section of the **Board Configuration** window (shown in Figure 7) can be used to enable or disable any of the transceivers on the *ez*LINX hardware platform. To enable or disable a transceiver, select or clear the box next to the appropriate interface name.

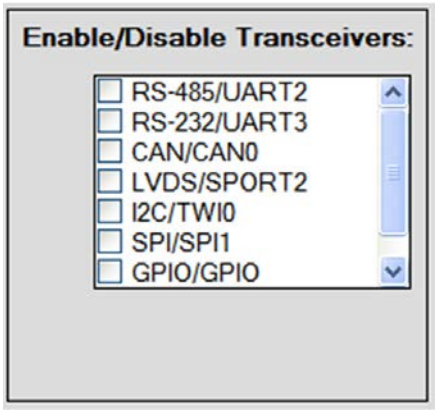

Figure 7. Enable/Disable Transceivers Box

A notification message is displayed when you hover the mouse over a button corresponding to a selected transceiver, indicating that the transceiver is currently enabled (see Figure 8).

Figure 8. Notification Message for Enabled Transceiver

ISOLATED RS-232

The isolated RS-232 interface on the *ez*LINX development platform is implemented using an Analog Devices ADM3251E driver/receiver. For more information about the hardware implementation of the RS-232 interface, see the *ez*LINX Isolated RS-232 Implementation wiki page.

RS-232 CONFIGURATION WINDOW

To open the RS-232 interface, click **RS232 UART3** from the right sidebar of any window in the application software. This opens the **RS-232 Configuration** window (see Figure 10).

To configure the RS-232 for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **RS-232 Configuration** window is divided into three sections that control selecting the communication interface, the RS-232 settings, and the RS-232 routing.

Selecting the Communication Interface

The upper left section of the **RS-232 Configuration** window (shown in Figure 9) is used to select the appropriate communication interface for the RS-232 transceiver. Select **UART3** from the **Interface** drop-down menu.

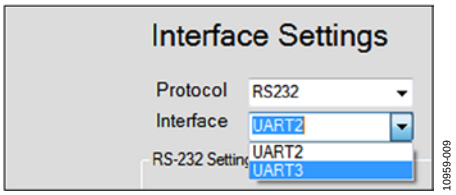

Figure 9. Selecting the Communication Interface

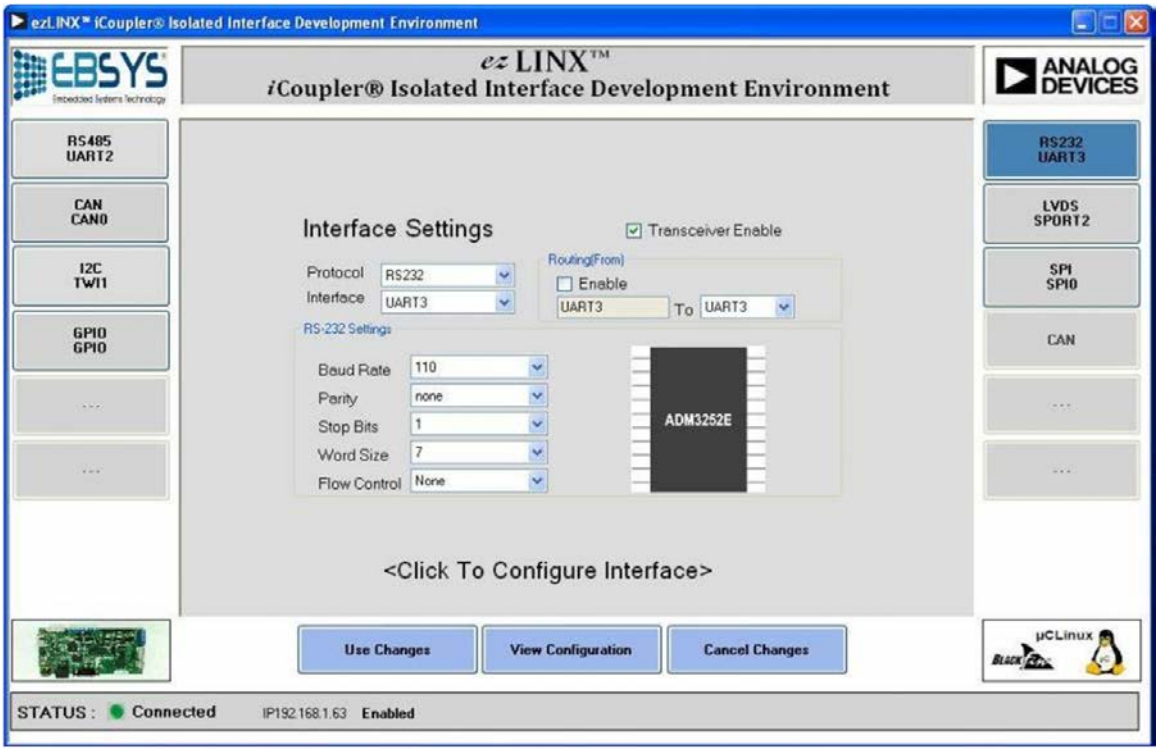

Figure 10. RS-232 Configuration Window

Configuring the RS-232 Settings

The **RS-232 Settings** box (shown in Figure 11) is used to communicate with the *ez*LINX hardware board through the RS-232 port.

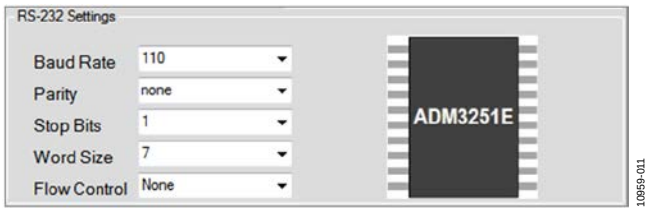

Figure 11. RS-232 Settings Box

Configure the device using the following controls:

- **Baud Rate** box: Select the baud rate for the RS-232 device. Note that the performance of the ADM3251E RS-232 transceiver is not specified for a baud rate above 460,800 bits/sec. From the **Baud Rate** drop-down menu, you can select different transmission rate values, from 110 bits/sec to 1,000,000 bits/sec.
- **Parity** box: Select whether to append an even, odd, or no parity bit to the end of each word transmitted.
- **Stop Bits** box: Select whether one or two stop bits are used.
- **Word Size** box: Select whether the application sends 7- or 8-bit words.
- **Flow Control** box: Select whether to use flow control. When communicating with another *ez*LINX hardware platform, select **None** in this box.

Configuring RS-232 Routing

The RS-232 interface supports hardware routing to the outputs of other interfaces. To enable hardware routing, select the **Enable** check box in the **Routing(From)** section, located in the upper right of the **RS-232 Configuration** window, and choose the interface to route to using the drop-down menu (see Figure 12). To route RS-232 to RS-485, select **UART2** from the drop-down menu.

Figure 12. Routing(From) Box

Confirm your selection by clicking **Use Changes** near the bottom of the window. If the sample PC application is connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **Send/Receive** window opens (see Figure 13).

