



Getting Started with SPARK using Trizeps4 and uConXS

Version 1.0

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

1.0 Introduction

The SPARK Your Imagination offering combines an embedded device with Windows Embedded CE and Visual Studio. The embedded device consists of a Trizeps4 module and a uConXS-base-board.

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

The uConXS-board is designed as motherboard for SODIMM200 Trizeps modules. It contains several interfaces, and is a good starting point for your first experiences with embedded computing.

The Microsoft Visual Studio development system is a suite of development tools integrated in a single integrated development environment (IDE). Windows Embedded CE Platform Builder is a plug-in to this development system.

Though no support is given for the SPARK-boards, Keith & Koep GmbH will host a Wiki at the company website (www.keith-koep.com). A feedback-form or similar will be included, so that questions not answered by this manual may be asked.

We offer professional-services and evaluation-boards including support if you want to start developing commercial devices.

2.0 Getting Started

2.1 Evaluation-Kit Contents

1. Trizeps4-Module
2. uConXS-Board
3. CD containing Board-Support-Package + Tools + Documentation.
4. Windows Embedded CE 6.0 R2
5. Visual Studio Professional 2005

You will need a power-supply and cables, which you may purchase as separate kit.

2.2 Starting the board

Normally the uConXS-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 Windows Embedded CE-image boots up. You may attach a display to the VGA-connector of the uConXS, before powering on the device.

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 board

The Windows Embedded CE-Image already stored on the Trizeps-module should include everything you will need to get started with your own project. Windows Embedded CE is made up from several components, which may be selected to be included or not. This allows fitting images to several devices. If something is missing, you might want to build an image using the Keith & Koep Board-Support-Package and Platform-Builder.

With Windows Embedded CE you can do almost everything, that you can do with a „big“ computer. Although a full OS can be squeezed into devices with less than 32MB flash (the MaxIE-project fits into 16MB (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 only minor changes.

The network-driver is set up to get its IP-address with DHCP. If you have no DHCP-server connected, you can change network settings at:

Start->Settings->Network and Dial-up Connections.

Double-Click DM9CE1 and set your network settings accordingly.

2.3.1 Internet Explorer 6

Surf the Internet with Internet Explorer 6.

2.3.2 Media Player 9

Play media-files (audio and video) from local storage devices or using network-media-streams.

2.3.3 Microsoft Word Pad

Do simple Text editing.

2.3.4 Remote Desktop

Connect to your Home-PC or Server using a remote-desktop-connection.

2.3.5 Use the HTTP, FTP Server

To attach to these servers, obtain the IP-address of the ethernet-controller (,double-tap the network-symbol in the task-bar) and open your browser with:

- ftp://wince:secret@<IP-Address>
i.e. ftp://wince:secret@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 on default.
- http://<IP-Address>/ADMIN
i.e. ftp://wince:secret@195.8.230.20/ADMIN
View [HKEY_LOCAL_MACHINE\COMM\HTTPD] registry keys for additional settings.

2.3.6 Connect to the SPARK-Device with Telnet

On your PC run „telnet <IP-Address>“.

login (username): wince

password: secret

2.3.7 Connect to the SPARK-Device with VNC

Execute VncViewer.exe contained in [CD:\\tools\vnc\vncviewer.exe]. Enter the IP-address of the SPARK-board. Password is: secret.

2.3.8 ActiveSync Tools

ActiveSync is a tool, that helps you connect the Trizeps4-SPARK-Board to your development workstation. Besides the functionality you know from PDA's or other devices, that use ActiveSync to synchronise phone-books 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, connect the SPARK-Board 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.

2.3.9 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.

2.3.10 KuK-Tools, drvlib_app.dll and the persistent 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.

KuK-Tools (Start->Programs->KuK_Tools) is a simple program that uses drvlib_app.dll. The main feature of the KuK-Tools is to store and erase the persistent registry. If you don't store the registry, changed values are lost on the next cold-boot.

2.3.11 Build your own application using Visual-Studio

View Visual-Studio Help for details.

1. Install SDK_SPARK_TR4uCONXS_MAXIE.msi found on the CD at [CD:\wince600\SDK]. SDK = Software Development Kit.
2. Start Visual Studio 2005.
3. File->New->Project...
4. Select Visual C++ -> Smart Device -> MFC Smart Device Application.
5. Name it mfcsample and press ok.
6. Press Next. This will select the Platforms-Page.
7. Move the SPARK-SDK to the Selected-Tab.
8. Remove other SDK's from the Selected-Tab.
9. Press „Finish“ to complete configuration. Press Next if you would like to do further modifications.
10. Connect the SPARK device with USB to your workstation.
11. ActiveSync should connect. If not, make sure you got ActiveSync installed.
12. Press „F5“-key. This will build the project, deploy it to the SPARK-device and start debugging.

2.3.12 Application-Notes, Samples and Updates

You will find application-notes, samples and updates on our homepage at:

www.keith-koep.com

3.0 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-interpretter:

1. Connect the uConXS-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 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	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>	load a file from a storage card.
fb	flash boot. Boots image stored in flash.

