phyBOARD®-Wega-AM335x

Application Guide

Document No.:	**L-802e_0**
SBC Prod. No..:	**PB-00802-xxx**
CB PCB No.:	**1405.0**
SOM PCB No.:	**1397.0**

Edition: July 2014

	EUROPE	NORTH AMERICA
Address:	PHYTEC Messtechnik GmbH Robert-Koch-Str. 39 D-55129 Mainz GERMANY	PHYTEC America LLC 203 Parfitt Way SW, Suite G100 Bainbridge Island, WA 98110 USA
Ordering Information:	+49 (6131) 9221-32 sales@phytec.de	1 (800) 278-9913 sales@phytec.com
Technical Support:	+49 (6131) 9221-31 support@phytec.de	1 (800) 278-9913 support@phytec.com
Fax:	+49 (6131) 9221-33	1 (206) 780-9135
Web Site:	http://www.phytec.de http://www.phytec.eu	http://www.phytec.com

Preliminary Edition Juli 2014

List of Figures

List of Tables

Conventions, Abbreviations and Acronyms

This hardware manual describes the PB-00802-xxx Singe Board Computer (SBC) in the following referred to as phyBOARD-Wega-AM335x. The manual specifies the phyBOARD-Wega-AM335x's design and function. Precise specifications for the Texas Instruments AM335x microcontrollers can be found in the Texas Instrumenten's AM335x Data Sheet and Technical Reference Manual.

Conventions

The conventions used in this manual are as follows:

- Signals that are preceded by an "n", "/", or “#”character (e.g.: nRD, /RD, or #RD), or that have a dash on top of the signal name (e.g.: $\overline{RD}$) are designated as active low signals. That is, their active state is when they are driven low, or are driving low.
- A "0" indicates a logic zero or low-level signal, while a "1" represents a logic one or high-level signal.
- The hex-numbers given for addresses of I^2C devices always represent the 7 MSB of the address byte. The correct value of the LSB which depends on the desired command (read (1), or write (0)) must be added to get the complete address byte. E.g. given address in this manual 0x41 => complete address byte = 0x83 to read from the device and 0x82 to write to the device.
- Tables which describe jumper settings show the default position in **bold, blue text.**
- Text in *blue italic* indicates a hyperlink within, or external to the document. Click these links to quickly jump to the applicable URL, part, chapter, table, or figure.

Abbreviations and Acronyms

Many acronyms and abbreviations are used throughout this manual. Use the table below to navigate unfamiliar terms used in this document.

Abbreviation	Definition
A/V	Audio/Video
BSP	Board Support Package (Software delivered with the Development Kit including an operating system (Windows, or Linux) preinstalled on the module and Development Tools).
CB	Carrier Board; used in reference to the phyBOARD-Wega Development Kit Carrier Board.
DFF	D flip-flop.
DSC	Direct Solder Connect
EMB	External memory bus.
EMI	Electromagnetic Interference.
GPI	General purpose input.
GPIO	General purpose input and output.
GPO	General purpose output.
IRAM	Internal RAM; the internal static RAM on the Texas Instruments AM335x microcontroller.
J	Solder jumper; these types of jumpers require solder equipment to remove and place.
JP	Solderless jumper; these types of jumpers can be removed and placed by hand with no special tools.
NC	Not Connected
PCB	Printed circuit board.
PDI	PHYTEC Display Interface; defined to connect PHYTEC display adapter boards, or custom adapters
PEB	PHYTEC Extension Board
PMIC	Power management IC
PoE	Power over Ethernet
PoP	Package on Package
POR	Power-on reset
RTC	Real-time clock.
SBC	Single Board Computer; used in reference to the PBA-CD-02 /phyBOARD-Wega-AM335x module
SMT	Surface mount technology.
SOM	System on Module; used in reference to the PCL-051 /phyCORE-AM335x module
Sx	User button Sx (e.g. S1, S2) used in reference to the available user buttons, or DIP-Switches on the CB.
Sx_y	Switch y of DIP-Switch Sx; used in reference to the DIP-Switch on the carrier board.
VSTBY	SOM standby voltage input

Table 1: Abbreviations and Acronyms used in this Manual

	At this icon you might leave the path of this Application Guide.
	This is a warning. It helps you to avoid annoying problems.
	You can find useful supplementary information about the topic.
	At the beginning of each chapter you can find information about the time required to read the following chapter.
	You have successfully completed an important part of this Application Guide.
	You can find information to solve problems.

Note: The BSP delivered with the phyBOARD-Wega-AM335x usually includes drivers and/or software for controlling all components such as interfaces, memory, etc. Therefore programming close to hardware at register level is not necessary in most cases. For this reason, this manual contains no detailed description of the controller's registers. Please refer to the AM335x Technical Reference Manual, if such information is needed to connect customer designed applications.

Preface

As a member of PHYTEC's new phyBOARD® product family the phyBOARD-Wega-AM335x is one of a series of PHYTEC System on Modules (SBCs) that offers various functions and configurations. PHYTEC supports a variety of 8-/16- and 32-bit controllers in two ways:

(1) as the basis for Rapid Development Kits which serve as a reference and evaluation platform

(2) as insert-ready, fully functional phyBOARD® OEM modules, which can be embedded directly into the user's peripheral hardware design.

Implementation of an OEM-able SBC subassembly as the "core" of your embedded design allows you to focus on hardware peripherals and firmware without expending resources to "re-invent" microcontroller circuitry. Furthermore, much of the value of the phyBOARD® SBC lies in its layout and test.

PHYTEC's new phyBOARD® product family consists of a series of extremely compact embedded control engines featuring various processing performance classes.

Production-ready Board Support Packages (BSPs) and Design Services for our hardware will further reduce your development time and risk and allow you to focus on your product expertise. Take advantage of PHYTEC products to shorten time-to-market, reduce development costs, and avoid substantial design issues and risks. With this new innovative full system solution you will be able to bring your new ideas to market in the most timely and cost-efficient manner.

For more information go to:

http://www.phytec.de/de/leistungen/entwicklungsunterstuetzung.html or www.phytec.eu/europe/oem-integration/evaluation-start-up.html

Ordering Information

Ordering numbers:
phyBOARD-Wega-AM335x Development Kit: **KPB-00802-xxx**
phyBOARD-Wega-AM335x SBC: **PB-00802-xxx**

In order to receive product specific information on changes and updates in the best way also in the future, we recommend to register at

http://www.phytec.de/de/support/registrierung.html or
http://www.phytec.eu/europe/support/registration.html

For technical support and additional information concerning your product, please visit the support section of our web site which provides product specific information, such as errata sheets, application notes, FAQs, etc.

http://www.phytec.de/de/support/faq/faq-phyBOARD-Wega-AM335x.html or
http://www.phytec.eu/europe/support/faq/faq-phyBOARD-Wega-AM335x.html

Declaration of Electro Magnetic Conformity of the PHYTEC phyBOARD-Wega-AM335x

PHYTEC Single Board Computers (henceforth products) are designed for installation in electrical appliances or as dedicated Evaluation Boards (i.e.: for use as a test and prototype platform for hardware/software development) in laboratory environments.

Caution:
PHYTEC products lacking protective enclosures are subject to damage by ESD and, hence, may only be unpacked, handled or operated in environments in which sufficient precautionary measures have been taken in respect to ESD-dangers. It is also necessary that only appropriately trained personnel (such as electricians, technicians and engineers) handle and/or operate these products. Moreover, PHYTEC products should not be operated without protection circuitry if connections to the product's pin header rows are longer than 3 m.

PHYTEC products fulfill the norms of the European Union's Directive for Electro Magnetic Conformity only in accordance to the descriptions and rules of usage indicated in this hardware manual (particularly in respect to the pin header row connectors, power connector and serial interface to a host-PC).

Implementation of PHYTEC products into target devices, as well as user modifications and extensions of PHYTEC products, is subject to renewed establishment of conformity to, and certification of, Electro Magnetic Directives. Users should ensure conformance following any modifications to the products as well as implementation of the products into target systems.

Product Change Management and information in this manual on parts populated on the SOM / SBC

When buying a PHYTEC SOM / SBC, you will, in addition to our HW and SW offerings, receive a free obsolescence maintenance service for the HW we provide.

Our PCM (Product Change Management) Team of developers, is continuously processing, all incoming PCN's (Product Change Notifications) from vendors and distributors concerning parts which are being used in our products.

Possible impacts to the functionality of our products, due to changes of functionality or obsolesce of a certain part, are being evaluated in order to take the right masseurs in purchasing or within our HW/SW design.

Our general philosophy here is: **We never discontinue a product as long as there is demand for it.**

Therefore we have established a set of methods to fulfill our philosophy:

Avoiding strategies

- Avoid changes by evaluating long-livety of parts during design in phase.
- Ensure availability of equivalent second source parts.
- Stay in close contact with part vendors to be aware of roadmap strategies.

Change management in case of functional changes

- Avoid impacts on product functionality by choosing equivalent replacement parts.
- Avoid impacts on product functionality by compensating changes through HW redesign or backward compatible SW maintenance.
- Provide early change notifications concerning functional relevant changes of our products.

Change management in rare event of an obsolete and non replaceable part

- Ensure long term availability by stocking parts through last time buy management according to product forecasts.
- Offer long term frame contract to customers.

Therefore we refrain from providing detailed part specific information within this manual, which can be subject to continuous changes, due to part maintenance for our products.

In order to receive reliable, up to date and detailed information concerning parts used for our product, please contact our support team through the contact information given within this manual.

1 Introduction

1.1 Hardware Overview

The phyBOARD-Wega for phyCORE-AM335x is a low-cost, feature-rich software development platform supporting the Texas Instruments AM335x microcontroller. Moreover, due to the numerous standard interfaces the phyBOARD-Wega-AM335x can serve as bedrock for your application. At the core of the phyBOARD-Wega is the PCL-051/phyCORE-AM335x System On Module (SOM) in a direct solder form factor, containing the processor, DRAM, NAND Flash, power regulation, supervision, transceivers, and other core functions required to support the AM335x processor. Surrounding the SOM is the PBA-CD-002/phyBOARD-Wega carrier board, adding power input, buttons, connectors, signal breakout, and Ethernet connectivity amongst other things.

The PCL-051 System On Module is a connector-less, BGA style variant of the PCM-051/phyCORE-AM335x SOM. Unlike traditional PHYTEC SOM products that support high density connectors, the PCL-051 SOM is directly soldered down to the phyBOARD-Wega using PHYTEC's Direct Solder Connect technology. This solution offers an ultra-low cost Single Board Computer for the AM335x processor, while maintaining most of the advantages of the SOM concept.

Adding the phyCORE-AM335x SOM into your own design is as simple as ordering the connectored version (PCM-051) and making use of our phyCORE Carrier Board (PCM-953) reference schematics.

1.1.1 Features of the phyBOARD-Wega-AM335x

The phyBOARD-Wega-AM335x supports the following features :

- PHYTEC’s phyCORE-AM335x SOM with Direct Solder Connect (DSC)
- Pico ITX standard dimensions (100 mm × 72 mm)
- Boot from MMC or NAND Flash
- Max. 1 GHz core clock frequency
- Three different power supply options (5 V only with 3.5 mm combicon or micro USB connector; external power module e.g. 12 V – 24 V input voltage)
- Two RJ45 jacks for 10/100 Mbps Ethernet
- One USB Host interface brought out to an upright USB Standard-A connector or at the expansion connector
- One USB OTG interface available at an USB Micro-AB connector at the back side
- One Secure Digital / Multi Media Memory Card interface brought out to a Micro-SD connector at the back side
- CAN interface at 5×2 pin header 2.54 mm

- Audiocodec with Stereo Line In and Line Out (3×2 pin header 2.54 mm) and mono speaker (2-pole Molex)
- RS-232 transceiver supporting UART1 incl. handshake signals with data rates of up to 1 Mbps (5×2 pin header 2.54 mm)
- Reset-Button
- Audio/Video (A/V) connectors
- Expansion connector
- Backup battery supply for RTC with Goldcap (lasts approx. 17 ½ days)

1.1.2 View of the phyBOARD-Wega-AM335x

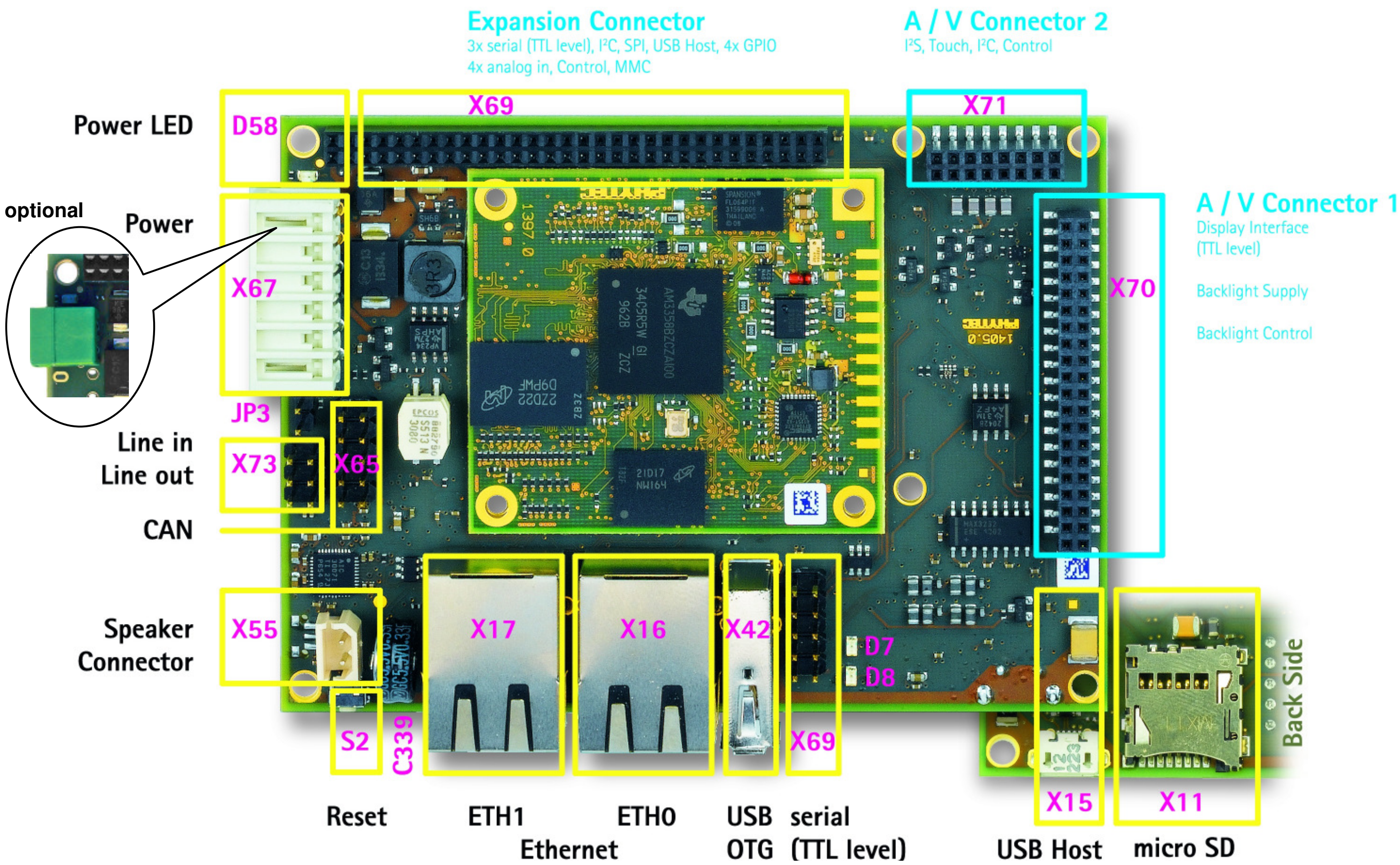


Figure 1: View of the phyBOARD-Wega-AM335x

1.1.3 Block Diagram

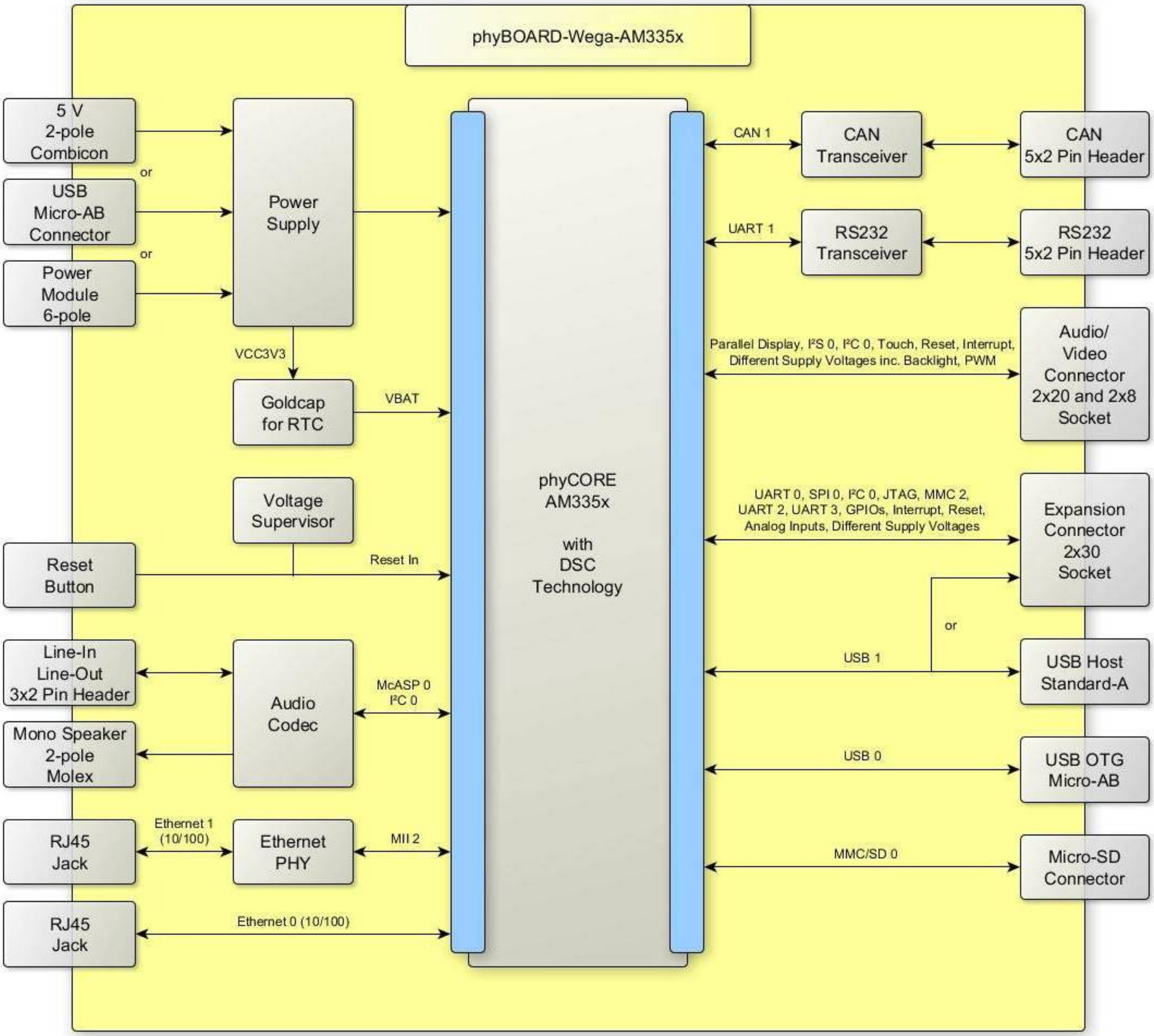


Figure 2: Block Diagram of the phyBOARD-Wega-AM335x

1.2 Software Overview

1.2.1 Visual Studio 2012

Visual Studio 2012 or Visual Studio 2013, as the main populated development IDE by Microsoft, is used to developing applications, drivers and board support packages for Windows Embedded Compact 2013 (WEC2013). You will find a trial version of VS2012/2013 on the following links:

Visual Studio 2012 Professional Trial:

http://www.microsoft.com/en-us/download/details.aspx?id=30682

Visual Studio 2013 Professional Trial:

http://www.microsoft.com/en-us/download/details.aspx?id=40763

Please install only one of the Visual Studio first. In the following chapters is Visual Studio 2012 used. If you decide to use VS 2013 you have to build your own Software Development KIT (SDK) which is needed to build Applications for WEC2013. After the installation you need the Application Builder for Windows Embedded Compact 2013. The application builder is needed to develop applications for WEC2013 devices:

Application Builder for Windows Embedded Compact 2013:

http://www.microsoft.com/en-us/download/details.aspx?id=38819

It could be that some of the upper links are not up-to-date. Therefore you have to use Google to find the development tools by your own.

