**Automation with PCs**

**ADVANTECH**

# Windows® CE .NET Based X86 Embedded System

# Users Manual

## Important Note: Read Carefully

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## Copyright Notice

**Part Number:**

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# Introduction

Microsoft Windows CE is a compact, highly efficient, scalable operating system that is designed for a broad range of embedded systems and products. Its multi-threaded, multi-tasking, fully preemptive OS environment is targeted specifically toward hardware with limited resources. It's modular design enables embedded system and application developers to customize it for a variety of products, such as industrial controllers and embedded communication devices. Using Windows CE, developers can leverage their existing Windows-based programming skills. Windows CE supports subset of Microsoft Win32 APIs and several additional programming interfaces.

## Advantech's Windows CE based Embedded System

It comes with the pre-configured Windows CE OS Image and Windows CE license. You don't need to waste time and energy on developing on-board device drivers or using the Platform Builder to build the Windows CE Image, we've done that for you!

All you need to do is develop your Windows CE applications!

## Advantech Enhancement for Windows CE

Advantech continues the effort to develop Windows® CE optimized drivers, tools and components to further enhance Microsoft Windows® CE package. Followings are the key enhancements:

  DOS-less boot loader
  Persistent Registry Solution
  Save Registry When Suspend
  Auto Launch Application Function
  Customizable boot logo
  Memory and Storage Setting Solution
  Floppy Support
  IDE hard disk or Flash disk support (faster than standard

CE .NET release)
Enhanced Serial Port Driver
Enhanced Parallel Port Driver
Enhanced PS2 mouse Driver
Instant On support (Optional)
Video Capture Support (Optional)

## Installation and Setting

Windows CE is an embedded operating system, not a general purpose desktop operating system. The Windows CE Image that comes with the product is pre-configured for the dedicated hardware and settings for on-board devices. So in most cases, you may not change the related BIOS, jumper, IRQ, DMA, I/O address and memory address settings for the on-board devices. If you really need to change the settings, please write down the original setting before changing any settings.

### DRAM Installation:

32MB DRAM is usually too small to run the full configuration Windows CE .NET Image, you may encounter memory low message – "Program Memory is Critically Low". We recommend 64MB DRAM for most applications.

Currently the default system support up to 128MB.

### Utility Programs

Bigger Windows CE image file (nk.bin) will consume more memory and make booting time longer. In order to save resource, some utility programs are not in "Windows" directory. It is available on CD or Floppy, You may copy it to the Flash disk when you need it.

The embedded system you get should have Windows CE software properly installed. Please be careful not to delete or modify the important systems files in the flash disk.

### System files

Followings are the systems files in the root directory of Flash disk. Please don't delete it or the system may not boot or work normally.

### Configuration file: bootcepc.cnf

Boot loader needs this file to load image. Please don't delete this file or change the default setting.

### Boot logo .pcx file: bootcepc.pcx

You may replace the bootcepc.pcx with your own logo file, but the file name must be the same. Please backup this file before using your logo file. The resolution should be 640x480 and color depth should be 256 colors.

### Kernel Image file (nk.bin)

This is the Windows CE image file. Please don't delete it or modify it.

**Note:** Microsoft Windows CE and Advantech software is protected by copyright laws. You need to get both Microsoft and Advantech license to legally utilize Advantech Windows CE releases. Please don't make any illegal copy.

# Tutorial – Using Windows CE .NET

### Shut down the system

Unlike other Windows Operating Systems, there is a shut down button. The Windows CE default shell is designed for Hand Held PC, the Suspend button does not work for x86 Windows CE Embedded System. To shut down the x86 Windows CE system, you have to close all applications. Then turn off of the power supply or reset the system. Advantech has developed the solution to use the Suspend button as the restart function. When you push Suspend button, the system will close all device drivers and then restart safely.