3.1 Loading files

Files loaded from the bootloader must contain a bootheader (;view [CD::\documentation\bootloader3.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::\wince600\Images]
- Boot-Bitmaps (Bitmap shown on boot):
[CD::\tools\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 (formatted as FAT12/16/32).
- CompactFlash/PCMCIA-Cards (formatted as FAT12/16/32).

3.1.1 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-interpretor.
5. Clear registry: „ereg“. This is extremely 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.

3.1.2 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.

3.1.3 Loading files using storage-card-interface

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

1. Copy the file to a SD or MMC -Card.
2. Insert it into the uConXS-Board.
3. Type „mount mmc“ to mount the card.
4. Type „boot mmc <filename>“.
5. Loading should begin.

or

1. Copy the file to a SD/MMC (note it should not be longer than 8 characters).
2. Create a file on the SD-card named autoboot.bat.
3. This file can have bootloader-commands like „boot mmc <filename>“. Where filename is the name of the file to boot.
4. Insert card and switch on power of the board.
5. While booting, the bootloader will check if a file named „autoboot.bat“ exists on a connected storage-media and will boot it.

4.0 Using the Windows Embedded CE Board-Support-Package (BSP)

The Windows Embedded CE-BSP helps you in creating your own custom CE-images. Prebuild CE-Images may be found at [CD::\wince600\Images] . Prior to installing the Board-Support-Package, you will need to install Visual-Studio-Professional 2005 and Windows Embedded CE6.0 R2 Platform Builder.

4.1 Installing the Trizeps4 Board-Support-Package

The BSP contains platform-files (tr4uconxs) and three projects (Minimal, CoreMax and MaxIE).

Copy the tr4uconxs-directory to <WINCEROOT>\platform\tr4uconxs.

Copy the three projects to <WINCEROOT>\OSDesigns.

[WINCEROOT = <Windows Embedded CE Installation path>\WinCE600]

4.2 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 uConXS-Board interfaces (VGA, UART, SD/MMC, 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]

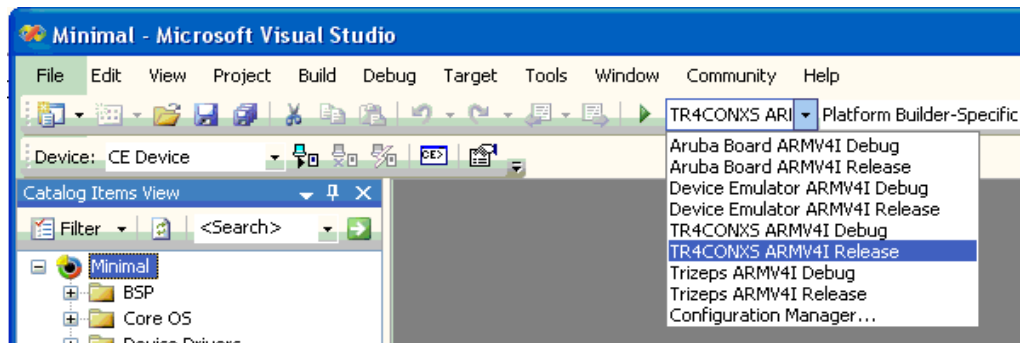
- MaxIE

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>\OSDesigns\<>project-name> directory.

Select a solution configuration (TR4UCONXS 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:\Documentation\bootloader3.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!

Also note that storing flash-images (`nk_rom` or `nk_zip.nb0`) with a size greater than 16MB might destroy the flashdisk. Either use `nk_ram.nb0` or remove the IPSP4000-catalog item in this case.

4.3 Downloading the Windows Embedded CE Image

The simplest way to download your Windows Embedded CE Image to the uConXS-Board is through SD-card.

If you only want to try your CE-Image, just put `nk_ram.nb0` on the card. Create an `autoboot.bat`-file containing:

```
display  
boot mmc nk_ram.nb0
```

(File must end with a blank line)

Insert the card and power-up the board.

`display`: shows boot bitmap

`boot mmc nk_ram.nb0` will copy the CE-image to RAM and boot it.

If you want to store the image permanently, put `nk_zip.nb0` on a SD-card, enter the bootloader and type:

```
boot mmc nk_zip.nb0
```

This will burn the image to flash. Type „fb“ or reset board.

If you previously stored the registry through Start->Programs->KuK Tools->Store, your new CE-Image might hang during boot. Before loading a different image, you must erase the registry either with the KuK Tools or with the bootloader-command `ereg`.

If the flashdisk does not exist or was destroyed (either by using a too large CE-Image or using another flashdisk-driver-version), the flashdisk gets reformatted. This might take some minutes and you will probably only see the CE-Image.

4.4 Downloading the Windows Embedded CE Image with Eboot

[please note that we recommend loading files through SD-card or TFTP, because Eboot has some limitation.]

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 uConXS-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 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\tr4uconxs\src\bootloader\ebboot 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. Download should start.

4.5 Using Debug-Images

There are two options to connect to a debug-image, which you may build when using configuration „TR4UCONXS 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). You must select Ethernet, even if you want to use USB as kitl-transport!

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.

4.6 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 TR4UCONXS: 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 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).