Trizeps4 and ConXS Getting Started with Windows Embedded CE 6.0

Version 1.2

This document guides you through the first steps of using the Trizeps4 running on the ConXS-Evaluation-Board.

1.0 Introduction

Thank you for purchasing the Trizeps4&ConXS-Evaluation-Kit.

The Trizeps4 is a small and complete SODIMM-size computer. Everything for a fully working system, like Flash-Storage, RAM etc. is already included and only a power-supply of 3.3V is needed to run it.

The ConXS-board is designed as motherboard for our SODIMM200-Trizeps-Modules. It contains several interfaces, and is a good starting point for your own product-design. A light-version of the ConXS-Board is availlable for use in your products.

Technical documentation can be found on the CD coming with this Evaluation-Board and on our FTP-Server [see chapter 4.6]. Sign the Non-Disclosure-Agreement [CD::\Board_Doc\DesignKits\ConXS\nda-conxs-englisch.pdf] to get additional information, like schematics and VHDL-code.

Support:

Hardware: hardware@keith-koep.com

Software: software@keith-koep.com

Sales: sales@keith-koep.com

2.0 Getting Started

2.1 Evaluation-Kit Contents

1. Trizeps4-Module
2. ConXS-Board with display
3. Power-Supply
4. Serial Null-Modem-Cable, USB-Cable
5. CD containing WinCE-Board-Support-Package, Tools and documentation.

2.2 Using the board

Normally the ConXS-Evaluation-Board should be assembled and ready to use. All you must do, is connect the power-supply to the ConXS-Board and wait till the pre-installed WinCE-image boots up.

If the SODIMM is not fitted with a Trizeps module when you receive your board, follow these instructions:

1. Slide the Trizeps into the socket taking account of the polarity mark. Do not touch the gold contacts. You can see that there is a polarization mark cut in the Trizeps ; this ensures that the module is adjusted correctly. Put the Trizeps module carefully at an angle of about 30 degrees into the socket.
2. Support the underside of the board and push the Trizeps down into the socket. It should click into its place.

2.3 Using the bootloader

The bootloader is the „BIOS" of the Trizeps-module. It decides what to boot and may assist you in testing your hardware.

To enter the bootloader-command-interpreter:

1. Connect the ConXS-board with a serial null-modem-cable to your pc.
2. Open Hyperterminal with 38,4kBaud, 8 data-bits, no parity, 1 stop bit, no flow control.
3. Press ESC and hold it pressed while turning on the Evaluation-Board.
4. Take a look at the supported bootloader-functions: „?".

TABLE 1.	Often used Bootloader-Commands

Command	Description
?	print supported functions.
tftp	load file from TFTP-server.
ereg	erase permanent registry (recommended, before loading a new WinCE-image).
eflasb0	erase everything from flash, except the bootloader.
epsm	erase persistant-storage (Flashdisk-folder in WinCE).
mount mmc or mount pcmcia	mount storage card. This must be called, before you can use the card.
cd, dir	navigate through the directory structure of a mounted storage card.
boot mmc <file> or boot pcmcia <file>	load a file from a storage card.
fb	flash boot. Boots image stored in flash.
contr, backlight	adjust contrast or brightness of a connected display.

2.3.1 Loading files

Files loaded from the bootloader must contain a bootheader (;view [CD::\MT6N_BSP_CD_2.10_05\Bootloader\KuK\Doc\bootloader2_02.pdf] for details.). The bootheader describes what to do with the data appended to it. Typically the bootheader describes where to store data (program code) and if to jump to a specified address in RAM/FLASH to execute this code.

Examples for loadable files:

- WinCE-Images:
  [CD::\wince500\Images\CONXS\TRIZEPS-IV]
- Boot-Bitmaps (Bitmap shown on boot):
  [CD::\MT6N_BSP_CD_2.10_05\Bootloader\KuK\bootblock\BitmapBoot]

The bootloader can load files from various locations:

- Ethernet using a BootP/TFTP-Server running on your PC.
- Ethernet using Windows Embedded CE Eboot.
- SD/MMC-Cards (formated as FAT12/16/32).
- CompactFlash/PCMCIA-Cards (formated as FAT12/16/32).