1.2.2 Windows Embedded Compact 2013

Windows Embedded Compact 2013 is a plugin for Visual Studio to build and develop a board support package (BSP) for a target device like the phyBOARD-WEGA. If you have the tendency to compile a WEC2013 BSP by yourself, you have to install WEC2013. Otherwise if you decided to develop applications for WEC2013 only then it is not necessary to install WEC2013. In the further chapters are described both development practice.

Windows Embedded Compact 2013 Trial:

http://www.microsoft.com/windowsembedded/en-us/downloads.aspx

2 Getting Started

During this chapter you will learn how to build your own C++ application for the target with Visual Studio.

We establish that you have first step through our Quickstart Guide.

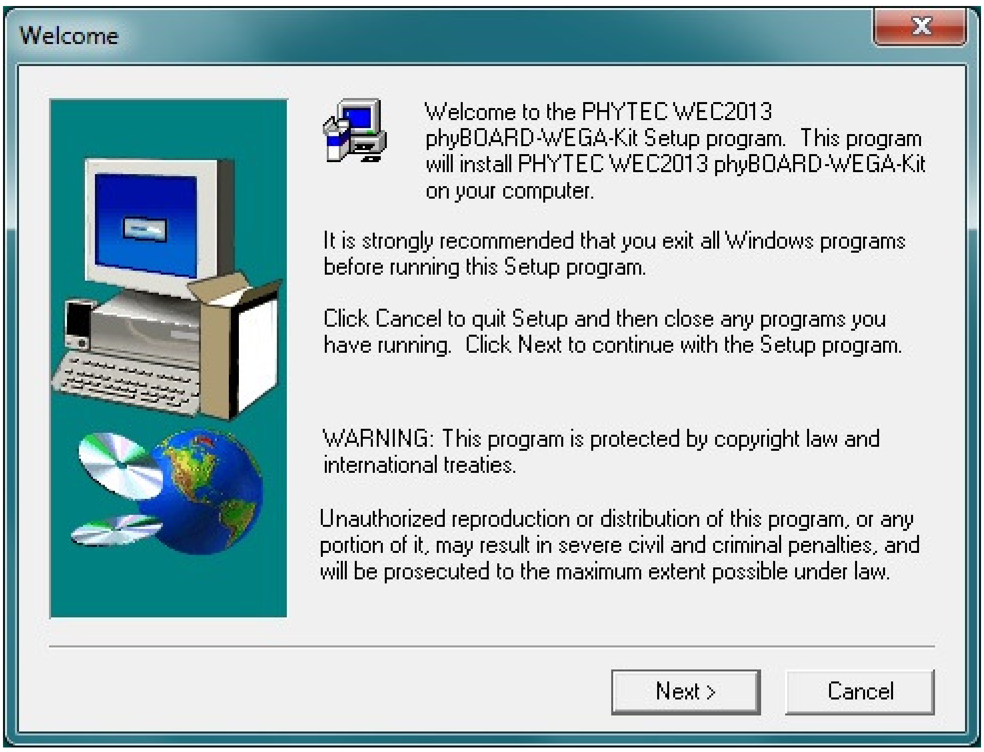
2.1 Installing the Phytec tool DVD for phyBOARD-WEGA

In this section you will find a description of the phyBOARD-WEGA tool DVD setup. This steup will install the following tools and programs:

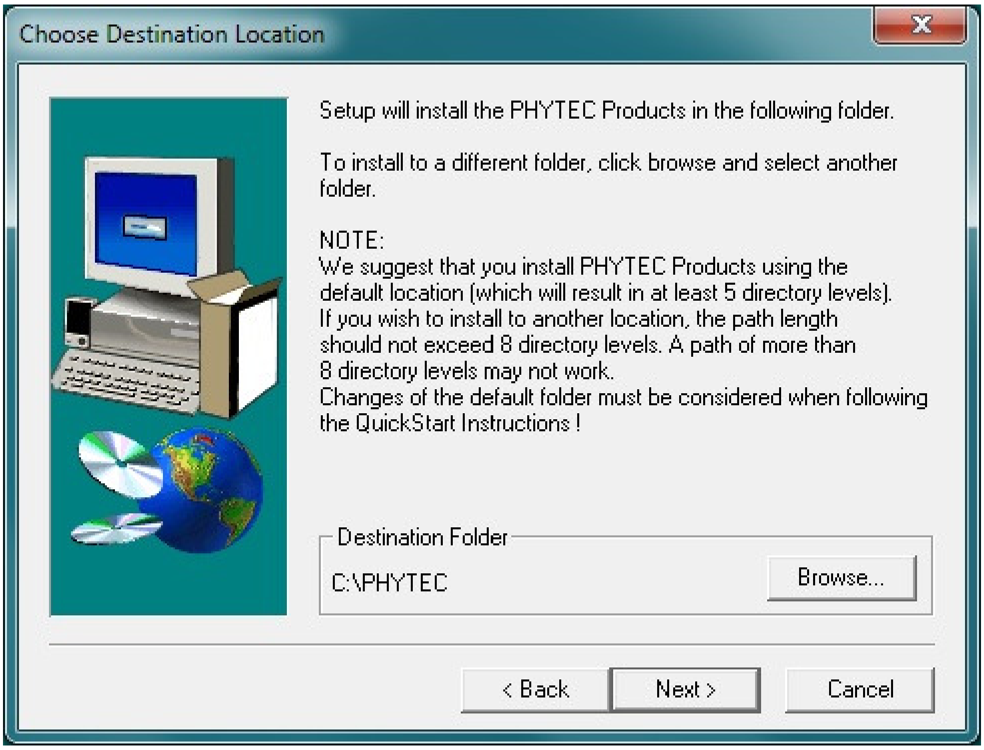
- SDK for phyBOARD-WEGA WEC2013
- A binary BSP for the phyBOARD-WEGA and a project to build an new image
- Example demo for Visual Studio 2012
- Digital versions hardware manuals for the phyBOARD-WEGA

The phyBOARD-WEGA SDK for WEC2013 is needed for writing target-oriented applications. It will integrate in the Visual Studio IDE, offering a new target device for code generation.

Insert the DVD "Tool DVD – phyBOARD-WEGA-AM335x" in your CDROM/DVD drive and start setup.exe.

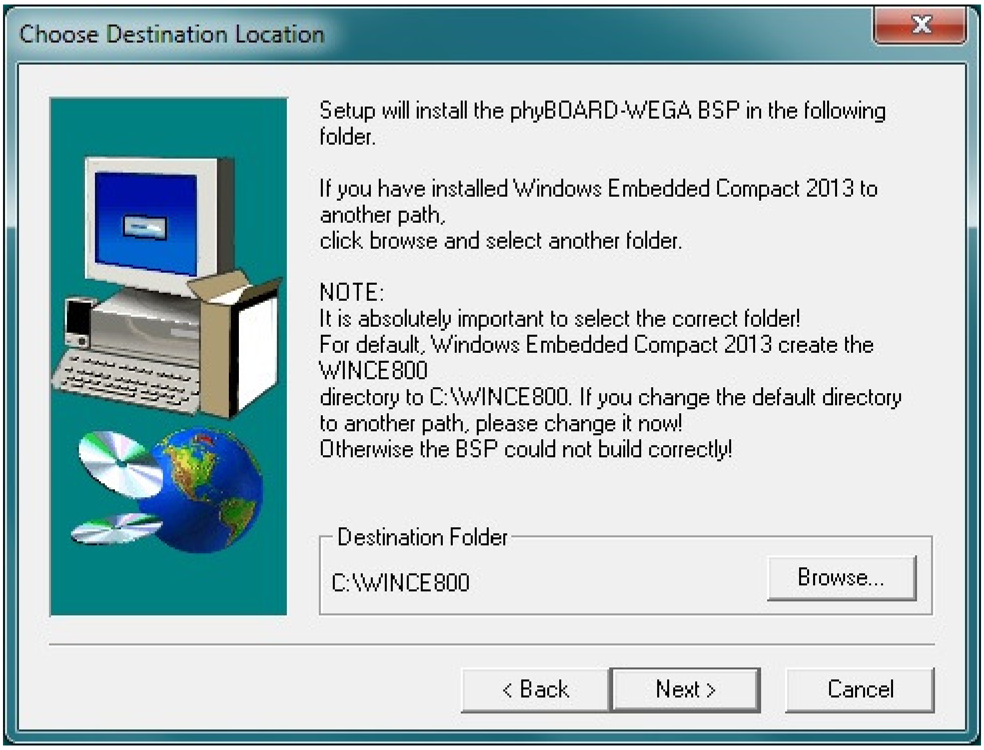


Click “Next” to choose your installation path for the Tool DVD. It is recommended to set the installation path as default “C:\Phytec”, because the default path is used in the following chapter in the Application Guide.



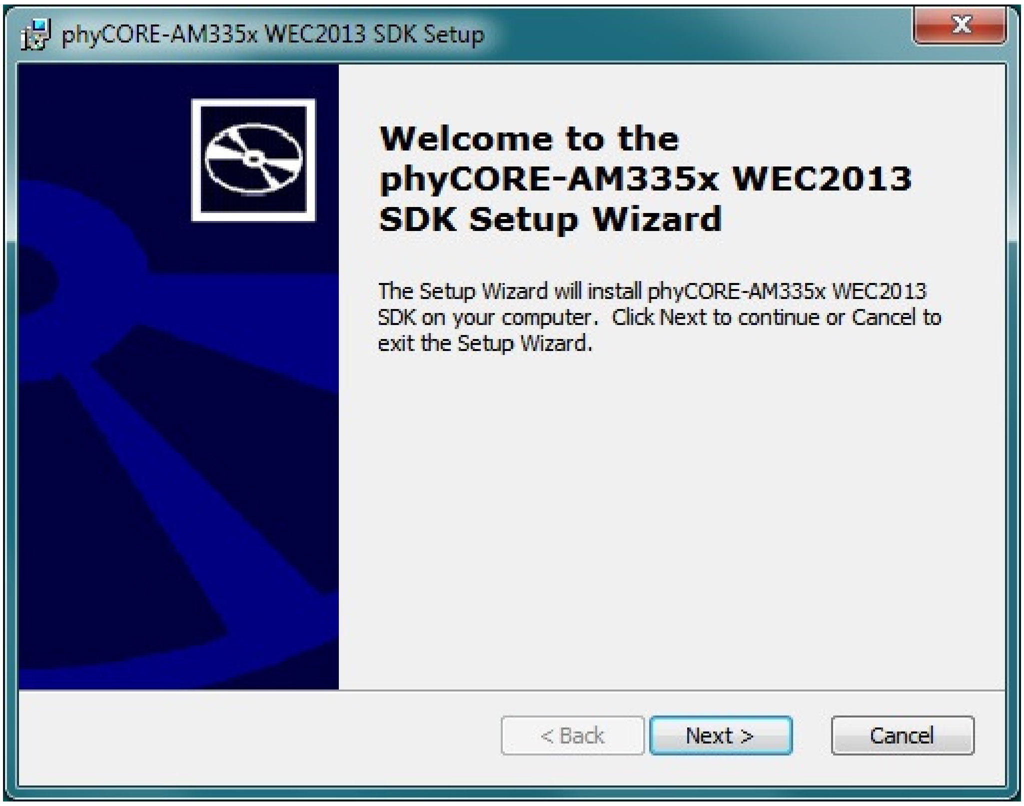
Click “Next” to continue for selecting the installation path for the BinaryBSP.

	It is absolutely important to select the correct path for the Binary BSP installation. The right path is where your Platform Builder installation was installed in the previous chapter. In example C:\WINCE800. Otherwise the BSP will not be able to build correctly.



In the next step you could choose where the Tool DVD takes place in the Program folder in Windows.

Now the Setup starts to copy the files to your path selection. After finishing, the sdk setup will be started.



Let all settings default during the installation. The setup is now finished and you will be able to go on with the next chapter to program your first application for Windows Embedded Compact 2013.

2.2 Working with Visual Studio 2012

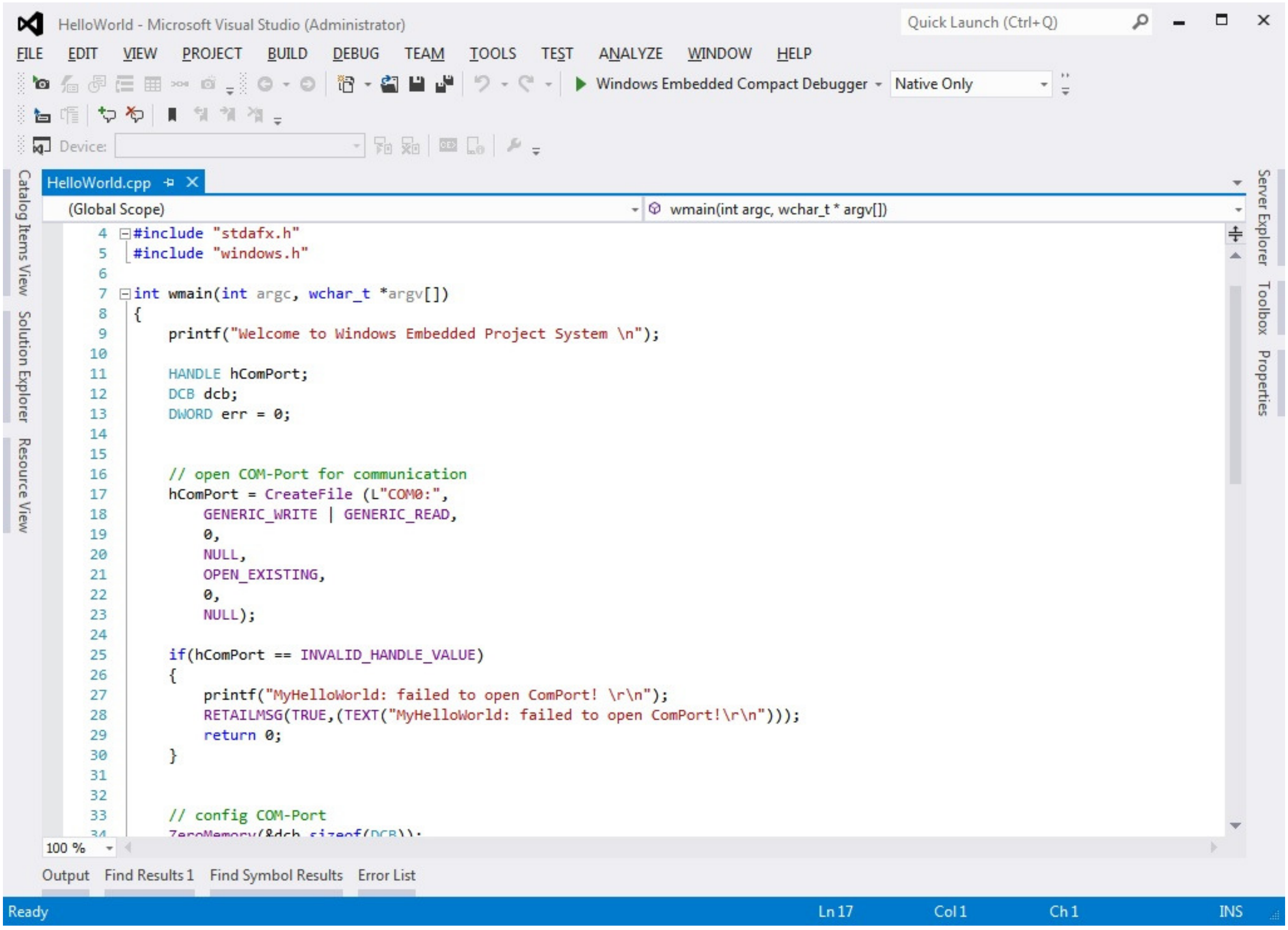
Now we start developing our own applications with the help of VS2012. First we will open and compile a demo application which put out some serial messages through the COM interface. After the successful start of the demo application we step deeper to develop your own application and debugging over Ethernet.

2.2.1.1 Work with the demo project

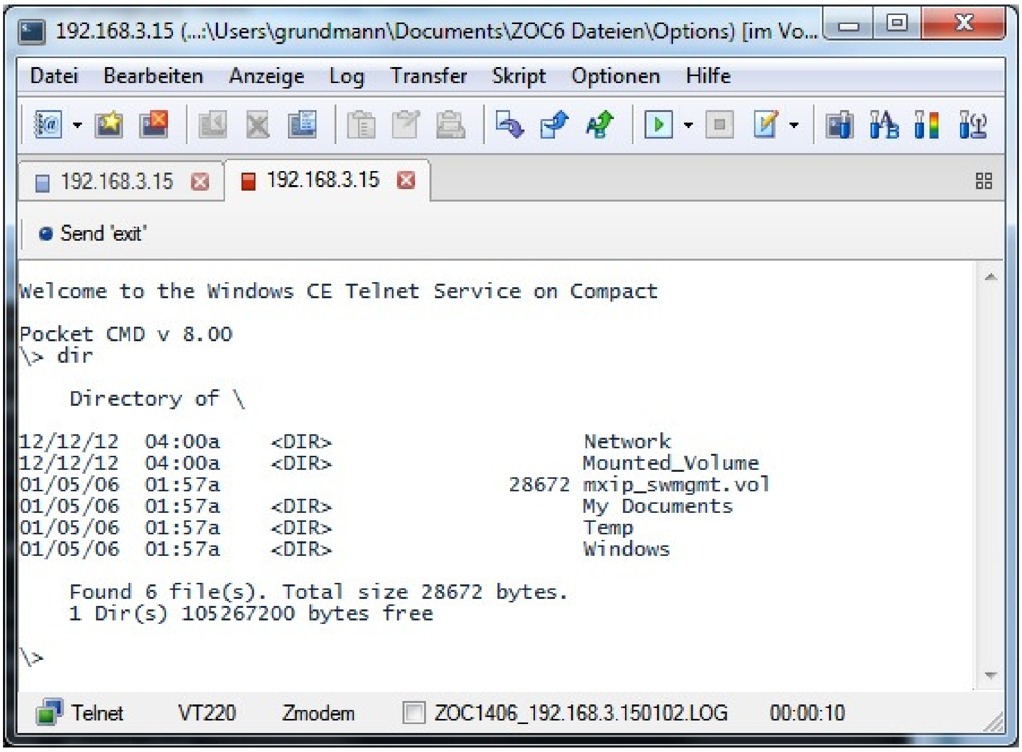
- Open the demo application project in the following path:

C:\PHYTEC\phyBOARD-WEGA\BSP\PD14.1.1\Demo\HelloWorld\HelloWorld.sln

- On the left site expand the Solution Explorer and Double Click on HelloWorld.cpp.

