



EVB-LAN9252-HBI+ Quick Start Guide

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Chandler, Arizona, 85224-6199
USA

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA


Derek Carlson
VP Development Tools

12-Sep-14
Date

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXA”, where “XXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using and configuring the EVB-LAN9252-HBI+. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [The Microchip Web Site](#)
- [Development Systems Customer Change Notification Service](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to configure the EVB-LAN9252-HBI+, such as the DIGIO and SPI, as well as various setup options, scanning, and programming. The manual layout is as follows:

- **Chapter 1. “Overview”** – Shows a brief description of the EVB-LAN9252-HBI+ board quick setup.
- **Chapter 2. “EVB-LAN9252-HBI+”** – Provides instructions in configuring HBI and SPI.
- **Appendix A. “Setting Up Master in Windows®”** – This appendix shows how to set up Master in Windows.
- **Appendix B. “EEPROM Programming”** – This appendix shows how to program EEPROM.
- **Appendix C. “Scanning EtherCAT Slaves”** – This appendix shows how to scan EtherCAT Slaves.
- **Appendix D. “Generating SSC Files”** – This appendix shows how to generate SSC files.
- **Appendix E. “Compiling and Programming SoC Firmware”** – This appendix

shows how to compile and program SoC firmware.

- **Appendix F. “Programming PIC32 Firmware Using Pre-Built Binaries”** – This appendix shows how to program the PIC32 firmware using pre-built binaries.
- **Appendix G. “Troubleshooting”** - This appendix shows some basic troubleshooting tips for common problems.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB® IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	“Save project before build”
Underlined, italic text with right angle bracket	A menu path	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-Opa+, -Opa-
	Bit values	0, 1
	Constants	0xFF, 'A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }

THE MICROCHIP WEB SITE

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The Development Systems product group categories are:

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- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART Plus and PIC-kit 2 and 3.

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Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at:
<http://www.microchip.com/support>

DOCUMENT REVISION HISTORY

Revisions	Section/Figure/Entry	Correction
DS50002425C (06-22-16)	Entire Document	Updated to EVB_LAN9252-HBI+.
	Appendix G. "Troubleshooting"	Added new appendix.
	Chapter 1. "Overview"	Updated terms in abbreviations.
	Chapter 2. "EVB-LAN9252-HBI+"	Updated entire chapter.
	Section 2.3 "EVB-LAN9252-HBI+ Calculations"	Added new section to chapter with calculations.
	Appendix B. "EEPROM Programming"	Updated pictures in appendix.
	Appendix C. "Scanning Ethernet Slaves"	Updated entire appendix.
	Figure D-9	Updated figure.
DS50002425B (02-24-16)	Appendix F. "Programming PIC32 Firmware Using Pre-Built Binaries"	Added new appendix.
	Appendix E. "Compiling and Programming SoC Firmware"	Added new appendix.
	Appendix D. "Generating SSC Files"	Added new appendix.
	Appendix D. Changing Vendor ID and Object Configuration	Removed entire appendix.
	Appendix C. "Scanning Ethernet Slaves"	Updated entire appendix.
	Appendix B. "EEPROM Programming"	Updated entire appendix.
	Appendix A. "Setting Up Master in Windows®"	Updated entire appendix.
	Chapter 2. "EVB-LAN9252-HBI+"	Moved from Chapter 3. LAN9252-HBI
	Chapter 2. DIGIO Configuration	Removed entire chapter.
	Section 1.1 "Introduction"	Updated first paragraph. Added note.
	Trademarks (Page 2)	Updated trademarks page.
DS50002425A (10-20-15)	Initial release of document	

Chapter 1. Overview

1.1 INTRODUCTION

This document describes how to use the EVB-LAN9252-HBI+ Software Development Kit (SDK) as a development tool for the Microchip EVB-LAN9252 EtherCAT[®] Slave Controller.

Note: All the figures in the document are captured from TwinCAT 3.1.

1.1.1 Abbreviations

ADC - Analog to Digital Converter

DAC - Digital to Analog Converter

ESC - EtherCAT Slave Controller

EVB - Evaluation Board

GPIO - General Purpose Input/Output

HAL - Hardware Abstraction Layer

HBI - Host Bus Interface

IDE - Integrated Development Environment

SPI - Serial Protocol Interface

SSC - Slave Stack Code

SoC - System on a Chip

UART - Universal Asynchronous Receiver/Transmitter

Chapter 2. EVB-LAN9252-HBI+

2.1 EVB-LAN9252-HBI+ IN HBI MODE

2.1.1 EtherCAT Master and Slave Configuration

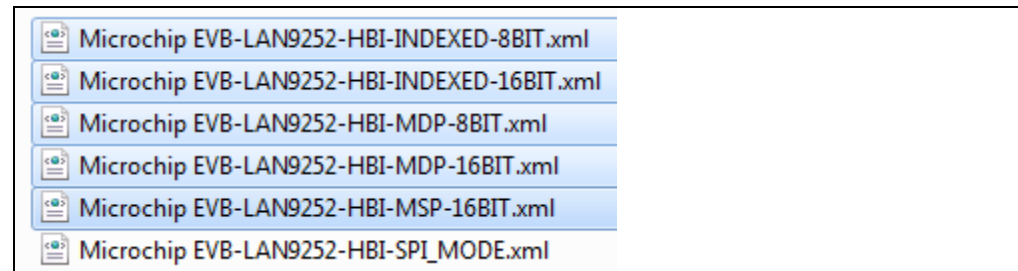
The following steps describe how to configure the LAN9252-HBI:

1. Configure the Master with the TwinCAT driver.
Refer to **Appendix A. “Setting Up Master in Windows®”** to configure the TwinCAT in Windows.
2. Download and extract EVB-LAN9252-HBI_SPI_PIC32_SDK_Vx.x.zip from the Microchip website (<http://www.microchip.com/LAN9252-041715a>).

Note: Vx.x denotes the version number of the SDK.

3. In the SDK, the \ESI Files directory contains the ESI files which can be loaded to EVB-LAN9252-HBI+ EEPROM using TwinCAT, as displayed in [Figure 2-1](#).

FIGURE 2-1: ESI FILES DIRECTORY



HBI ESI files:

ESI File name	Description
Microchip EVB-LAN9252-HBI-INDEXED-8BIT.xml	Configures LAN9252 in HBI - Indexed 8-bit mode.
Microchip EVB-LAN9252-HBI-INDEXED-16BIT.xml	Configures LAN9252 in HBI - Indexed 16-bit mode.
Microchip EVB-LAN9252-HBI-MDP-8BIT.xml	Configures LAN9252 in HBI - Multiplexed dual phase 8-bit mode.
Microchip EVB-LAN9252-HBI-MDP-16BIT.xml	Configures LAN9252 in HBI - Multiplexed dual phase 16-bit mode
Microchip EVB-LAN9252-HBI-MSP-16BIT.xml	Configures LAN9252 in HBI - Multiplexed single phase 16-bit mode.

Note: Refer to **Appendix D. “Generating SSC Files”** to change the Vendor ID and slave information in the ESI files.

4. Copy Microchip EVB-LAN9252-HBI-MSP-16BIT.xml for this example to the directory path C:\TwinCAT\3.1\Config\Io\EtherCAT for TwinCAT 3.1.

Note: There can only be one microchip .xml file present in the directory path at a time. Please remove any .xml not being used.

5. Configure the evaluation board in HBI mode and change the switches to 16-bit Multiplexed single-phase mode, as mentioned in “Section 2.4 Configuration” of *EVB-LAN9252-HBI-SPI-SQI-GPIO EtherCAT User’s Guide*, which can be downloaded from the Microchip website (<http://www.microchip.com/Development-Tools/ProductDetails.aspx?PartNO=evb-lan9252-hbi>).
6. By default, the corresponding ESI file of PIC32 firmware is flashed to the delivered EVB-LAN9252-HBI+. Refer to **Appendix F. “Programming PIC32 Firmware Using Pre-Built Binaries”**

To change the firmware in the PIC32 SoC, refer to **Appendix D. “Generating SSC Files”** and **Appendix E. “Compiling and Programming SoC Firmware”**.

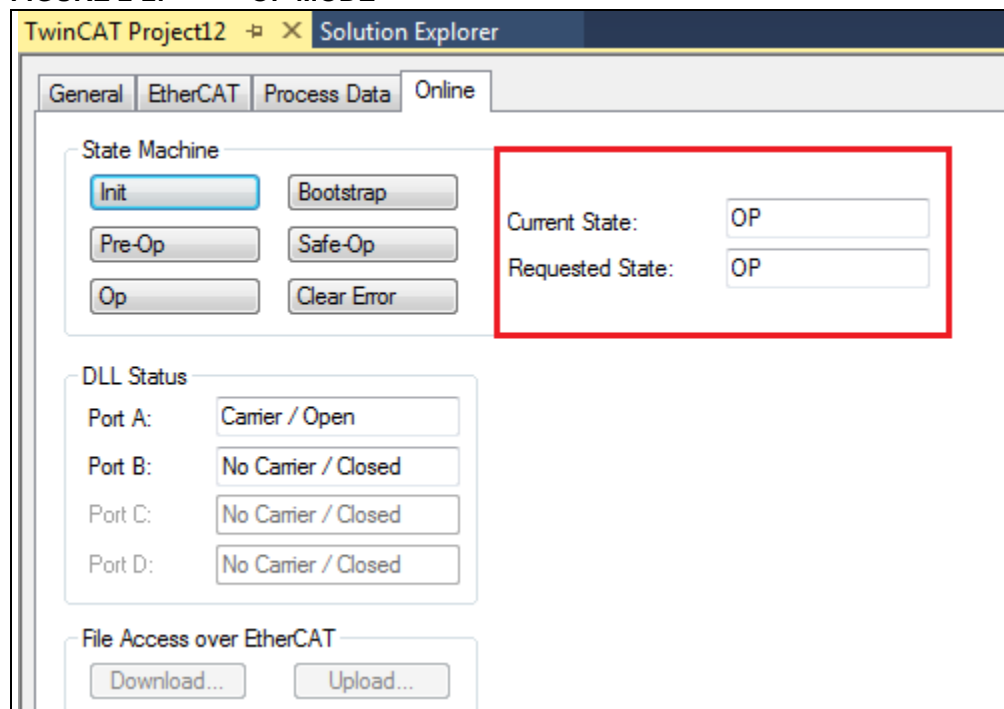
Note: The pre-built binaries are available from the Binaries directory found in the SDK.

7. Launch TwinCAT and scan EtherCAT slaves from TwinCAT.
Refer to **Appendix C. “Scanning EtherCAT Slaves”** for steps on scanning EtherCAT slaves.

Note: Please reset the board using SW2 or go to TWINCAT -> EtherCAT Devices -> Reload Device Descriptions

8. Program EEPROM using Microchip EVB-LAN9252-HBI-MSP-16BIT.xml.
Refer to **Appendix B. “EEPROM Programming”** for steps on EEPROM programming.
Once the EEPROM has been programmed, power cycle the board without closing the TwinCAT project.
If the EEPROM programming is successful, the state will change to ‘OP’ mode as displayed in [Figure 2-2](#).

FIGURE 2-2: OP MODE



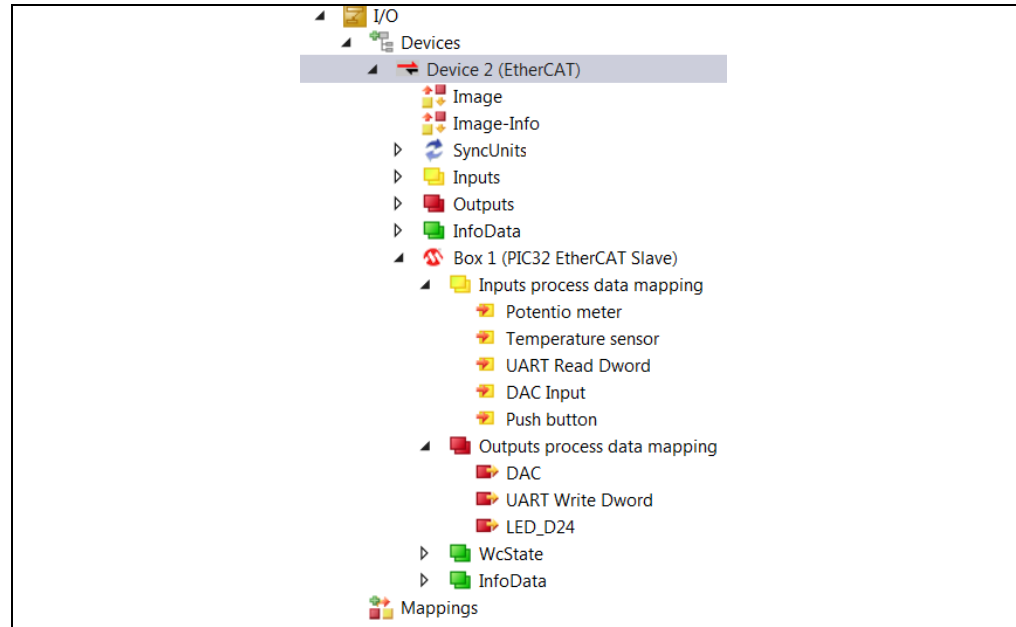
Note: If it changes to OP mode as highlighted above, then the device is in operational state. Otherwise there is an issue with the setup.

2.1.2 HBI Demo

The following describes a demo of EVB-LAN9252-HBI+ in HBI mode:

1. Follow the steps as provided in **Section 2.1.1 “EtherCAT Master and Slave Configuration”**. Eight demo objects exist, 3 Outputs and 5 inputs, that can be seen on the Solution Explorer of the TwinCAT tool, as displayed in [Figure 2-3](#).

FIGURE 2-3: HBI DEMO



As part of this demo, eight object variables are mapped to PIC32 pins as detailed in [Table 2-1](#).

TABLE 2-1: OBJECT VARIABLE MAPPING

Variable	PIC32 GPIO
Potentiometer (Input)	PIC32 RB1
Temperature Sensor (Input)	PIC32 RB0
UART Read Dword (Input)	PIC32 RF2
DAC Input (Input)	PIC32 AETXEN and PIC32 AETXCLK
Push Button (Input)	PIC32 RD3
DAC (Output)	PIC32 RB2
UART Write Dword (Output)	PIC32 RF8
LED_D24 (Output)	PIC32 RD2

- To change GPIO inputs, click the Inputs process data mapping option under Box 1 in the Solution Explorer, as displayed in [Figure 2-3](#).

The TwinCAT project window displays.

- There are 5 different inputs that can be observed in [Figure 2-4](#):
 - Potentiometer can be adjusted on the board (ADC Pot1: See [Figure 2-7](#)).
 - Temperature Senor output can be used to calculate ambient temperature. Refer to **Section 2.3.1 “Calculating Temperature”** for more information.
 - UART Read Dword will display the information seen on RX from J24 RS232 connector. It will be a decimal number reflecting 4 characters. Refer to **Section 2.3.2 “UART Decimal to ASCII Conversion”** for information on converting this decimal number into hex and eventually ASCII.
 - DAC Input will display the input data going into the PIC. Refer to **Section 2.3.3 “DAC Calculations”** for how this number is obtained.
 - Push Button (SW50: See [Figure 2-7](#)) will be 1 when not pressed and 0 when pressed.

FIGURE 2-4: INPUT VALUES

Name	Online	Type	Size	>Ad...	In/O...	User...	Linked to
▶ Potentiometer	511	UDINT	4.0	39.0	Input	0	
▶ Temperature...	236	UDINT	4.0	43.0	Input	0	
▶ UART Read ...	1482185281	UDINT	4.0	47.0	Input	0	
▶ DAC Input	251	UDINT	4.0	51.0	Input	0	
▶ Push button	1	BIT	0.1	55.0	Input	0	

4. To view GPIO outputs, click Outputs process data mapping under Box 1 in the Solution Explorer, as displayed in [Figure 2-3](#).
5. There are 3 different outputs that can be observed in [Figure 2-5](#):
 - DAC is a value that can be set and will adjust the DAC output voltage as well as the ADC output. Refer to **Section 2.3.3 “DAC Calculations”** for more information.
 - UART Write Dword will output the value entered through TX on J24 RS232 connector in a repeated fashion.
 - LED_D24 can be set as high or low as can be seen in [Figure 2-6](#) and on the board in [Figure 2-7](#).