RS-232 SEND/RECEIVE WINDOW

The **RS-232 Send/Receive** window is shown in Figure 13. The window consists of two main sections: a **Send** section on the left and a **Receive** section on the right.

To send data from the RS-232 port, type the data to be sent into the **Send** box, located just to the left of the **Send Data Format** box. Click **Send Data** to transmit the contents of the text box. Data sent to the RS-232 port automatically appears in the **Receive** section of the window in real time.

The **RS-232 Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the RS-232 transceiver is disconnected and cannot transmit or receive data.
- **Send Data** button: Transmits the text contained in the **Send** box.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Opens a menu to select a .txt file to be loaded. After the file is loaded, the contents of the file are automatically sent through the RS-232 port.
- **Clear** button: Clears any text that was entered in the **Send** box.
- **Send Data Format** box: Allows choosing whether to send the characters in the **Send** box as hexadecimal or ASCII data.
- **Receive Data Format** box: Allows choosing whether to display the received data as hexadecimal or ACSII characters.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **RS-232 Send/Receive** window, turn the transceiver off and click a different interface button, or click **RS232 UART3** from the right sidebar to return to the **RS-232 Configuration** window.

Figure 13. RS-232 Send/Receive Window

ISOLATED RS-485/RS-422

Both the isolated RS-485 and the isolated RS-422 interfaces on the *ez*LINX development platform are implemented using an Analog Devices ADM2587E transceiver.

For more information about the hardware implementation of the RS-485/RS-422 interfaces, see the *ez*LINX Isolated RS-485/RS-422 Implementation wiki page.

RS-485/RS-422 CONFIGURATION WINDOW

In the *ez*LINX sample PC application, both the RS-485 and the RS-422 protocols are accessed from the same configuration window. To open the RS-485/RS-422 interface, click **RS485 UART2** from the left sidebar of any window in the application software. This opens the **RS-485/RS-422 Configuration** window (see Figure 15).

To configure the RS-485/RS-422 for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **RS-485/RS-422 Configuration** window is divided into three sections that control selecting the communication interface, the RS-485/RS-422 settings, and the RS-485/RS-422 routing.

Selecting the Communication Interface

The upper left section of the **RS-485/RS-422 Configuration** window (shown in Figure 14) is used to select the appropriate communication interface for the RS-485/RS-422 transceiver. Select **UART2** from the **Interface** drop-down menu

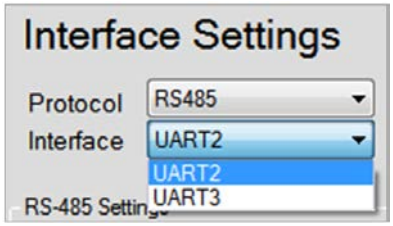

Figure 14. Selecting the Communication Interface

Figure 15. RS-485 Configuration Window

Selecting the RS-485 Settings

The **RS-485 Settings** box (shown in Figure 16) is used to communicate with the *ez*LINX hardware board through the RS-485 port.

Figure 16. RS-485 Settings Box

Configure the device using the following controls:

- **Baud Rate** box: Select the baud rate for the RS-485/RS-422 device. Note that the performance of the ADM2587E RS-485/RS-422 transceiver is not specified for a baud rate above 500 kbits/sec. From the **Baud Rate** drop-down menu, you can select different transmission rate values, from 110 bits/sec to 1,000,000 bits/sec.
- **Parity** box: Select whether to append an even, odd, or no parity bit to the end of each word transmitted.
- **Stop Bits** box: Select between using one or two stop bits.
- **Word Size** box: Select whether the application sends 7- or 8-bit words.
- **Flow Control** box: Select whether to use flow control. When the sample PC application is connected to the *ez*LINX hardware platform, select **None** in this box.
- **Duplex** box: Choose between half- and full-duplex operation. If using half-duplex operation, Jumpers JP3, JP4, and JP40 should be connected on the *ez*LINX hardware board.

Selecting the RS-485/RS-422 Routing

The RS-485/RS-422 interface supports hardware routing to the outputs of other interfaces. To enable hardware routing, select the **Enable** check box in the **Routing(From)** section, located in the upper right of the **RS-485/RS-422 Configuration** window, and choose the interface to route to using the drop-down menu (see Figure 17). To route RS-485/RS-422 to RS-232, select **UART3** from the drop-down menu.

Figure 17. Routing(From) Box

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **Send/Receive** window opens (see Figure 18).

RS-485/RS-422 SEND/RECEIVE WINDOW

The **RS-485/RS-422 Send/Receive** window is shown in Figure 18. The window is identical to the **RS-232 Send/Receive** window. The left section of the window is used to transmit data by clicking **Send Data**, and the right section of the window is used to receive data in real time.

The **RS-485/RS-422 Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the RS-485/RS-422 transceiver is disconnected and cannot transmit or receive data.
- **Send Data** button: Transmits the text contained in the **Send** box.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Opens a menu to select a .txt file to be loaded. After the file is loaded, the contents of the file are automatically sent through the RS-485/RS-422 port.
- **Clear** button: Clears any text that was entered in the **Send** box.
- **Send Data Format** box: Allows choosing whether to send the characters in the **Send** box as hexadecimal or ASCII data.
- **Receive Data Format** box: Allows choosing whether to display the received data as hexadecimal or ACSII characters.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **RS-485/RS-422 Send/Receive** window, turn the transceiver off and click a different interface button, or click **RS485 UART2** from the left sidebar to return to the **RS-485/RS-422 Configuration** window.

Figure 18. RS-485/RS-422 Send/Receive Window

ISOLATED I²C

The isolated inter-integrated circuit (I²C) interface on the *ez*LINX development platform is implemented using Analog Devices ADuM1250 and ADuM5000 isolators.

For more information about the I²C hardware implementation, see the *ez*LINX Isolated I²C Implementation wiki page.

I²C CONFIGURATION WINDOW

To open the I²C interface, click **I2C TWI1** from the left sidebar of any window in the application software. The **I²C Configuration** window opens (see Figure 20)

To configure the I²C for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **I²C Configuration** window is divided into two sections that control selecting the communication interface and the I²C settings.

Selecting the Communication Interface

The upper left section of the **I²C Configuration** window (shown in Figure 19) is used to select the appropriate communication interface for the I²C transceiver. Select **TWI1** from the **Interface** drop-down menu.