2.3.2 Loading files using Ethernet (BootP/TFTP)

To load a file through Ethernet, you must set up a BootP/TFTP-Server:

1. Download boottft.zip from our FTP-Server [ftp://www.keith-koep.com/pub/ bootloader/BootTftpServer_Windows].

2. Unpack and install Cabletron tftp/Bootp-Server.

3. Connect Evaluation-Board with Host-PC (Ethernet and serial connection).

4. Open Hyperterminal and enter the bootloader-command-interpreter.

5. Clear registry: „ereg". This is extremly recommended for every new image you load. Old registry-settings may result in misbehaviour of the system.

6. Obtain MAC-address of the Ethernet-Controller: „mac". This will print the current mac-address. If you wish to change this, enter a new one, else press ESC. (All Trizeps4-modules with Ethernet-Controller have an unique MAC-address shown on the label).

7. Start Cabletron TFTP/BOOTP-Server. Choose BootP-Tab and enter Ethernet-Address, a free IP-Address, and the place, where your image-file resides. Push „Update". **Note:** The MAC-address must use „-" seperators (i.e. 00-50-C2-0E-CD-12). You must have „Broadcast Reply to Bootp Request" selected.

8. Type „tftp".

9. Wait till upload finished. If you loaded a RAM-Image (nk_ram.nb0) it will start automatically, else (if ROM-Image (nk_rom.nb0, nk_zip.nb0)) type „fb" to start image.

2.3.3 Loading files using Ethernet (Eboot)

This procedure can only be used for Windows Embedded CE images (nk.bin). See „Using the WinCE Board-Support-Package" for details.

2.3.4 Loading files using storage-card-interface

To load a file using a SD/MMC or CompactFlash-Card:

1. Copy the file to a SD/MMC or CompactFlash-Card.

2. Insert it into the ConXS-Evaluation-Board.

3. Type „mount mmc" or „mount pcmcia" to mount the card.

4. Type „boot mmc <filename>" or „boot pcmcia <filename>".

5. Loading should begin.

or

1. Copy the file to a SD/MMC or CompactFlash-Card:

2. Rename file to autoboot.000.

3. Insert card and switch on power of the Evaluation-board.

4. While booting, the bootloader will check if a file named „autoboot.000" exists on a connected storage-media and will boot it. After autoboot.000 has been loaded, the bootloader will check if autoboot.001 to .999 exists and boot them in this order. New bootloaders will also check for a autoboot.bat file, which may contain bootloader-commands. For instance „boot mmc nk_ram.nb0" to start a Windows Embedded CE-Image named nk_ram.nb0 from SD-Card.

3.0   Using the WinCE Board-Support-Package (BSP)

The WinCE-BSP helps you in creating your own custom WinCE-images. Prebuild WinCE-Images may be found at [CD::\wince600\Images] or on our FTP-Server [see chapter 4.6].

3.1   Installing the Trizeps4 Board-Support-Package

You will need Platform-Builder 6.00 from Microsoft (free Eval-Versions are availlable) and our BSP [CD::\wince600\BSP\].

First install Microsofts Platform-Builder. As of Windows Embedded CE 6.0, Platform-Builder is a plugin-component for Microsoft Visual Studio.

The BSP contains platform-files (tr4conxs) and three projects (Minimal, CoreMax and MaxIE).
Copy the tr4conxs-directory to <WINCEROOT>\platform\tr4conxs.
Copy the three projects to <WINCEROOT>\project.
[WINCEROOT = <Windows Embedded CE Installation path>\WinCE600]

3.2   Creating an image with an existing project

To give you a good starting point, we've included 3 projects with this BSP.

- Minimal
  This is a minimal configuration, including all components needed, to use all of the ConXS-Evaluation-Board interfaces (Display, UART, SD/MMC, CompactFlash, etc.).
  [Windows Embedded CE 6.0 Core Run-Time License]

- CoreMax
  This is a typical configuration. It's a good example of what features are still part of a Core Run-Time License.
  [Windows Embedded CE 6.0 Core Run-Time License]

- MaxIE
  This is a full-featured Windows Embedded CE 6.0 image, including Internet-Explorer and Media-Player. And yet it does not include all Windows Embedded CE-components.
  [Windows Embedded CE 6.0 Professional Run-Time License]

To open one of these projects double-click the Microsoft Visual Studio Solution (*.sln) file in the <WINCEROOT>\project\<project-name> directory.