FIGURE 2-5: OUTPUT VALUES

Name	Online	Type	Size	>Ad...	In/O...	User...	Linked to
▶ DAC	1004	UDINT	4.0	39.0	Out...	0	
▶ UART Write ...	0	UDINT	4.0	43.0	Out...	0	
▶ LED_D24	1	BIT	0.1	47.0	Out...	0	

FIGURE 2-6: GPIO_INPUTS VARIABLE

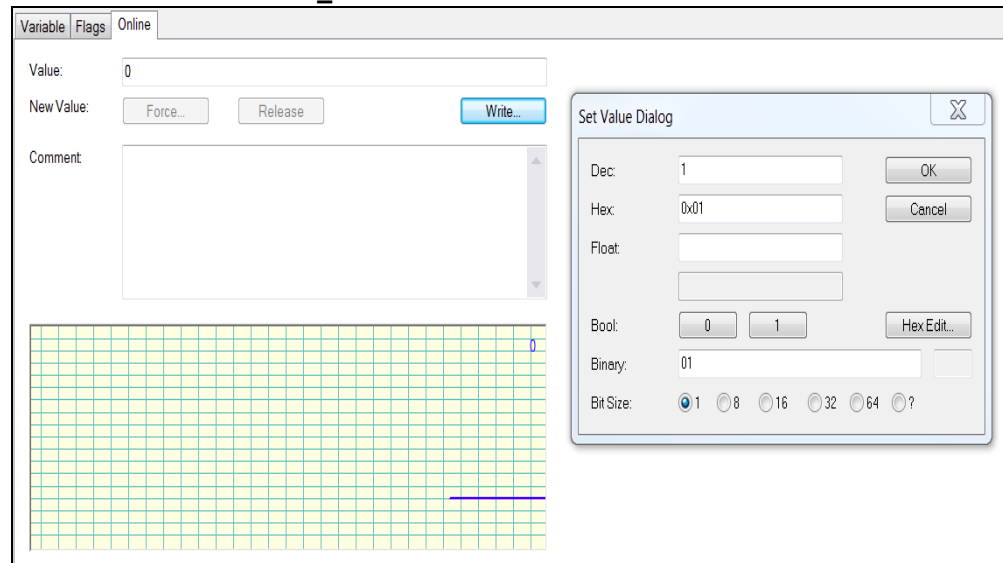
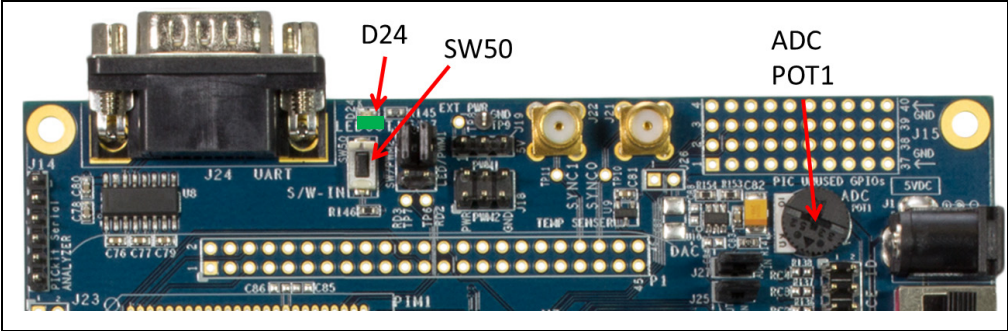


FIGURE 2-7: FEATURES ON HBI+ BOARD



2.2 EVB-LAN9252-HBI+ IN SPI MODE

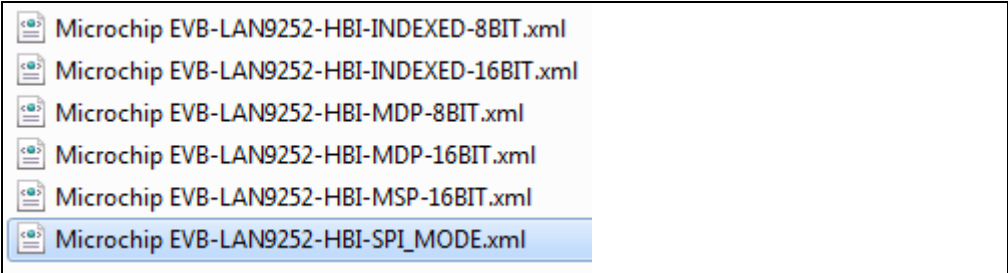
2.2.1 EtherCAT Master and Slave Configuration

- 1. Configure the Master with the TwinCAT driver.
Refer to **Appendix A. “Setting Up Master in Windows®”** to configure the TwinCAT in Windows.
- 2. Download and extract EVB-LAN9252-HBI_PIC32_SDK_Vx.x.zip from the Microchip website (<http://www.microchip.com/LAN9252-041715a>).

Note: Vx.x denotes the version number of the SDK.

- 3. In SDK, the \ESI Files directory contains the ESI files which can be loaded to EVB-LAN9252-HBI+ EEPROM using TwinCAT, as displayed in [Figure 2-8](#).

FIGURE 2-8: ESI FILES DIRECTORY



SPI ESI files:

ESI File name	Description
Microchip EVB-LAN9252-HBI-SPI_MODE.xml	Configures LAN9252 in SPI with GPIO - 2-port mode.

Note: Refer to **Appendix D. “Generating SSC Files”** to change the Vendor ID and slave information in the ESI files.

- 4. Copy Microchip EVB-LAN9252-HBI-SPI_MODE.xml to the directory path C:\TwinCAT\3.1\Config\Io\EtherCAT for TwinCAT 3.1.

Note: There can only be one microchip .xml file present in the directory path at a time. Please remove any .xml not being used.

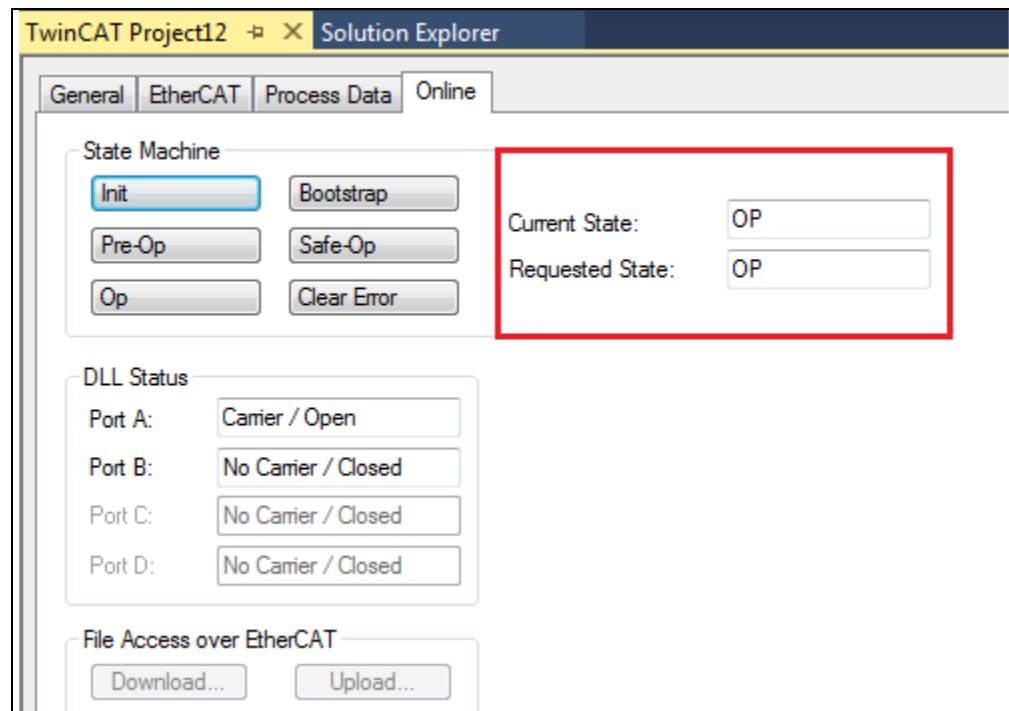
5. Configure the evaluation board in SPI mode as mentioned in “Section 2.4 Configuration” of *EVB-LAN9252-HBI-SPI-SQI-GPIO EtherCAT User's Guide*, which can be downloaded from the Microchip website (<http://www.microchip.com/DevelopmentTools/ProductDetails.aspx?PartNO=evb-lan9252-hbi>).
6. By default, the corresponding ESI file of PIC32 firmware is flashed to the delivered EVB-LAN9252-HBI+. Refer to **Appendix F. “Programming PIC32 Firmware Using Pre-Built Binaries”**

To change the firmware in PIC32 SoC, refer to **Appendix D. “Generating SSC Files”** and **Appendix E. “Compiling and Programming SoC Firmware”**..

Note: The pre-built binaries are available from the `Binaries` directory. This step can be skipped if pre-built binary is used for programming.

7. Launch TwinCAT and scan EtherCAT slaves from TwinCAT.
Refer to **Appendix C. “Scanning EtherCAT Slaves”** for steps on scanning EtherCAT slaves.
8. Program Microchip `EVB-LAN9252-HBI-SPI_MODE.xml` ESI file to EEPROM using TwinCAT.
Once the EEPROM has been programmed, power cycle the board without closing the TwinCAT project.
If the EEPROM programming is successful, state will change to ‘OP’ mode as displayed in [Figure 2-9](#).

FIGURE 2-9: OP MODE



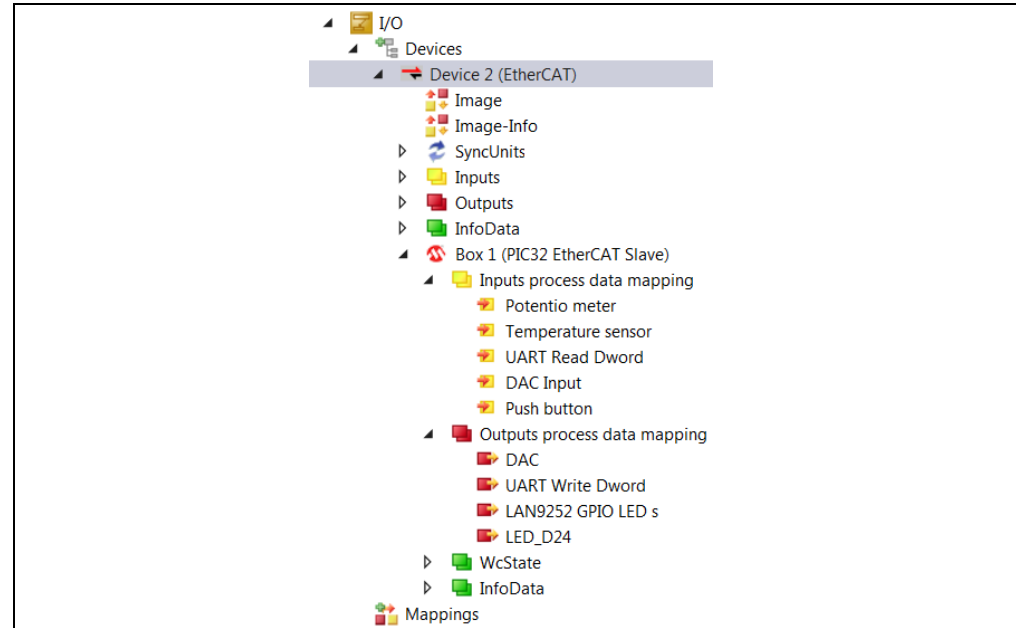
Note: If it changes to OP mode as highlighted above, then the device is in operational state. Otherwise there is an issue with the setup.

2.2.2 SPI Demo

The following describes a demo of EVB-LAN9252-HBI+ in SPI mode:

1. Follow the steps as provided in **Section 2.2.1 “EtherCAT Master and Slave Configuration”**. Nine demo objects, 4 outputs and 5 inputs, can be seen on the Solution Explorer of the TwinCAT tool, as displayed in [Figure 2-10](#).

FIGURE 2-10: SPI DEMO



2. As part of this demo, nine object variables are mapped to LAN9252 GPIOs as in [Table 2-2](#).

TABLE 2-2: OBJECT VARIABLE MAPPING

Variable	LAN/PIC32 GPIOs
Potentiometer (Input)	PIC32 RB1
Temperature Sensor (Input)	PIC32 RB0
UART Read Dword (Input)	PIC32 RF2
DAC Input (Input)	PIC32 AETXEN and PIC32 AETXCLK
Push Button (Input)	PIC32 RD3
DAC (Output)	PIC32 RB2
UART Write Dword (Output)	PIC32 RF8
LAN9252 GPIO LEDs (Output)	LAN9252 GPO0-15
LED_D24 (Output)	PIC32 RD2

3. To change GPIO inputs, click the Inputs process data mapping option under Box 1 in the Solution Explorer, as displayed in [Figure 2-10](#).

The TwinCAT project window displays.

4. There are 5 different inputs that can be observed in [Figure 2-11](#):
 - Potentiometer can be adjusted on the board (ADC Pot1: See [Figure 2-7](#)).
 - Temperature Sensor output can be used to calculate ambient temperature. Refer to **Section 2.3.1 “Calculating Temperature”** for more information.
 - UART Read Dword will display information seen on RX from J24 RS232 connector. It will be a decimal number reflecting 4 characters. Refer to **Section 2.3.2 “UART Decimal to ASCII Conversion”** for information on

converting this decimal number into hex and eventually ASCII.

- DAC Input will display the input data going into the PIC. Refer to **Section 2.3.3 “DAC Calculations”** for how this number is obtained.
- Push Button (SW50: See [Figure 2-7](#)) will be 1 when not pressed and 0 when pressed.

FIGURE 2-11: INPUTS IN SPI MODE

Name	Online	Type	Size	>Ad...	In/O...	User...	Linked to
Potentiometer	511	UDINT	4.0	39.0	Input	0	
Temperature...	236	UDINT	4.0	43.0	Input	0	
UART Read ...	1482185281	UDINT	4.0	47.0	Input	0	
DAC Input	251	UDINT	4.0	51.0	Input	0	
Push button	1	BIT	0.1	55.0	Input	0	

- To view GPIO outputs, click Outputs process data mapping under Box 1 in the Solution Explorer, as displayed in [Figure 2-10](#).
- There are 4 different outputs that can be observed in [Figure 2-12](#):
 - DAC is a value that can be set and will adjust the DAC output voltage as well as the ADC output. Refer to **Section 2.3.2 “UART Decimal to ASCII Conversion”** for information on how to calculate this.
 - UART Write Dword will output the value entered through TX on J24 RS232 connector in a repeated fashion.
 - LAN9252 GPIO LEDs can be turned on and off by clicking on LAN9252 GPIO LEDs under the Outputs process data mapping. An example on how to do this and what it looks like on the board can be seen in [Figure 2-13](#) and [Figure 2-14](#) respectively.
 - LED_D24 (See [Figure 2-7](#)) can be set as high or low for on or off respectively.