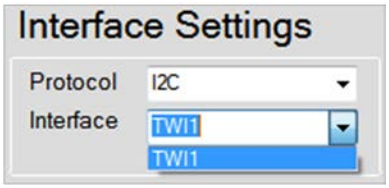

Figure 19. Selecting the Communication Interface

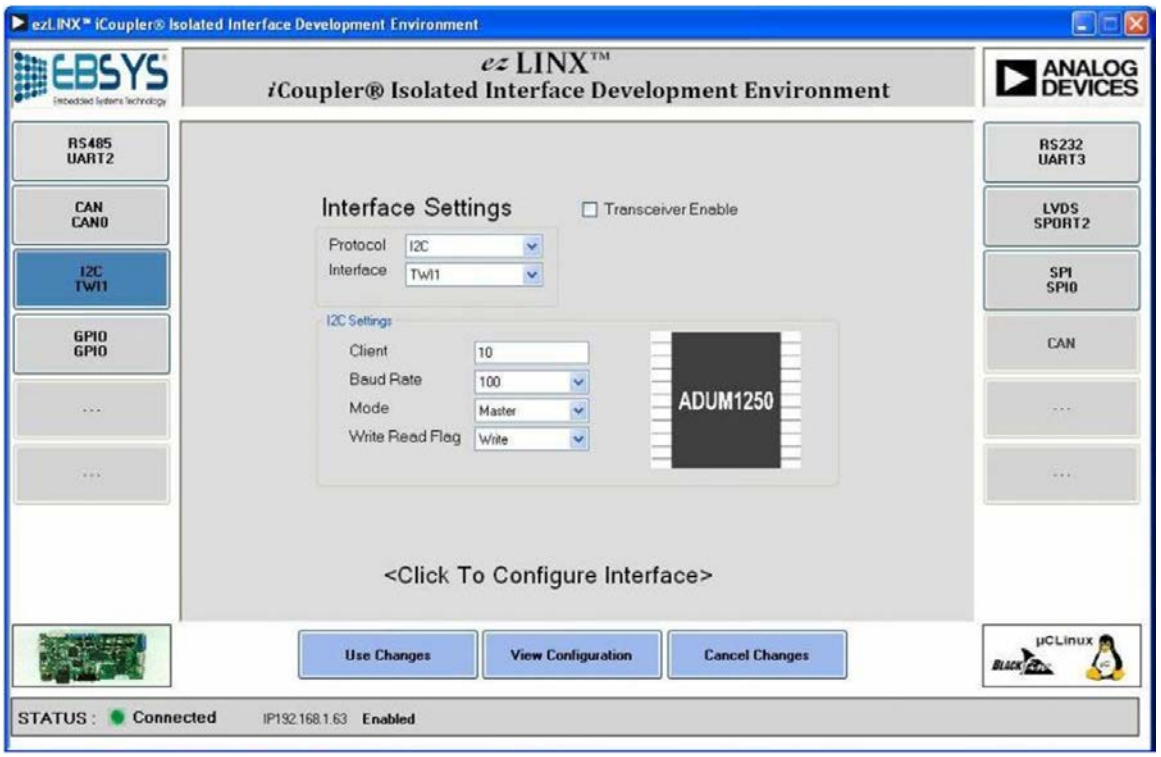

Figure 20. I²C Configuration Window

Selecting the I²C Settings

The **I²C Settings** box (shown in Figure 21) is used to communicate with the *ez*LINX hardware board through I²C protocol.

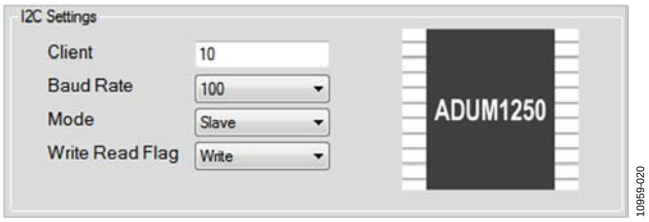

Figure 21. I²C Settings Box

Configure the device using the following controls:

- **Client** box: When the ADuM1250 is used as a master device, this box specifies which client to connect to. When the ADuM1250 is used as a slave device, this box specifies the client address of the transceiver.
- **Baud Rate** box: Select either 100 bits/sec or 400 bits/sec as the baud rate.
- **Mode** box: Select whether to configure the connected device as a master or a slave.
- **Write Read Flag** box: Select whether the device is performing a read or write operation. Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **I²C Send/Receive** window opens (see Figure 22).

I²C SEND/RECEIVE WINDOW

The **I²C Send/Receive** window is shown in Figure 22. The window is identical to the **RS-232 Send/Receive** window. The left section of the window is used to transmit data by clicking **Send Data**, and the right section of the window is used to receive data in real time.

The I²C module can only send hexadecimal data. When the *ez*LINX I²C transceiver is used to write to a slave device, data must be sent in multiples of two bytes (four hexadecimal digits) for proper operation.

The first byte represents the memory address to write to, and the second byte contains the value to be written to that address. When the I²C transceiver is used to read from a slave device, the data must be sent as one or more whole bytes (multiples of two hexadecimal digits). Each byte specifies a memory address to read from. When a byte of data is sent from a register of the slave, the value of that register is received by the master and is displayed in the **Receive** section of the window in real time.

The **I²C Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the I²C transceiver is disconnected and cannot transmit or receive data.
- **Send Data** button: Transmits the text contained in the **Send** box.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Opens a menu to select a .txt file to be loaded. After the file is loaded, the contents of the file are automatically sent through the I²C port. Files must contain hexadecimal characters only.
- **Clear** button: Clears any text that was entered in the **Send** box.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **I²C Send/Receive** window, turn the transceiver off and click a different interface button, or click **I2C TWI1** from the left sidebar to return to the **I²C Configuration** window.

Figure 22. I²C Send/Receive Window

ISOLATED SPI

The two isolated serial peripheral interface (SPI) ports on the *ez*LINX development platform are implemented using Analog Devices ADuM3401, ADuM3402, and ADuM5000 signal and power isolators.

For more information about the SPI hardware implementation, see the *ez*LINX Isolated SPI Implementation wiki page.

SPI CONFIGURATION WINDOW

To open the SPI interface, click **SPI SPIO** on the right sidebar of any window in the application software. This opens the **SPI Configuration** window (see Figure 24).

To configure the SPI for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **SPI Configuration** window interface is divided into three sections that control selecting the communication interface, the SPI settings, and the SPI routing.

Selecting the Communication Interface

The upper left section of the **SPI Configuration** window (shown in Figure 23) is used to select the appropriate communication interface for the SPI transceiver. Select **SPI0**, **SPI1**, or **SPI2** from the **Interface** drop-down menu.