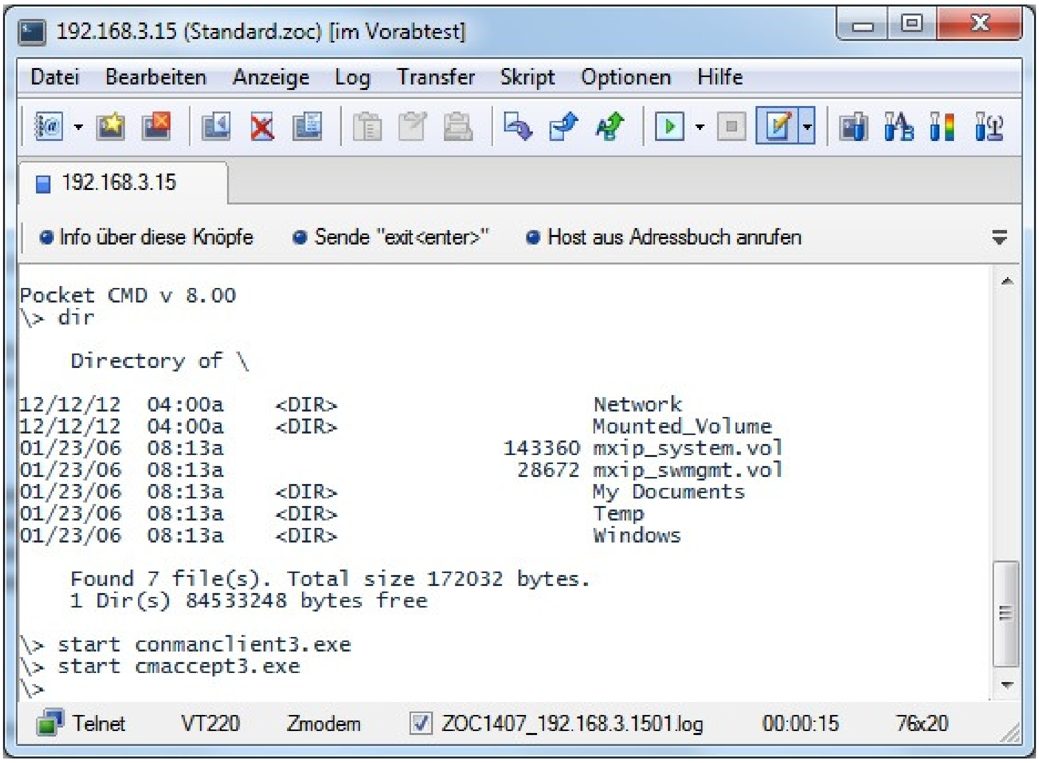


- Open a Telnet program of your choice and connect to the IP Address **192.168.3.15**
- Following screen should appear.

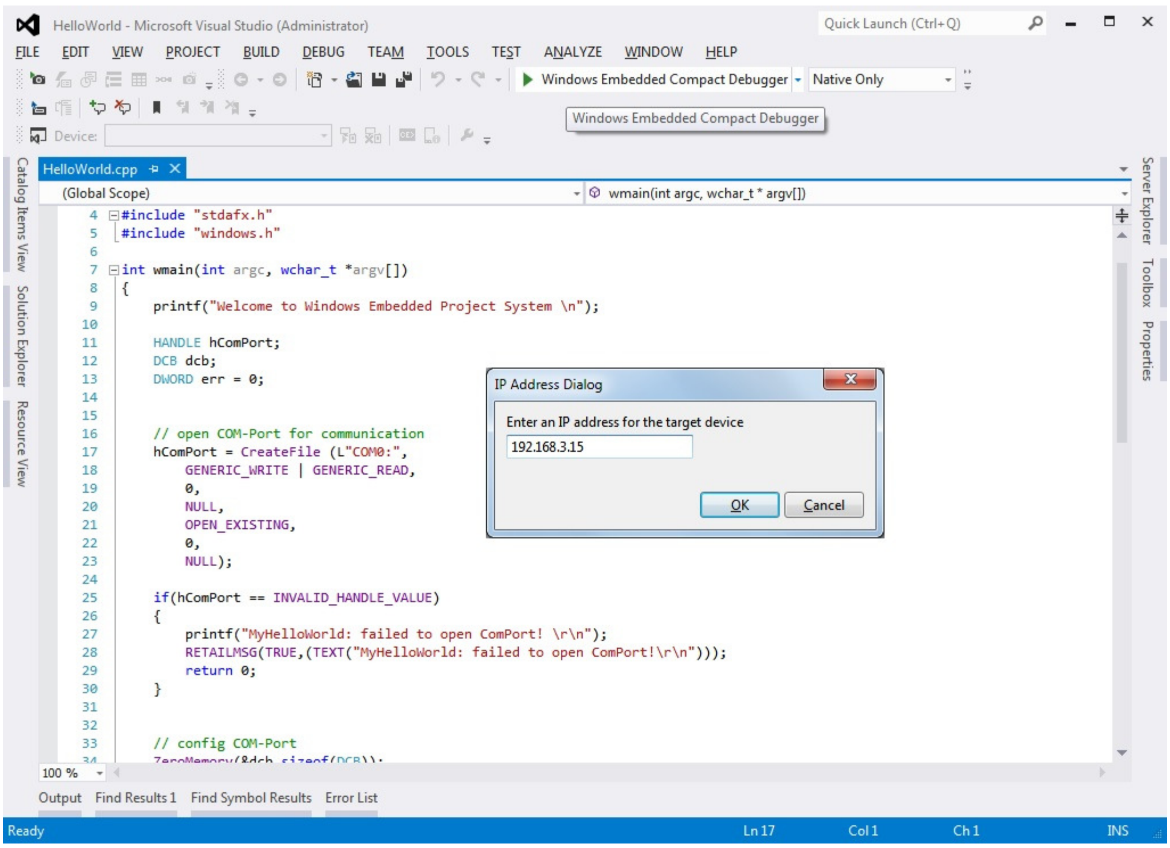


- To execute the demo application over Ethernet, you have to start two debug services on the device. Type the following commandos in your telnet program:
    - **start conmanclient3.exe**
    - **start cmaccept3.exe**

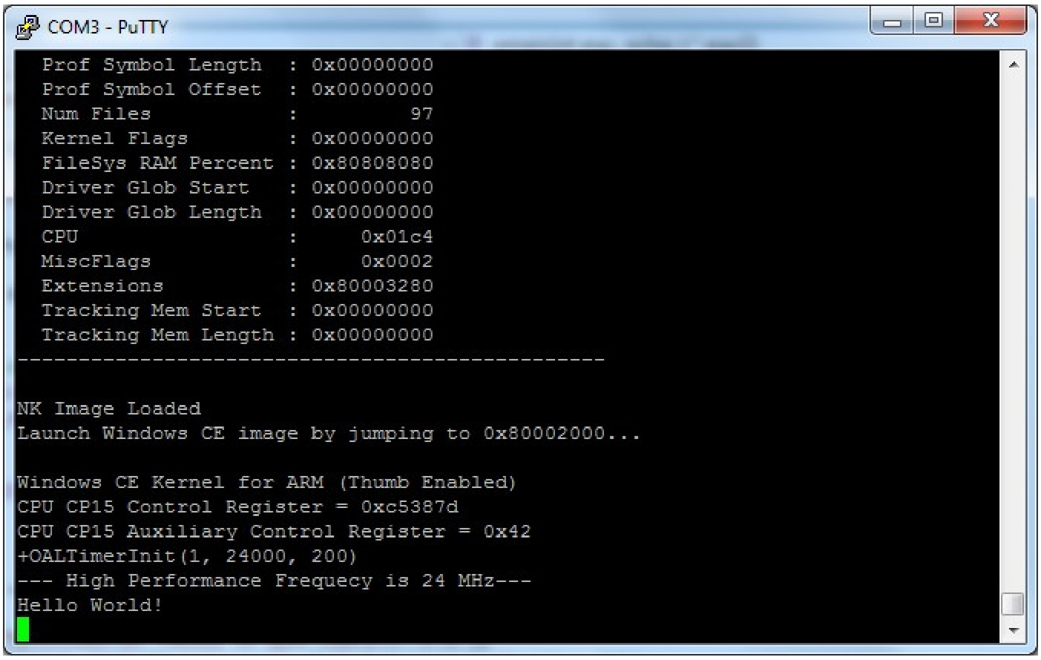
	NOTE: If you boot up the device, you have to start the service **conmanclient3.exe** once. The service **cmaccept3.exe** needs to be start before you will deploy or debug your application. The service **cmaccept3.exe** is closed automatically after 3 minutes. Be sure to connect your application with the device during this time period. Otherwise you have to start the **cmaccept3.exe** again.



- You are now able to start the demo application.
- Back to Visual Studio select “Windows Embedded Compact Debugger” and type the IP address of the device in the pop-up window.



- Click "OK" and the application starts compiling and will be automatically deploy and execute on the device.
- You should now see the following output on the serial terminal program if you have connected a serial cable to the PEB-EVAL-01 board.
- If you like to use the second serial port on the phyBOARD-WEGA, you have to change the parameter 1 of the "CreateFile" function to "**COM2:**"

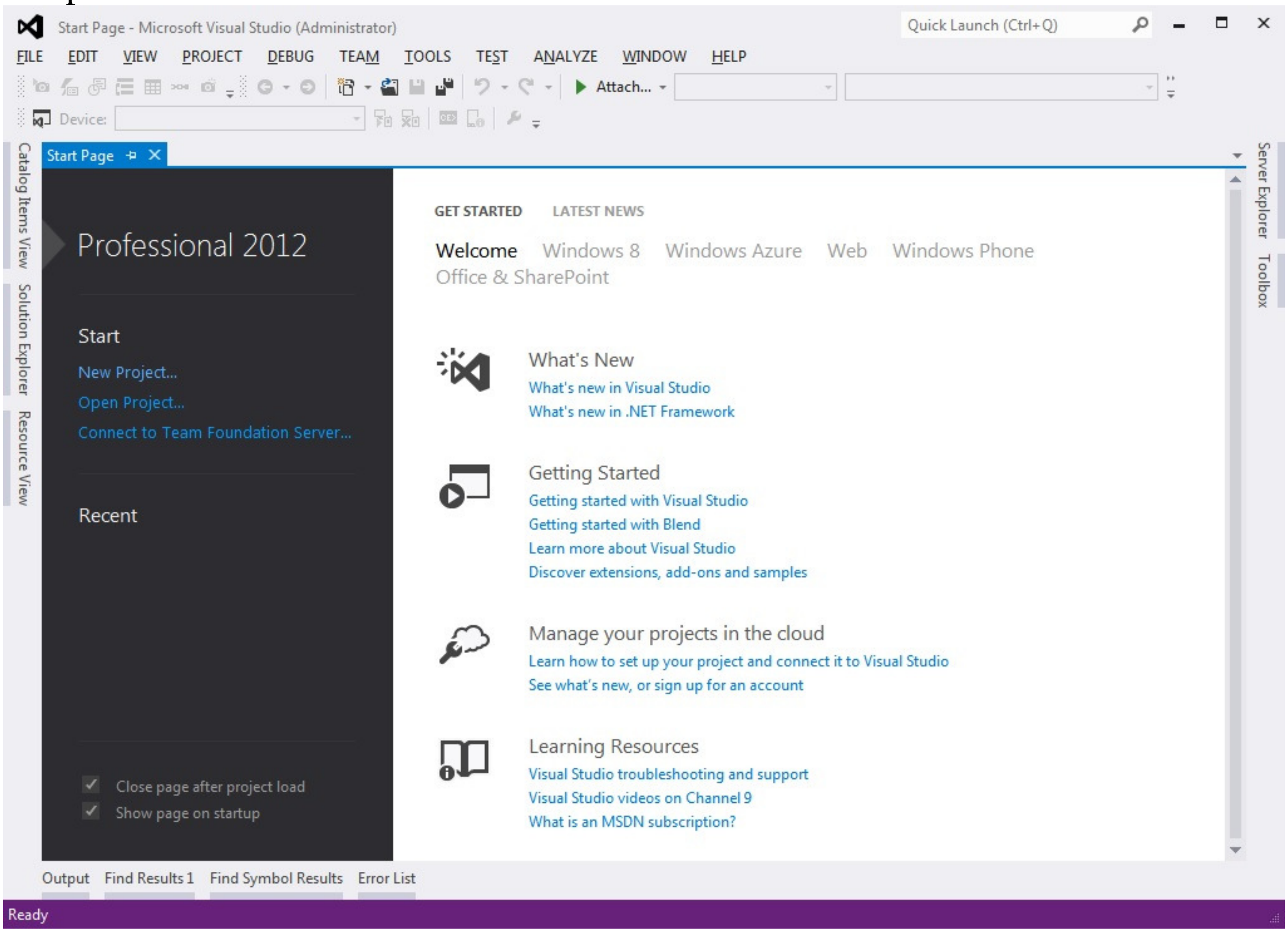


You have successfully passed the first steps with the demo application and Visual Studio 2012. You are now able to develop and debug your own application by using Visual Studio 2012.

2.2.1.2 Creating a New Project

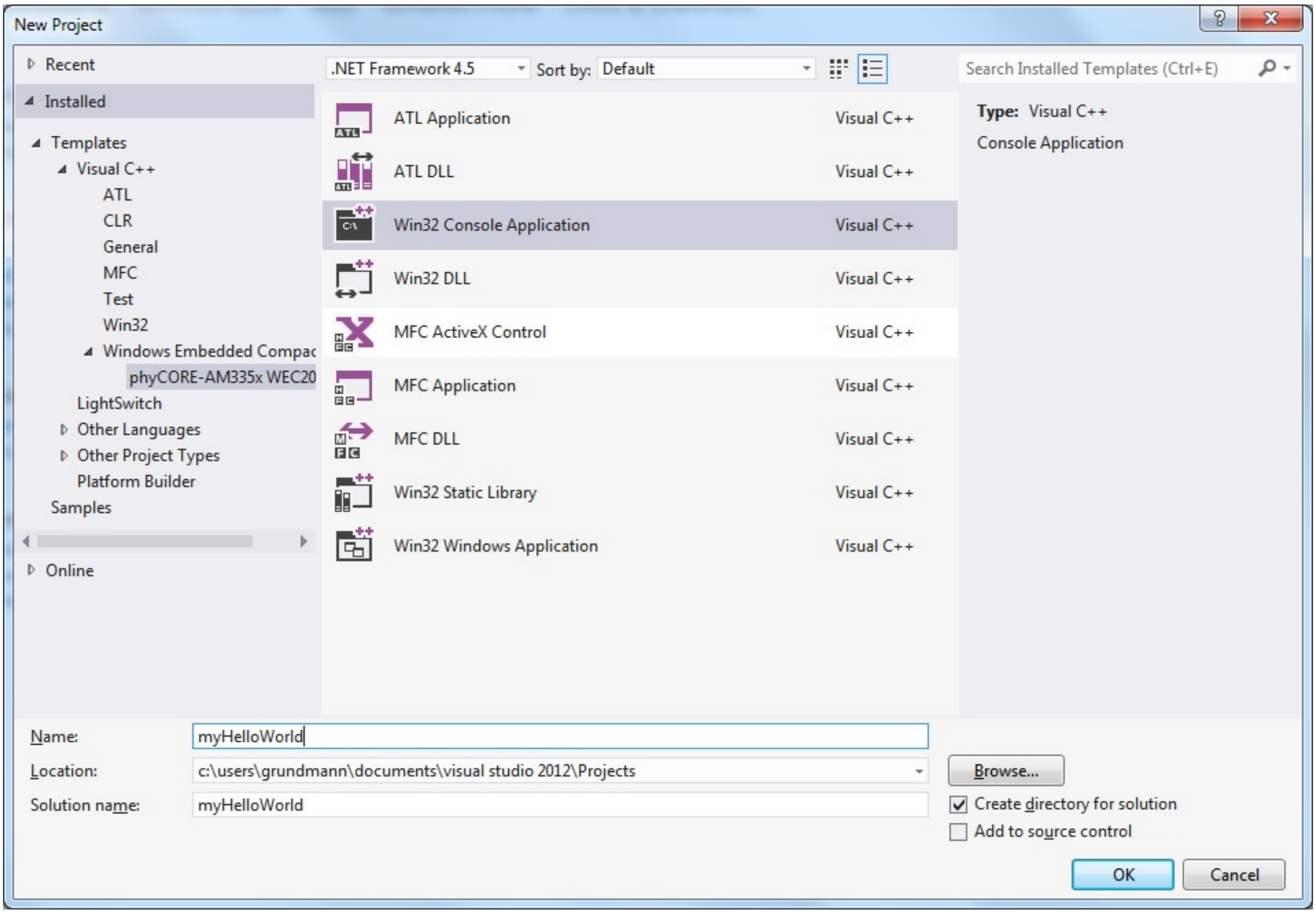
In this section you will learn how to create a new project with Visual Studio 2012 and how to debug your application over Ethernet.

- Open Visual Studio 2012

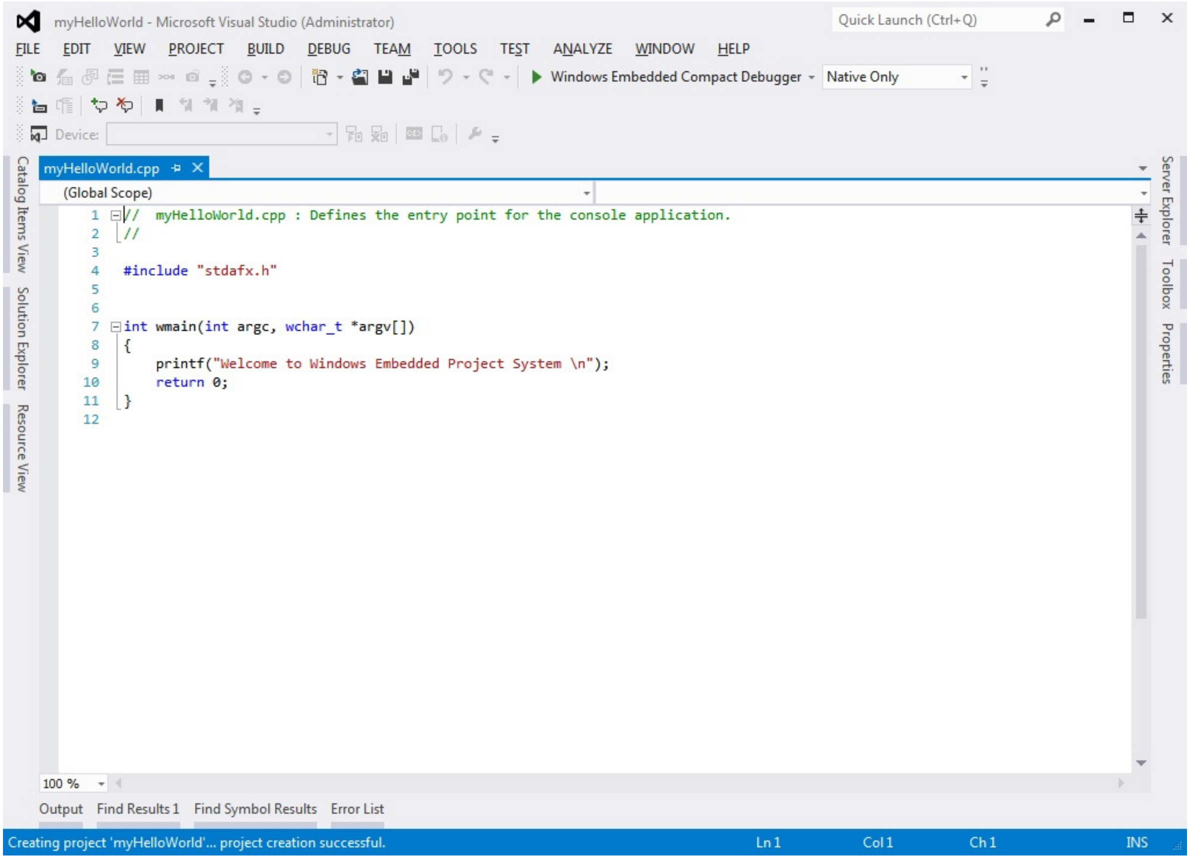


- Select *"New Project"* on the start screen.