FIGURE 2-12: OUTPUTS IN SPI MODE

Name	Online	Type	Size	>Ad...	In/O...	User...	Linked to
DAC	0	UDINT	4.0	39.0	Out...	0	
UART Write ...	0	UDINT	4.0	43.0	Out...	0	
LAN9252 GPI...	33825	UDINT	4.0	47.0	Out...	0	
LED_D24	0	BIT	0.1	51.0	Out...	0	

FIGURE 2-13: SETTING LAN9252 GPIO OUTPUTS

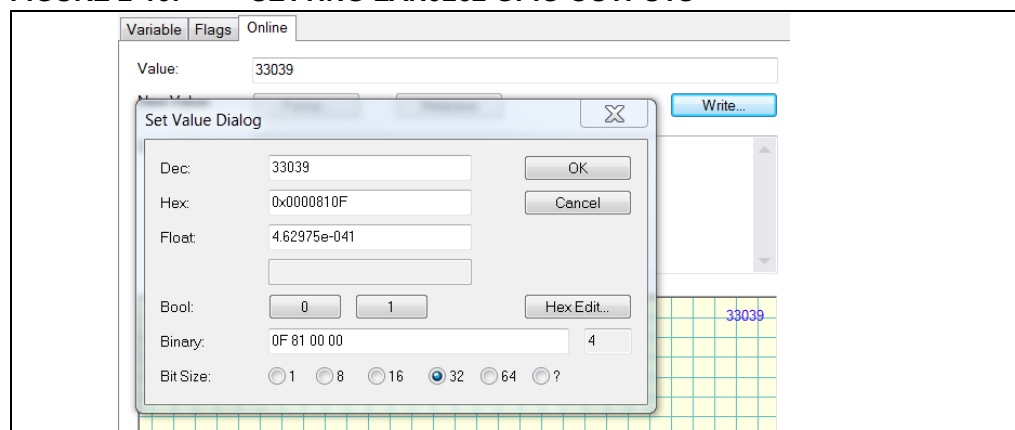
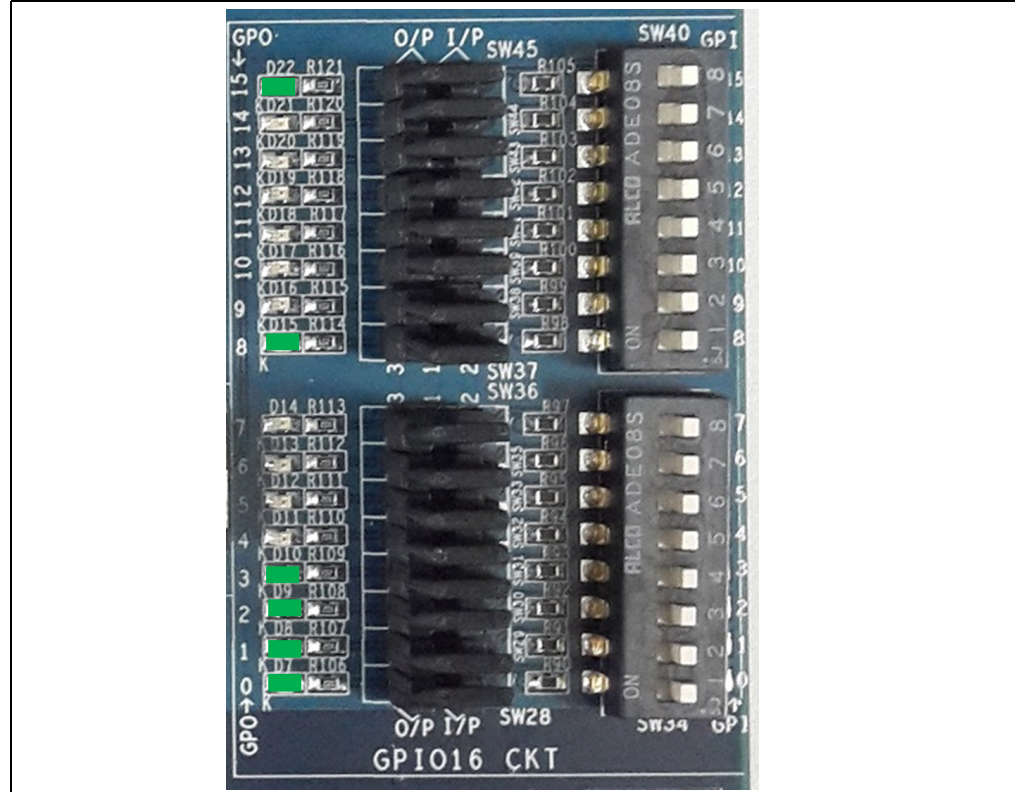


FIGURE 2-14: MODIFIED GPIOs ON THE BOARD



2.3 EVB-LAN9252-HBI+ CALCULATIONS

2.3.1 Calculating Temperature

The Vout of the temperature sensor is connected to the ADC. The output of the ADC (ADCout) will be the value displayed in the EtherCAT application and be named Temperature Sensor. To get the output voltage (Vout) see [Equation 2-1](#)

EQUATION 2-1: TEMP SENSOR VOUT

$$V_{out} = \left(\frac{ADC_{out} \times 3300mV}{1023mV} \right)$$

Now use Vout and calculate the temperature in degrees Celsius ([Equation 2-2](#)):

EQUATION 2-2: TEMPERATURE

$$Temp(^{\circ}C) = \left(\frac{V_{out} - 500mV}{10 \frac{mV}{^{\circ}C}} \right)$$

EXAMPLE 2-1: ETHERCAT APPLICATION OUTPUTS 235 (ADCOUT=235).

$$V_{out} = \frac{(235 \times 3300mV)}{1023mV} = 758.06mV$$

$$Temp(^{\circ}C) = \frac{(758.06mV - 500mV)}{10 \frac{mV}{^{\circ}C}} = 25.8^{\circ}C$$

2.3.2 UART Decimal to ASCII Conversion

The EtherCAT application will display the UART input as decimal. This decimal number represents 4 different characters. [Example 2-2](#) details how to convert from a decimal number to hex and then ASCII. The characters entered in order were a, A, 1, !.

EXAMPLE 2-2: DECIMAL TO HEX TO ASCII

Decimal = 556876129
Hex = 0x21314161
ASCII = 21 = !
ASCII = 31 = 1
ASCII = 41 = A
ASCII = 61 = a

2.3.3 DAC Calculations

Depending on the value entered into the DAC Output, a calculated voltage will be present on the DAC output. This voltage is then sent to the ADC on the PIC and this number is displayed on the DAC input. An example can be found in [Example 2-3](#) below. The first equation needed is the calculation of the output voltage of the DAC ([Equation 2-3](#)).

EQUATION 2-3: DAC OUT

$$\text{DACout} = \frac{(3300\text{mV} \times \text{DAC})}{\# \text{ of Resistors in Ladder}}$$

of Resistors in Ladder will always be 4096 for this board

After calculating the DAC output voltage, it is possible to determine the value produced from the ADC ([Equation 2-4](#)).

EQUATION 2-4: ADC OUT

$$\text{ADCout} = \frac{(\text{DACout} \times 1023)}{3300}$$

1023 is the MAX ADC according to the ADC Transfer Function

EXAMPLE 2-3: A VALUE OF 1250 IS ENTERED INTO THE DAC OUTPUT.

$$\begin{aligned}\text{DACout} &= \frac{(3300\text{mV} \times 1250\text{mV})}{4096} = 1007\text{mV} \\ \text{ADCout} &= \frac{(1007\text{mV} \times 1023)}{3300\text{mV}} = 312\end{aligned}$$

Appendix A. Setting Up Master in Windows[®]

A.1 INTRODUCTION

This appendix details how to setup a Master in Windows[®].

Download and install TwinCAT on Windows from <http://beckhoff.com>.

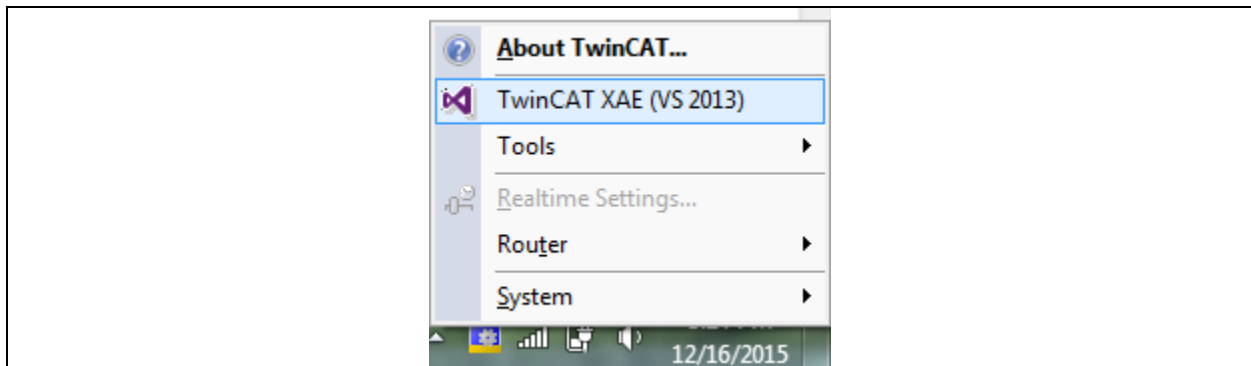
A.1.1 TwinCAT Ethernet Driver - Installation

To install the TwinCAT Ethernet Driver:

1. If TwinCAT installed successfully, a TwinCAT icon will display in the bottom-right corner of the desktop. Click the TwinCAT icon.
A pop-up menu displays.
2. Select TwinCAT XAE (VS XXXX), as displayed in [Figure A-1](#).

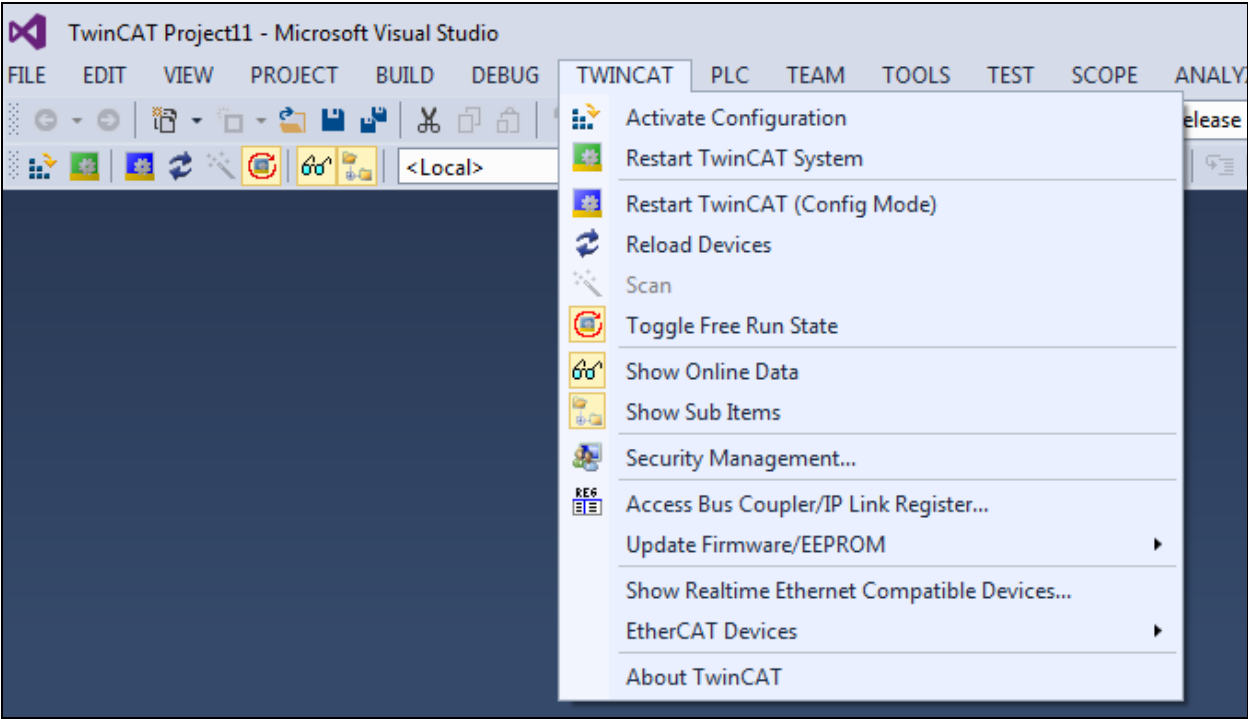
Note: VS XXXX refers to the version of Visual Studio installed on the computer.

FIGURE A-1: SYSTEM MANAGER



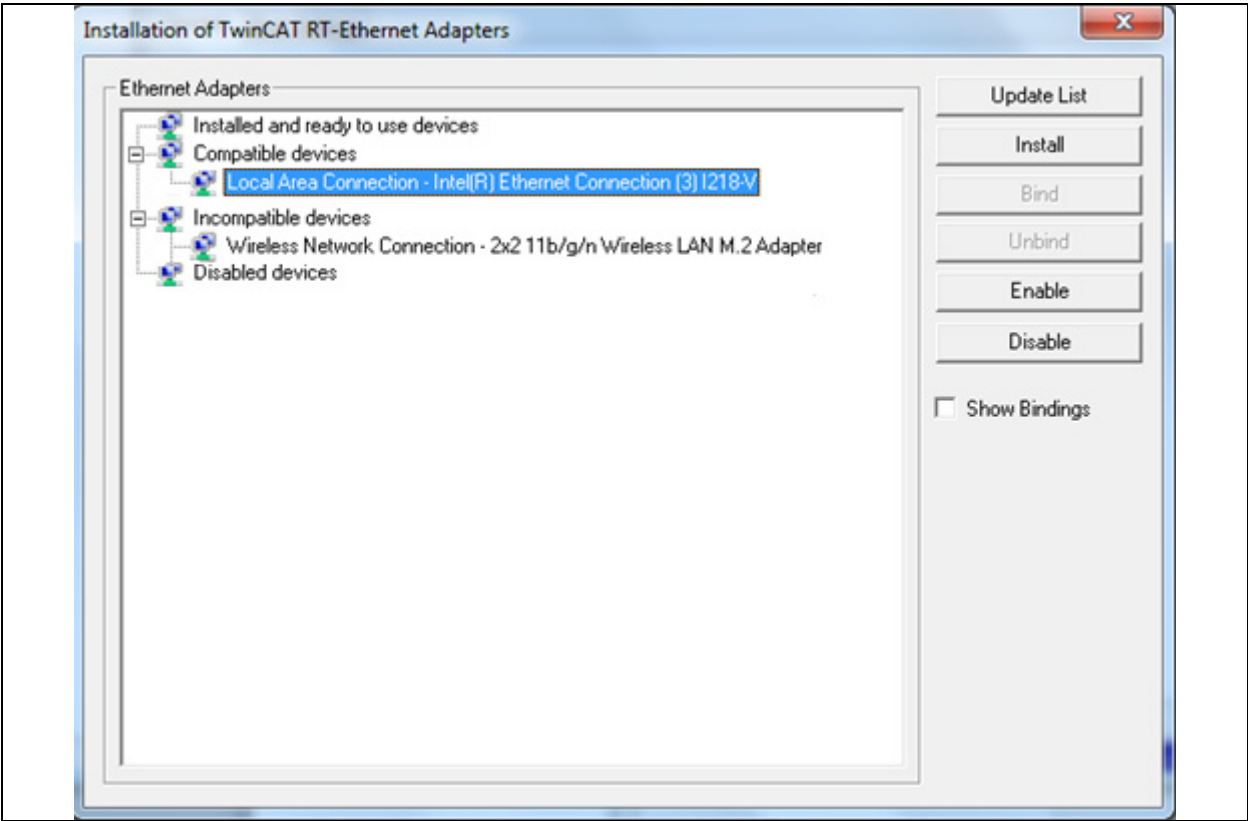
3. Go to *TWINCAT>Show Real Time Ethernet Compatible Devices...* as in [Figure A-2](#).