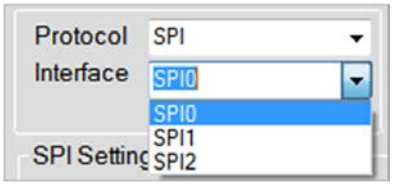

Figure 23. Selecting the Communication Interface

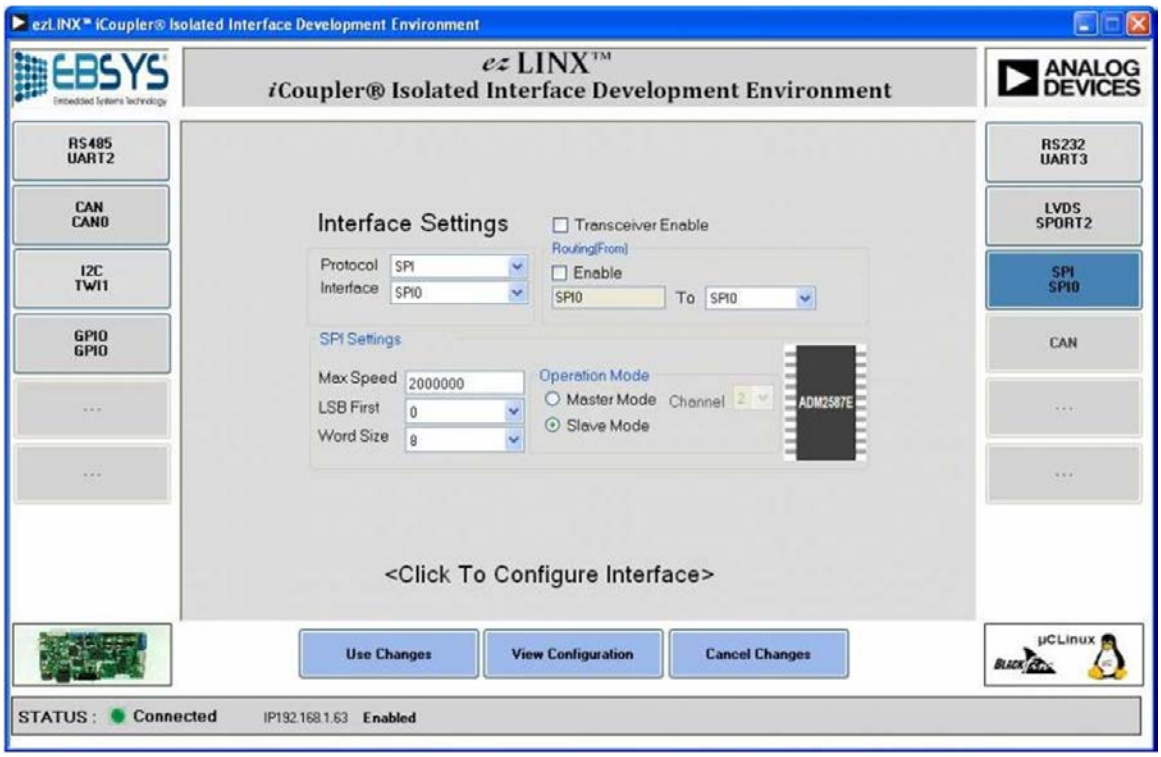

Figure 24. SPI Configuration Window

Selecting the SPI Settings

The **SPI Settings** box (shown in Figure 25) is used to communicate with the *ez*LINX hardware board through SPI protocol.

Figure 25. SPI Settings Box

Use the following controls to set the SPI parameters:

- **Max Speed** box: Specify the maximum speed (in bps) for the SPI interface. The maximum data rate that can be used is 32.81 MHz.
- **LSB First** box: Activate the least significant byte (LSB) first mode. Upon power up, the most significant byte (MSB) first mode is the default. The mode can be changed by programming the configuration register. In LSB first mode, the serial exchange starts with the lowest order bit (LSB) and ends with the highest order bit (MSB). The instruction is 16 bits long, consisting of two bytes. From the **SPI Configuration** window, you can choose the number of bits to be reversed using the **LSB First** drop-down box.
- **Word Size** box: Select whether to send data as 8-, 16-, or 32-bit words.
- **Operation Mode** box: Select whether the device is operating as a master or as a slave.
- **Channel** box: Select which slave to connect to; each channel corresponds to a slave select line. This function is available only when the operation mode selected is master. The *ez*LINX hardware platform has three slave select lines; therefore, a master can be connected to up to three slave devices. Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **SPI Send/Receive** window opens (see Figure 27).

Selecting the SPI Routing

The SPI interface supports hardware routing to the outputs of other interfaces. To enable hardware routing, select the **Enable** check box in the **Routing(From)** section, located in the upper right of the **SPI Configuration** window, and choose the interface to route to from the drop-down menu (see Figure 26). To route SPI to RS-232, select **UART3** from the drop-down menu.

Figure 26. Routing(From) Box

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **SPI Send/Receive** window opens.

SPI SEND/RECEIVE WINDOW

The **SPI Send/Receive** window is shown in Figure 27. The window is identical to the **RS-232 Send/Receive** window. The left section of the window is used to transmit data by clicking **Send Data**, and the right section of the window is used to receive data in real time.

The **SPI Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the SPI transceiver is disconnected and cannot transmit or receive data.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Opens a menu to select a .txt file to be loaded. After the file is loaded, the contents of the file are automatically sent through the SPI port.
- **Clear** button: Clears any text that was entered in the **Send** box.
- **Send Data Format** box: Allows choosing whether to send the characters in the **Send** box as hexadecimal or ASCII data.
- **Receive Data Format** box: Allows choosing whether to display the received data as hexadecimal or ACSII characters.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **SPI Send/Receive** window, turn the transceiver off and click a different interface button, or click **SPI SPIO** from the right sidebar to return to the **SPI Configuration** window.

Figure 27. SPI Send/Receive Window

ISOLATED CAN

The isolated controller area network (CAN) interface on the *ez*LINX development platform is implemented using an Analog Devices ADM3053 transceiver.

For more information about CAN hardware implementation, see the *ez*LINX Isolated CAN Implementation wiki page.

CAN CONFIGURATION WINDOW

To open the CAN interface, click **CAN CAN0** from the left sidebar of any window in the application software. This opens the **CAN Configuration** window (see Figure 29).
(The **CAN** button in the right sidebar is unimplemented and cannot be selected.)

To configure the CAN for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **CAN Configuration** window is divided into three sections that control selecting the communication interface, the CAN settings, and the CAN routing.

Selecting the Communication Interface

The upper left section of the **CAN Configuration** window (shown in Figure 28) is used to select the appropriate communication interface for the CAN transceiver. Select **CAN0** from the **Interface** drop-down menu.

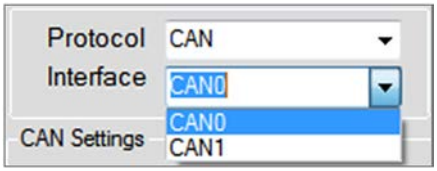

Figure 28. Selecting the Communication Interface

Figure 29. CAN Configuration Window

Selecting the CAN Settings

The **CAN Settings** box (shown in Figure 30) is used to communicate with the *ez*LINX hardware board through the CAN protocol.