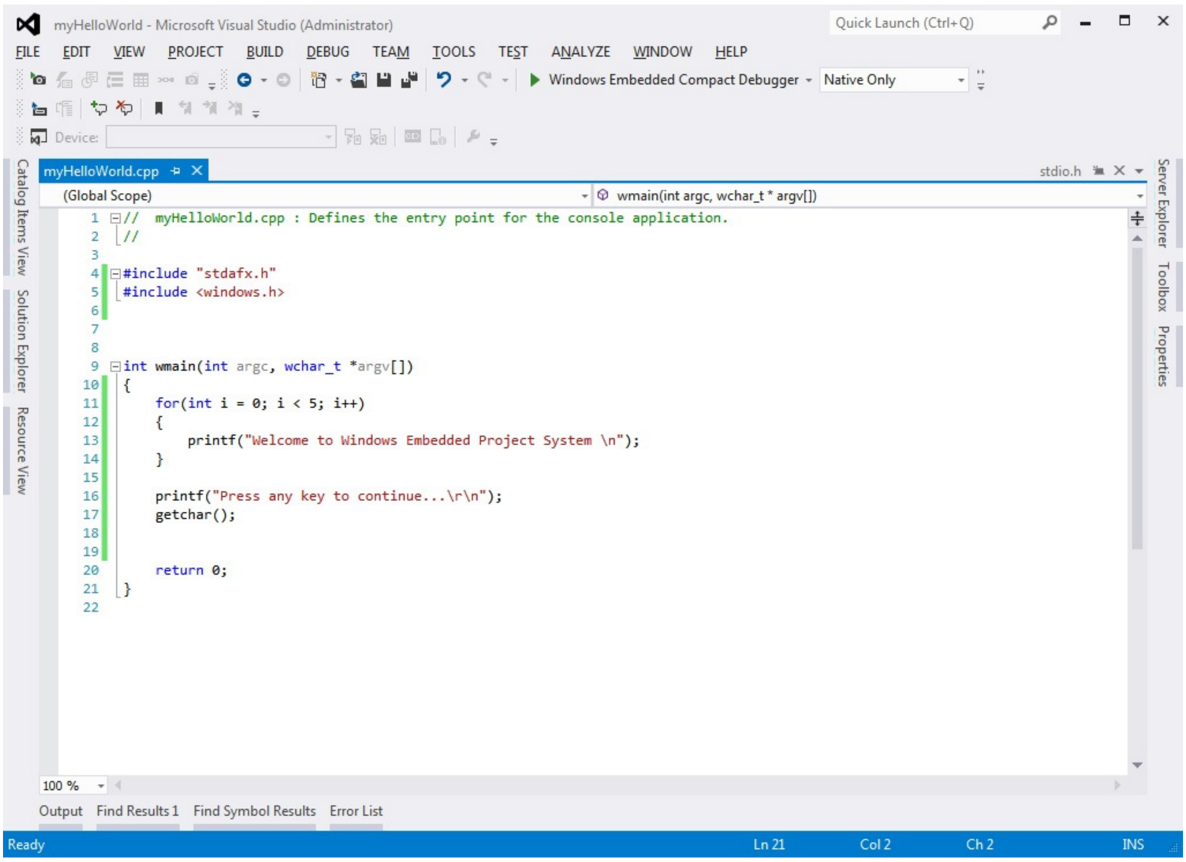
A new dialog opens



- Select “Templates -> Visual C++ -> Windows Embedded Compact -> phyCORE-AM335x WEC2013” on the left site
- On the right site select “Win32 Console Application” and type “myHelloWorld” as project name.
- Enter “OK” to start the wizard creating your application environment.
- Open “Solution Explorer” on the left site and open the myHelloWorld.cpp file.



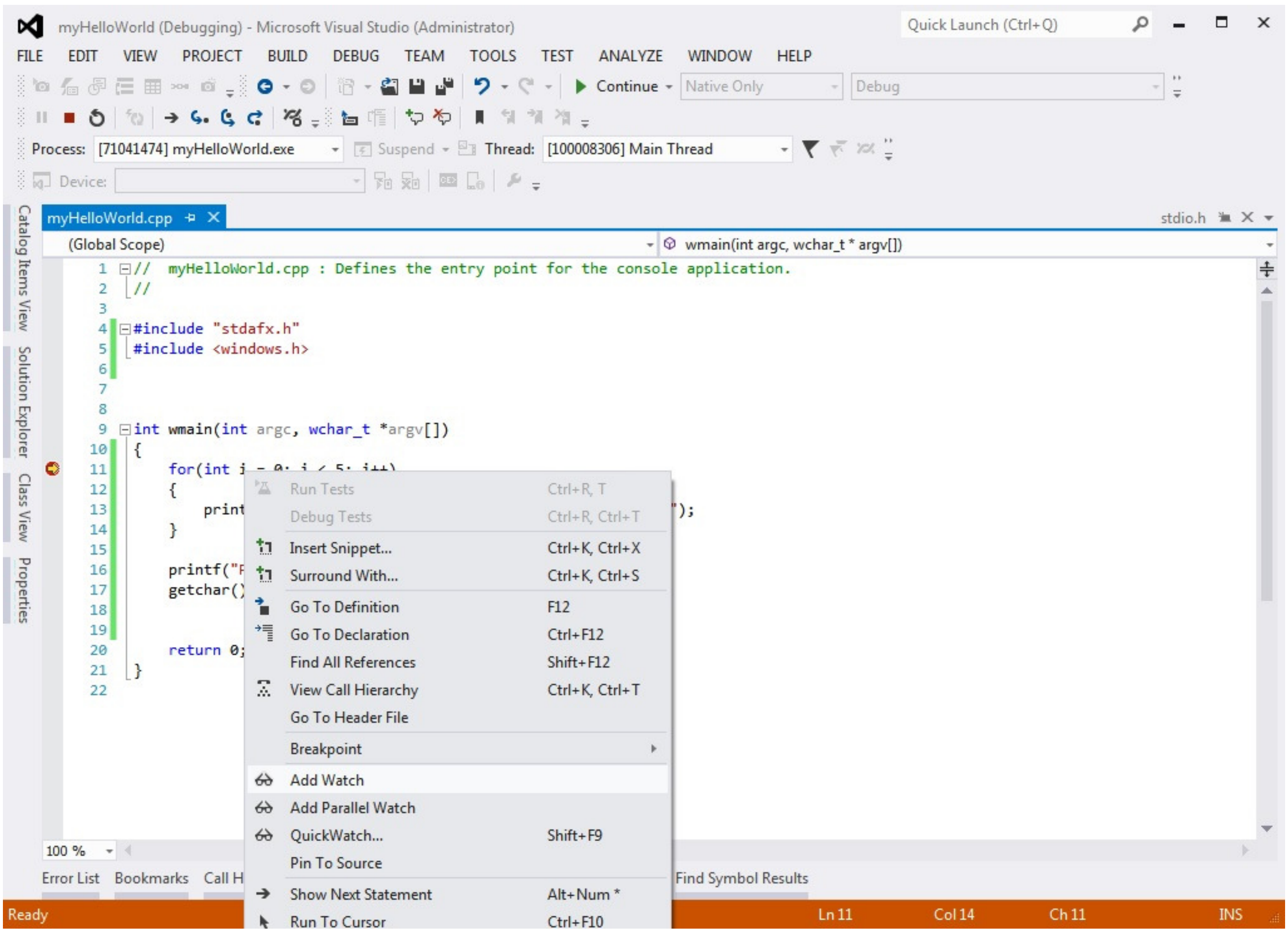
- Edit the source code like the following screen:



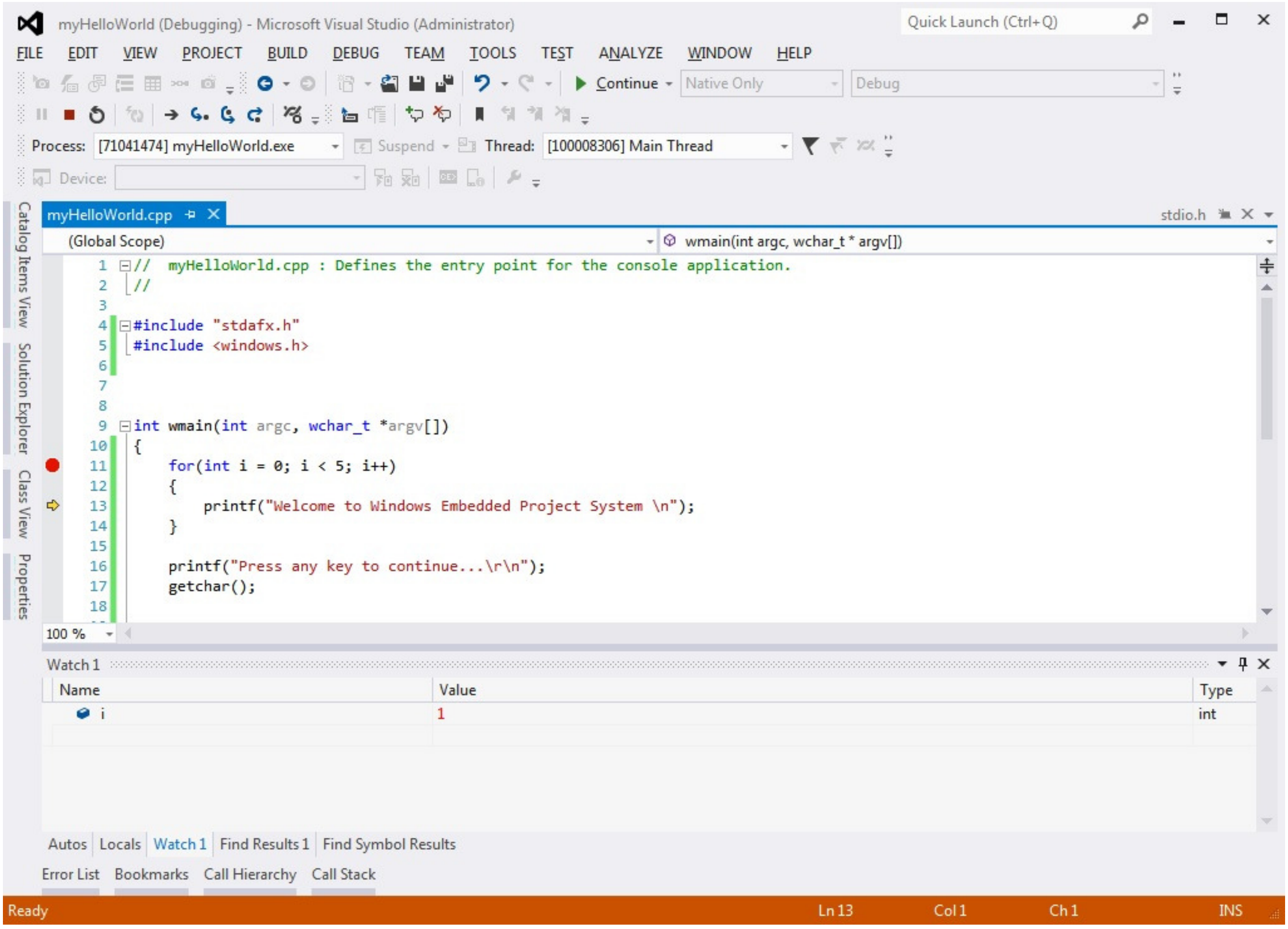
- Open a telnet program of your choice and connect to the IP address **192.168.3.15**
- Type the following commandos in your telnet program:
    - **start conmanclient3.exe**
    - **start cmaccept3.exe**

> NOTE: If you boot up the device, you have to start the service **conmanclient3.exe** once. The service **cmaccept3.exe** needs to be start before you will deploy or debug your application. The service **cmaccept3.exe** is closed automatically after 3 minutes. Be sure to connect your application with the device during this time period. Otherwise you have to start the **cmaccept3.exe** again.

- Back to Visual Studio 2012 set the cursor to line 11 an press F9 on your keyboard to enable a breakpoint.
- Click on "Windows Embedded Compact Debugger" to start the debug on the device.
- Enter the IP address **192.168.3.15** in the pop up window.
- The application should start and stop on the enabled breakpoint.
- Right-Click on the integer variable "i" and select "Add watch" to add the variable to the watch window.



- Press F10 to step further during the runtime of the application. If the "for" loop reaches the second time, the integer variable "i" should be increase and red highlighted.



- Click on the Value field and change the value to "5". Step further in the debug process and have a look at the command line window which output was generated.

You have successfully created your first own project with Visual Studio. You have configured the project to create an application for your target platform.

You are now ready prepared to start your project. The following section will give you detailed information on the different features and interfaces of the phyBOARD-Wega and how to use them within your application.

If your project is more complex, or if you crave more information about working with the BSP, continue with chapter 4. Chapter 4ff inlcude step by step instructions on how to modify and download the BSP using Platform Builder.

3 Accessing the phyBOARD-Wega Interfaces

PHYTEC phyBOARD-Wega is fully equipped with all mechanical and electrical components necessary for the speedy and secure start-up and subsequent communication to and programming of applicable PHYTEC System on Module (SOM) modules. phyBOARD-Wega Boards are designed for evaluation, testing and prototyping of PHYTEC System on Module in laboratory environments prior to their use in customer designed applications.

3.1 Concept of the phyBOARD-Wega

The phyBOARD-Wega provides a flexible development platform enabling quick and easy start-up and subsequent programming of its soldered phyCORE-AM335x System on Module. The carrier board design allows easy connection of additional extension boards featuring various functions that support fast and convenient prototyping and software evaluation. The carrier board is compatible with phyCORE-AM335x only.

This modular development platform concept includes the following components:

- the **phyCORE-AM335x module** populated by default with the AM3354 processor and all applicable SOM circuitry such as DDR SDRAM, Flash, PHYs, and transceivers to name a few.

- the **phyBOARD-Wega** which offers all essential components and connectors for start-up including: A power socket which enables connection to an **external power adapter**, interface connectors such as **DB-9**, **USB** and **Ethernet** allowing for use of the SOM's interfaces with standard cable.

The following sections contain specific information relevant to the operation of the phyCORE-AM335x mounted on the phyBOARD-Wega Carrier Board.

3.2 Overview of the phyBOARD-Wega Peripherals

The phyBOARD-Wega is depicted in *Figure 1*. It features many different interfaces and is equipped with the components as listed in *Table 2*, and *Table 3*. For a more detailed description of each peripheral refer to the appropriate chapter listed in the applicable table.*Figure 1* highlights the location of each peripheral for easy identification.

3.2.1 Connectors and Pin Header

Table 2 lists all available connectors on the phyBOARD-Wega. *Figure 1* highlights the location of each connector for easy identification.

Reference Designator	Description	See Section
X11	Secure Digital / Multi Media Card (Micro-slot)	*3.3.8*
X15	USB Host connector (USB 2.0 Standard-A)	*3.3.4*
X16	Ethernet 0 connector (RJ45 with speed and link LED)	*3.3.3*
X17	Ethernet 1 connector (RJ45 with speed and link LED)	*3.3.3*
X42	USB On-The-Go connector (USB Micro-AB)	*3.3.4*
X55	Mono Speaker output (2-pole Molex)	*3.3.5*
X65	CAN connector (5×2 pin header)	*0*
X66	RS-232 with RTS and CTS (UART1 5×2 pin header)	*3.3.2*
X67	Power supply 5 V only (via 6-pole WAGO male header, or 2-pole PHOENIX base strip)	*3.3.1.1*
X69	Expansion connector (2×30 socket connector)	*3.3.7*
X70	A/V connector #1 (2×20 socket connector)	*3.3.6*
X71	A/V connector #2 (2×8 socket connector)	*3.3.6*
X72	Optional 5 V power supply via USB Micro-AB connector	*3.3.1.1*
X73	Stereo Line Out and Line In connector (2×3 pin header)	*3.3.5*

Table 2: phyBOARD-Wega Connectors and Pin Headers

Note:
Ensure that all module connections are not to exceed their expressed maximum voltage or current. Maximum signal input values are indicated in the corresponding controller User's Manual/Data Sheets. As damage from improper connections varies according to use and application, it is the user‘s responsibility to take appropriate safety measures to ensure that the module connections are protected from overloading through connected peripherals.

3.2.2 LEDs

The phyBOARD-Wega is populated with three LEDs to indicate the status of the USB VBUS voltages, as well as of the power supply voltage.

Figure 1 shows the location of the LEDs. Their function is listed in the table below:

LED	Color	Description	See Section
D7	green	Indicates presence of VBUS1 at the USB Host interface	*3.3.4*
D8	green	Indicates presence of VBUS0 at the USB OTG interface	*3.3.4*
D58	red	3.3 V voltage generation of the phyBOARD-Wega	*3.3.1.2*

Table 3: phyBOARD-Wega LEDs Descriptions

Note:
Detailed descriptions of the assembled connectors, jumpers and switches can be found in the following chapters.

3.3 Functional Components on the phyBOARD-Wega Board

This section describes the functional components of the phyBOARD-Wega. Each subsection details a particular connector/interface and associated jumpers for configuring that interface.

3.3.1 Power Supply

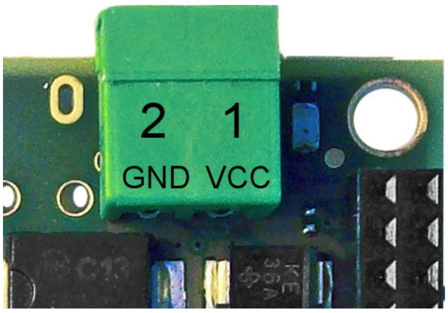
Caution:
Do not change modules or jumper settings while the phyBOARD-Wega is supplied with power!

3.3.1.1 Power Connectors (X67 and X72)

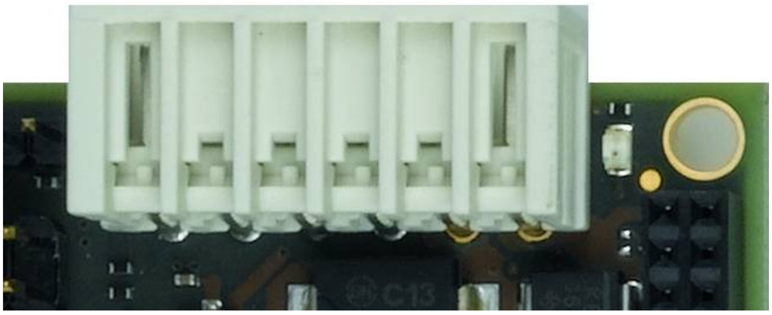
The phyBOARD-Wega is available with three different power supply connectors. Depending on your order you will find one of the following connectors on your SBC:

1. a 2-pole PHOENIX base strip 3.5 mm connector suitable for a single 5 V supply voltage, or
2. an USB Micro-AB connector to connect a standard 5 V USB power supply, or
3. a 6-pole WAGO male header to attach the Power Module for phyBOARD-Wega (PEB-POW-01) which provides connectivity for 12 V – 24 V

The required current load capacity for all power supply solutions depends on the specific configuration of the phyCORE mounted on the phyBOARD-Wega the particular interfaces enabled while executing software as well as whether an optional expansion board is connected to the carrier board. A 5 V adapter with a minimum supply of 1.5 A is recommended.



PHOENIX base strip



WAGO male header 6-pole

Figure 3: Power Supply Connectors

3.3.1.1.1 PHOENIX 2-pole Base Strip

The permissible input voltage is +5 V DC if your SBC is equipped with a 2-pole PHOENIX connector.

Figure 3 and the following table show the pin assignment.

Pin	Signal	Description
1	**VCC5V_IN**	**+5V power supply**
2	**GND**	**Ground**

Table 4: Pin Assignment of the 2-pole PHOENIX Connector at X67

3.3.1.1.2 USB Micro-AB

If your board provides an USB Micro-AB female connector at the upper side of the board a standard USB Micro power supply with +5 V DC can be used to supply the phyBOARD-Wega.

Caution!
Do not confuse the USB Micro connector on the upper side of the board with the one on the back side of the board which provides USB OTG connectivity. The USB Micro connector on the upper side is exclusively used for power supply and has no other USB functionality!

3.3.1.1.3 WAGO 6-pole Male Header

If a WAGO 6-pole male header is mounted on your board (see *Figure 1* and *Figure 3*) your board is prepared to connect to a phyBOARD-Wega Power Module (PEB-POW-01), or a custom power supply circuitry. The mating connector from WAGO has the EAN 4045454120610.

Use of the 6-pole connector has the following advantages:

- Higher and wider operate range of the input voltage
- External scaling potential to optimize the electrical output current
- 5 V, 3.3 V and backlight power supply

Pin assignment of the 6 –pole WAGO connector:

Pin	Signal	Description
1	**VCC5V_IN**	**+5 V power supply**
2	**GND**	**Ground**
3	**VCC3V3_PMOD**	**+3.3 V power supply**
4	**VCC_BL**	**Backlight power supply**
5	**PMOD_PWRGOOD**	**Power good signal (connected to reset nRESET_IN)**
6	**PMOD_PWRFAIL**	**Power fail signal**

Table 5: Pin Assignment of the 6-pole WAGO Connector at X67

A detailed description of the Power Module for phyCORE-Wega can be found in the Application Guide for phyBOARD-Wega-AM335x Expansion Boards (L-793e_0).