FIGURE A-2: SHOW REAL TIME ETHERNET COMPATIBLE DEVICES



4. Select the network adapter and install the TwinCAT driver as in [Figure A-3](#).

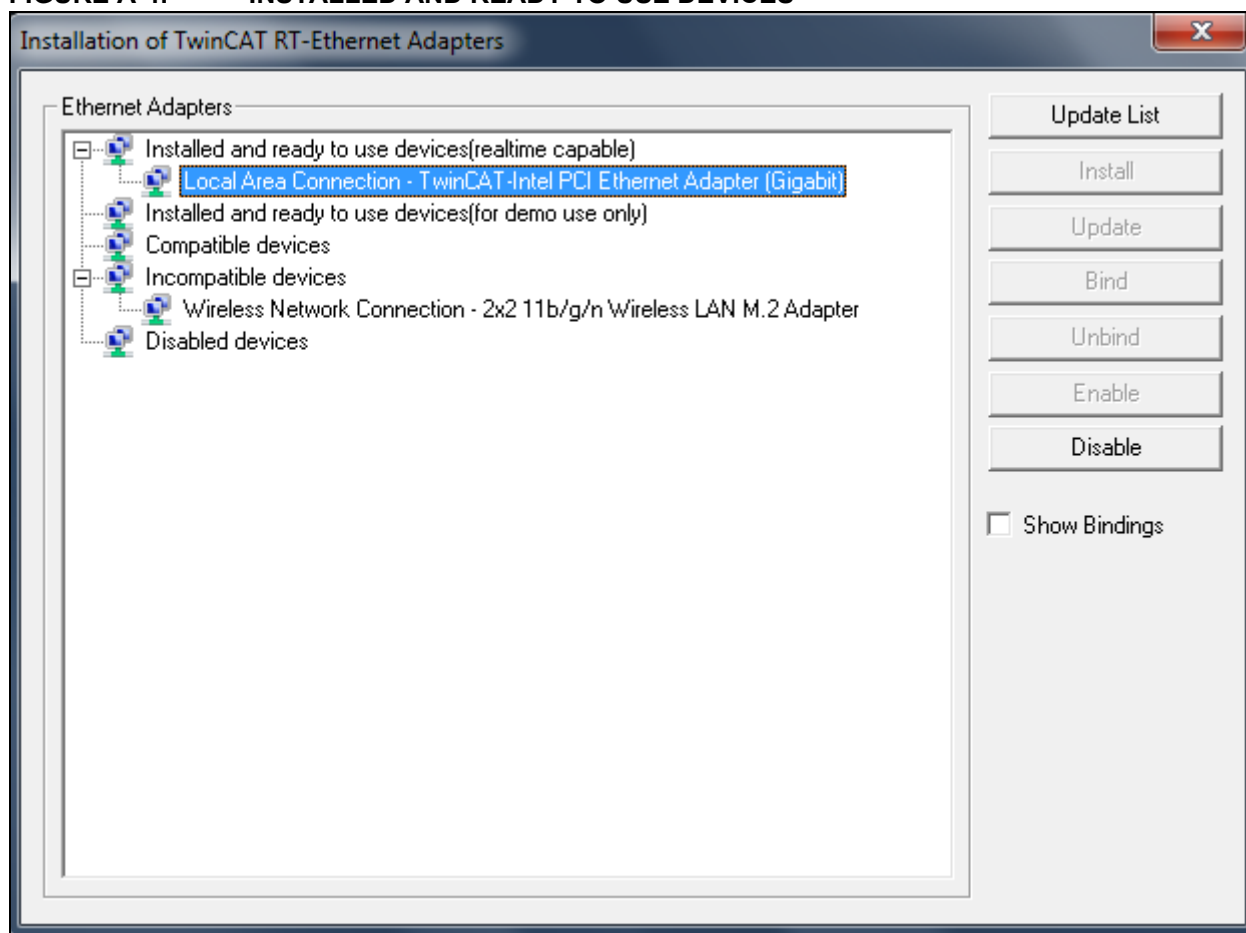
FIGURE A-3: ETHERNET ADAPTERS DIALOG



Setting Up Master in Windows

Once the TwinCAT driver is installed successfully, the driver is compatible with the TwinCAT master. The network adapter will then be moved to “Installed and ready to use devices” as displayed in [Figure A-4](#).

FIGURE A-4: INSTALLED AND READY TO USE DEVICES



5. Go to the corresponding network adapter properties and then select TwinCAT drivers as displayed in [Figure A-5](#) and [Figure A-6](#). To access network adapter properties as seen in the figures below go to Control Panel\Network and Internet\Network Connections.

FIGURE A-5: NETWORK ADAPTER PROPERTIES MENU

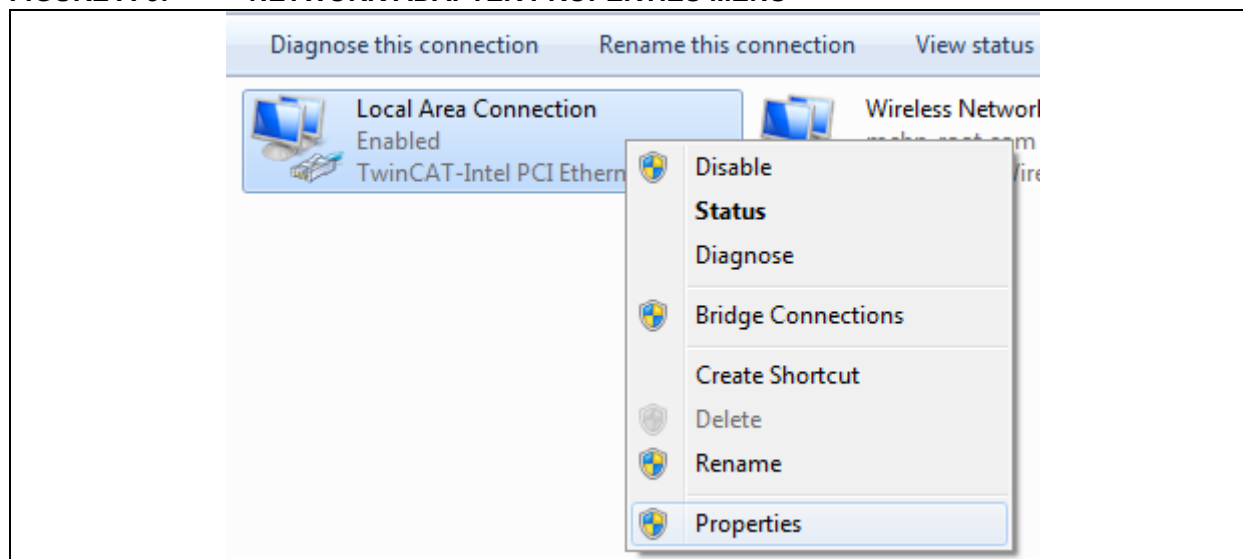
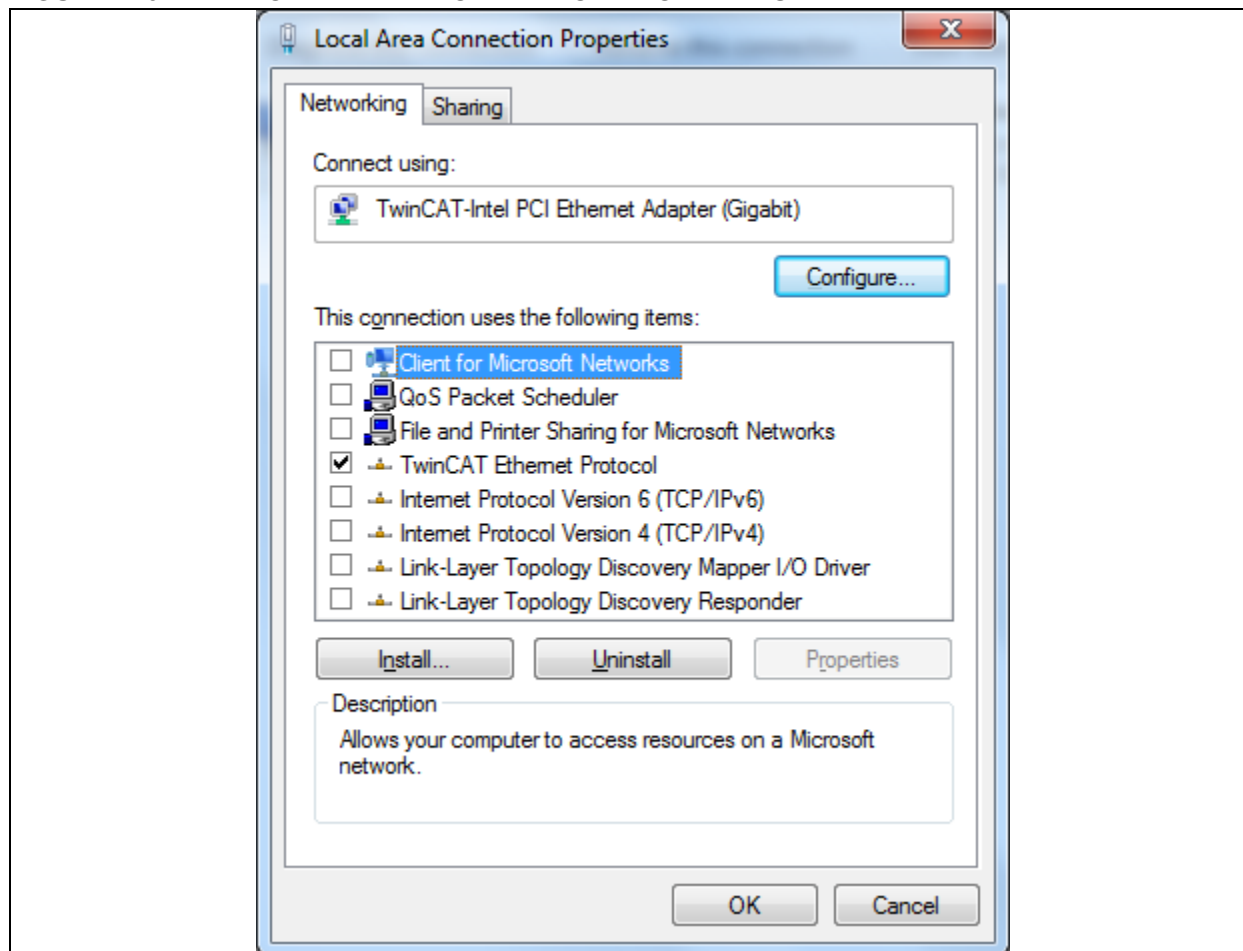


FIGURE A-6: LOCAL AREA CONNECTION PROPERTIES



Note 1: Only select TwinCAT drivers.

2: If TwinCAT cannot find the EtherCAT slaves after following the steps in **Appendix C. "Scanning EtherCAT Slaves"**, restart the computer and attempt to scan again.

Appendix B. EEPROM Programming

B.1 INTRODUCTION

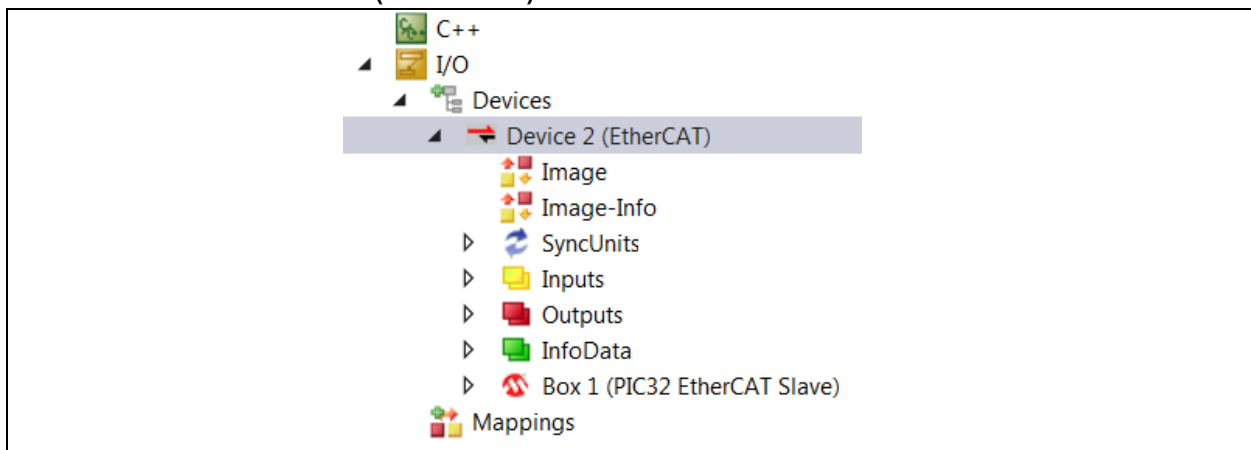
This appendix shows how to program EEPROM.

B.1.1 EEPROM Programming

To program EEPROM:

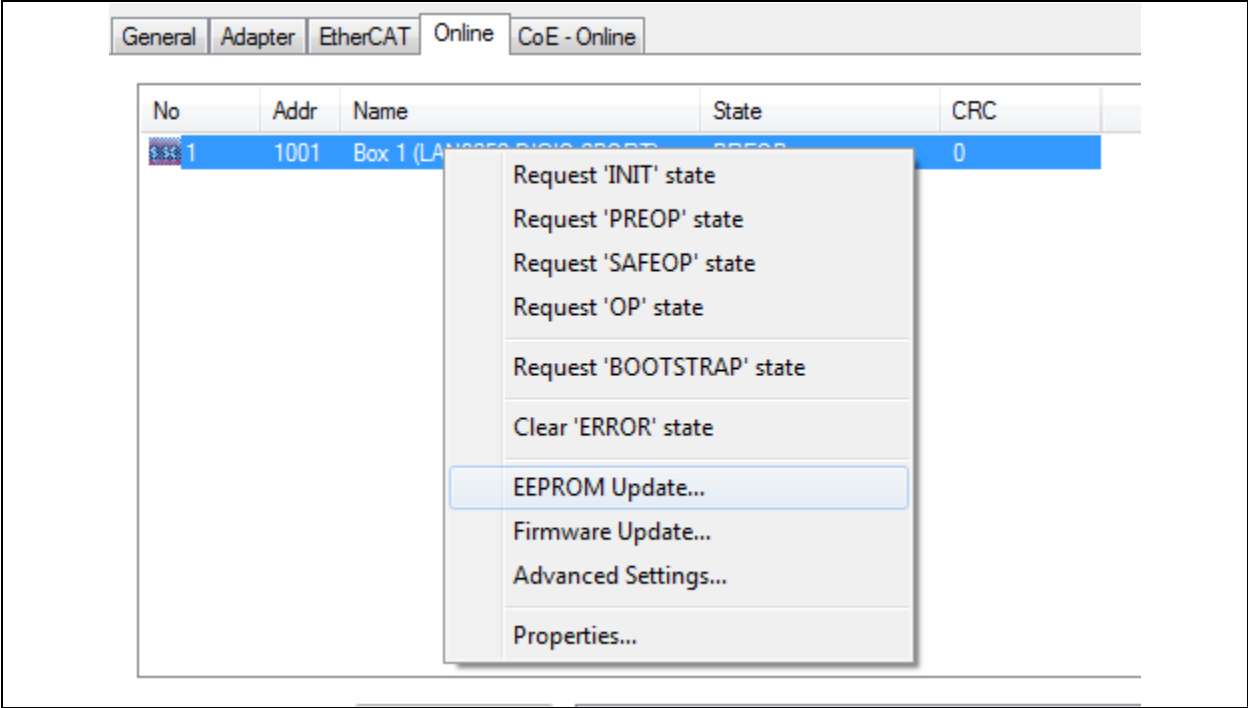
1. After a successful scan, click the arrow next to “Device 2 (EtherCAT)” on the Solution Explorer in the TwinCAT tool, as displayed in [Figure B-1](#).

FIGURE B-1: DEVICE 2 (ETHERCAT)



2. Click the **Online** tab in the TwinCAT project window.
3. Right-click the LAN9252 listing and select EEPROM Update from the contextual menu, as displayed in [Figure B-2](#).