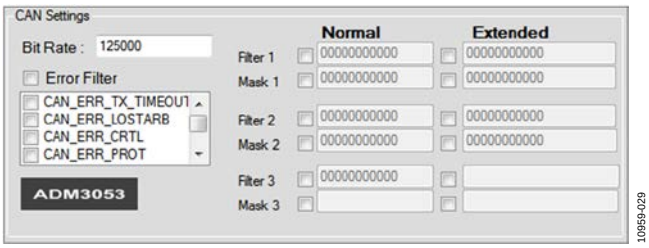

Figure 30. CAN Settings Box

Use the following controls to specify the CAN settings:

- **Bit Rate** box: Select the bit rate for the ADM3053. Note that the ADM3053 is not specified at bit rates greater than 1 Mbps.
- **Error Filter** box: Detects hardware issues on the physical transceiver layer as well as arbitration problems and error frames. The reception of error frames is disabled by default. To enable this function, select the **Error Filter** box. You can then choose your desired error filter from the following list by selecting the relevant box:
  - **CAN_ERR_TX_TIMEOUT**: transceiver timeout (net device driver)
  - **CAN_ERR_LOSTARB**: lost arbitration
  - **CAN_ERR_CRTL**: controller problems
  - **CAN_ERR_PROT**: protocol violations
  - **CAN_ERR_TRX**: transceiver status
  - **CAN_ERR_ACK**: received no acknowledgement of transmission
  - **CAN_ERR_BUSOFF**: bus off
  - **CAN_ERR_BUSERROR**: bus error
  - **CAN_ERR_RESTARTED**: controller restarted
  - **CAN_ERR_MASK**: omit EFF, RTR, ERR flags
- **Filter/Mask** boxes: The reception of CAN frames can be controlled by three sets of filters/masks. Each filter/mask can be used for messages with either standard or extended identifiers. Note that you must select the check box next to the appropriate name of the filter/mask before entering your selected value. The available filters and masks are as follows:
  - **Normal Filter 1** to **Normal Filter 3**: filter for standard frame (11-bit identifier).
  - **Extended Filter 1** to **Extended Filter 3**: filter for extended frame (29-bit identifier).
  - **Normal Mask 1** to **Normal Mask 3**: mask for standard frame (11-bit identifier).
  - **Extended Mask 1** to **Extended Mask 3**: mask for extended frame (29-bit identifier).

Selecting the CAN Routing

The CAN interface supports hardware routing to the outputs of other interfaces. To enable hardware routing, select the **Enable** check box in the **Routing(From)** section, located in the upper right of the **CAN Configuration** window, and choose the interface to route to from the drop-down menu. To route CAN to RS-485, select **UART2** from the drop-down menu.

Figure 31. Routing(From) Box

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **CAN Send/Receive** window opens.

CAN SEND/RECEIVE WINDOW

The **CAN Send/Receive** window is shown in Figure 33. The window is identical to the **RS-232 Send/Receive** window. The left section of the window is used to transmit data by clicking **Send Data**, and the right section of the window is used to receive data in real time.

The CAN module can only send hexadecimal data. A colon is used to separate the two parts of each CAN message. Each CAN message has both an identifier and the data. The identifier can be either a standard identifier (SID), ranging from 0x000 to 0x7FF, or an extended ID (EXID), ranging from 0x8000 0000 to 0xFFFF FFFF. The data section of each CAN message must be sent as whole bytes (multiples of two hexadecimal digits). Some examples of CAN messages are shown in Figure 32.

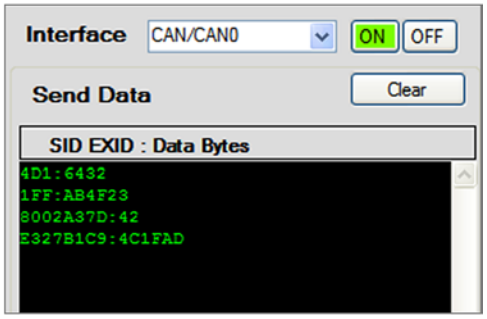

Figure 32. Examples of CAN Messages

The **CAN Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the CAN transceiver is disconnected and cannot transmit or receive data.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Before using this function, you must select the **File** check box. Clicking **Load File** opens a menu

to select a .txt file to be loaded. Your choice must be a correctly formatted file containing only hexadecimal values, with the identifier and data sections of each CAN message separated by a colon (no spaces). After the file is loaded, the contents of the file are automatically sent through the CAN port.

- **Clear** button: Clears any text that was entered in the **Send** box.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **CAN Send/Receive** window, turn the transceiver off and click a different interface button, or click **CAN CAN0** from the left sidebar to return to the **CAN Configuration** window.

Figure 33. CAN Send/Receive Window

ISOLATED LVDS

The isolated low voltage differential signaling (LVDS) interface on the *ez*LINX hardware platform is implemented using the ADuM3442 and ADuM5000 signal and power isolators and the ADN4663 and ADN4664 LVDS receivers and drivers.

For more information about LVDS implementation, see the *ez*LINX Isolated LVDS Implementation wiki page.

LVDS CONFIGURATION WINDOW

To open the LVDS interface, click **LVDS SPORT2** from the right sidebar of any window in the application software. The **LVDS Configuration** window opens (see Figure 35).

To configure the LVDS for use, select the **Transceiver Enable** check box. This box is present on all the configuration windows and is used to enable or disable the corresponding transceiver on the *ez*LINX hardware.

The **LVDS Configuration** window is divided into three sections that control selecting the communication interface, the LVDS settings, and the LVDS routing.

Selecting the Communication Interface

The upper left section of the **LVDS Configuration** window (shown in Figure 34) is used to select the appropriate communication interface for the LVDS transceiver. Select **SPORT2** from the **Interface** drop-down menu.

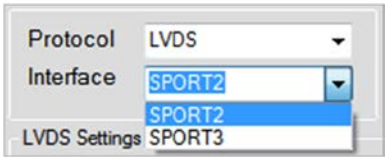

Figure 34. Selecting the Communication Interface

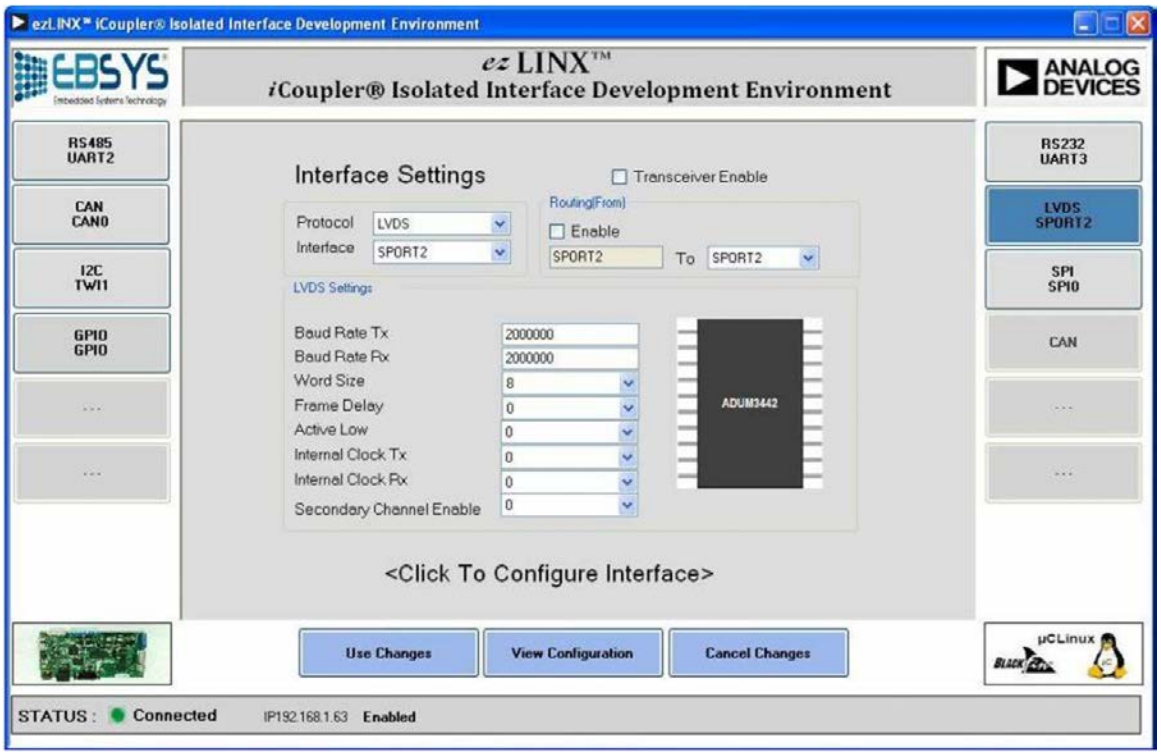

Figure 35. LVDS Configuration Window

Selecting the LVDS Settings

The **LVDS Settings** section (shown in Figure 36) is used to communicate with the *ez*LINX hardware board through the LVDS protocol.