3.3.1.2 Power LED D58

The red LED D58 right next to the power connector (see *Figure 1*) indicates the presence of the 3.3 V supply voltage generated from the 5 V input voltage.

3.3.1.3 VBAT and RTC

On the phyBOARD-Wega the internal RTC of the AM335x is used for real-time or time-driven applications. To backup the RTC on the module, a goldcap (C339) is placed on the phyBOARD-Wega. This voltage source supplies the backup voltage domain VBAT of the AM335x which supplies the RTC and some critical registers when the primary system power, VCC5V_IN, is removed. The backup supply lasts approximately 17 ½ days.

3.3.2 RS-232 Connectivity (X66)

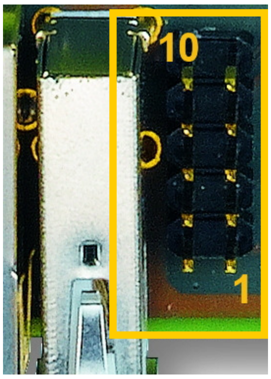


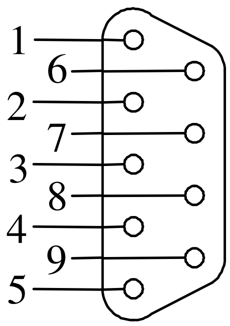
Figure 4: RS-232 Interface Connector X66

Pin header connector X66 located next to the USB host connector (see *Figure 1)* provides the UART1 signals of the AM335x at RS-232 level. The serial interface is intended to be used as data terminal equipment (DTE) and allows for a 5-wire connection including the signals RTS and CTS for hardware flow control. *Table 6* below shows the signal mapping of the RS-232 level signals at connector X66.

Pin	Signal	Pin	Signal
1	**NC**	2	**NC**
3	**UART1_RXD_RS232**	4	**UART1_RTS_RS232**
5	**UART1_TXD_RS232**	6	**UART1_CTS_RS232**
7	**NC**	8	**NC**
9	**GND**	10	**NC**

Table 6: Pin Assignment of RS-232 Connector X66

An adapter cable is included in the phyBOARD-Wega-Am335x Kit to facilitate the use of the UART1 interface. The following figure shows the signal mapping of the adapter.



Pin 2: RxD-RS232
Pin 7: RTS-RS232
Pin 3: TxD-RS232
Pin 8: CTS-RS232

Pin 5: GND

Figure 5: RS-232 Connector Signal Mapping

Note:
The UART0 interface which is required for debugging is routed to expansion connector X69. The Evaluation Board (PEB-EVAL-01) delivered with the kit allows easy use of this interface. Please find additional information on the Evaluation Board in Application Guide for phyBOARD-Wega-AM335x Expansion Boards (L-793e_0)

3.3.2.1 Software Implementation

See the previous chapters which describes the usage of the serial port in the DEMO Application.

3.3.3 Ethernet Connectivity (X16 and X17)

The Ethernet interfaces of the phyBOARD-Wega are accessible at two RJ45 connectors (X16 and X17) on the board.

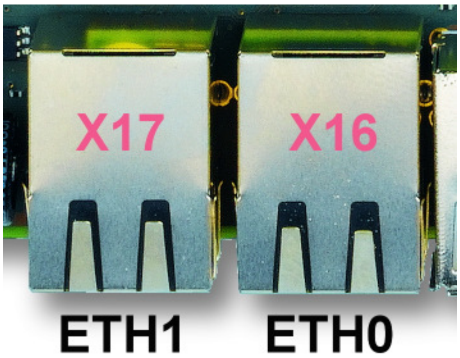


Figure 6: Ethernet Interfaces at Connectors X16 and X17

Ethernet 0 interface is available at X16, while Ethernet 1 interface is brought out at X17.

Both Ethernet interfaces are configured as 10/100Base-T networks. The LEDs for LINK (green) and SPEED (yellow) indication are integrated in the connector. Both LAN8710AI Ethernet transceivers support HP Auto-MDIX technology, eliminating the need for the consideration of a direct connect LAN cable, or a cross-over path cable. They detect the TX and RX pins of the connected device and automatically configure the PHY TX and RX pins accordingly.

3.3.3.1 Software Implementation

Only one 10/100 Mbit Ethernet interface is currently implemented. The default IP address is **192.168.3.15**.

The interface offer a standard Windows network port which can be programmed using the NDIS socket interface.

3.3.4 USB Connectivity (X15 and X42)

The phyBOARD-Wega provides one USB Host and one USB OTG interface.

USB0 is accessible at connector X42 (USB Micro-AB) located at the back side of the phyBOARD-Wega. It is configured as USB OTG. USB OTG devices are capable to initiate a session, control the connection and exchange host and peripheral roles between each other. This interface is compliant with USB revision 2.0.

USB1 is accessible on the top at connector X15 (USB Standard-A) and is configured as USB Host.

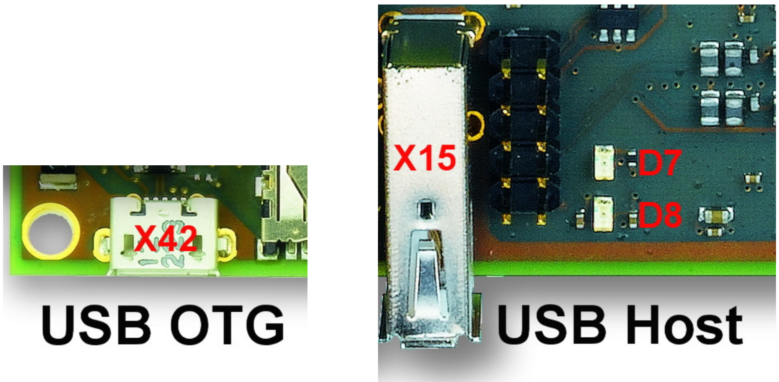


Figure 7: Components supporting the USB Interfaces

LED D8 displays the status of USB0_VBUS and LED D7 the status of USB1_VBUS.

For later expansion boards the USB1 interface can be routed to the expansion connector (X69) by populating J72 and J73 (2+3).

3.3.4.1 Software Implementation

3.3.4.1.1 USB Host

The AM335x CPU embeds a USB 2.0 EHCI controller that is also able to handle low and full speed devices (USB 1.1).

The BSP includes support for mass storage devices and keyboards. Other USB related device drivers must be enabled in the kernel configuration on demand.

Due to *udev*, connecting various mass storage devices get unique IDs and can be found in */dev/disk/by-id*. These IDs can be used in */etc/fstab* to mount different USB memory devices in a different way.

3.3.4.1.2 USB OTG

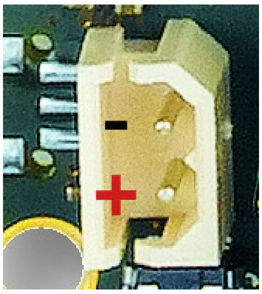
Currently not supported.

3.3.5 Audio Interface (X55 and X73)

The audio interface provides a method of exploring AM335x's audio capabilities. The phyBOARD-Wega is populated with an audio codec at U35. The audio codec is connected to the AM335x's McASP0 interface to support stereo line input and stereo line output at connector X73. In addition to that the phyBOARD-Wega has one direct mono speaker output (2 × 1 W) at the Molex connector X55.

X55:

Speaker



X73:

Line In
Line Out

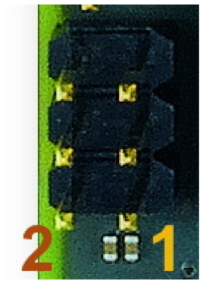


Figure 8: Audio Interfaces at Connectors X55 and X73

Pin assignment at X73

Pin	Signal	Pin	Signal
1	**LINE_IN_L**	2	**LINE_IN_R**
3	**AGND**	4	**AGND**
5	**LINE_OUT_L**	6	**LINE_OUT_R**

Pin assignment at X55

Pin	Signal	Description
1	**SPOP**	**Class-D positive differential output**
2	**SPOM**	**Class-D negative differential output**

For additional audio applications the McASP0 interface of the AM335x including the signals X_MCASP0_AHCLKX, X_I2S_CLK, X_I2S_FRM, X_I2S_ADC and X_I2S_DAC are routed to the A/V connector X71 (please refer to *section 4.5.1* for additional information on the A/V connector).

Please refer to the audio codec's reference manual for additional information regarding the special interface specification.

3.3.5.1 Software Implementation

Currently not supported.

CAN Connectivity

The CAN1 interface of the phyBOARD-Wega-AM335x is accessible at connector X65 (2×5 2.54 mm pin header).

Jumper JP3 can be installed to add a 120 Ohm termination resistor across the CAN data lines if needed.

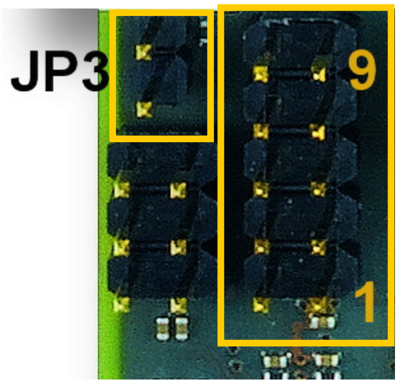


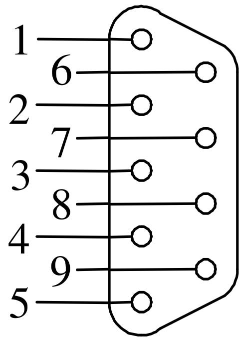
Figure 9: Components supporting the CAN Interface

Table 7 below shows the signal mapping of the CAN1 signals at connector X65.

Pin	Signal	Pin	Signal
1	**NC**	2	**GND**
3	**X_CANL**	4	**X_CANH**
5	**GND**	6	**NC**
7	**NC**	8	**NC**
9	**Shield**	10	**NC**

Table 7: Pin Assignment of CAN Connector X65

An adapter cable is included in the phyBOARD-Wega-Am335x Kit to facilitate the use of the CAN interface. The following figure shows the signal mapping of the adapter.



Pin 6:	GND
Pin 2:	X_CANL
Pin 7:	X_CANH
Pin 3:	GND
Pin 5:	Shield

Figure 10: CAN Connector Signal Mapping

3.3.5.2 Software Implementation

Currently not supported.

3.3.6 Audio/Video connectors (X70 and X71)

The Audio/Video (A/V) connectors X70 and 71 provide an easy way to add typical A/V functions and features to the phyBOARD-Wega. Standard interfaces such as parallel display, I²S and I^{2}C as well as different supply voltages are available at the two A/V female dual entry connectors. Special feature of these connectors are their connectivity from the bottom or the top.

For further information of the A/V connectors see *chapter 4.5.1*. Information on the expansion boards available for the A/V Connecctors can be found in the Application Guide for phyBOARD-Wega Expansion Boards (L-793e_0).

3.3.7 Expansion connector (X69)

The expansion connector X69 provides an easy way to add other functions and features to the phyBOARD-Wega. Standard interfaces such as JATG, UART, MMC2, SPI and I^{2}C as well as different supply voltages and some GPIOs and Analog Inputs are available at the expansion female connector. The pinout of the expansion connector is shown in Secure Digital Memory Card/ MultiMedia Card (X11)
.

For further information of the expansion connector see see *chapter 4.5.5*. Information on the expansion boards available for the expansion connecctor can be found in the Application Guide for phyBOARD-Wega Expansion Boards (L-793e_0)

3.3.8 Secure Digital Memory Card/ MultiMedia Card (X11)

Figure 11: SD / MM Card interface at connector X11

The phyBOARD-Wega provides a standard microSDHC card slot at X11 for connection to SD/MMC interface cards. It allows easy and convenient connection to peripheral devices like SD- and MMC cards. Power to the SD interface is supplied by inserting the appropriate card into the SD/MMC connector, who features a card detection, a lock mechanism and a smooth extraction function by Push-in /-out of card.

The AM335x processor on the phyBAORD-Wega can boot from this interface.

3.3.8.1 Software Implementation

The phyBOARD-Wega supports a slot for Micro Secure Digital Cards and Micro Multi Media Cards to be used as storage device in the WEC2013 file system.

After inserting an MMC/SD card, it should be accessible via the root file system under the name “Storage_Card”.

3.3.9 Boot Mode

The pyhBOARD-Wega has a defined boot sequence:

1. NAND
2. SD/MMC

The exact choosen boot mode in the processor is SYSBOOT[4:0] = 10011b : NAND, NANDI2C, MMC0, UART0

3.3.10 System Reset Button (S2)

The phyBOARD-Wega is equipped with a system reset button at S2. Pressing this button will toggle the X_nRESET_IN pin (X64A11) of the phyCORE SOM low, causing the module to reset. Additionally, a reset is generated on nRESET_OUT to reset peripherals.

Figure 12: System Reset Button S2

4 Advanced Information

4.1 About this Section

This Section addresses advanced developers who want to configure, build and install a new OS image for WEC2013

- Step by step instructions on how to configure, build and install a new OS image using Visual Studio 2012 and Platform Builder.
- A description how to update the Bootloader and how to write OS image into the Flash with the help of VS2012

4.2 Software Overview

In the chapter 2 you have learned how to work with Visual Studio 2012. The following section shows you how to work with the Platform Builder.

Platform Builder is an Plugin for Visual Studio 2012 which will be autamtically integrated in the VS IDE after installing Windows Embedded Compact 2013. Within the Plugin you could generate your own OS image or to modify or implement drivers to the BSP.

4.3 Getting Started with the BSP

In this chapter you will go through some software topics. First you will configure and compile your own OS image. With the help of Platform Builder you can add additional features, or disable them if they are not needed. After compiling the new images, you will learn how to write the newly created OS image into target's flash memory and how to start from.

4.3.1 Working with Platform Builder

In this part you will learn how to configure and build a new OS image with the help of Visual Studio 2012 and the integrated Platform Builder. Then you will downloading and executing the new OS image. After that, you will learn how to configure the new OS image as an NAND-Flash image to store it on the device.

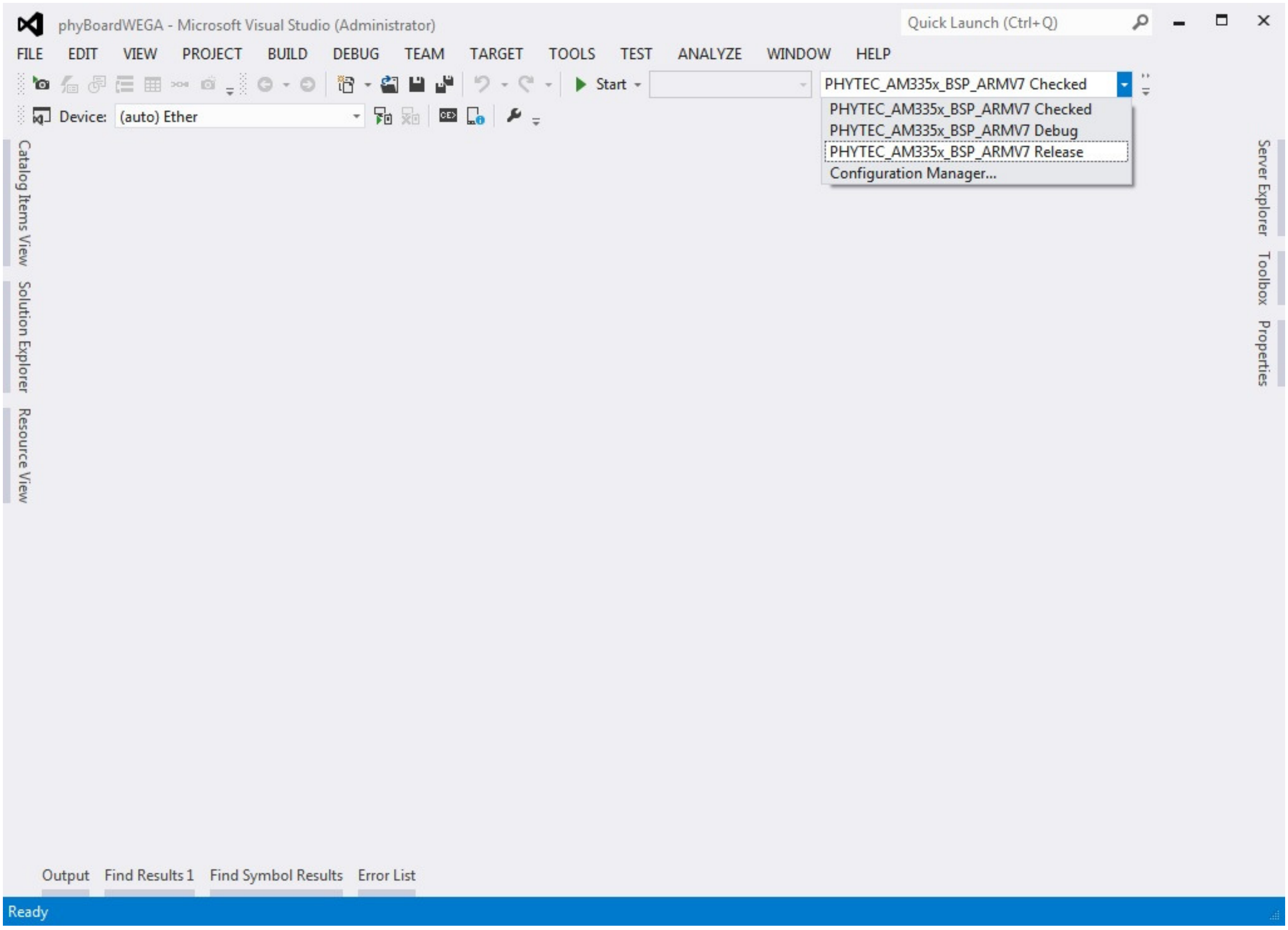
Let us start:

- Open the Example Project for the binary BSP in the following path:
    - ..\WINCE800\OSDesigns\phyBoardWEGA\phyBoardWEGA.sln

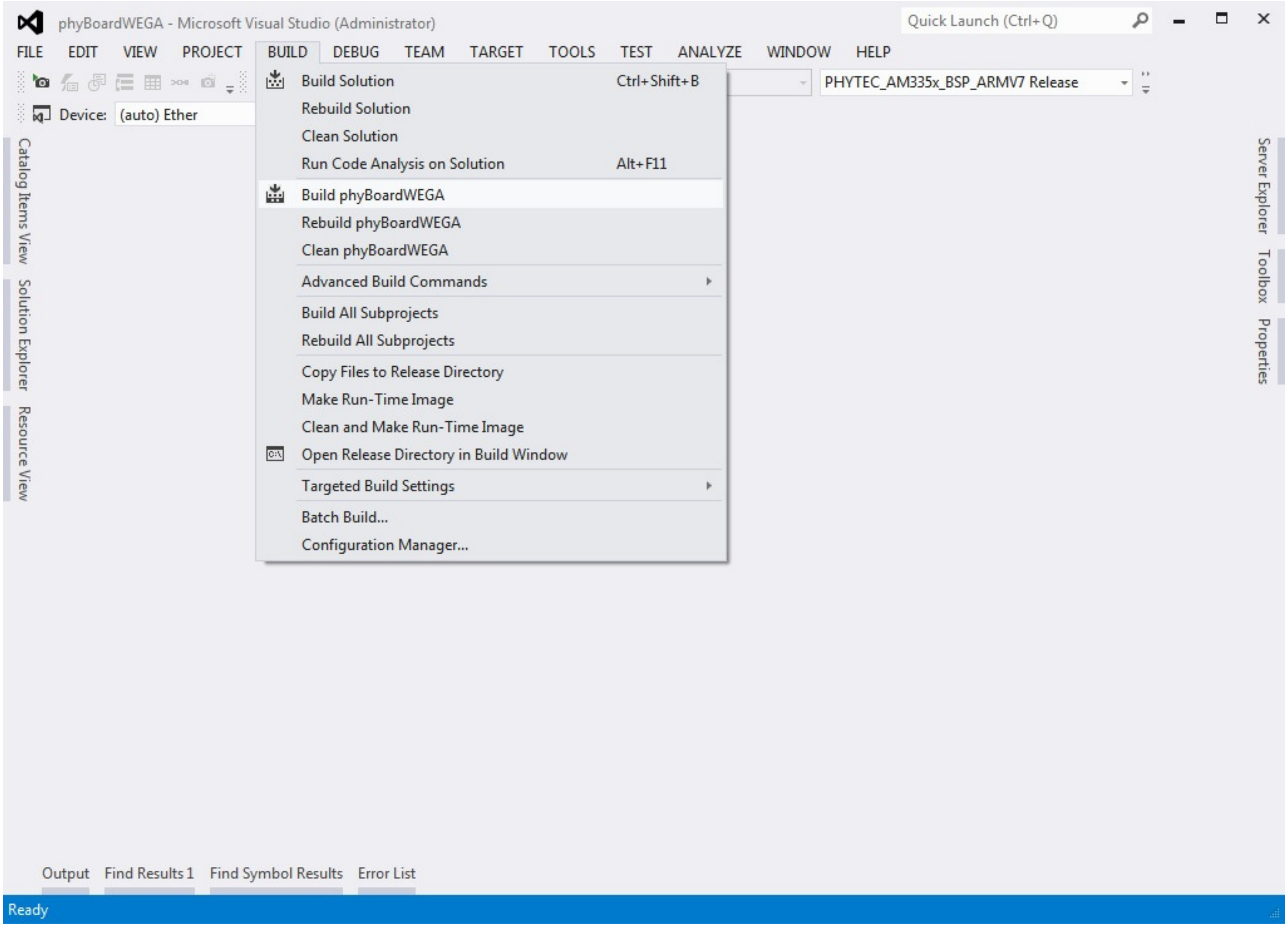
	NOTE: You will find the WINCE800 folder, where you have chosen it during the Windows Embedded Compact 2013 installation. For default it is C:\WINCE800. In this folder you will find other example BSPs for Freescale and TI processors.