FIGURE B-2: EEPROM UPDATE



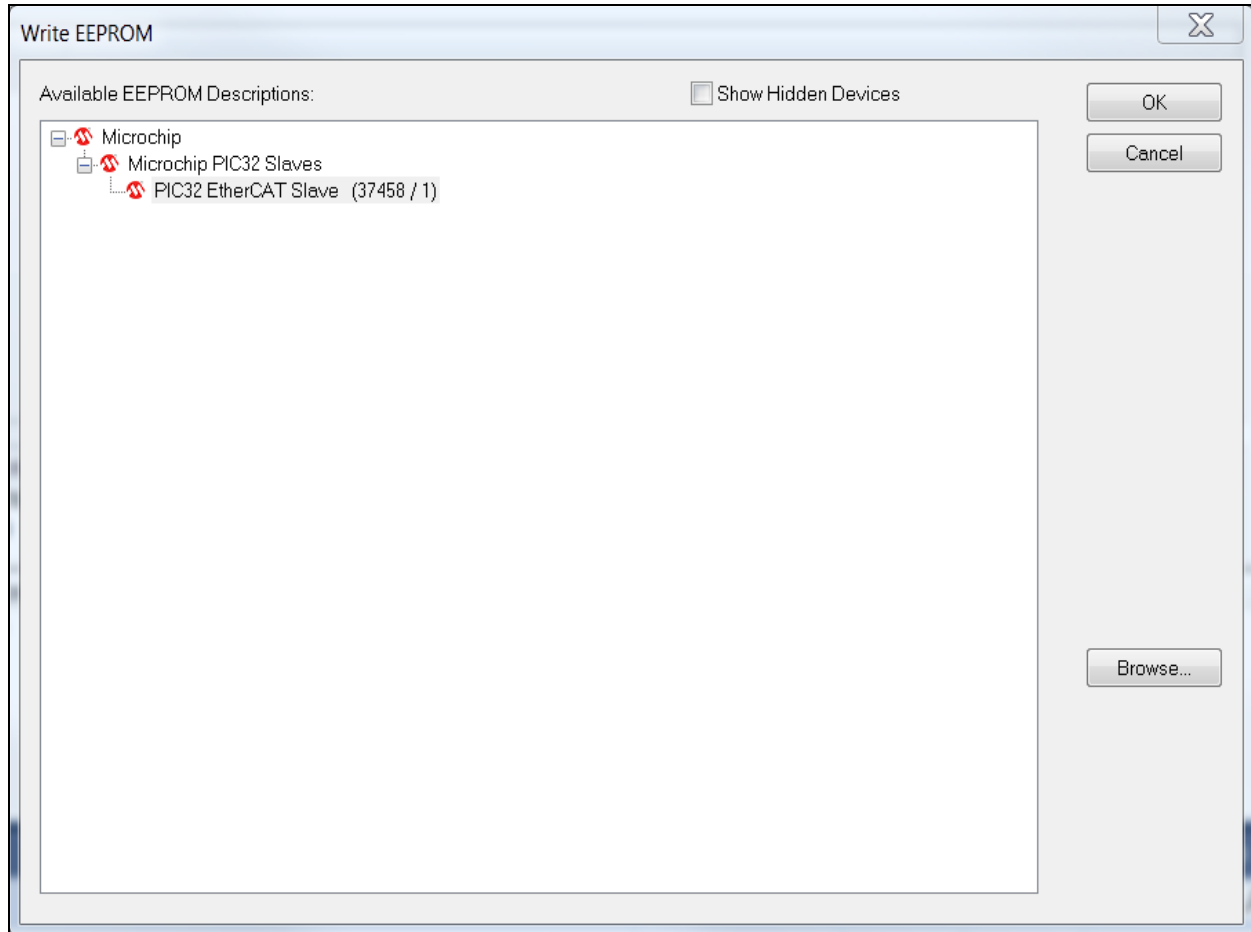
The Write EEPROM window displays.

- 4. Select the corresponding EEPROM configuration and then click **OK** to initiate EEPROM programming.

For example, [Figure B-3](#) shows LAN9252 one of DIGIO configuration is selected for EEPROM programming in TwinCAT.

Note: The xml file that is to be programmed MUST be copied into “C:\TwinCAT\3.1\Config\Io\EtherCAT

FIGURE B-3: WRITE EEPROM DIALOG



Appendix C. Scanning EtherCAT Slaves

C.1 INTRODUCTION

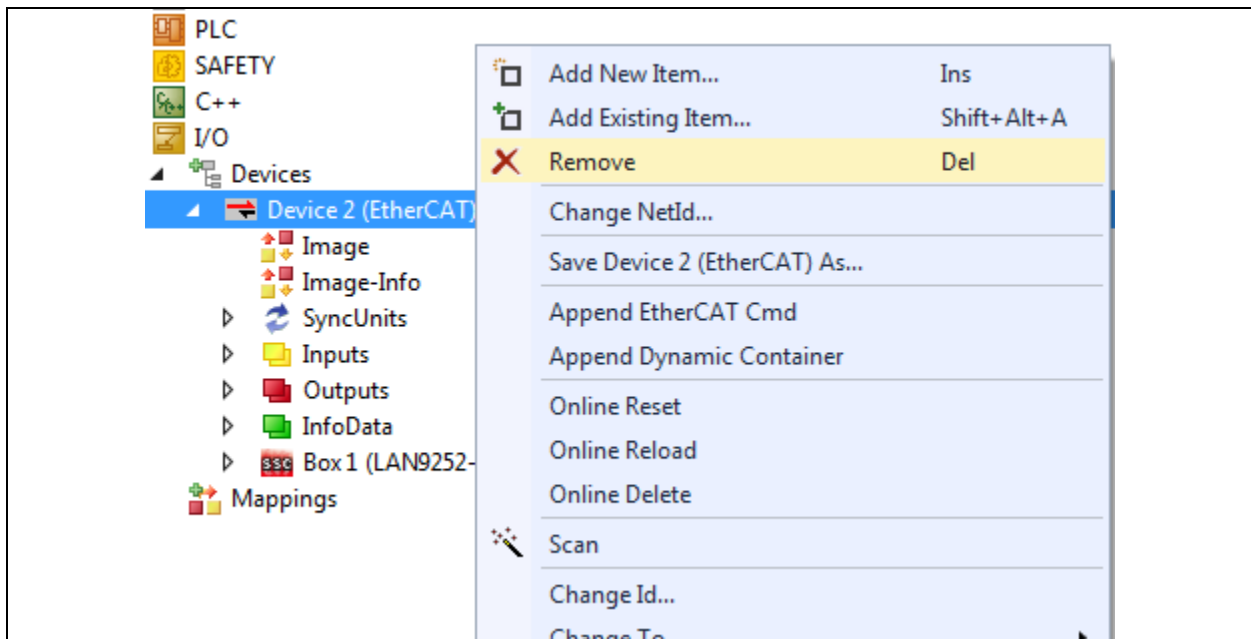
This appendix shows how to scan EtherCAT Slaves.

C.1.1 Scanning EtherCAT Slaves

To scan EtherCAT slaves:

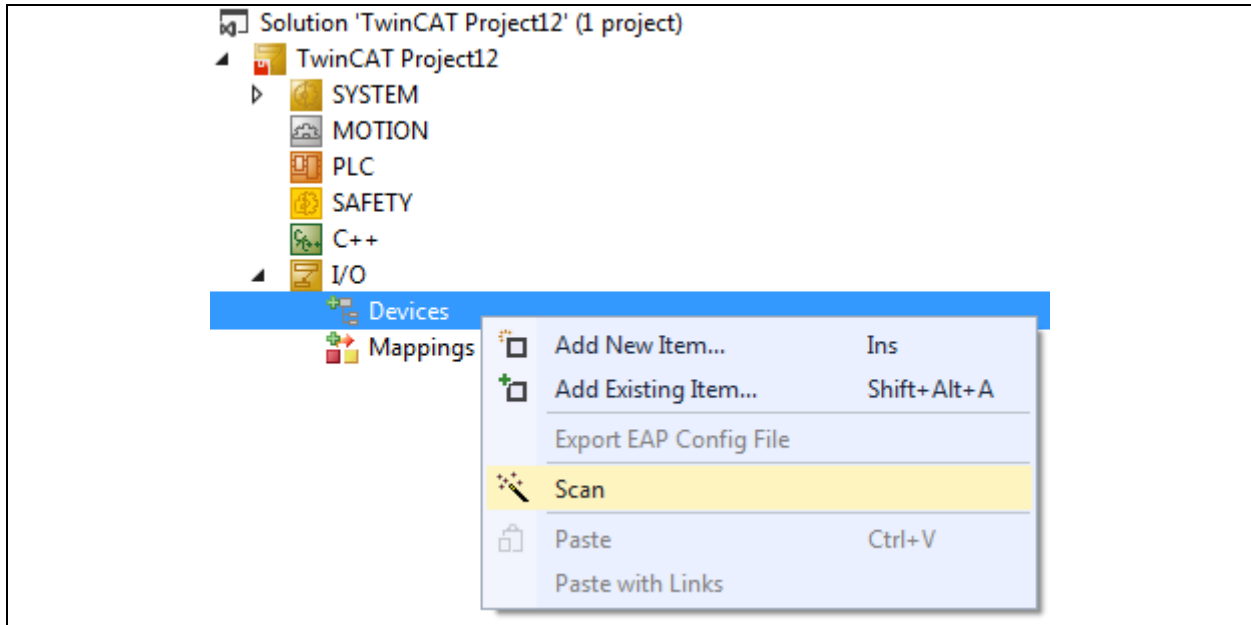
1. Connect Port 0 of the device to the master using RJ45 Ethernet cable, and then power up the board. The Link/Act LED should be ON at Port 0 when the cable is present. If the Link/Act LED is not ON, it indicates there is an issue with the connection or cable.
2. If any devices are present, delete them accordingly by right-clicking the device and selecting Remove, as displayed in [Figure C-1](#).

FIGURE C-1: REMOVE DEVICE



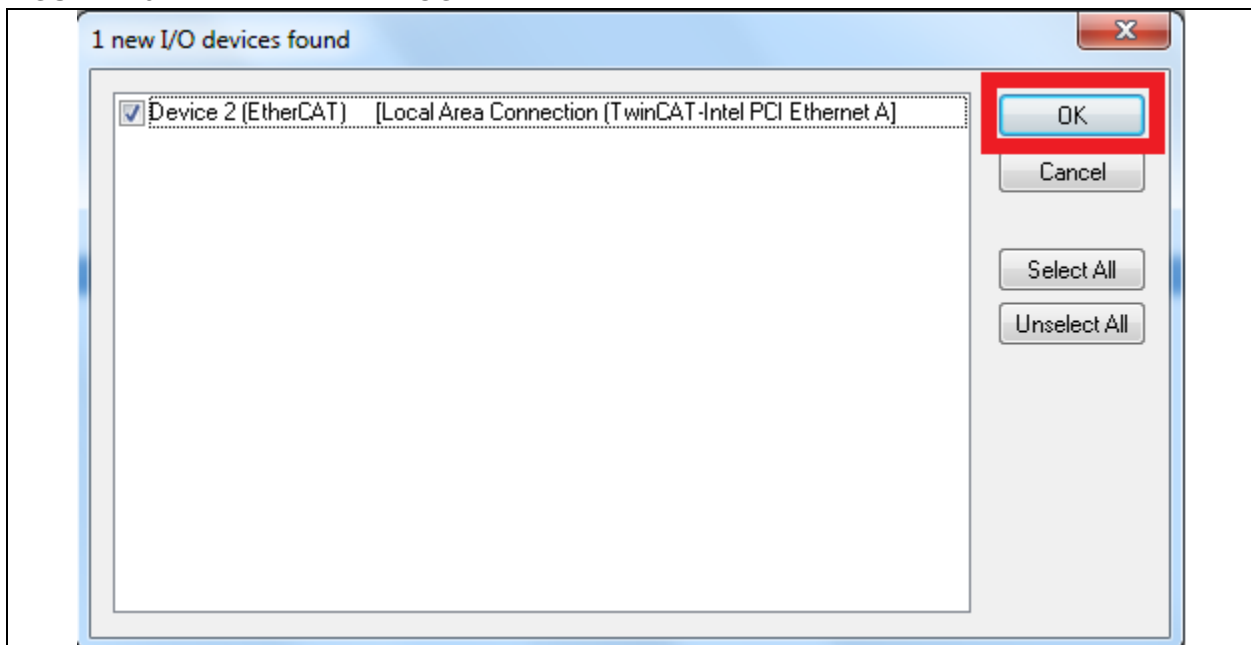
3. Scan for EtherCAT slave devices by right-clicking Devices under I/O and then selecting Scan, as displayed in [Figure C-2](#).

FIGURE C-2: SCAN DEVICES MENU



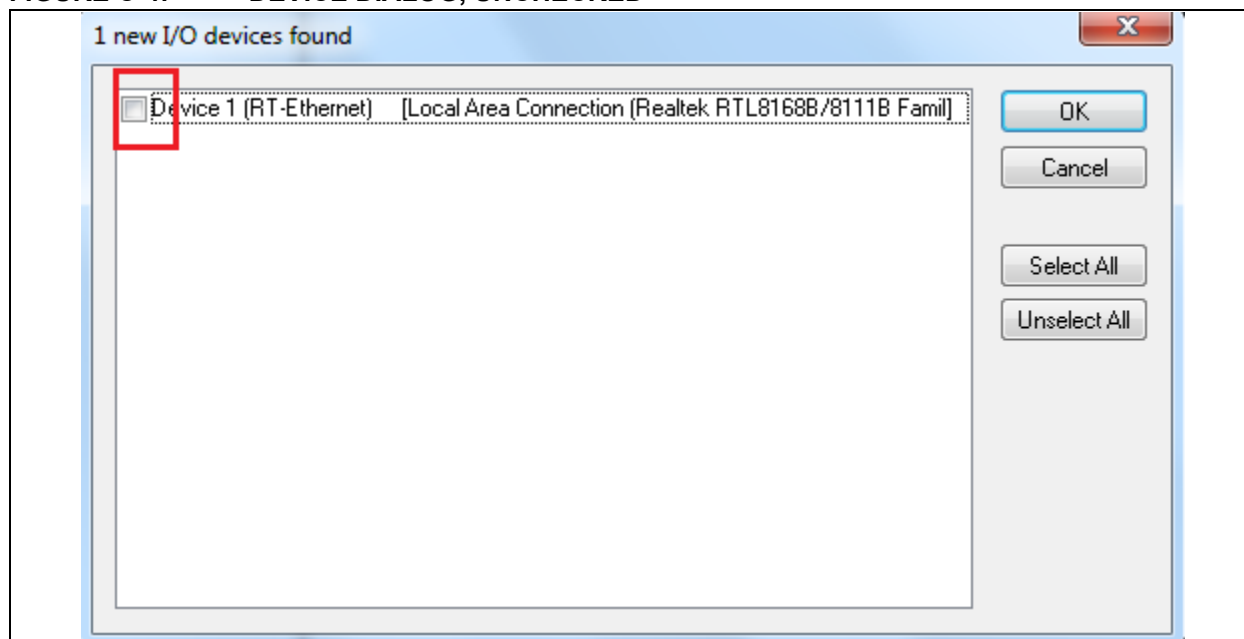
4. Click **OK** to continue scanning as in [Figure C-3](#).

FIGURE C-3: DEVICE DIALOG



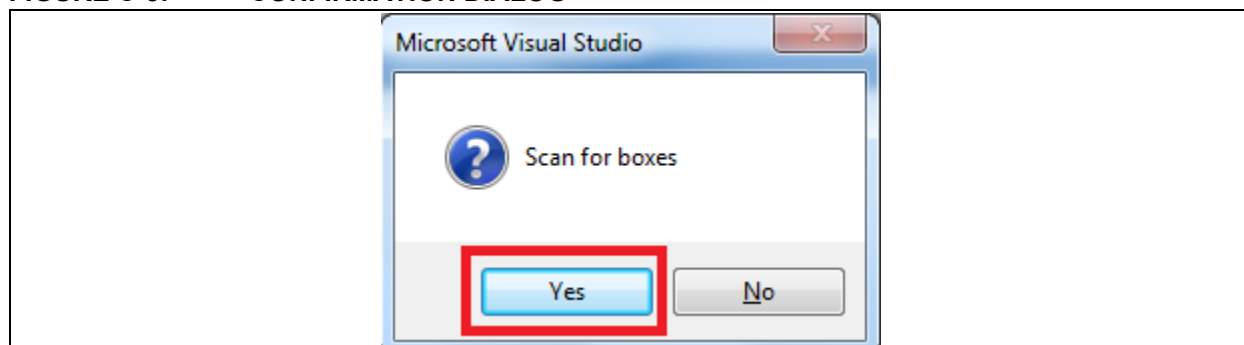
If the check box is not checked as displayed in [Figure C-4](#), then either the device is not functional or the driver is not installed properly.