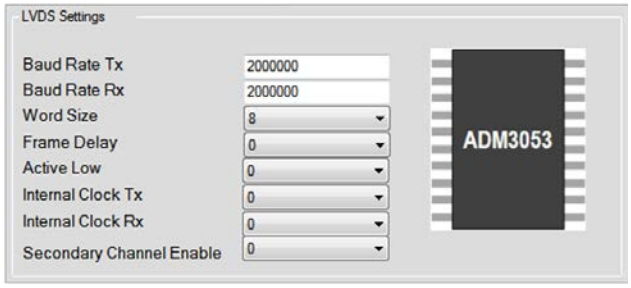

Figure 36. LVDS Settings Box

Configure the device using the following controls:

- **Baud Rate Tx** box: Select the baud rate for transmitting data via the LVDS interface.
- **Baud Rate Rx** box: Select the baud rate for receiving data via the LVDS interface.
- **Word Size** box: Select whether to send data as 8- or 16-bit words.
- **Frame Delay** box: Sets the transfer delay.
- **Active Low** box: Select either **Active Low Enable** or **Power-Down Input with Pull-Down** (3 V TTL/CMOS). If EN is held high, EN enables the drivers when low or open circuit and disables the drivers and powers down the device when high.
- **Internal Clock Tx** box: Select whether to use the internal clock to drive the LVDS transmitter or to trigger on an external clock. Select 1 for an internal clock or 0 for an external clock. For best results with board-to-board communication, one device should use an internal clock and the other device should trigger on this clock.
- **Internal Clock Rx** box: Select whether to use the internal clock to drive the LVDS receiver or to trigger on an external clock. Select 1 for an internal clock or 0 for an external clock. For best results with board-to-board communication, one device should use an internal clock and the other device should trigger on this clock.
- **Secondary Channel Enable** box: Select whether to enable the second LVDS channel (Pin 17 to Pin 32). Select 1 to enable this channel or 0 to disable it.

Selecting the LVDS Routing

The LVDS interface supports hardware routing to the outputs of other interfaces. To enable hardware routing, select the **Enable** check box in the **Routing(From)** section, located in the upper right of the **LVDS Configuration** window, and choose the interface to route to from the drop-down menu (see Figure 37). To route LVDS to RS-485, select **UART2** from the drop-down menu.

Figure 37. Routing(From) Box

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an *ez*LINX hardware platform and the **Transceiver Enable** check box is selected, the **LVDS Send/Receive** window opens.

LVDS SEND/RECEIVE WINDOW

The **LVDS Send/Receive** window for the LVDS protocol is shown in Figure 38. The window is identical to the **RS-232 Send/Receive** window. The left section of the window is used to transmit data by clicking **Send Data**, and the right section of the window is used to receive data in real time.

The **LVDS Send/Receive** window also offers a variety of other functions, as follows:

- **On/Off** button: Enables or disables the transceiver, respectively. When **Off** is clicked, the LVDS transceiver is disconnected and cannot transmit or receive data.
- **Auto** button: Enables or disables the auto setting. When the auto setting is enabled, data is transmitted automatically as you type it in the **Send** box.
- **Load File** button: Opens a menu to select a .txt file to be loaded. After the file is loaded, the contents of the file are automatically sent through the LVDS port.
- **Clear** button: Clears any text that was entered in the **Send** box.
- **Send Data Format** box: Allows choosing whether to send the characters in the **Send** box as hexadecimal or ASCII data.
- **Receive Data Format** box: Allows choosing whether to display the received data as hexadecimal or ACSII characters.
- **Save To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is saved to this file. To stop saving all received data to this file, click **Save To File** again.
- **Log To File** button: Opens a window to create a .txt file. After a .txt file is created, all received data is logged to this file with a timestamp. To stop logging all received data to this file, click **Log To File** again.

To close the **LVDS Send/Receive** window, turn the transceiver off and click a different interface button, or click **LVDS SPORT2** from the right sidebar to return to the **LVDS Configuration** window.

Figure 38. LVDS Send/Receive Window

GPIO (LEDs)

The sample PC application also has GPIO functionality, through which you can control six LEDs on the *ez*LINX hardware platform.

GPIO CONFIGURATION WINDOW

To open the GPIO interface, click **GPIO GPIO** on the left sidebar of any window in the application software. The **GPIO Interface Settings** window opens (see Figure 41).

To enable a GPIO pin, click the corresponding check box (**GPIO 1** to **GPIO 6**) in the **GPIO Settings** section of the window.

The **GPIO Configuration** window is divided into two sections that control selecting the communication interface and the GPIO settings.

Selecting the Communication Interface

The upper left section of the **GPIO Configuration** window (shown in Figure 39) is used to select the appropriate communication interface for the GPIO transceiver. Select **GPIO** from the **Interface** drop-down menu.

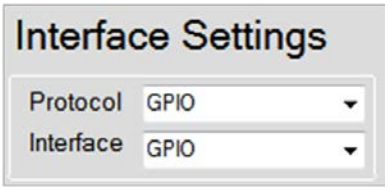

Figure 39. Selecting the Communication Interface

Selecting the GPIO Settings

The **GPIO Settings** box (shown in Figure 40) is used to configure the GPIO pins.

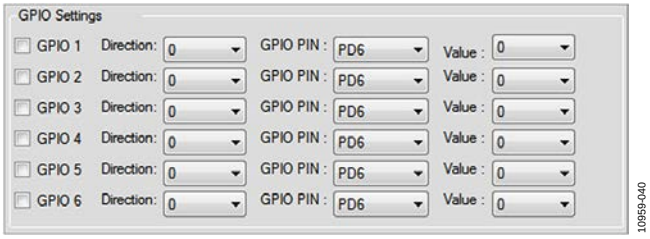

Figure 40. GPIO Settings Box

Configure the device using the following controls:

- **Direction** boxes: Select whether to configure each GPIO pin as an input or an output. Select 0 for input or 1 for output.
- **GPIO PIN** boxes: Select which GPIO pins to use.
- **Value** boxes: Select the binary value for each GPIO pin. By enabling multiple GPIO pins (via the **GPIO 1** to **GPIO 6** check boxes), you can use multiple GPIO pins together. Confirm your settings by clicking **Use Changes** near the bottom of the window.