- Be sure to select the build configuration like the following screen.
    - The differences between the three configurations (Checked/Debug/Release) is the among of debug output which should be enabled during startup.
    - Checked/Debug build put all available debug messages out for each driver.
    - Release build is the cleanest message output.

- For our example it is enough to decide to build the Release configuration.



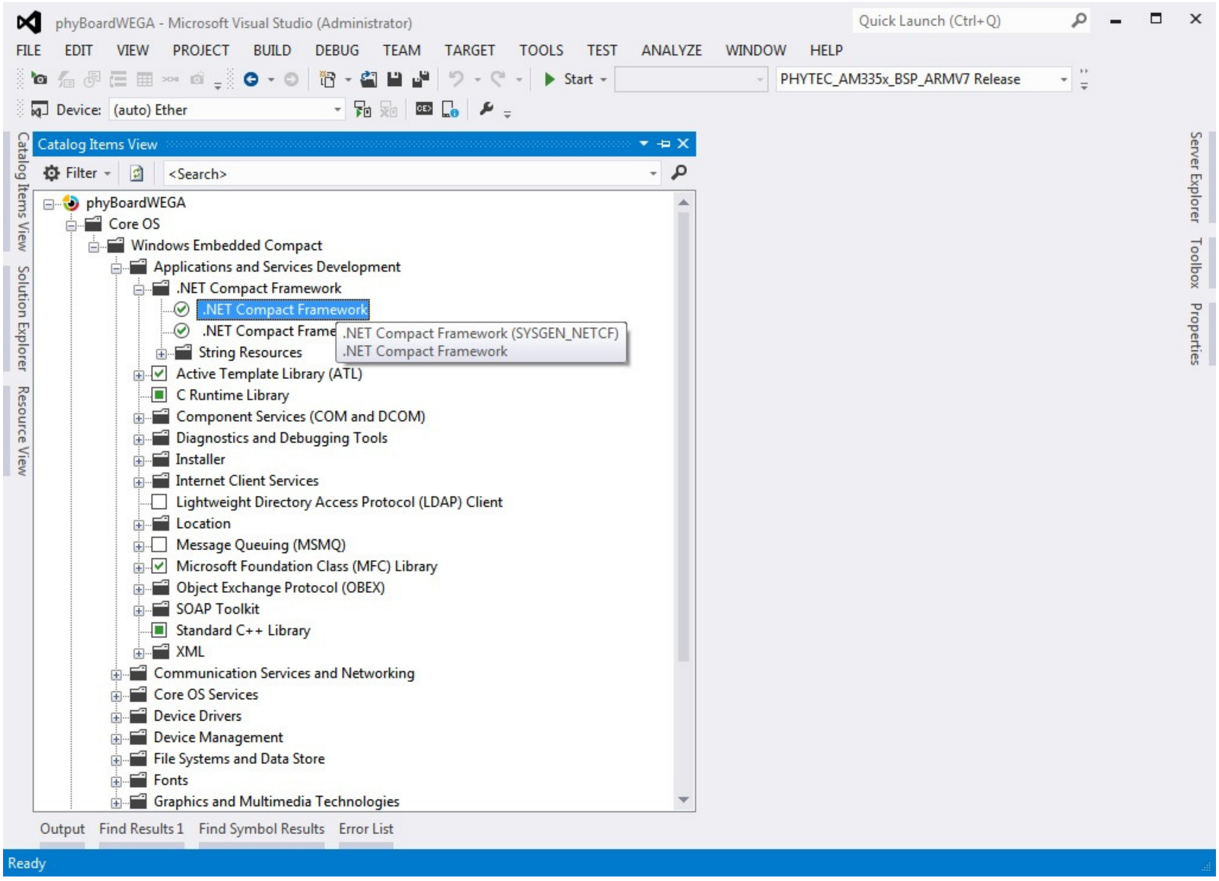
- In the Visual Studio 2012 menu bar select "Build –> Build phyBoardWEGA" to start compiling and generating your first OS image.



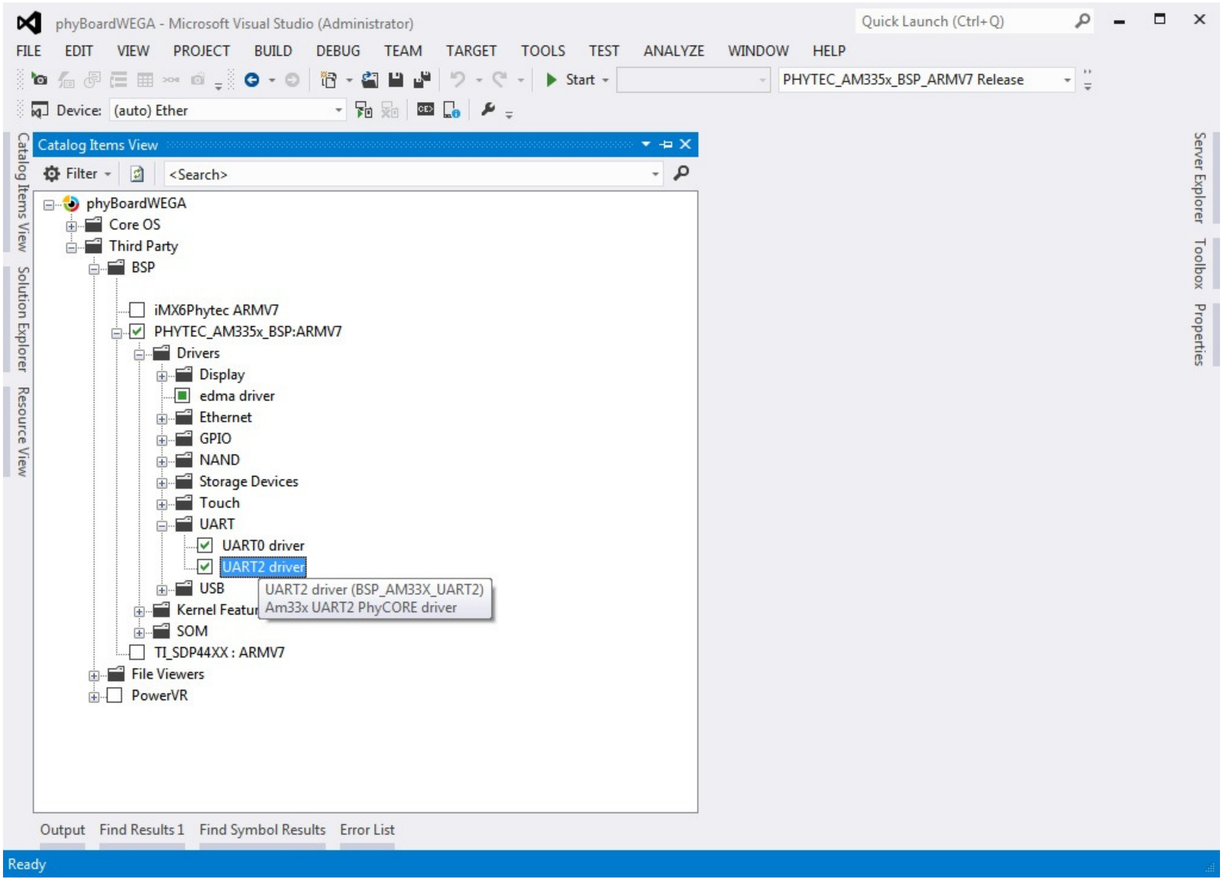
- It depends on which development PC you have how long it take to build a full OS image. Round about 10-15 minutes.

During the build phase, we could have a look of the possibilities to create a customized OS image.

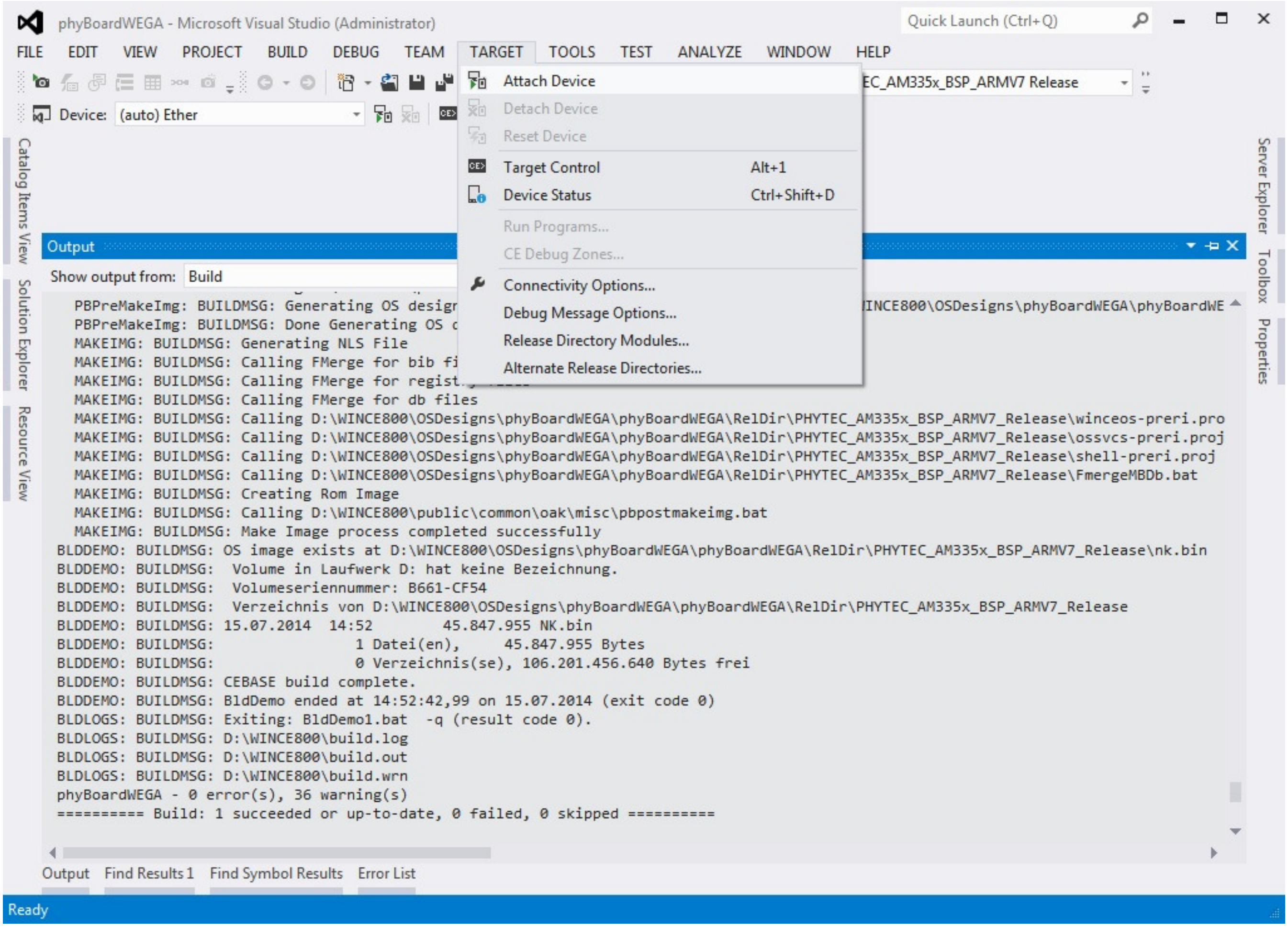
- On the left site you will find the Catalog Item View. If not got to the menu bar "View -> Other Windows -> Catalog Items View".
- In the following screen you will see the Core OS features which comes from Microsoft. You have the option to select or deselect the features of your choice. In example the .Net Compact Framework.



- On the bottom of the Catalog Items View you will find under “Third Party -> BSP -> PHYTEC_AM335x_BSP:ARMV7 -> Drivers” the set of drivers which are available in the current BSP.

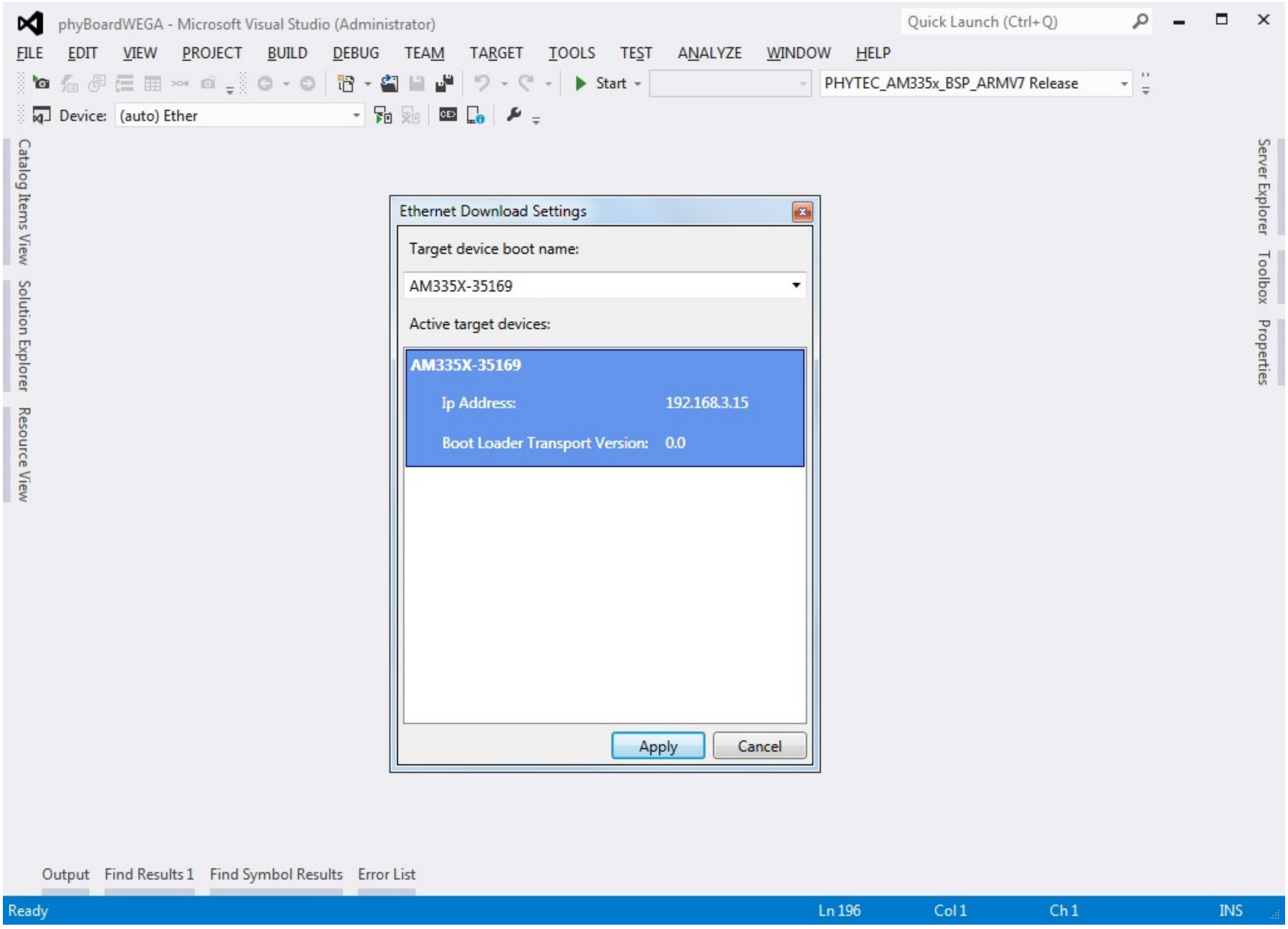


- After studying the Catalog Items View for long time, the OS image should be finished.
- Now you are able to download your OS image. Select "Target –> Attach Device" in the menu bar.



- A pop-up window should appear which is waiting for the device to attach.
- Please power up the baseboard and press space to enter in the bootloader main menu.
- Press "2" to enter the boot selection menu and press "1" to configure the bootloader to download the OS image over Ethernet.
- Please be sure that the bootloader ip address matches the ip range of your workstation.
    - Press "4" for Network settings
    - Press "1" to get an overview of the settings. If it is not matching your IP range, change the IP by pressing "6".

- Back to main menu, press "0" to start receive requests from bootloader.
- Switch back to Visual Studio. Following content should appear in the pop-up window.

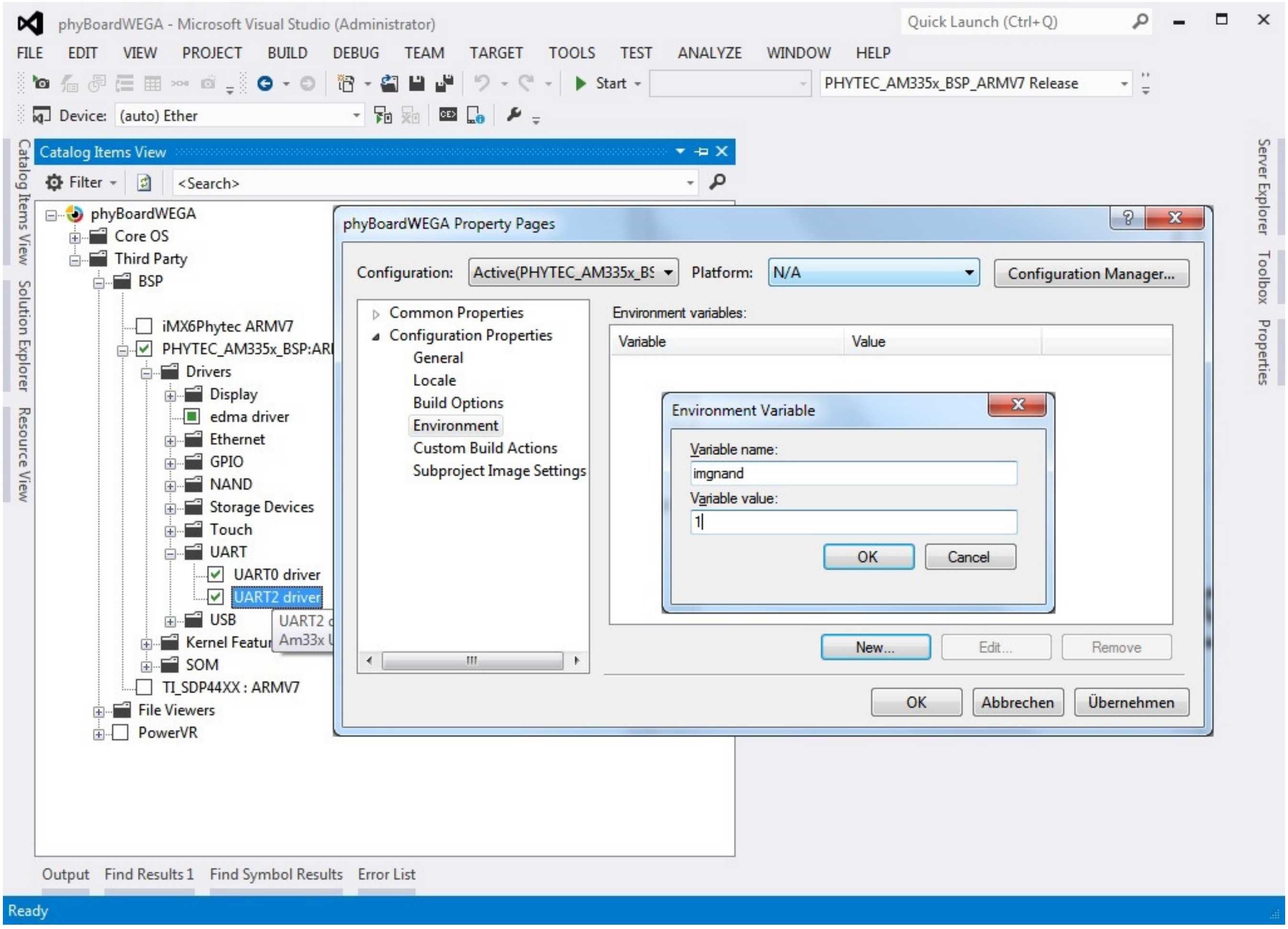


Press "Apply" and the download should start directly. After a while, the OS image should boot up and you should see the WEC2013 startup screen.