Select the solution configuration (TR4CONXS ARMVI Release or Debug):
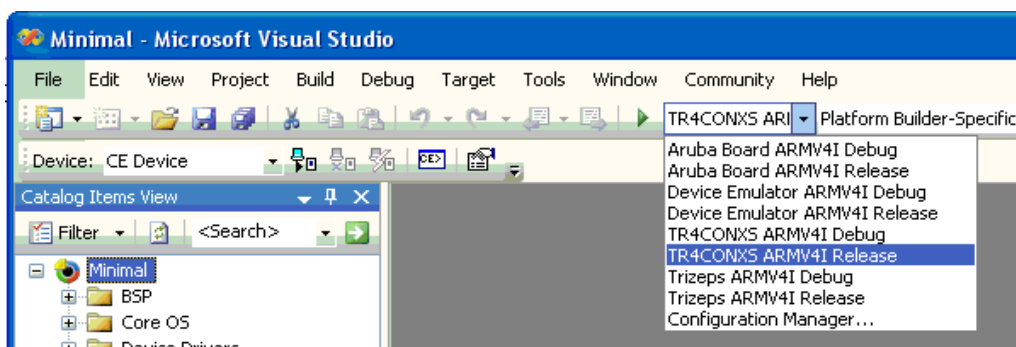
To build a project, choose Build->Build <project-name> from the menu.

If no errors occur, the build process runs makeimg.exe. which will create a nk.bin file in your _FLATRELEASEDIR (Build -> Open Release Directory in Build Window). After nk.bin is created, PostMakeImg.bat will run. This batch will create 3 binaries, patched with a bootheader (see [CD::\MT6N_BSP_CD_2.10_05\Bootloader\KuK\Doc\bootloader2_02.pdf] for further details).

- nk_ram.nb0   Image will be loaded to RAM and execute.
- nk_rom.nb0   Image will be stored to flash (uncompressed).
- nk_zip.nb0   Image will be stored to flash (compressed).

These files can be downloaded to the device through the standard bootloader in many ways (see 2.3.1. Loading files).

The maximum size of a Windows Embedded CE-image build with this Board-Support-Package is 95MB. Note that the image will be copied to the end of RAM at startup, leaving (RAM-size) - (nk_ram.nb0-size) for use as program and storage memory. Windows might not boot on low memory conditions!

3.3   Downloading the Windows Embedded CE Image with Eboot

Eboot is the „Microsoft Bootloader" for Windows Embedded CE -devices and offers a good integration in the Visual-Studio IDE. You may also use the methods described in chapter „2.3.1 Loading Files".
If you want to use an Eboot-interface for downloading images to the ConXS-Evaluation-Board, you have two options:

- Rename eboot.nb0 (found at the same directory as nk_ram.nb0) to autoboot.000 and copy it to a SD, MMC or CompactFlash card. After booting, eboot will be started.
- Use the bootloader to download ebootrom.nb0. This will copy eboot to flash. Eboot will be started on next boot.

After Eboot starts, it tries to get an IP-address through DHCP. View Eboot source-code at <WINCEROOT>\platform\tr4conxs\src\bootloader\eboot to change to a static IP-address.

Open Target->Connectivity Options... and select Ethernet as download.
Press the settings button next to the download-lisbox and wait till an active target device shows up. Select this one and press OK, Apply and Close.
After building the image select Target-> Attach Device.
Donwload should start.

3.4   Using Debug-Images

There are two options to connect to a debug-image, which you may build when using configuration „TR4CONXS ARMV4I Debug".

1. Using DM9000-Ethernetcontroller.
Copy nk_ram.nb0 to a SD-card and create an autoboot.bat-file with this content:

boot mmc nk_ram.nb0 kitl dm9k_base=0xA8300300 dm9k_int=0x01002465

2.) Using USB-Slave as RNDIS-device.
Copy nk_ram.nb0 to a SD-card and create an autoboot.bat-file with this content:

boot mmc nk_ram.nb0 rndis

If you don't specify a kitl-transport option, debug output will be directed to COM1.

Start the device with the created SD-Card.
Open Target->Connectivity Options... and select Ethernet as transport (download set to none, debugger set to KdStub).
Press the settings button next to the transport-lisbox and wait till an active target device shows up. Select this one and press OK, Apply and Close.
Select Target-> Attach Device.
Debugger should connect.

If you are using the USB-RNDIS option for the first time, you may have to specify a valid usb8023.inf-file and usb8023.sys:
C:\WINCE600\PUBLIC\COMMON\OAK\DRIVERS\ETHDBG\RNDIS-MINI\HOST\usb8023.inf
C:\WINDOWS\system32\drivers\usb8023.sys
After the network-adapter appears, assign a static IP-address of 192.168.254.2.