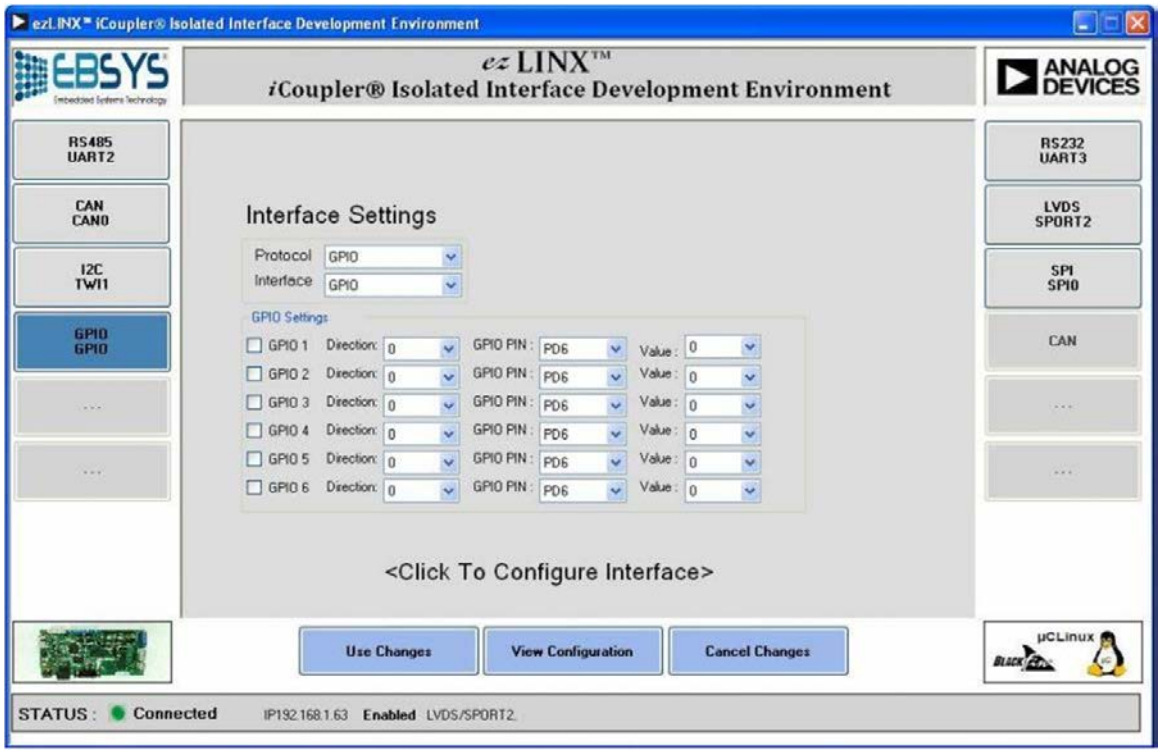

Figure 41. GPIO Configuration Window

UPDATING THE FIRMWARE

To update the embedded software version on the evaluation board,

1. Configure Windows Firewall to allow the use of **FTPServer.exe** on your computer.
   a. If using Windows XP or Windows Vista, click **Start** > **Control Panel** > **Windows Firewall** > **Exceptions** > **Add Program** and select **FTPServer.exe** from the list of programs and services (see Figure 42).
   b. If using Windows 7, click **Start** > **Control Panel (All Control Panel Items)** > **Windows Firewall** > **Allow a program or feature through Windows Firewall** > **Change settings**. A dialog box opens asking if you want to allow Windows Firewall to make changes to the computer. Click **Yes**, and then click **Allow another program** and select **FTPServer.exe** from the list of programs and services (see Figure 42).

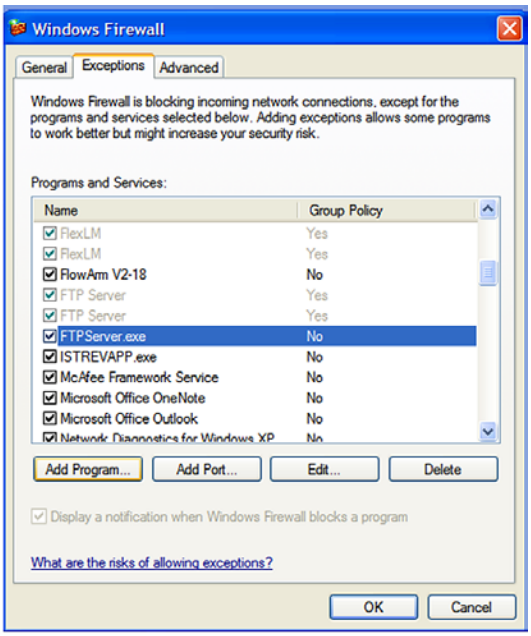

Figure 42. Allow FTPServer.exe Through Windows Firewall

2. Configure the application to connect to the correct IP address. From the **IP address** drop-down box in the **PASV Settings** section (see Figure 43), select the IP address of the adapter used to connect the board to the PC.

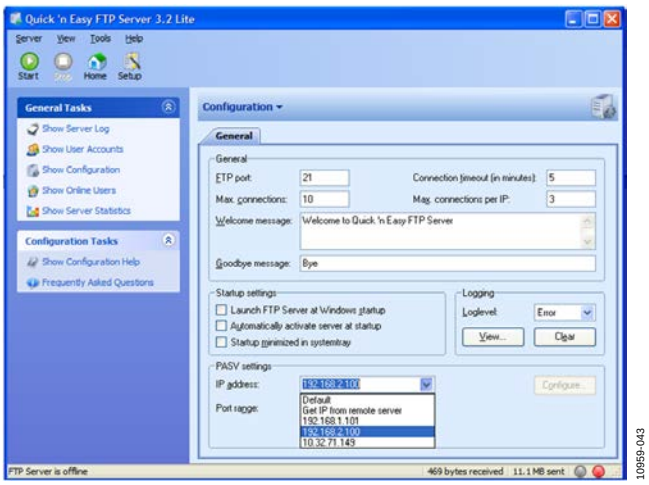

Figure 43. Update Firmware

3. Click **Show User Accounts** and change the path to the directory containing the uImage file to be downloaded to the *ez*LINX hardware platform.
4. Click **Start** near the top left of the application to begin running the FTP service.
5. In the **IP address** box of the **Quick 'n Easy FTP Server** window, enter the IP address of the server that contains the needed uImage, and then click **Configure**.
6. The software application then prompts you to restart the application (see Figure 44). Click **OK**.

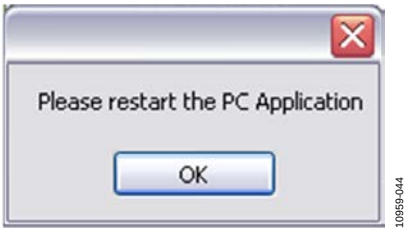

Figure 44. Restart Application to Update the Embedded Software Version

7. Close the application and wait approximately 2 minutes to 3 minutes for the application to erase the hardware platform and download and extract the new firmware version. (Warning: Do not reset the *ez*LINX hardware until the transfer is complete, which is indicated when the data sent counter near the bottom right of the **Quick 'n Easy FTP Server** application window equals the size of the update file.)
8. Reset the board and restart the PC application.
9. Confirm that the firmware update was downloaded correctly by opening the **Board Configuration** window and clicking **Check**, located next to the **Embedded Version** box (see Figure 3 and Figure 4). The new version should be displayed.

