ezLINX iCoupler Isolated Interface Development Environment

FEATURES
Sample PC application
Open source software
Uses Microsoft .NET Framework, Version 4
Integrates with the ezLINX 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
ezLINX sample PC application install
ezLINX USB drivers

SOFTWARE REQUIREMENTS
Windows XP, Windows Vista, or Windows 7

GENERAL DESCRIPTION
The ezLINX™ hardware platform contains an Analog Devices, Inc., ADSP-BF548 processor running the uCLinux™ kernel and the ezLINX embedded software. A sample PC application is also provided, interfacing with the ezLINX 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 ezLINX 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 ezLINX hardware system for a given application. The source code and sample PC application can be downloaded from the ezLINX iCoupler Isolated Interface Development Environment wiki page.

Figure 1.
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# REVISION HISTORY

12/13—Revision 0: Initial Version
MAIN WINDOW

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

This window provides a complete overview of the ezLINX 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 ezLINX 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 ezLINX 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 ezLINX 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 ezLINX hardware platform that the PC application software connects to.
- Changing the IP configuration of the connected ezLINX hardware board.
- Applying updates to the embedded software of the ezLINX hardware board.

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**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 ezLINX 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 ezLINX hardware platform, the buttons appear as Connect, View Configuration, and Configure.

![Figure 3. Board Configuration Window Accessed by Clicking Configure](image-url)
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 ezLINX hardware platform.

The boxes in this section can be used as follows:

- **Connect To IP Address** box: Specify the IP address of the ezLINX 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 ezLINX hardware platform. You must select the Set New Address To box and connect an ezLINX 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 ezLINX hardware platform.
- **New IP Gateway** box: Specify a new IP gateway to configure the connected ezLINX 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).

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 ezLINX 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 ezLINX 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 ezLINX hardware platform. To enable or disable a transceiver, select or clear the box next to the appropriate interface name.

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 7. Enable/Disable Transceivers Box

Figure 8. Notification Message for Enabled Transceiver
**ISOLATED RS-232**

The isolated RS-232 interface on the ezLINX 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 ezLINX 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 ezLINX 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](image)

![Figure 10. RS-232 Configuration Window](image)
Configuring the RS-232 Settings

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

![Figure 11. RS-232 Settings Box](image)

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 ezLINX 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](image)

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 ezLINX 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 ezLINX Isolated RS-485/RS-422 Implementation wiki page.

RS-485/RS-422 CONFIGURATION WINDOW

In the ezLINX 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 ezLINX 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](image-url)

![Figure 15. RS-485 Configuration Window](image-url)
Selecting the RS-485 Settings

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

![RS-485 Settings Box](image)

**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 ezLINUX 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 ezLINUX 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.

![Routing(From) Box](image)

**Figure 17. Routing(From) Box**

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an ezLINUX 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 ASCII 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 ezLINX development platform is implemented using Analog Devices ADuM1250 and ADuM5000 isolators.

For more information about the I²C hardware implementation, see the ezLINX 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 ezLINX 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](image)

![Figure 20. I²C Configuration Window](image)
Selecting the I2C Settings

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

![I2C Settings Box](image)

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 ezLINX 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 ezLINX 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 ezLINX 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 ezLINX 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 ezLINX 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.
Selecting the SPI Settings

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

![Figure 25. SPI Settings Box](image)

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 ezLINX 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 ezLINX hardware platform and the Transceiver Enable check box is selected, the SPI Send/Receive window opens.

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](image)

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 ASCII 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 ezLINX development platform is implemented using an Analog Devices ADM3053 transceiver.

For more information about CAN hardware implementation, see the ezLINX 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 ezLINX 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](image)

![Figure 29. CAN Configuration Window](image)
Selecting the CAN Settings

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

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_BUSERERROR: 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.

Confirm your selection by clicking Use Changes near the bottom of the window. If you are connected to an ezLINX 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.

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](image-url)
ISOLATED LVDS

The isolated low voltage differential signaling (LVDS) interface on the ezLINX 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 ezLINX 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 ezLINX 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](image)

Figure 35. LVDS Configuration Window
Selecting the LVDS Settings

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

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 36. LVDS Settings Box](image)

![Figure 37. Routing(From) Box](image)

Confirm your selection by clicking **Use Changes** near the bottom of the window. If you are connected to an ezLINX 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 ASCII 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 ezLINX 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.

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

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.
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).

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.

3. Click Show User Accounts and change the path to the directory containing the uImage file to be downloaded to the ezLINX 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.

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 ezLINX 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 ezLINX 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.

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 48. Transceivers Configuration Window
NOTES

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

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