4.3.2 Writing the OS Image into the Target's Flash

In this section you will find a description on how to write the newly created OS image into the phyBOARD-Wega-AM335x's flash memory. Before the OS image can be written into the flash, you have to modify one project setting in the Example Project of the Binary BSP.

- In Visual Studio go to "Project -> phyBoardWEGA Properties -> Configuration Properties –> Environment"
- Press "New" and input following Environment Variable



- Apply with “OK”. You should see the created environment variable in the Environment window.
- Press “OK” to save the configuration in your project.
- Go to “Build –> Make Run-Time Image” to generate a new image with the possibility to flash it into NANDFlash.

Download the image like in the previous steps described. After downloading, the OS image will be automatically program into flash and executed directly from flash.

	All files are also downloadable from our ftp server or you can find them on our WEC2013-phyBOARD-Wega-AM335x-Kit-DVD under */PHYTEC/BSP/*. If you want other versions check our ftp server too: ftp://ftp.phytec.de/pub/Products/

	In this section you learned how to download OS image with the help of Visual Studio into the RAM of the target. Also, you have learned how to build a OS image for the NAND Flash.

4.4 Updating the software

If you found a newer BSP on our ftp server ftp://ftp.phytec.de/pub/Products and want to flash it, this chapter shows how to do. Also in case that your phyBOARD-Wega-AM335x doesn't start anymore because you damaged its software during the previous chapter, you're right here, too. In the latter case you'll find all needed original images on the DVD under */phyBOARD-WEGA/BSP*.

4.4.1 Creating a bootable SD card

In case that your phyBOARD-Wega doesn't start anymore due to a damaged bootloader, you need to boot from an SD card. The SD card must be formatted with a tool which you will find on the DVD or in the path where you have installed the tool DVD:

\phyBOARD-WEGA\BSP\PD14.1.1\Tools

Please run the batch-file in the windows command line like described below:

Prepsd.bat G:

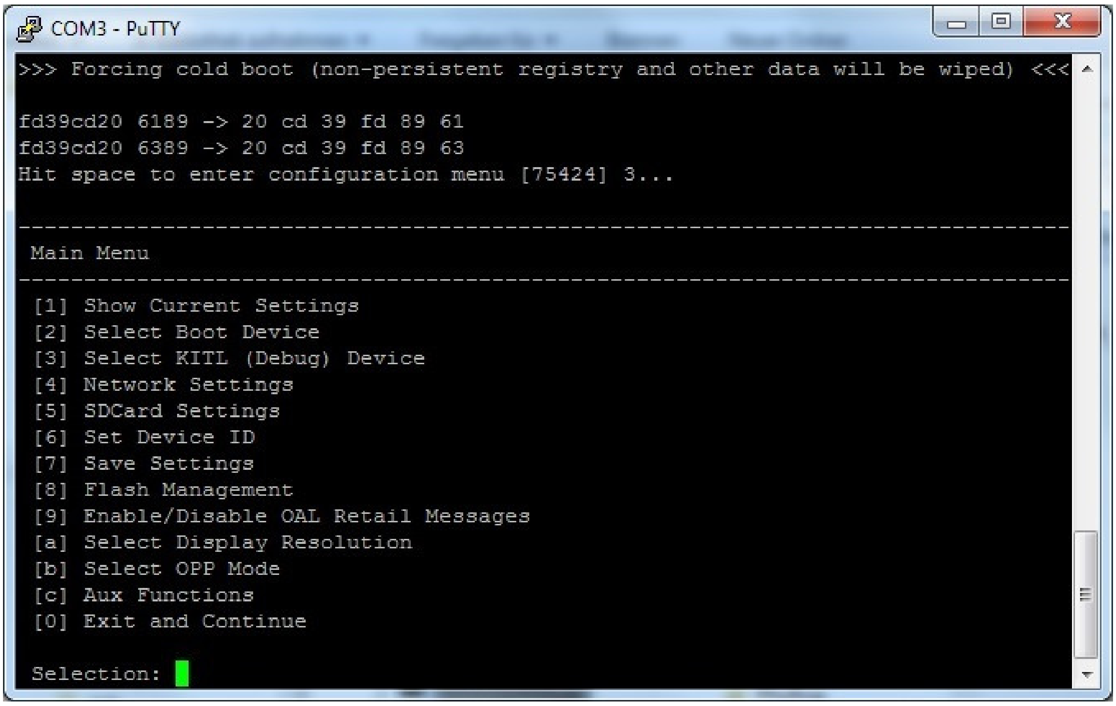
"G:" has to be changed to the drive letter where you SD-card is mounted.

After your SD-card was formatted successfully, you have to copy the following. You find the files on the DVD or in the path where you have installed the tool DVD:

\phyBOARD-WEGA\BSP\PDxx.x.x\Bootloader\SD\MLO
\phyBOARD-WEGA\BSP\PDxx.x.x\Bootloader\SD\EBOOTSD.nb0
\phyBOARD-WEGA\BSP\PDxx.x.x\Bootloader\NAND\XLDRNAND.bin
\phyBOARD-WEGA\BSP\PDxx.x.x\Bootloader\NAND\EBOOTND.bin
\phyBOARD-WEGA\BSP\PDxx.x.x\Image\NAND\NK.bin

4.4.2 Flashing the Bootloader

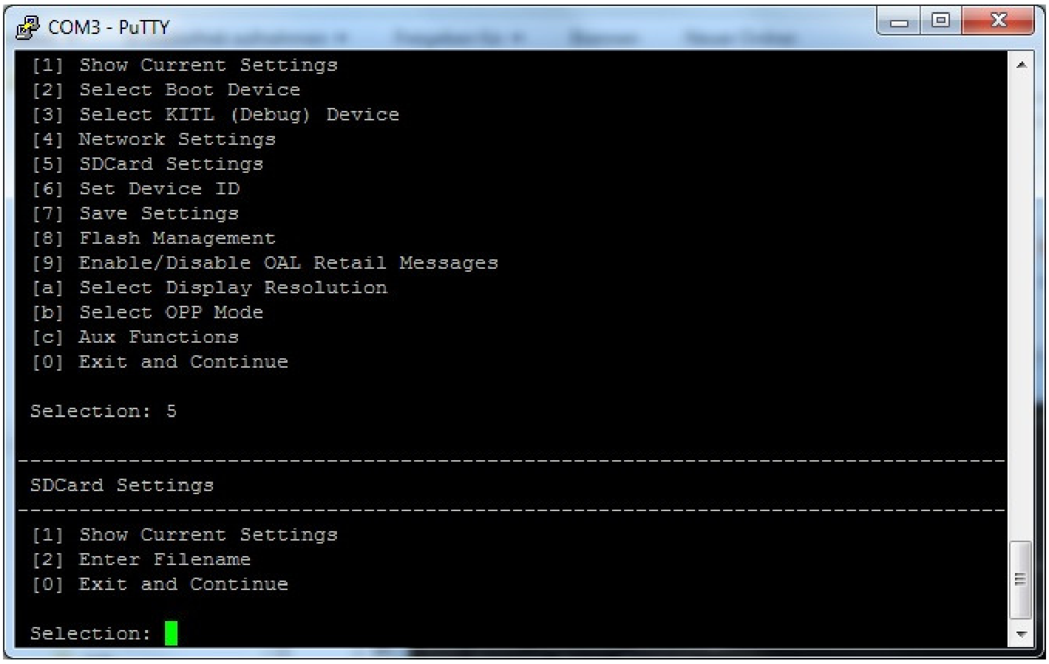
- Insert the bootable SD-card in the micro SDHC slot on the phyBOARD-WEGA.
- You need to switch the boot jumper on the board. You will find the boot jumper under the PEB-AV-Adapter board. To boot from SD-card it is necessary to set the boot jumper to "ON".
- Before powering-up the phyBOARD, please open a terminal program to see the output messages from the bootloader.
- Now power-up the phyBOARD. If you see the message "Hit space to enter configuration menu" press space on the keyboard to get in the bootloader menu. Following screen should appear:



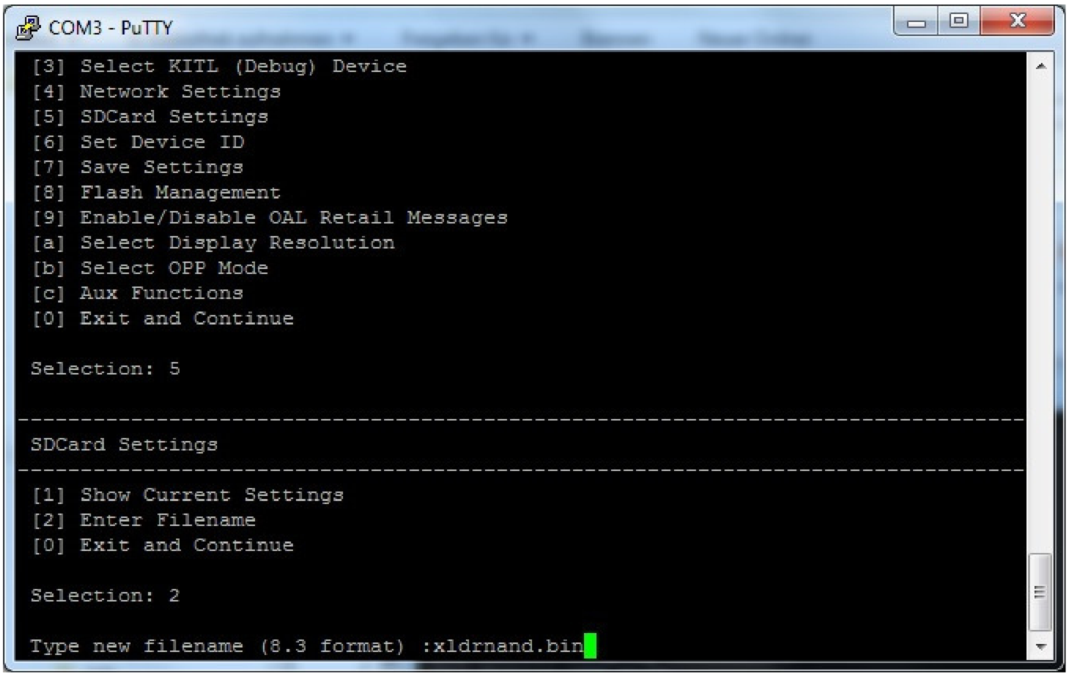
Note: It could be that it takes a while to see the message during the first boot, because the bootloader format the NAND Flash and create some partitions.

Now you are able to flash the bootloader to NAND-Flash.

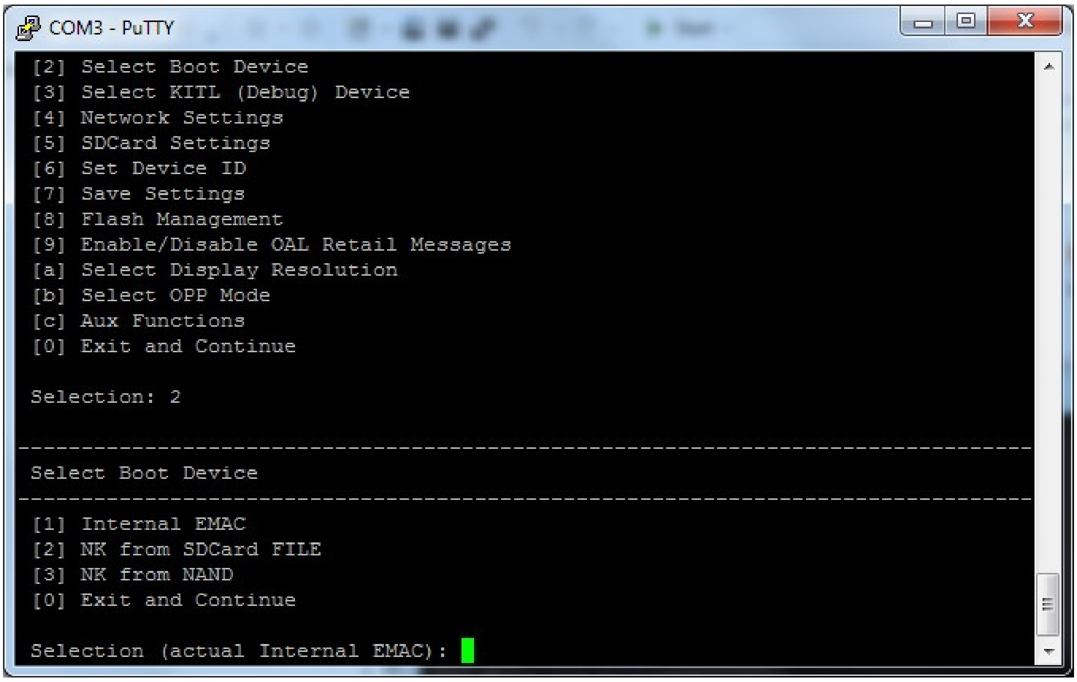
- Press “5” to get in the SDCard Settings menu. Following screen should appear:



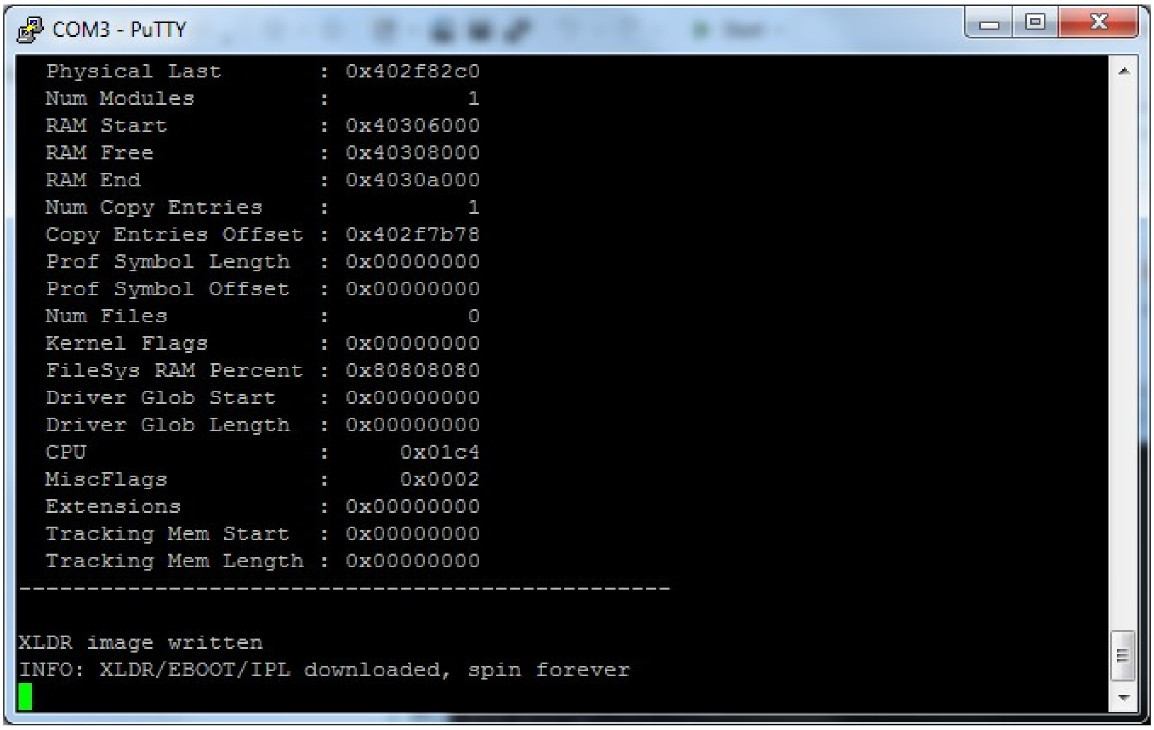
- Press “2” to enter the filename, which should program into flash.



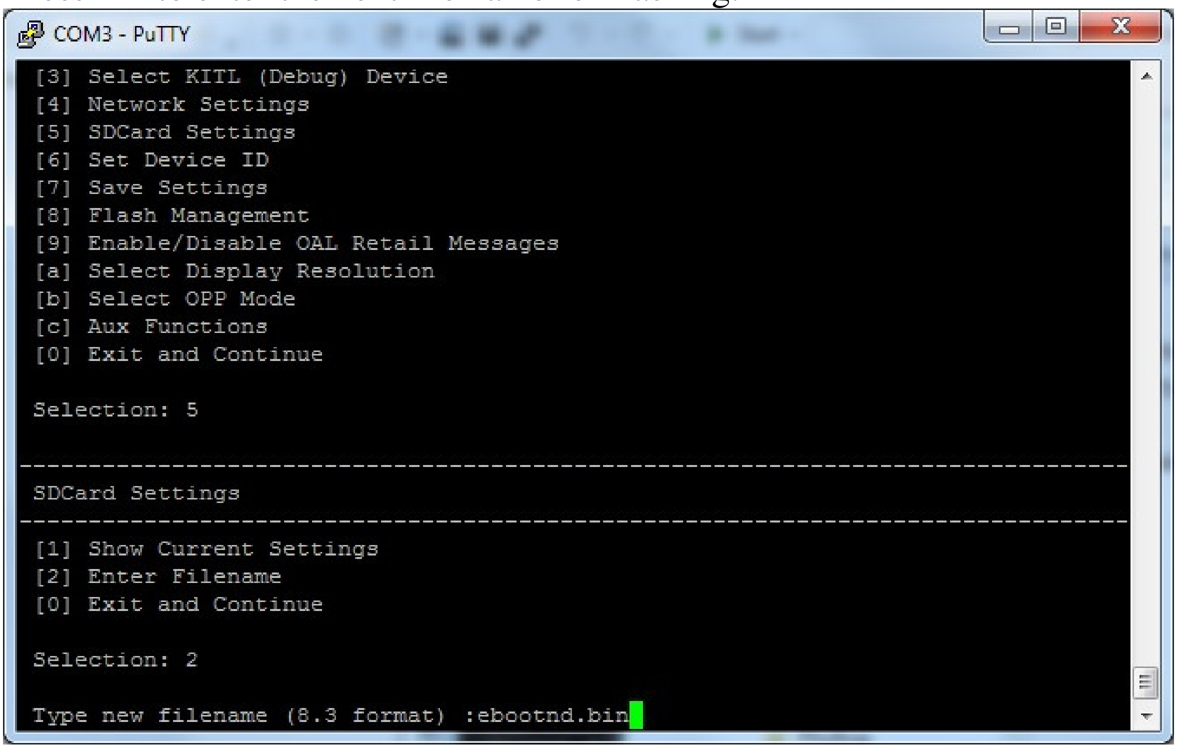
- Press “ENTER” to save the filename. Type “0” to leave the SDCard settings menu. Now you are back in the main menu. Press “2” to select the boot device.