TRANSCEIVERS STATUS WINDOW

The **Transceivers Status** window (see Figure 45) allows monitoring the status of each interface as it transmits data. To access the **Transceivers Status** window, click the word **STATUS** at the bottom left of the application window. The enabled transceivers are indicated by the check boxes in the **Transceivers Enable** section.

The amount of data sent and received through each interface during the current session is also shown; this information is displayed in the **Transfer status** section of the window. Each **TX** box displays the amount of kilobytes of data that has been sent through the corresponding transceiver, and each **RX** box displays the amount of kilobytes of data that has been received. These values do not update in real time; therefore, to refresh the values, you must close and reopen the **Transceivers Status** window.

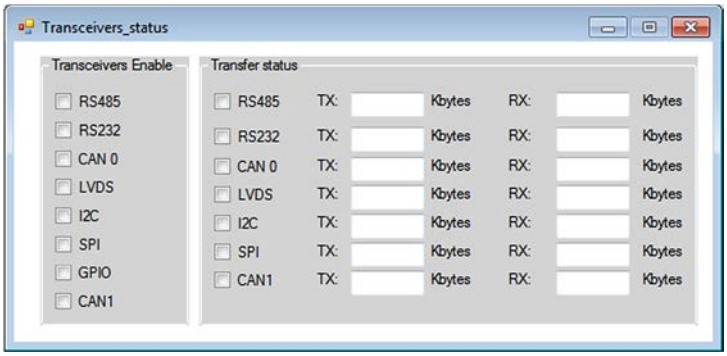

Figure 45. Transceiver Status Window

TRANSCEIVERS CONFIGURATION WINDOW

To access the **Transceivers Configuration** window (see Figure 48), click **View Configuration** near the bottom of any window in the application software. The **Transceivers Configuration** window allows viewing the global configuration of all transceivers and GPIOs on the *ez*LINX hardware platform. From this window, you can see which transceivers are enabled, what hardware routing is active, and the settings of each individual interface. The configuration cannot be modified from this window; however, the application supports loading and saving a configuration as an .xml file.

TRANSCEIVERS CONFIGURATION WINDOW BUTTONS AND OPTIONS

To save the current configuration, click **Save** and choose a name. To load a previously saved configuration, click **Load** and select the desired .xml configuration file.

The **Transceivers Configuration** window has three buttons (**Load**, **Save**, and **Close**) at the bottom left of the window that enable the functionalities described in this section.

Load Button

Click **Load** to load an existing configuration from an .xml file. The **LoadInterface** dialog box appears (see Figure 46).

In the **LoadInterface** box,

- Clicking **Ok** loads the configuration.
- Clicking **Cancel** cancels the load, and the **LoadInterface** window closes.

Note that before a configuration is loaded, you must exit the **Transceivers Configuration** window by clicking **Close** from the **File** menu. Exiting the window by clicking the **Close** button (represented by a red box with an X) in the upper right corner of the window does not allow a configuration to be loaded.

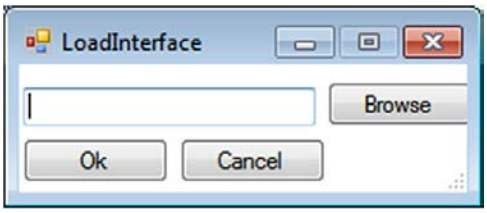

Figure 46. Loading an Existing Configuration to the Board

Save Button

Click **Save** to save the current configuration to a new .xml file.

Close Button

Click **Close** to close the **Transceivers Configuration** window. A confirmation message appears, asking whether you want to save the current configuration.

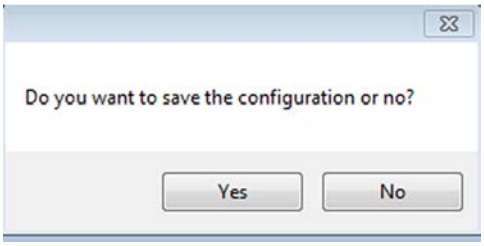

Figure 47. Asking Whether to Save the Current Configuration Before Closing the Transceivers Configuration Window

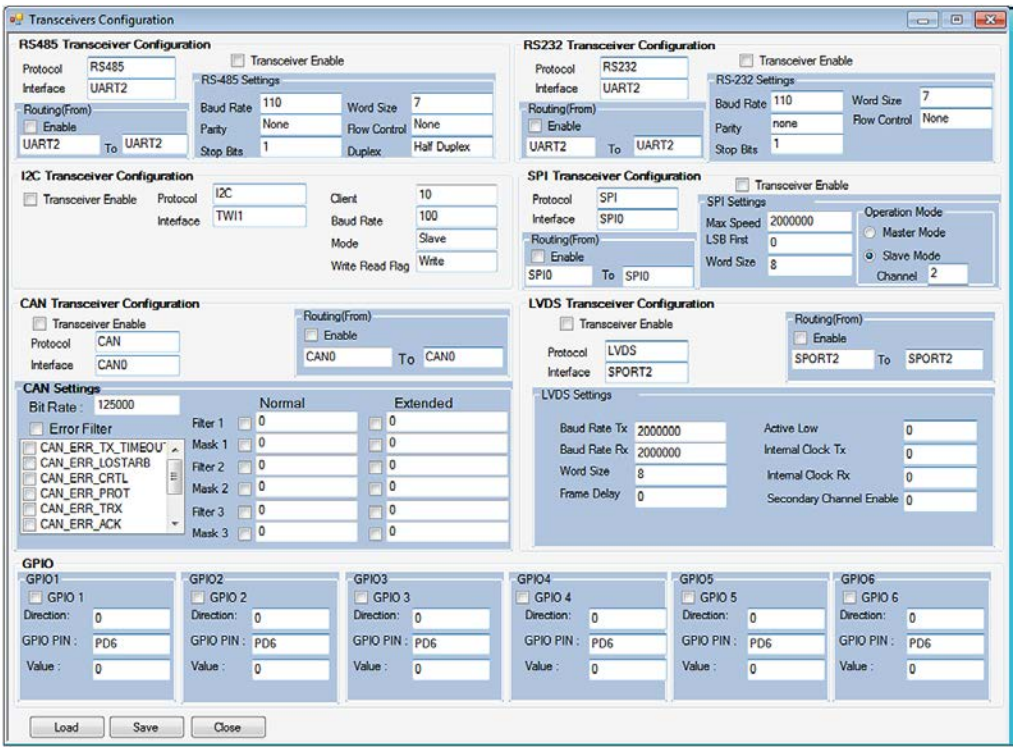

Figure 48. Transceivers Configuration Window

NOTES

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NOTES

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).