3.5   Creating an image from scratch

1. File-> New Project...

2. Choose Project type: „Platform Builder for CE 6.0"

3. Select „OS-Design" and press OK.

4. When Windows Embedded CE6.0 OS Design Wizard opens, press Next.

5. Choose TR4CONXS: ARMV4I as Board Support Package.

6. Follow the instruction of the design wizard..

Note:

Add the RAM-based Registry component (SYSGEN_FSREGRAM) to your solution.

If a component added is excluded from build (red-cross instead a green check mark), you get the reason by pressing the right-mouse-button on that icon and choosing „Reason for Exclusion of Item".

Sometimes drivers need additional components from the Microsoft Platform-Builder to function as expected!

- To use Compact-Flash storage cards, include the ATADISK and the FAT-Filesystem component.
- To use a SD/MMC storage card, you have to include the FAT-Filesystem component.

SD/MMC: add „SD Memory" SYSGEN_SD_MEMORY

USB-Slave: add at least one of the USB-Function clients (RNDIS, Serial(ActivSync), Mass Storage) (i.e. Serial: SYSGEN_USBFN_SERIAL).

Known Issues:

If you want to use the UCB-Touch driver, always include the Wave driver. Otherwise the system may hang after suspend/resume!

4.0   Things you can do with Windows Embedded CE

With Windows Embedded CE you can do almost everything, that you can do with a „big" computer. Allthough a full OS can be squizzed into devices with less than 32MB flash (the MaxIE-project fits into 15MB (zipped), the Minimal-project only uses 4MB), many interfaces from the bigger Desktop-Windows can be used. Simple Applications written for Windows would also recompile for WinCE with no major changes.

4.1   ActiveSync Tools

ActiveSync is a tool, that helps you connect the Trizeps4-Evaluation-Board to your development workstation. Besides the functionality you know from PDA's or other devices, that use ActiveSync to synchronise your phone-book or download programs, you may also use ActiveSync to debug your program or use some of the remote tools (i.e. Remote Registry Editor). If not already installed, you can get ActiveSync from Microsoft for download.

To use ActiveSync, just connect the EvaluationBoard through an USB-cable. ActiveSync will connect automatically. If not, open Microsoft ActiveSync and choose „File->Connection Settings..." and validate that „Allow USB connections" is selected.

Note: On Trizeps4, USB-Host port 2 is disabled during an USB-Slave-connection.

4.2   KuK-Tools, drvlib_app.dll and the persistant registry

drvlib_app.dll is a DLL which contains many useful functions to do device-specific things like reset, storing and erasing the registry and i2c-communication. For a documentation of these function view [%_WINCEROOT%\platform\TR4ConXS\docs\DrvLib_App.chm]

KuK-Tools is a simple program that uses drvlib_app.dll. The main feature of the KuK-Tools is, that you can store and erase the persistant registry. If you don't store the registry, changed values are lost on the next cold-boot.

4.3 RotateScreen

A little tool named RotateScreen exists, which is shown in the taskbar:

- Tap it once to rotate the screen.
- Tap it twice to open a control-panel, which lets you set the rotation-angles.

4.4 FTP, HTTP, VNC-Server

The CoreMax and MaxIE images include an FTP and HTTP-server. To attach to these servers, obtain the IP-address of the connected ethernet-card („double-tap the network-symbol in the task-bar) and open your browser with:

- ftp://wince:secret@<IP-Address (i.e. 195.8.230.20)>

  View [HKEY_LOCAL_MACHINE\COMM\FTPD] registry keys for additional settings.

  The ftp-server is configured to use the „\temp"-directory.
- http://<IP-Address (i.e. 195.8.230.20)>/ADMIN

  View [HKEY_LOCAL_MACHINE\COMM\HTTPD] registry keys for additional settings.
- Execute VncViewer.exe contained in [%_WINCEROOT%\PLATFORM\Tr4conxs\Vnc_4_customers\vnc.zip]. You must have included the VNC-server item to your image!

4.5 Application-Notes, Samples and Updates

You will find application-notes, samples and updates in the private part of our ftp-server at:

ftp:\\ce500:ce500@www.keith-koep.com

ftp:\\ce600:ce600@www.keith-koep.com