FIGURE C-4: DEVICE DIALOG, UNCHECKED



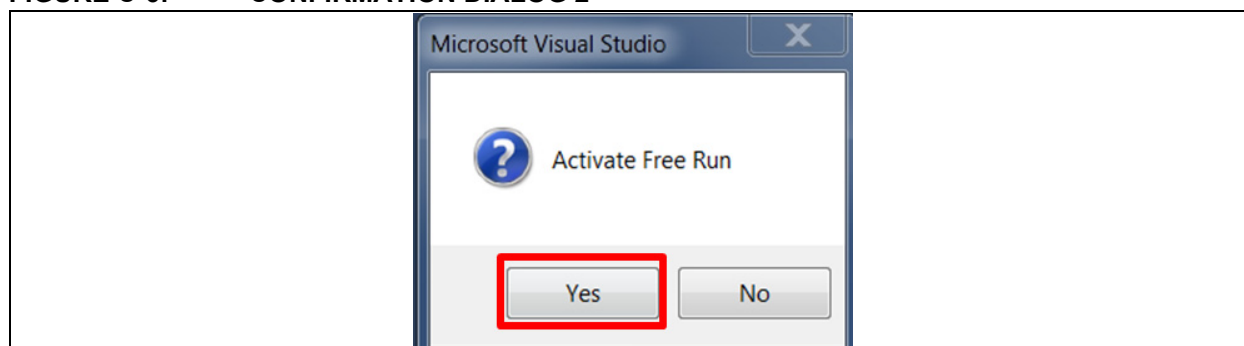
5. Click **Yes** as displayed in [Figure C-5](#) to scan for boxes.

FIGURE C-5: CONFIRMATION DIALOG



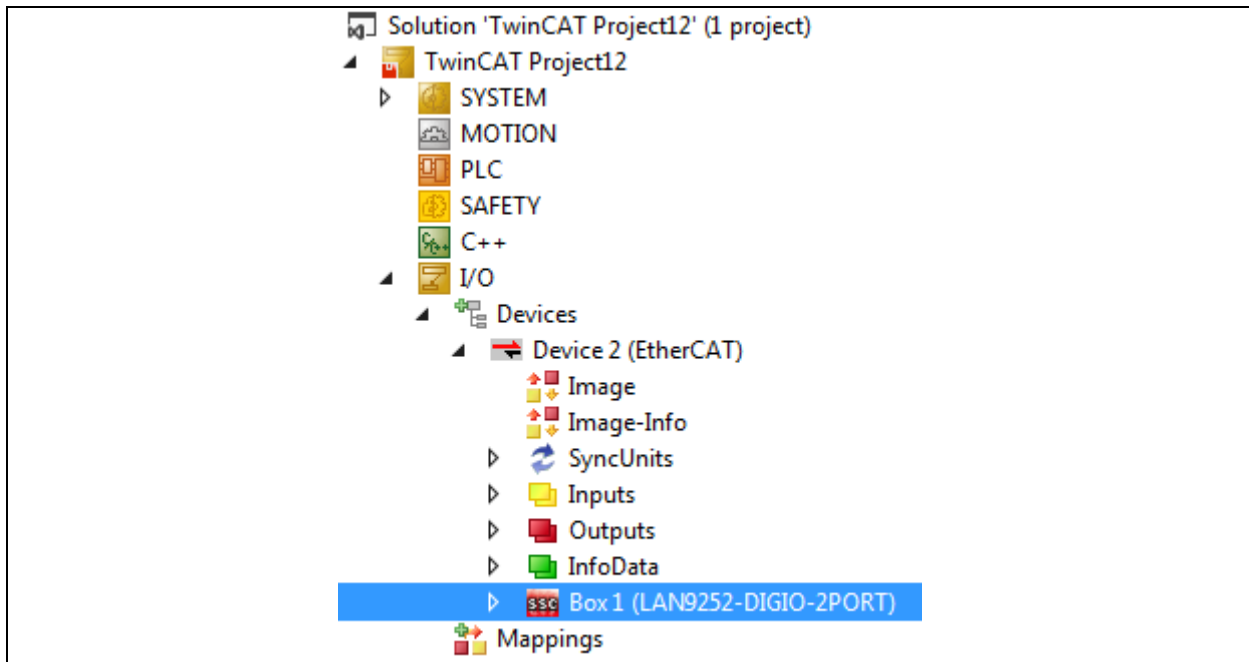
6. Click **Yes** as displayed in [Figure C-6](#) to allow free run.

FIGURE C-6: CONFIRMATION DIALOG 2



7. The device list is displayed as seen in [Figure C-7](#).

FIGURE C-7: DEVICE LIST



8. After a successful scan, there will be activity on Link/Act LED at Port 0 (It will blink rapidly).

Appendix D. Generating SSC Files

D.1 INTRODUCTION

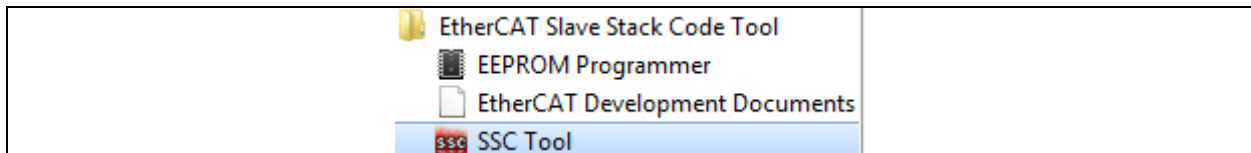
This appendix details how to generate SSC files. These files can be found here:
<http://www.microchip.com/SWLibraryWeb/producttc.aspx?product=LAN9252%20EtherCAT%20SDK>

D.1.1 Generating SSC Files

To generate SSC files:

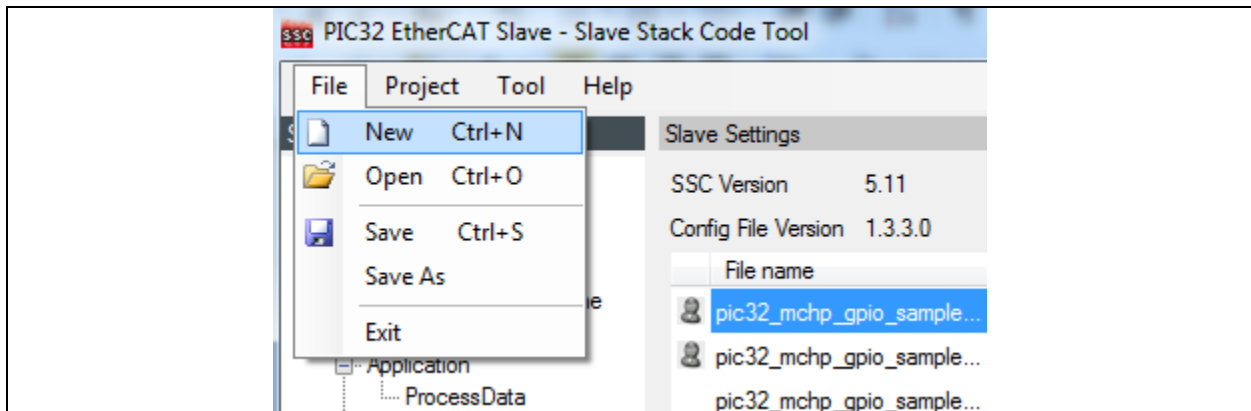
1. Start the SSC Tool from the Windows Start menu, as displayed in [Figure D-1](#).

FIGURE D-1: SSC TOOL



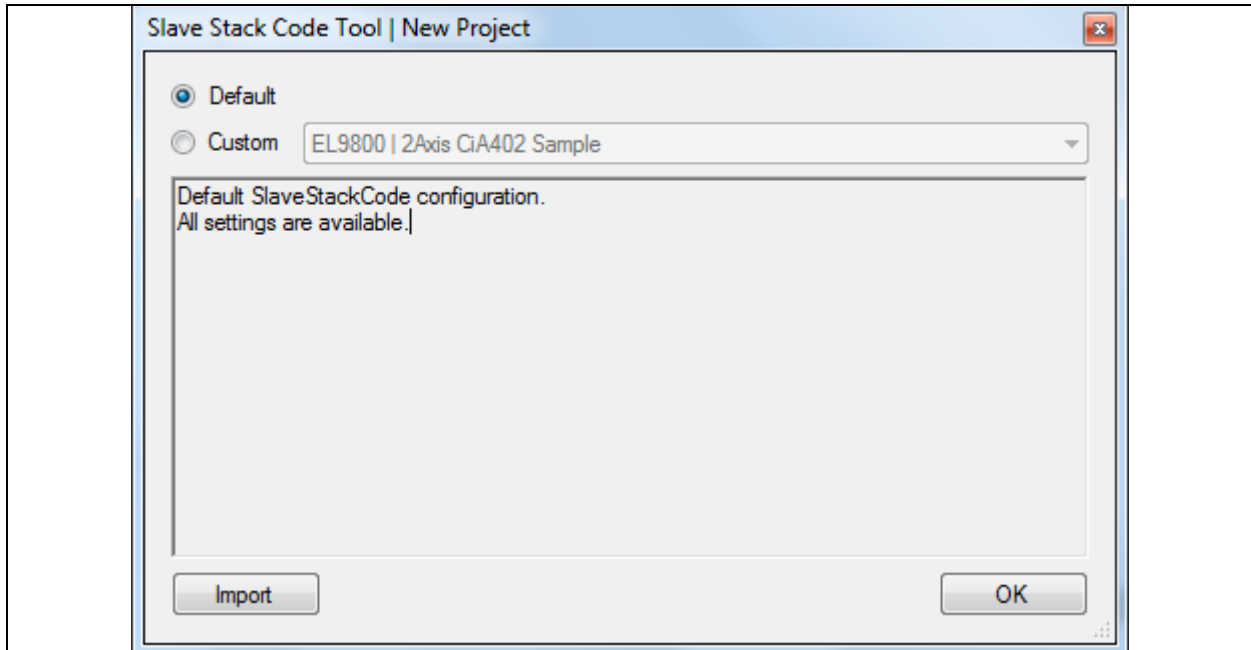
2. From the menu bar, click *File>New* as displayed in [Figure D-2](#).

FIGURE D-2: NEW ETHERCAT SLAVE



3. Click **Import** to import the SSC Tool configuration file `Microchip EVB-LAN9252-HBI-SPI-SSC-CONFIG.xml` from the directory `{SDK_INSTALL_PATH}/EVB-LAN9252_SDK_VX.X/SSC/` as displayed in [Figure D-3](#).

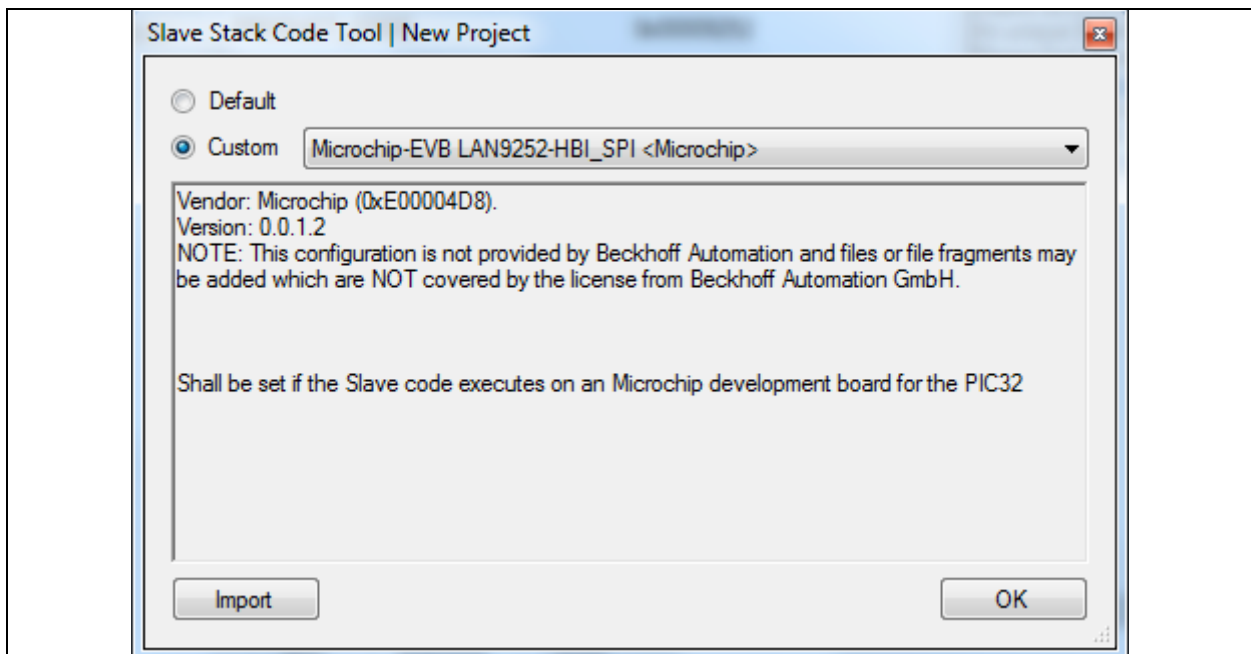
FIGURE D-3: IMPORT PROJECT



After selecting the file, click **Open** to import the SSC Tool configuration file.

- Once imported, check the "Custom" drop-down box, select the "Microchip-EVB-LAN9252-HBI" configuration, and then click **OK**, as displayed in [Figure D-4](#).

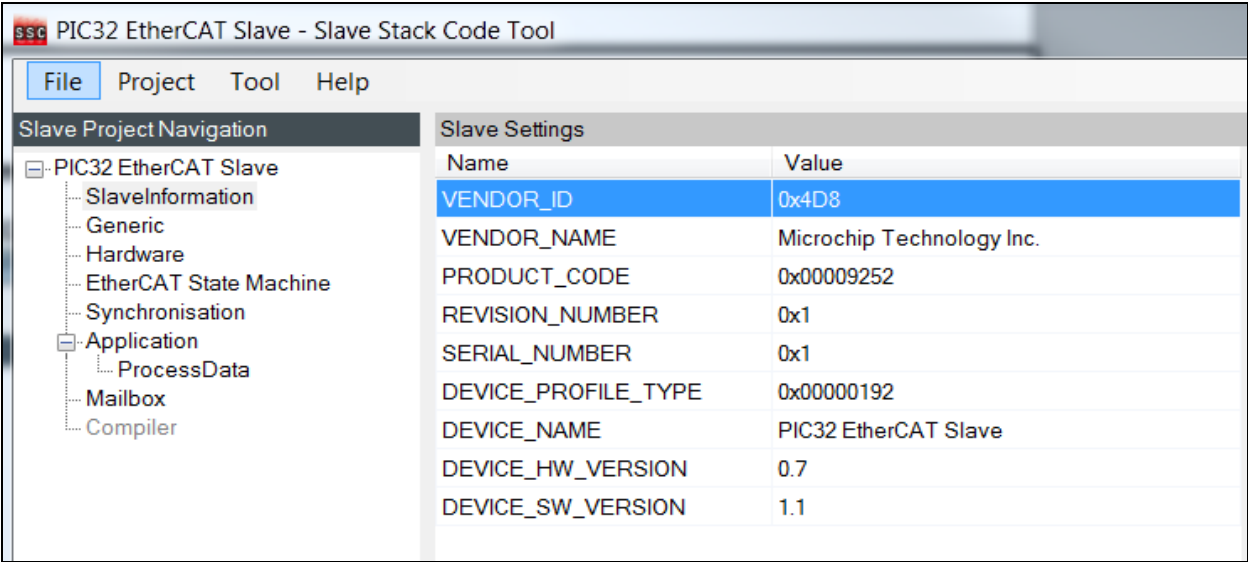
FIGURE D-4: CUSTOM SSC FILE SELECTED



- All listed parameters under the **Slave Information** tab can be changed, as displayed in [Figure D-5](#).

