Application Note

AM263 EtherCAT SubDevice with TwinCAT

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ABSTRACT

EtherCAT is widely used for Industry communication.

This application note demonstrates the TI AM263 running the EtherCAT, and shows how the TwinCAT interacts with the AM263. Several key important tips are discussed in this document.

Table of Contents

Trademarks

1 Introduction

This application note has two goals:

- How to build the code merged with Beckoff EtherCAT SubDevice code for AM26
- How to test the AM26 with TwinCAT for proving EtherCAT SubDevice is working

The user can study this note and follow it to make the EtherCAT work with TwinCAT.

2 Hardware and Software Preparation

HW EVM:

EVM User Guide

EVM Ordering

EVM picture:

Figure 2-1. AM263EVM

SW preparation:

IDE tool:

CCS 12.6: (or newer will be used.)

CCS can be downloaded from here: CCSTUDIO

AM263P SDK:

AM263P SDK

Find this package for Ethercast SubDevice.

VStudio TwinCAT 3.1:

VStudio TwinCAT 3.1

Beckoff ETH driver:

Beckoff ETH Driver

The following Add-on Tools must be installed:

ETHERCAT STACK from Beckoff:

EtherCAT

To get the stack, the customer must have the Beckoff Stack via their own account.

GnuWin32 tool:

GuuWin32

Unix2Dos or Dos2Unix tool:

Unix2Dos

Important documents:

Industrial Communications Toolkit

EtherCAT Subdevice Setup with TwinCAT

3 How to Generate the ETHERCAT Stack Code for AM263P

Read this Readme file in the SDK path: C:\ti\ind_comms_sdk_am263x_09_02_00_13\source\industrial_comms\EtherCAT_slave\beckhoff_stack\stack_sources

There are two ways to generate the ETHERCAT Salve Stack code.

1. Using the patch file
2. Using Beckhoff SSC Tool

TI recommends using the first option (Using the patch file) to generate the code, as the user does not need to find and learn the Beckoff SSC Tool.

Follow these steps:

1. Visit Beckoff Website: EtherCAT
2. Click Download.
3. Set the filter as “SSC”; the user will find the SSC (Slave Stack Code) with the 5.13 version.
4. Download Windows Patch Utility. The user can get this utility from here.
5. Download Dos2Unix/Unix2Dos-Text file format converters from gnuwin32 sourceforge. The user can get gnuwin32 from here.
6. Copy this file: unix2dos.exe to this path: C:\TI\ind_comms_sdk_am263x_09_02_00_13\source\industrial_comms\EtherCAT_slave\beckhoff_stack\patch, and issue this command: unix2dos.exe TI_ETHERCAT.patch
7. Go to: C:\patch-2.5.9-7-bin\bin\. Issue this command on your windows prompt: (The below is very long 1 single cmd.)

   patch.exe

   -i C:\TI\ind_comms_sdk_am263x_09_02_00_13/source/industrial_comms/EtherCAT_slave/beckhoff_stack/patch/TI_ETHERCAT.patch

   -d C:\TI\ind_comms_sdk_am263x_09_02_00_13/source/industrial_comms/EtherCAT_slave/beckhoff_stack/stack_sources/

   When you perform the patch.exe, you can manually assign the file path + file name together. as shown here:

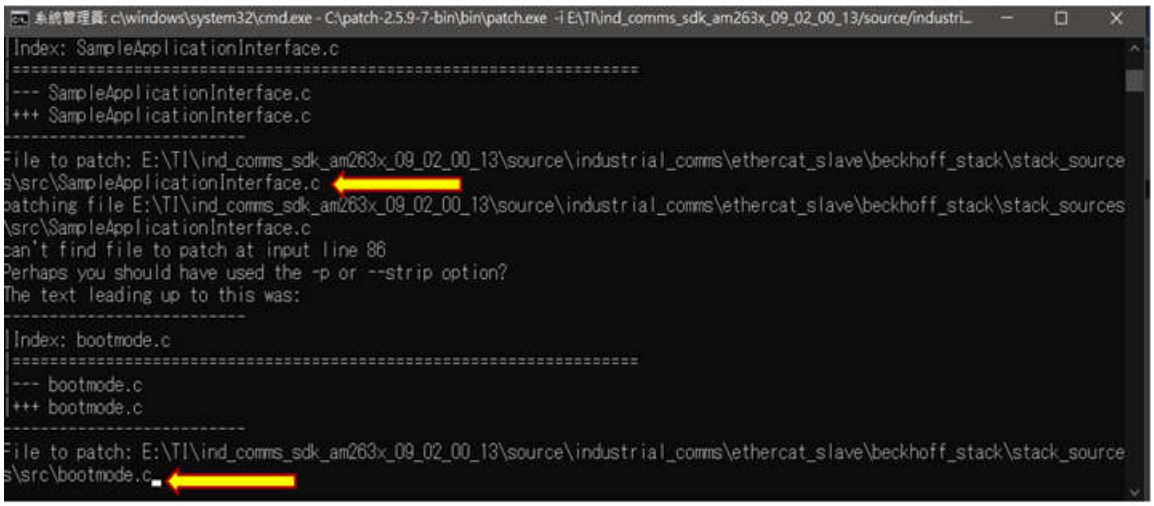

Figure 3-1. SSC Patch Example

8. Return to the CCS to build the build. This code will be built successfully. See the following image:

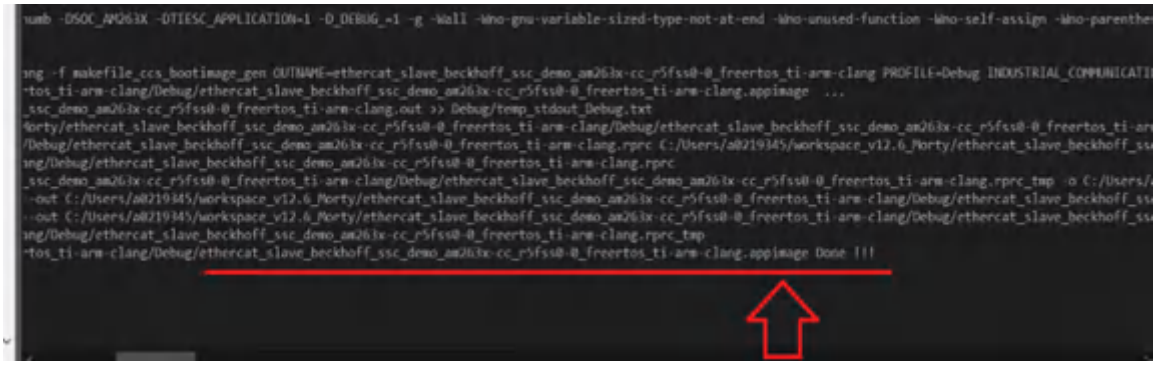

Figure 3-2. ETHERCAT Code Build-out

4 How to Run the AM263 EVM with the ETHERCAT

Follow these steps:

1. Set the **SW5** on the EVM to use XDS110 JTAG, as in the following image:

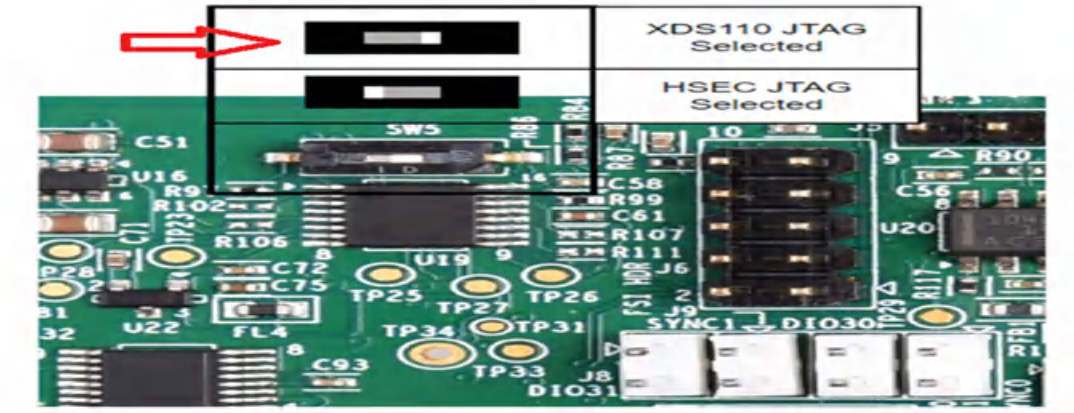

Figure 4-1. EVM SW5 Switch – XDS110

2. Connect to the PRU0 port. This port is the default one to test the ETHERCAT, as in the following image:

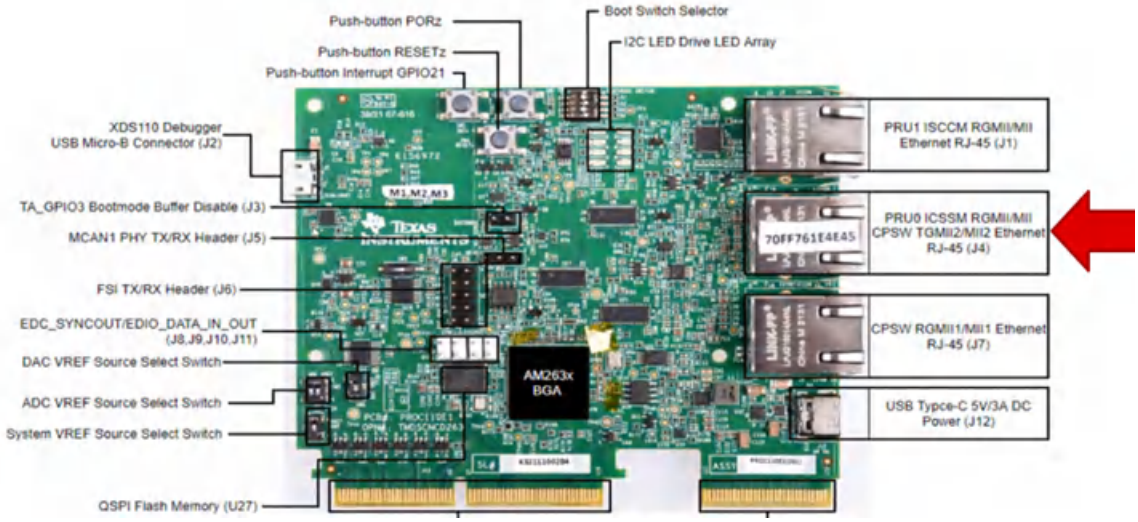

Figure 4-2. Default PRU0 ETHERCAT Tested Port

3. Create the AM263.ccxml, set as XDS110, and test the JTAG first.
4. Launch the AM263.ccxml.
5. Connect to the R5F_0 core, as in the following image:

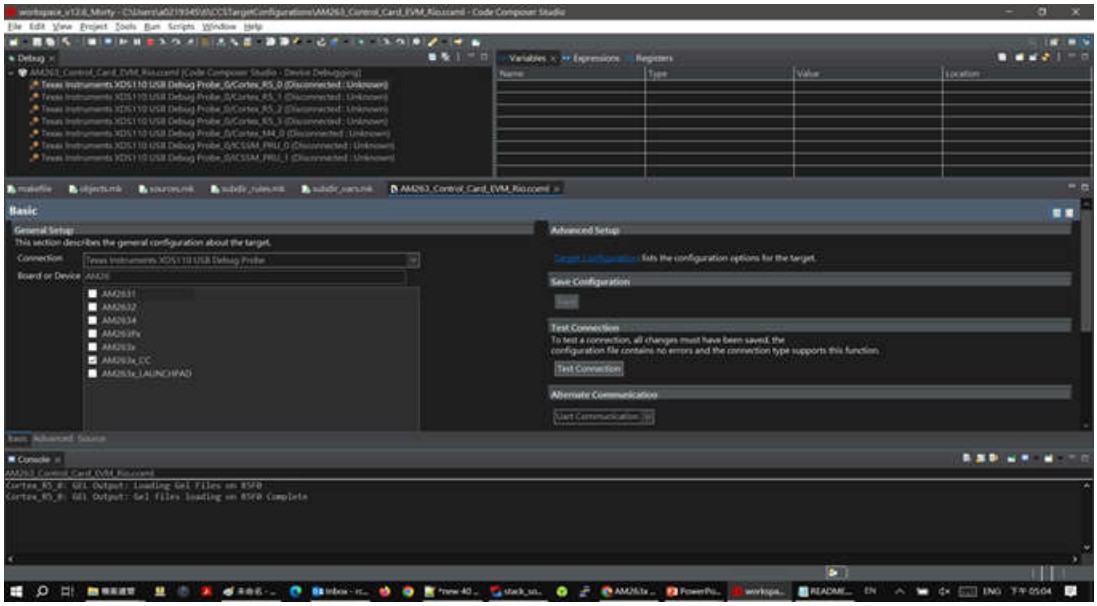

Figure 4-3. R5F_Core 0 Position

6. Download the ETHERCAT built code, as in the following image:

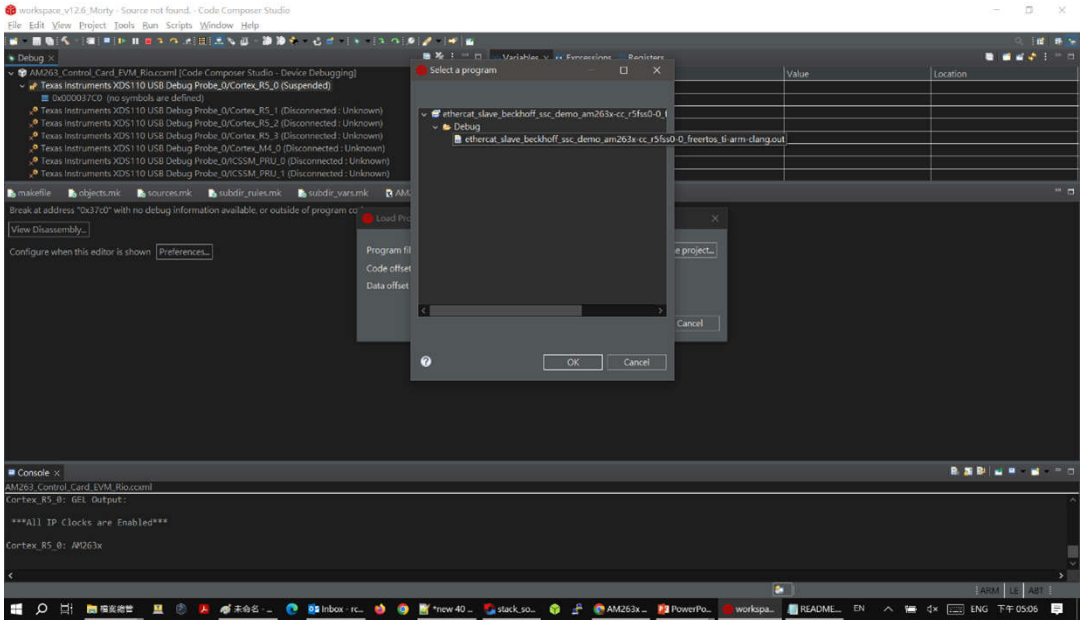

Figure 4-4. R5F_Core 0 Selected

7. Free run the code, and open your teraterm console log; you will see the following screen.

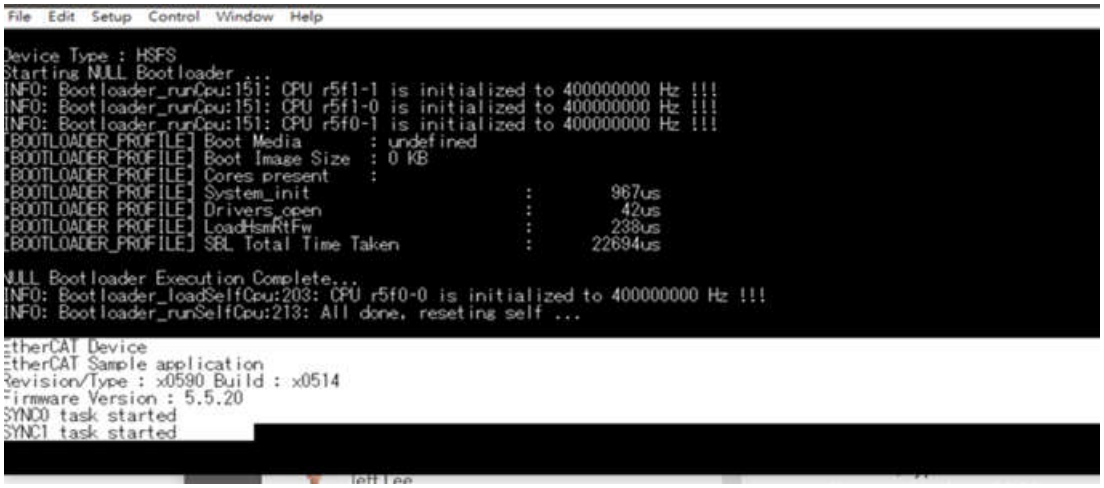

Figure 4-5. ETHERCAT Running Console Log Example

5 How to Run the TwinCAT

This tool is to test your ETHERCAT code on the AM263.

The Topology is this:

PC / NB → Run with TwinCAT ← Ethernet → AM263 with ETHERCAT.

The user must read these important documents first:

- TwinCAT Setup
- Supported Network Controllers
- EtherCAT SubDevice Setup with TwinCAT

Follow these steps:

1. Install this package; it must match your Windows version:

   https://cstweb.wtb.tue.nl/4tc00/_downloads/d67baccd94aeeeb468136e6aad54629a/TC31-Full-Setup.3.1.4024.56.exe
2. Go to your Windows Networking setting, choose the Ethernet1 (the Default port.)
3. Check the “TwinCAT RT-Ethernet Filter Driver”, as shown here:

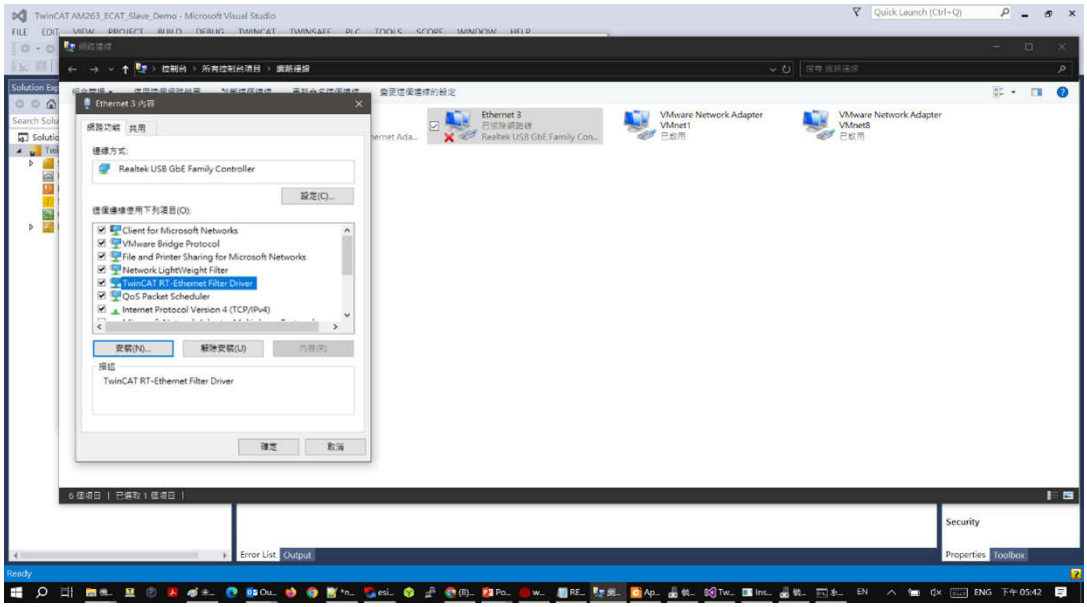

Figure 5-1. TWINCAT Driver in the Network Setting

4. Install the TWINCAT.

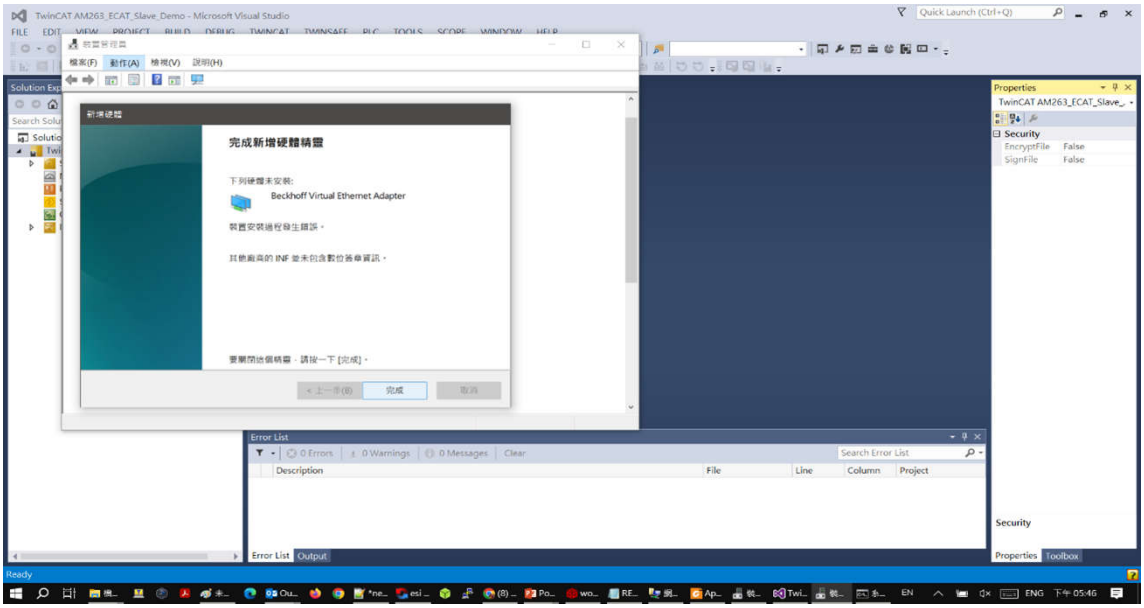

Figure 5-2. Installed the TWINCAT Driver Completed

5. Go to the device manager, check “Network adapters”, and check if this one is present: TwinCAT Intel PCI Ethernet Adapter (Gigabit), as in the following:

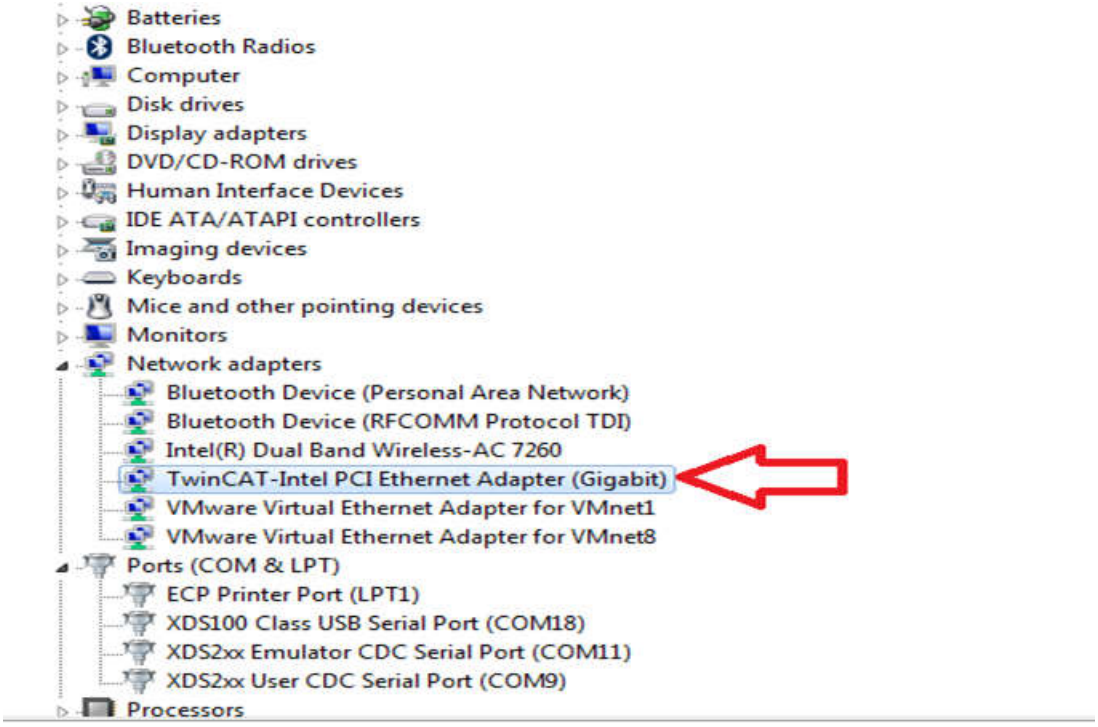

Figure 5-3. TWINCAT Intel Driver Installed in the DevMgr

6. Launch the TWINCAT XAE.
7. Go to “Device”, Click “Scan”, as in following:

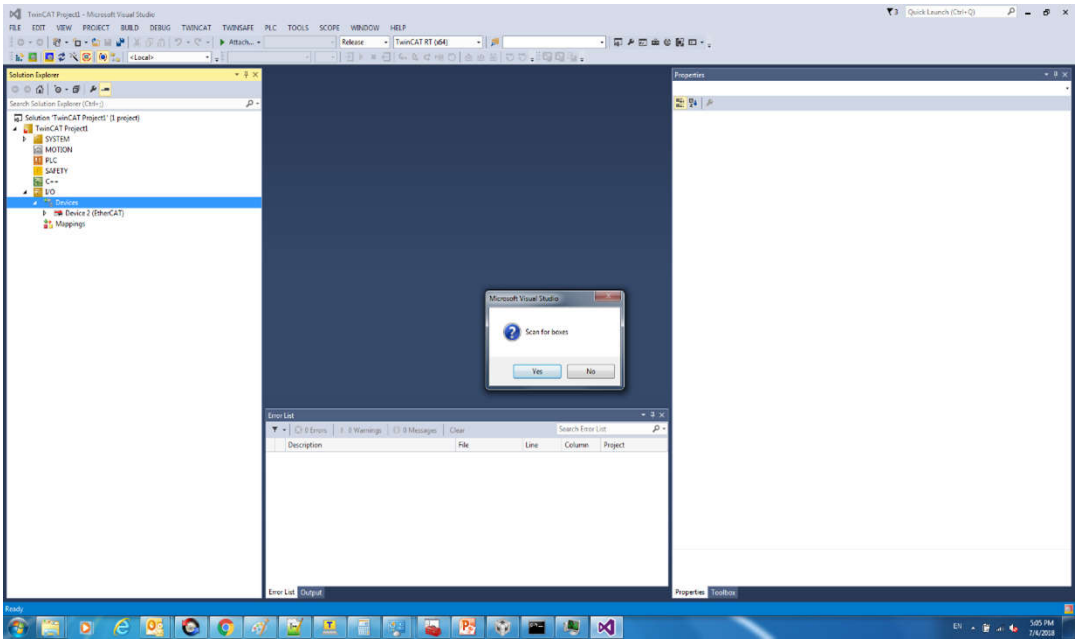

Figure 5-4. Scan the Box

8. This “Activate Free Run” is a mandatory key step, without this box showing, the TwinCAT will not work.

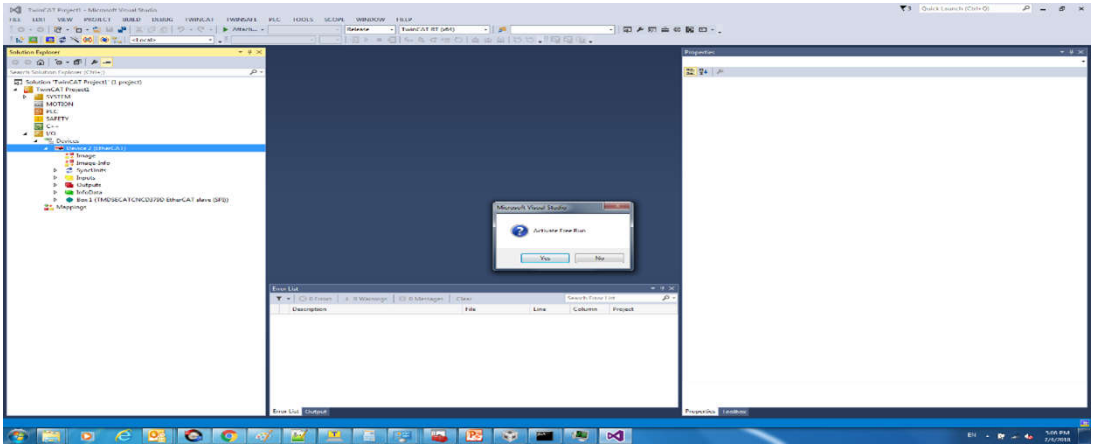

Figure 5-5. Activate Free Run Example

6 Demo

Google this keyword: TI Rio AM263 on YouTube.

The user can see this demo movie and can control the LED on/off on the AM262 EVM through EtherCAT protocol.

7 References

- TI AM263 EVM User guide: https://www.ti.com/lit/an/sprade4/sprade4.pdf
- VS Studio TWINCAT: https://infosys.beckhoff.com/english.php?content=../content/1033/tc3_installation/179467147.html&id=
- Beckoff Content: https://infosys.beckhoff.com/english.php?content=../content/1033/tc3_overview/9309844363.html&id
- Beckoff ETH Driver: https://infosys.beckhoff.com/english.php?content=../content/1033/EtherCATsystem/1036996875.html&id=
- TwinCAT setup: https://cstweb.wtb.tue.nl/4tc00/TwinCAT/setup.html
- TI TwinCAT setup: https://software-dl.ti.com/processor-industrial-sw/esd/ind_comms_sdk/am263x/latest/docs/api_guide_am263x/ETHERCAT_SUBDEVICE_DEMO_TWINCAT.html

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