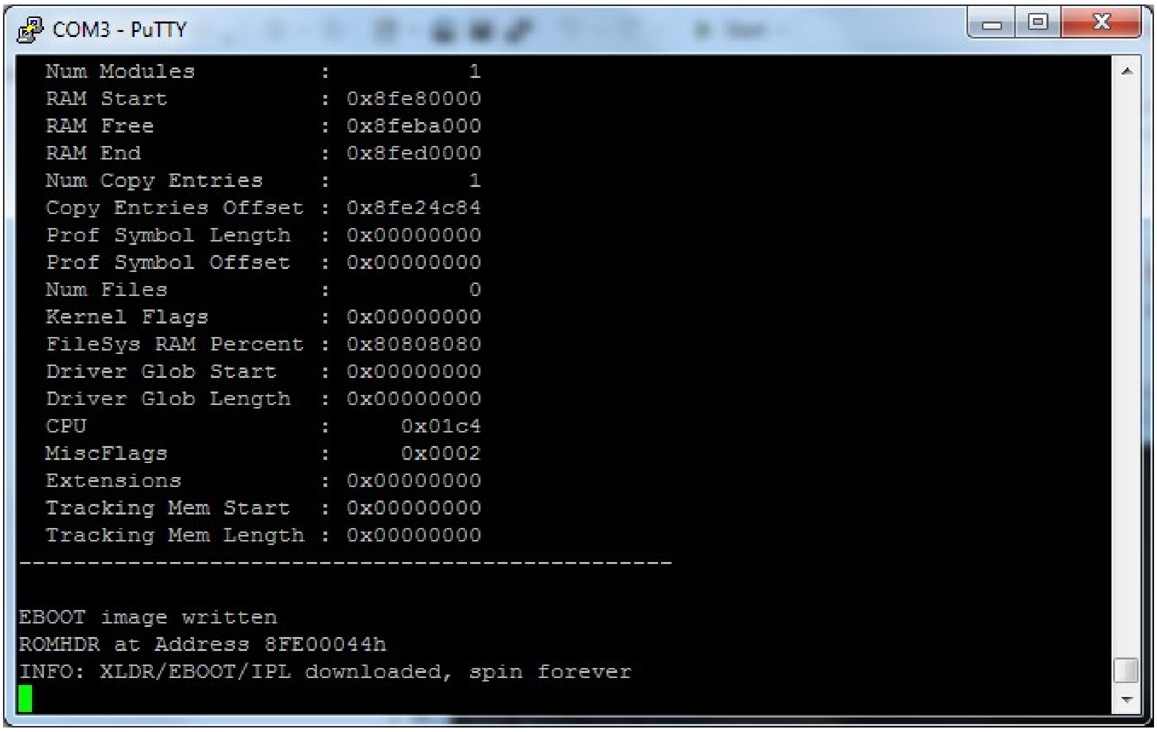
- Type “2” to set the boot device to “SDCard”. Now you are back in the main menu and you have to start downloading the typed file after press “0”.



- If the upper message appear, you have successful written the XLDR first stage bootloader into the nand flash. Please power off and on the phyBOARD to go on to program the next file into the nand flash.
- Hit space to enter the main menu, again. Type “5” to enter the SDCard settings menu. Press “2” to enter the next file name for flashing.



- Press enter and select the boot device by type “2” to enter the boot device menu and press “2” to select the SDCard as boot device.
- Now press “0” again to start the flash programming.



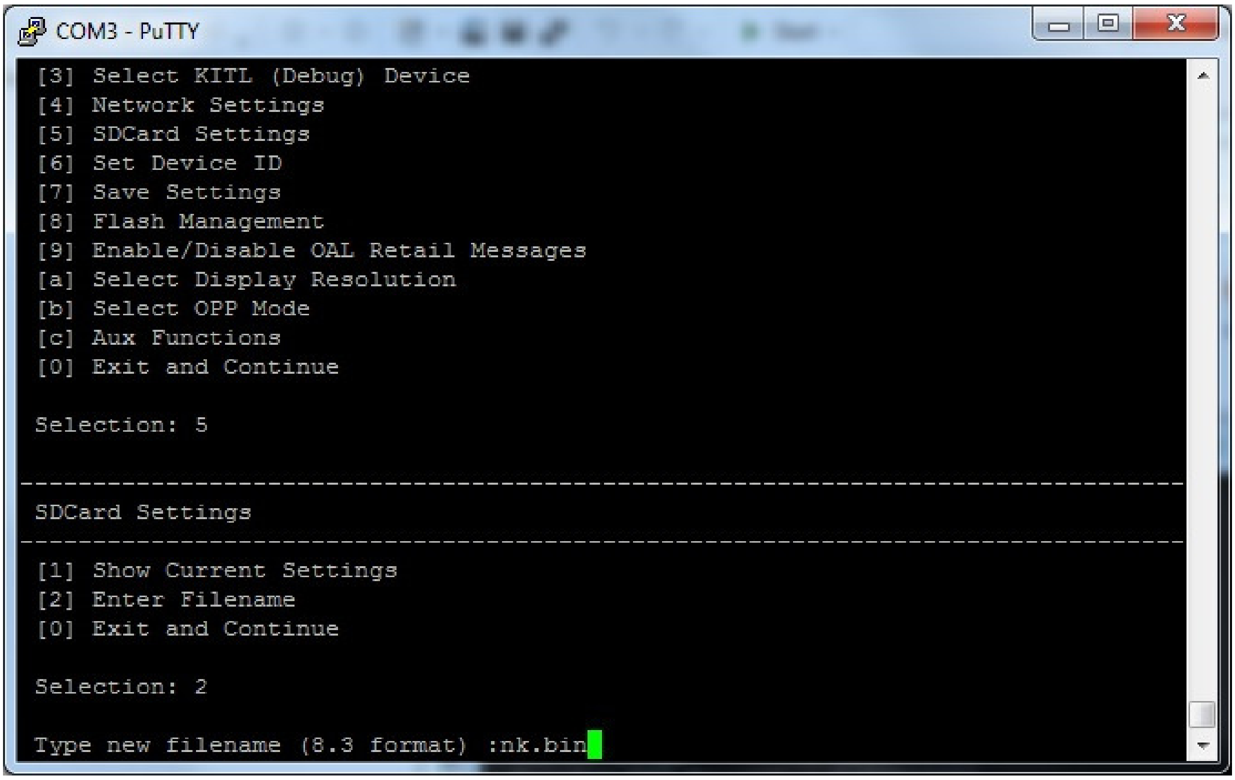
- You have successfully program the bootloader (fist stage and second stage bootloader) into the nand flash. Please switch back the boot jumper to boot from nand flash. Please let the SDCard in the slot, you will need it in the next chapter again.

4.4.3 Writing NK.bin to the Nand Flash

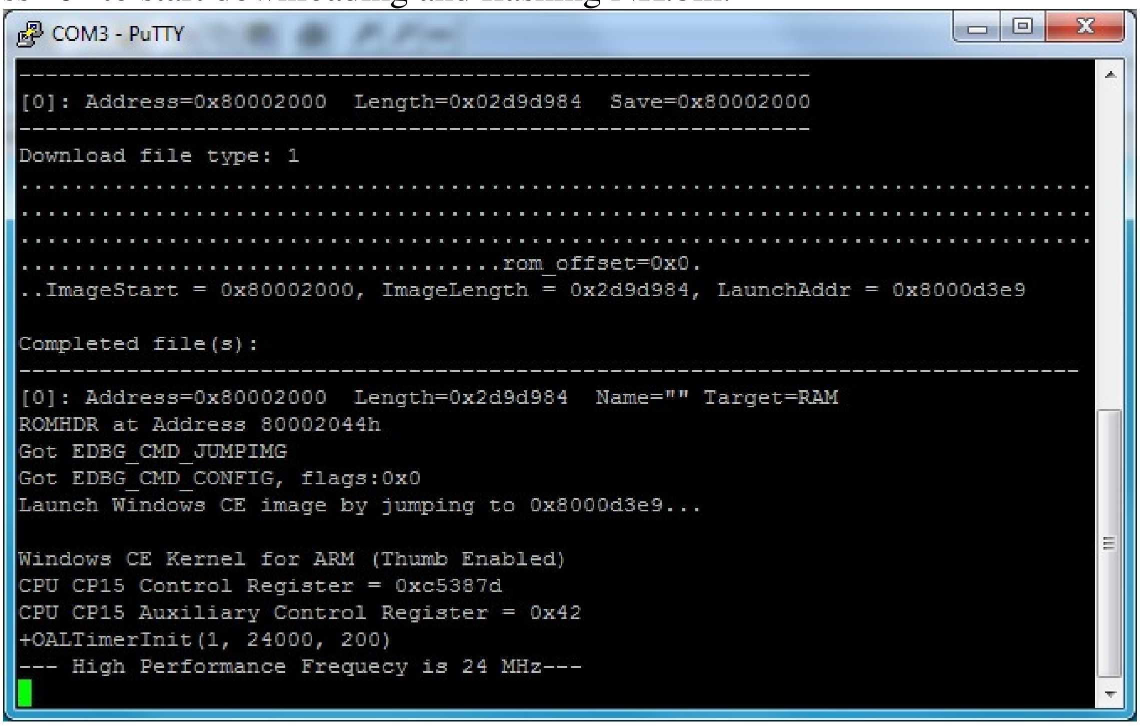
You should now able to boot the bootloader from NAND Flash. After the first boot from NAND-Flash, the bootloader create a boot partition for the OS image. This step is necessary to program the OS image into the nand flash.

After creating boot partition you should able to enter the boot main menu again. If so, please power off the phyBOARD and switch the boot jumper back to boot from SDCard. This is currently a workaround, because the SDCard bootloader could not create a partition for the OS image.

- Power on the phyBOARD and hit space to enter the main menu.
- Press “5” to enter SDCard settings menu and press “2” to enter the file name “nk.bin” which should program into flash.



- Press Enter to confirm the file name and type “0” to go back to the main menu.
- Back in the main menu press “2” twice to configure the bootloader to boot from SDCard.
- Press “9” and be sure to disable OAL Retail Messages. Note: This step is necessary to boot the OS correctly. If the Retail Messages are enabled, it prevents the OS image to boot. The OS try to initialize the Serial COM Interface and if the OAL Retail Messages are enabled its locked the Serial COM driver.
- Press “a” to select the correct display. (“[5] 7in EMERGING ETM07”)
- Press “0” to start downloading and flashing NK.bin.



- Now you have finished programming bootloader and image to the phyBOARD.
- Power off the phyBOARD, switch the boot jumper back to start from Nand Flash.
- Power on and hit space to enter main menu.
- Press "2" and "2" to configure the bootloader to boot NK image from flash.
- Press "8" to disable the OAL Retail Messages.
- Press "7" to save your settings.
- Press "0" to execute OS image from flash.

4.5 System Level Hardware Information

4.5.1 Audio/Video connectors

The Audio/Video (A/V) connectors X70 and 71 provide an easy way to add typical A/V functions and features to the phyBOARD-Wega. Standard interfaces such as parallel display, I²S and I^{2}C as well as different supply voltages are available at the two A/V female dual entry connectors. Special feature of these connectors are their connectivity from the bottom or the top. The pinout of the A/V connectors are shown in *Table 8* and *Table 9.*

Pin #	Signal Name	Description
1	GND	Ground
2	X_LCD_D21	LCD D21
3	X_LCD_D18	LCD D18
4	X_LCD_D16	LCD D16
5	X_LCD_D0	LCD D0
6	GND	Ground
7	X_LCD_D1	LCD D1
8	X_LCD_D2	LCD D2
9	X_LCD_D3	LCD D3
10	X_LCD_D4	LCD D4
11	GND	Ground
12	X_LCD_D22	LCD D22
13	X_LCD_D19	LCD D19
14	X_LCD_D5	LCD D5
15	X_LCD_D6	LCD D6
16	GND	Ground
17	X_LCD_D7	LCD D7
18	X_LCD_D8	LCD D8
19	X_LCD_D9	LCD D9

20	X_LCD_D10	LCD D10
21	GND	Ground
22	X_LCD_D23	LCD D23
23	X_LCD_D20	LCD D20
24	X_LCD_D17	LCD D17
25	X_LCD_D11	LCD D11
26	GND	Ground
27	X_LCD_D12	LCD D12
28	X_LCD_D13	LCD D13
29	X_LCD_D14	LCD D14
30	X_LCD_D15	LCD D15
31	GND	Ground
32	X_LCD_PCLK	LCD Pixel Clock
33	X_LCD_BIAS_EN	LCD BIAS
34	X_LCD_HSYNC	LCD Horizontal Synchronisation
35	X_LCD_VSYNC	LCD Vertical Synchronisation
36	GND	Ground
37	GND	Ground
38	X_PWM1_OUT	Pulse Wide Modulation
39	VCC_BL	Backlight power supply
40	VCC5V	5 V power supply

Table 8: PHYTEC A/V connector X70

Pin #	Signal Name	Description
1	X_I2S_CLK	I²S Clock
2	X_I2S_FRM	I²S Frame
3	X_I2S_ADC	I²S Analog-Digital converter (microfone)
4	X_I2S_DAC	I²S Digital-Analog converter (speaker)
5	X_AV_INT_GPIO1_30	A/V interrupt; GPIO1_30
6	X_MCASP0_AHCLKX	McASP0 high frequency clock
7	GND	Ground
8	nRESET_OUT	Reset
9	TS_X+	Touch X+
10	TS_X-	Touch X-
11	TS_Y+	Touch Y+
12	TS_Y-	Touch Y-
13	VCC3V3	3.3 V power supply

14	GND	Ground
15	X_I2C0_SCL	I²C Clock
16	X_I2C0_SDA	I²C Data

Table 9: PHYTEC A/V connector X71

4.5.2 Software Implementation

4.5.3 Audio I²S

Audio support on the module is done via the I2S interface and controlled via I2C.

On the phyBOARD-Wega the audio codec's registers can be accessed via the I2C0 interface at address 0x18 (7-bit MSB addressing).

As of the printing of this manual the BSP delivered with the phyCARD-Wega-Am335x does not support the audio interfaces. Please visit the PHYTEC website for a road map of the BSP.

4.5.4 I²C Connectivity

The I²C interface of the AM335x is available at different connectors on the phyBOARD-Wega. The following table provides a list of the connectors and pins with I²C connectivity.

Connector	Location
Expansion connector X69	pin 11 (I²C_SDA); pin 13 (I²C_SCL)
A/V connector X71	pin 16 (I²C_SDA); pin 15 (I²C_SCL)

Table 10: I²C Connectivity

To avoid any conflicts when connecting external I²C devices to the phyBOARD-Wega the addresses of the on-board I²C devices must be considered. *Table 11* lists the addresses already in use. The table shows only the default address.

Board	Prod. No.	Device	Address used (7 MSB)
phyCORE-AM335x	PCL-051	EEPROM	0x52
		RTC	0x68
		PMIC	0x2D, 0x12
phyBOARD-Wega	PBA-CD-02	Audio	0x18
AV-Adapter HDMI	PEB-AV-01	HDMI Core	0x70
		CEC Core	0x34
AV-Adapter Display	PEB-AV-02	GPIO Expander	0x41
Evaluation Board	PEB-EVAL-01	EEPROM	0x56
M2M Board	PEB-C-01	GPIO Expander	0x20
		GPIO Expander	0x21
		GPIO Expander	0x22

Table 11: I^2C Addresses in Use

4.5.5 Expansion connector

The expansion connector X69 provides an easy way to add other functions and features to the phyBOARD-Wega. Standard interfaces such as UART, SPI and I^2C as well as different supply voltages and some GPIOs are available at the expansion female connector. The pinout of the expansion connector is shown in Secure Digital Memory Card/ MultiMedia Card (X11)

.

Pin #	Signal Name	Description
1	VCC3V3	3.3 V power supply
2	VCC5V	5 V power supply
3	VDIG1_1P8V	1.8 V power supply
4	GND	Ground
5	X_SPI0_CS0	SPI 0 chip select 0
6	X_SPI0_MOSI	SPI 0 master output/slave input
7	X_SPI0_MISO	SPI 0 master input/slave output
8	X_SPI0_CLK	SPI 0 clock output
9	GND	Ground
10	X_UART0_RXD	UART 0 receive data (standard debug interface)
11	X_I2C0_SDA	I²C 0 Data
12	X_UART0_TXD	UART 0 transmit data (standard debug interface)

13	X_I2C0_SCL	I²C 0 Clock
14	GND	Ground
15	X_JTAG_TMS	JTAG Chain Test Mode Select signal
16	X_nJTAG_TRST	JTAG Chain Test Reset
17	X_JTAG_TDI	JTAG Chain Test Data Input
18	X_JTAG_TDO	JTAG Chain Test Data Output
19	GND	Ground
20	X_JTAG_TCK	JTAG Chain Test Clock signal
21	X_USB1_DP_EXP	USB1 data plus
22	X_USB1_DM_EXP	USB1 data minus
23	nRESET_OUT	Reset
24	GND	Ground
25	X_MMC2_CMD	MMC command
26	X_MMC2_DAT0	MMC data 0
27	X_MMC2_CLK	MMC clock
28	X_MMC2_DAT1	MMC data 1
29	GND	Ground
30	X_MMC2_DAT2	MMC data 2
31	X_UART2_RX_GPIO3_9	UART 2 receive data; GPIO3_19
32	X_MMC2_DAT3	MMC data 3
33	X_UART2_TX_GPIO3_10	UART 2 transmit data; GPIO3_10
34	GND	Ground
35	X_UART3_RX_GPIO2_18	UART 3 receive data; GPIO2_18
36	X_UART3_TX_GPIO2_19	UART 3 transmit data; GPIO2_19
37	X_INTR1_GPIO0_20	Interrupt 1; GPIO0_20
38	X_GPIO0_7	GPIO0_7
39	X_AM335_EXT_WAKEUP	External wakeup
40	X_INT_RTCn	Interrupt from the RTC
41	GND	Ground
42	X_GPIO3_7	GPIO3_7; Caution: Also connected to power fail signal through R415!
43	nRESET_IN	Push-button reset
44	X_GPIO3_8	GPIO 3_8; Caution: Also connected to power down circuit through R412!
45	X_AM335_NMIn	AM335x non-maskable interrupt
46	GND	Ground
47	X_AIN4	Analog input 4

48	X_AIN5	Analog input 5
49	X_AIN6	Analog input 6
50	X_AIN7	Analog input 7
51	GND	Ground
52	X_USB1_DRVVBUS	USB 1 bus control output
53	X_USB1_ID	USB 1 port identification
54	USB1_VBUS	USB 1 bus voltage
55	X_USB1_CE	USB 1 charger enable
56	GND	Ground
57	X_PMIC_POWER_EN	Enable Power Management IC for AM335x
58	X_PB_POWER	Power On for Power Management IC for AM335x
59	GND	Ground
60	VCC5V_IN	5 V input supply voltage

Table 12: PHYTEC Expansion Connector X69

4.5.5.1 Software Implementation

4.5.6 SPI Connectivity

Not implemented yet.

4.5.7 User programmable GPIOs

There are different User programmable GPIOs available. The signals are available on the expansion connector or the corresponding expansion-boards like PEB-EVAL-01. For more information look at Application Guide for the Expansion Boards or section “Expansion connector” in the System Guide.

4.5.7.1 Software Implementation

Please ask our support for example code how to communicate with the GPIO driver interface.

5 Revision History

Date	Version #	Changes in this manual
25.11.2013	Manual L-792e_0	First edition. Describes the phyBOARD-Wega-AM335x SOM (PCB 1397.0) with phyBOARD-Wega- Carrier Board (PCB 1405.0).

Index

B

E

F

L

P

S

U

Document: phyBOARD-Wega-AM335x
Document number: L-802e_0, July 2014

How would you improve this manual?

Did you find any mistakes in this manual? page

Submitted by:
Customer number:

Name:

Company:

Address:

Return to:

PHYTEC Messtechnik GmbH
Postfach 100403
D-55135 Mainz, Germany
Fax : +49 (6131) 9221-33

Published by

Ordering No. L-792e_0

Printed in Germany