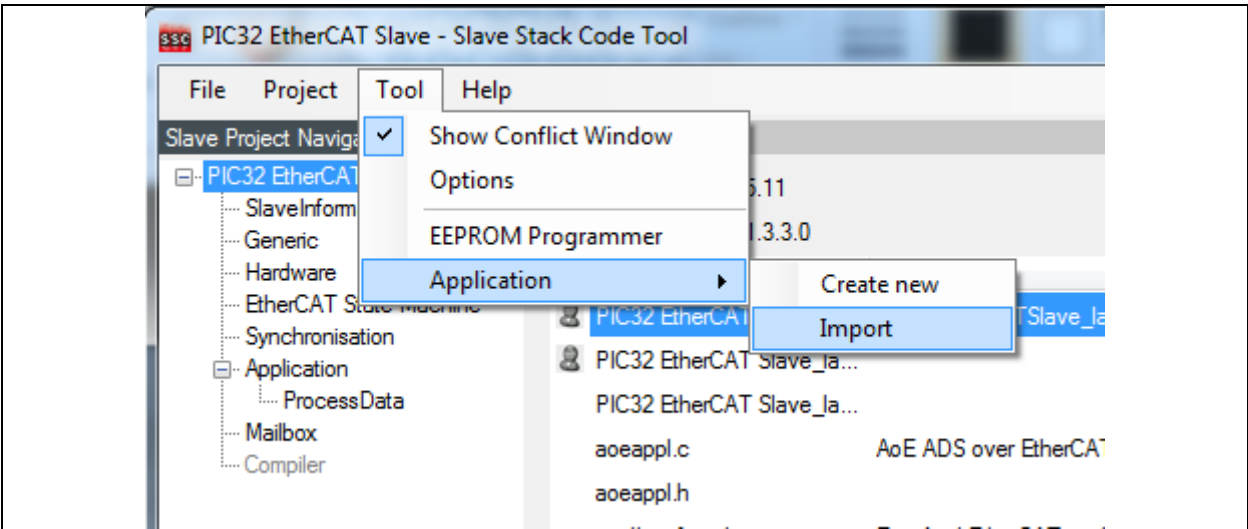
Note: By default, SDK ESI files have an object configuration with Microchip Vendor ID.

FIGURE D-5: SLAVE SETTINGS



6. Click Tool>Application>Import from the menu bar, as displayed in [Figure D-6](#).

FIGURE D-6: IMPORT MENU

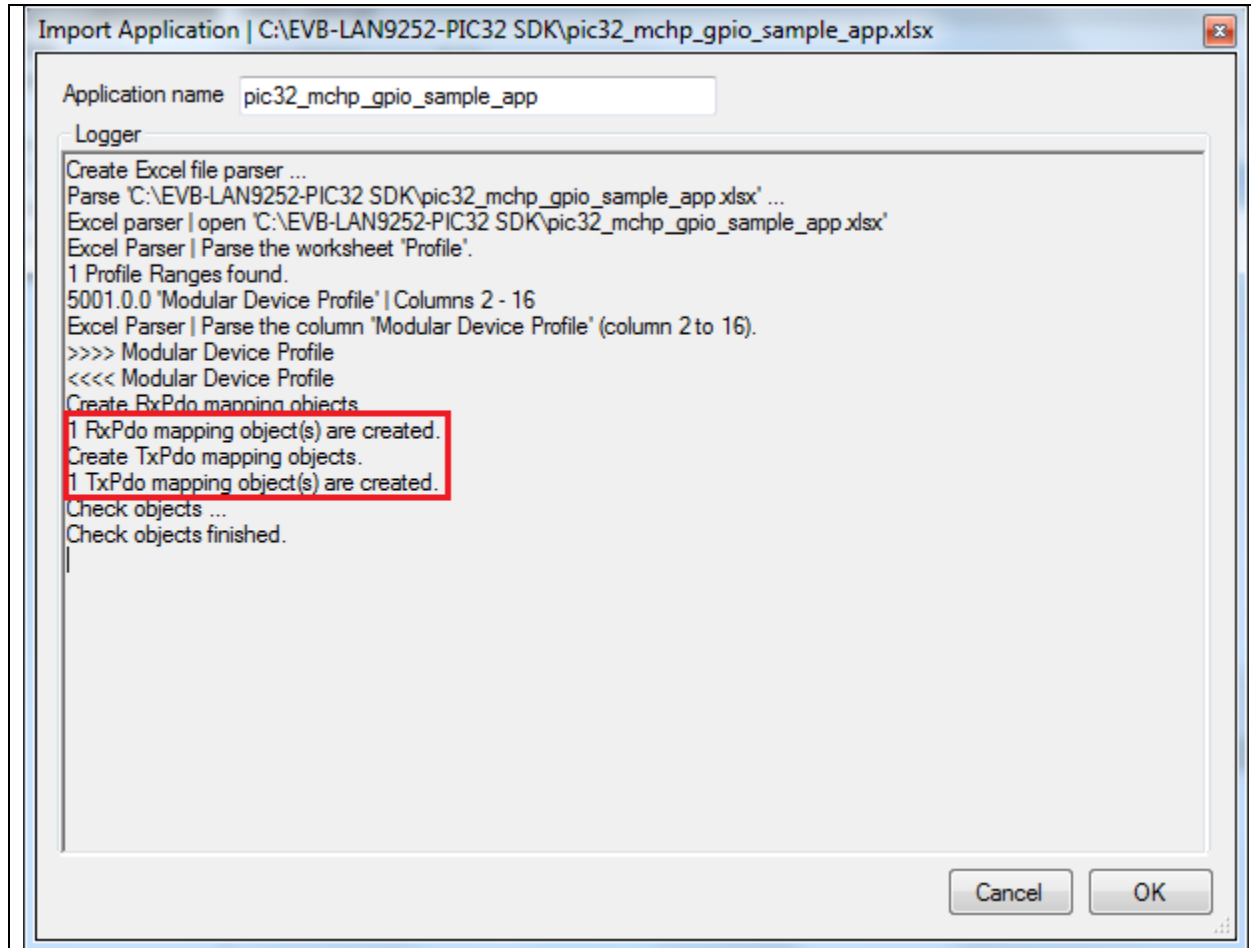


7. Select the file `pic32_mchp_gpio_sample_app.xlsx` which can be found in the directory `{SDK_INSTALL_PATH}/EVB-LAN9252_SDK_VX.X/HBI Application/` or `{SDK_INSTALL_PATH}/EVB-LAN9252_SDK_VX.X/SPI Application/` depending on the mode the board is configured for.

`pic32_mchp_gpio_sample_app.xlsx` is an object file which contains the information about application objects.

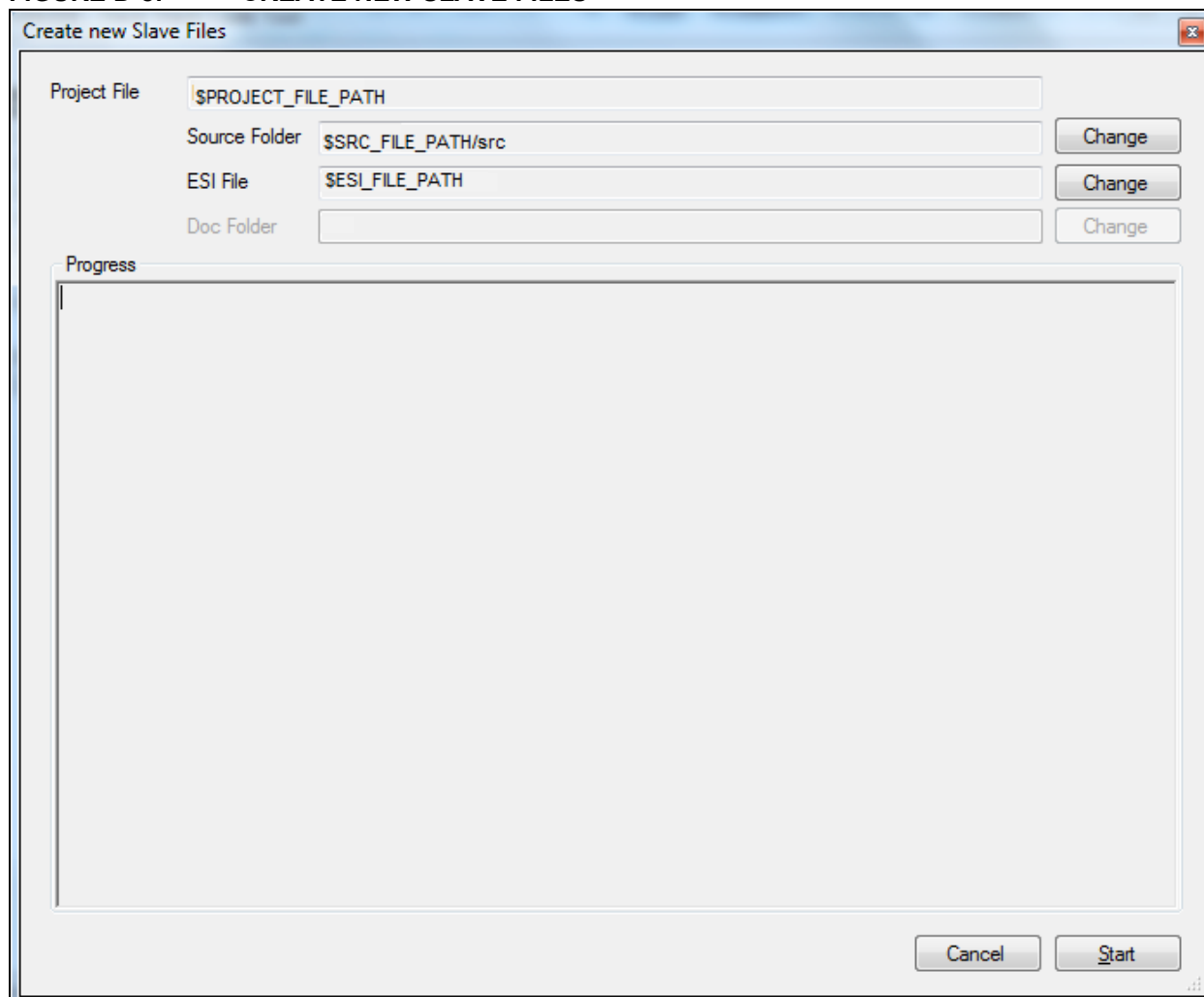
A status message displays as in [Figure D-7](#).

FIGURE D-7: STATUS MESSAGE



8. Click **OK** to continue.
9. From the menu bar, click *Project>Create New Slave Files*.
The Create new Slave Files window displays, as in [Figure D-8](#).

FIGURE D-8: CREATE NEW SLAVE FILES



Note: The above values signify the following:

- \$PROJECT_FILE_PATH - The location where the SSC project file is saved.
- \$SRC_FILE_PATH - Default path is \$PROJECT_FILE_PATH. It can be changed by clicking its corresponding **Change** button.
- \$ESI_FILE_PATH - Default path is \$PROJECT_FILE_PATH. It can be changed by clicking its corresponding **Change** button.

10. Click the Windows **Start** button to create a new project file, Src folder, and ESI file (Slave Information file) in the desired directory path.

A pop-up window will indicate that the files have been successfully created.

11. Click **OK** to continue.

Along with generated new slave files, an ESI file (.xml file) also will be generated. This ESI file will have information about new Vendor ID and object configuration. Program this ESI file into EEPROM as mentioned in **Appendix B. “EEPROM Programming”**.

12. Replace generated application files with SDK application files as displayed in [Figure D-9](#).

SDK Application files can be found either the HBI Application or SPI Application and then Sample Application Files depending on the board configuration.

FIGURE D-9: SDK APPLICATION FILES

Name	Date modified	Type	Size
 pic32_mchp_gpio_sample_app.c	3/23/2016 11:57 A...	C File	14 KB
 pic32_mchp_gpio_sample_app.h	3/23/2016 11:57 A...	C/C++ Header File	2 KB
 pic32_mchp_gpio_sample_appObjects.h	3/23/2016 11:57 A...	C/C++ Header File	14 KB

Note: Application files would be named as `pic32_mchp_gpio_sample_app` as in [Figure D-10](#). This is because in this demo, input object file is given as `pic32_mchp_gpio_sample_app.xlsx`.

FIGURE D-10: APPLICATION FILES

 ecatslv.h	6/24/2015 5:06 PM	C/C++ Header	30 KB
 emcy.c	6/24/2015 5:06 PM	C Source	10 KB
 emcy.h	6/24/2015 5:06 PM	C/C++ Header	5 KB
 eoeappl.c	6/24/2015 5:06 PM	C Source	11 KB
 eoeappl.h	6/24/2015 5:06 PM	C/C++ Header	10 KB
 esc.h	6/24/2015 5:06 PM	C/C++ Header	13 KB
 foeappl.c	6/24/2015 5:06 PM	C Source	11 KB
 foeappl.h	6/24/2015 5:06 PM	C/C++ Header	2 KB
 mailbox.c	6/24/2015 5:06 PM	C Source	39 KB
 mailbox.h	6/24/2015 5:06 PM	C/C++ Header	9 KB
 objdef.c	6/24/2015 5:06 PM	C Source	74 KB
 obidef.h	6/24/2015 5:06 PM	C/C++ Header	15 KB
 pic32_mchp_gpio_sample_app.c	6/24/2015 5:06 PM	C Source	13 KB
 pic32_mchp_gpio_sample_app.h	6/24/2015 5:06 PM	C/C++ Header	2 KB
 pic32_mchp_gpio_sample_appObjects.h	6/24/2015 5:06 PM	C/C++ Header	9 KB
 pic32_mchp_spigpio_sample_app.xml	6/24/2015 5:06 PM	XML Document	42 KB
 sdoserv.c	6/24/2015 5:06 PM	C Source	60 KB
 sdoserv.h	6/24/2015 5:06 PM	C/C++ Header	33 KB

13. Browse to the directory where the new files were created, as shown in the example:

- Src (Folder): This folder contains the Beckhoff Slave Stack code.
- Microchip PIC32 Slaves (ESP): This is the SSC Tool project file.
- Microchip PIC32 Slaves (XML): This is the EtherCAT slave information file that must be used as an input to the EtherCAT master tool to configure EtherCAT slave controllers.

14. Copy all the files inside the Src folder to the following directory:

{SDK_INSTALL_PATH}/EVb-LAN9252-HBI_PIC32_SDK_VX.X/SSC/Common

D.1.1.1 WHY REPLACE IS REQUIRED

Generated application files will not have the code for accessing the GPIO lines. GPIO support is provided in delivered SDK application files. Hence, the replace is required to get the demo application.

Appendix E. Compiling and Programming SoC Firmware

E.1 INTRODUCTION

This appendix details how to compile and program SoC firmware.

E.1.1 Compiling and Programming SoC Firmware

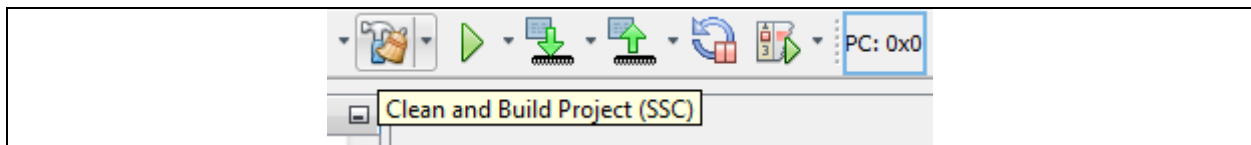
To compile and program SoC firmware:

1. Open the MPLAB IDE and import the SSC project.

The MPLAB project file is located under {SDK_INSTALL_PATH}/EVB-LAN9252-HBI_PIC32_SDK_VX.X/SSC/.

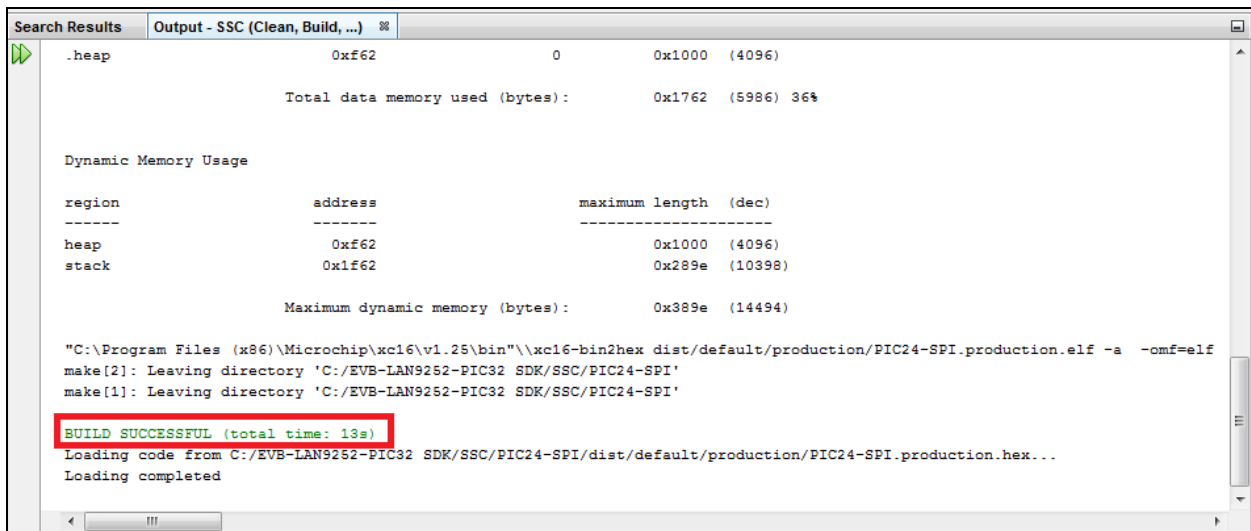
2. Compile the source code as displayed in [Figure E-1](#).

FIGURE E-1: SOURCE CODE



If the compilation is successful, the output window will display “BUILD SUCCESSFUL” as shown in [Figure E-2](#).

FIGURE E-2: BUILD SUCCESSFUL



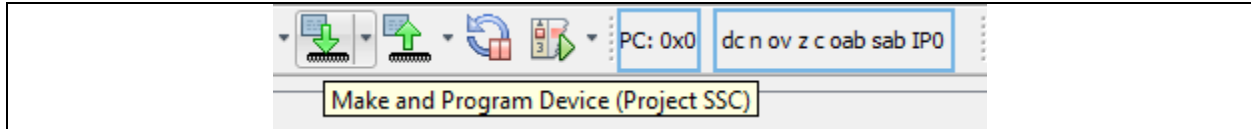
3. Before initiating the firmware download, ensure the debugger/programmer is connected to the EVB's JTAG pins.

Note: This demo project is debugged with the PICkit-3 In-Circuit debugger/programmer.

4. To program the PIC32 SoC, click the **Make and Program Device Main Project** button, as displayed in [Figure E-3](#).

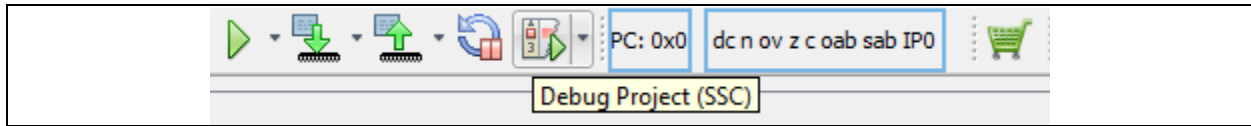
Compiling and Programming SoC Firmware

FIGURE E-3: MAKE AND PROGRAM DEVICE MAIN PROJECT BUTTON



5. To debug the PIC32 SoC, click the **Debug Main Project** button, as displayed in [Figure E-4](#).

FIGURE E-4: DEBUG MAIN PROJECT BUTTON



Appendix F. Programming PIC32 Firmware Using Pre-Built Binaries

F.1 INTRODUCTION

This appendix shows how to program PIC32 firmware.

F.1.1 Programming PIC32 Firmware Using Pre-Built Binaries

To program the PIC32 firmware using pre-built binaries:

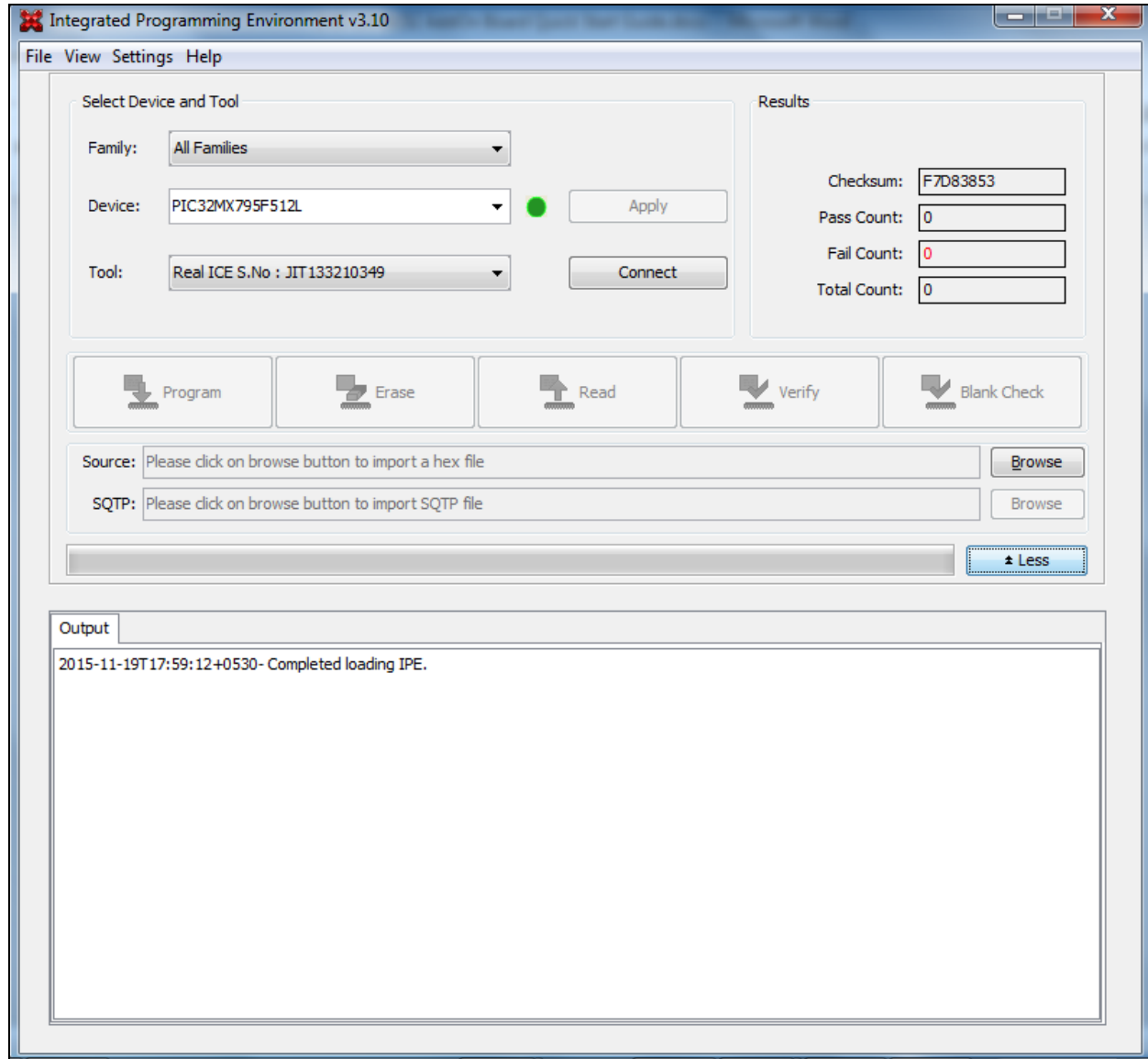
1. Download and install MPLAB IPE V X.X from the following link:
<http://microchip.wikidot.com/ipe:installation>

Note: x.xx denotes the version number of the MPLAB IPE.
--

2. Before initiating the firmware download, ensure the debugger/programmer is connected to the EVB's JTAG pins.
3. Open the MPLAB IPE.
The window displays as in [Figure F-1](#).

Programming PIC32 Firmware Using Pre-Built Binaries

FIGURE F-1: MPLAB IPE



4. Select the corresponding device from the “Device” drop-down box and then click **Apply**.
5. Select the debugger/programmer from the “Tool” drop-down box and then click **Connect**.
6. From “Source,” click the **Browse** button and select the hex files which can be found in the “Binaries” directory of EVB-LAN9252-HBI_PIC32_SDK V X.X.
7. Once the hex files are loaded, click **Program**.

Appendix G. Troubleshooting

G.1 INTRODUCTION

This appendix details how to troubleshoot some issues that may occur when using the EVB-LAN9252-HBI+. If the issue cannot be resolved using this troubleshooting appendix, please use the Microchip website to request further assistance.

G.1.1 Cannot Program PIC32

If the situation arises where the PIC32 will not program, ensure the proper header is being used.

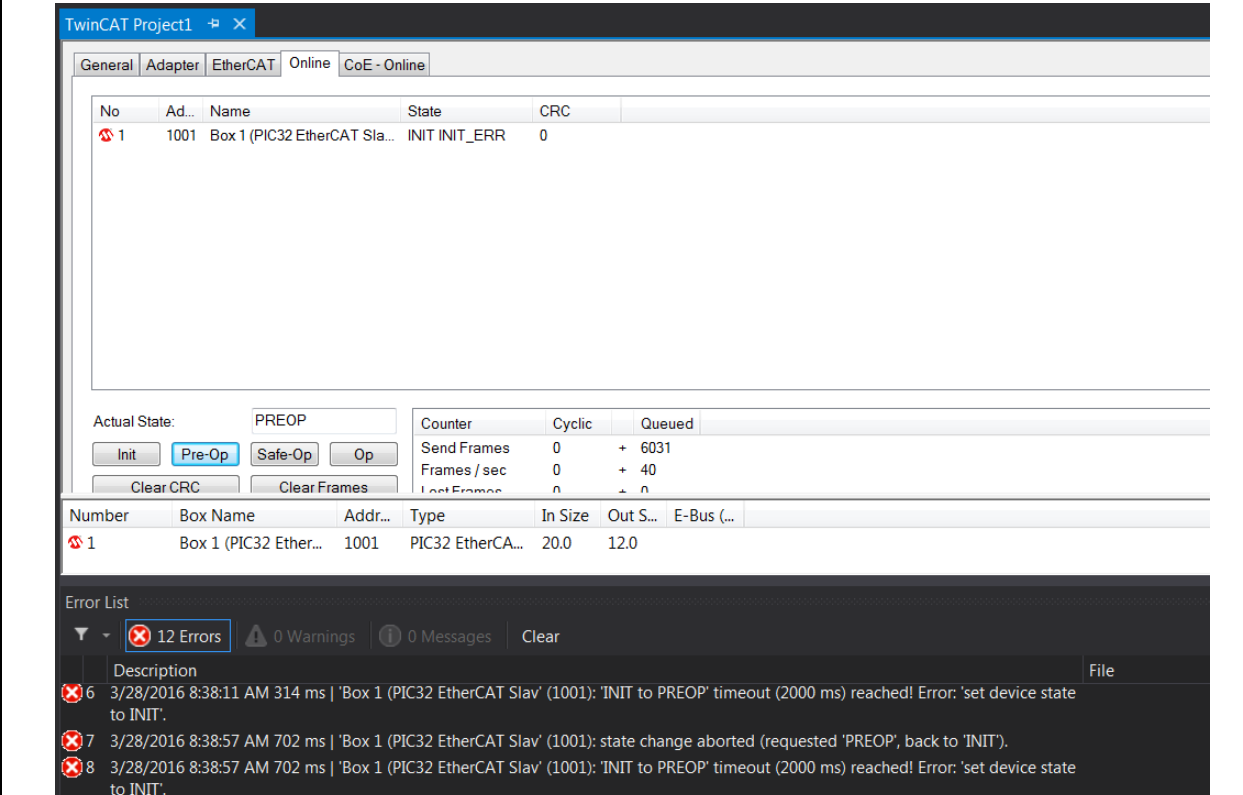
DO NOT USE J14 to Program the PIC32.

DO USE J13 to program the PIC32. Align PIN1 of the programming device with PIN1 of the header as labeled on the board.

G.1.2 Error when board requests PREOP

If an error similar to that seen in [Figure G-1](#) occurs, it could be the result of two possible issues:

FIGURE G-1: PREOP FAILURE



The screenshot shows the TwinCAT Project1 interface. The 'EtherCAT' tab is active, displaying a table of EtherCAT slaves. Box 1 (PIC32 EtherCAT Slave) is shown with a state of 'INIT INIT_ERR' and a CRC of 0. Below the table, the 'Actual State' is set to 'PREOP'. The 'Counter' section shows 'Send Frames' at 0, 'Cyclic' at 6031, 'Frames/sec' at 0, and 'Lost Frames' at 0. The 'Error List' at the bottom shows 12 errors, with the first three being related to a timeout and state change issues for Box 1.

No	Ad...	Name	State	CRC
1	1001	Box 1 (PIC32 EtherCAT Sla...	INIT INIT_ERR	0

Number	Box Name	Addr...	Type	In Size	Out S...	E-Bus (...)
1	Box 1 (PIC32 Ether...	1001	PIC32 EtherCA...	20.0	12.0	

Error List

12 Errors | 0 Warnings | 0 Messages | Clear

Description	File
3/28/2016 8:38:11 AM 314 ms 'Box 1 (PIC32 EtherCAT Slave)' (1001): 'INIT to PREOP' timeout (2000 ms) reached! Error: 'set device state to INIT'.	
3/28/2016 8:38:57 AM 702 ms 'Box 1 (PIC32 EtherCAT Slave)' (1001): state change aborted (requested 'PREOP', back to 'INIT').	
3/28/2016 8:38:57 AM 702 ms 'Box 1 (PIC32 EtherCAT Slave)' (1001): 'INIT to PREOP' timeout (2000 ms) reached! Error: 'set device state to INIT'.	

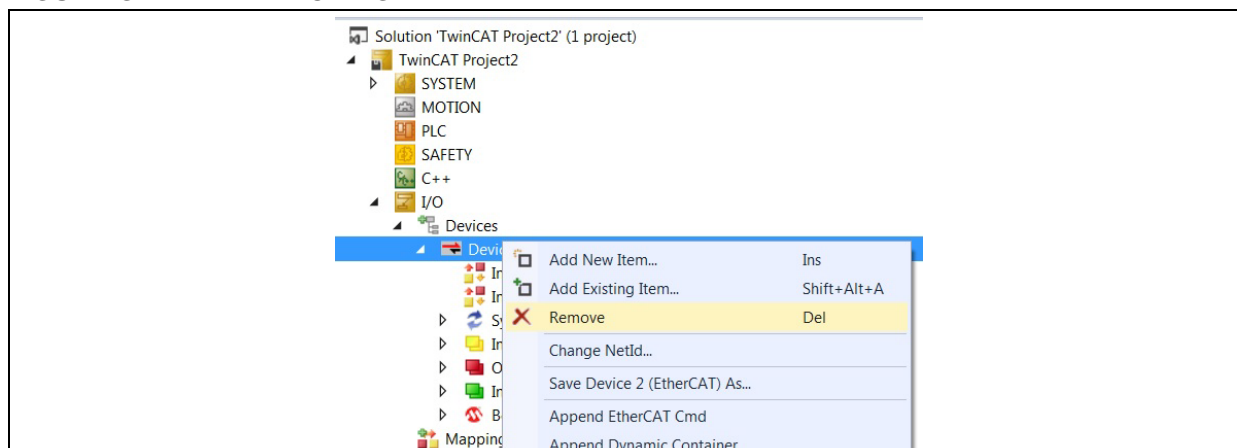
- The board is not configured correctly to use the desired mode. Please refer back to **Section 2.1.1 "EtherCAT Master and Slave Configuration"** for information on the proper configuration of the board for HBI mode and **Section 2.2.1 "EtherCAT Master and Slave Configuration"**

for information on the proper configuration of the board for SPI mode.

2. After programming the board's EEPROM, one must follow the following steps:

- 1: Remove the device as seen in Figure G-2
- 2: Power cycle the board
- 3: Rescan for devices

FIGURE G-2: REMOVING A DEVICE



G.1.3 Values Do not Update in Application

If this issues occurs, please power cycle or reset the board and try changing the output value again. If the input values do not update please also power cycle or reset the board.

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