### Task Manager

Press **Alt+Tab** key to run Task Manager
**Button description:**
**Switch To**: You can use arrow keys to select the task.
**End Task**: You can stop the selected task.
**Cancel**: Exit Task Manager

### Command Prompt (CMD.EXE)

The command Prompt provides similar commands as the DOS prompt. You will be able to copy, delete, move and execute files.
Type **Help** for a list of commands.
Select **Start** > **Programs** > **Command Prompt** or just run **cmd.exe**.

### Advantech Persistent Registry Solution & Setting

The default storage for Windows CE Registry is DRAM. However, the x86 platform does not have a battery to backup the DRAM data after power off. So, the Registry settings will be gone after the power is off. You will find the Registry settings will go back to the default value when you power-on again. To solve this problem, Advantech had developed the solution for x86 Persistent Registry.

**Setting for Persistent Registry**

The persistent registry solution needs a persistent storage (Flash disk or hard drive) to store the backup registry (registry.dat). Please go to control panel and double click "Registry Settings". Key in the path to store the registry.dat. Example: Key in "\DiskOnChip" to store backup registry in "\DiskOnChip\registry.dat". If you don't complete this setup, the system will prompt you when system start up every time.

**How to change Registry settings?**

1. Modify by Control Panel: Some registry settings can be modified in Control Panel.
2. Modify by Remote Registry tool in Microsoft eMbedded Visual Tool.
3. Modify by Advantech Registry Edit Utility (**regcedit.exe**)
4. Write your own application to call Registry related APIs Example APIs: RegOpenKeyEx, RegQueryValueEx, RegSetValueEx and RegCloseKey.

**How to backup the Registry into persistent storage?**

**Automaticly:** Advantech's utility will backup registry if you use Suspend button to restart system.

**Manually**: You may also manually use Advantech Registry backup utility (**regsave.exe**).

The Registry backup file (**registry.dat**): You may have to delete this file if you need to update or reinstall a new image (nk.bin).

**Advantech Auto Launch Application Solution**

The default way to launch applications during Windows CE booting is to put your applications in a special Registry key and rebuild the Windows CE Image. This is too complicated and not flexible for most application developers. To solve this problem, Advantech has developed the "Auto Launch" solution. With this solution, you can let the system run your applications without rebuilding the Windows CE Image.

1. Go to **Control Panel** > **Registry Settings**.
2. Click "**Auto Launch**"
3. Click "**New**"
4. Add the applications with the full path name and arguments to the list. Example:
   \Windows\cmd.exe /k dir
   \Windows\pvbload.exe \DiskOnChip\my.vb

   **Note:** You need to use pvbload.exe to run Visual Basic programs (.vb files).

**Advantech Memory Adjust Solution**

The Windows CE default setting for Storage Memory and Program Memory ratio is fixed. Even you can change the setting, however, the setting will go back to the default after resetting the system. Because x86 platform does not have battery to backup the setting in DRAM, also the setting is not in Registry, so the Windows Image has to be rebuilt for the new setting.

Advantech has developed the solution and integrate into the pre-configured Windows CE Image. You only have to follow the procedure to change the setting.

1. Go to **Control Panel** > **System**
2. Click "**Memory**"
3. Move slider to the left for more memory to run programs,

move slider to the right for more storage room.

4. Restart the system

## VGA Display Setting

1. Go to **Control Panel** > **Display Resolution**
2. Select the resolution and color depth
3. Restart the system

**Note:**

1. This utility is only for Flat display driver. This Flat display driver supports display chips with VESA 2.0 compatible VGA BIOS. For the other display chip/driver, Advantech may develop special utility. In this case, please refer to the related document for more details.
2. Please don't select the resolution and color depth which are not supported by the display chip. You may also need to update the VGA BIOS to support different resolution or LCD type. For more details, please check the hardware user manual.

## Touch screen

If the target hardware does not come with the Touch screen, please skip this session. Touch screen is available as an option on most Panel PCs. For the other CPU board platforms, the default pre-configured Windows CE Image does not include Touch screen driver and the serial port is available for the other device. To add a Touch screen to the Windows CE platform, the Windows CE Image needs to be rebuilt with the Touch screen driver. The touch screen calibration utility is in the Control Panel.

### Calibration Utility

You need to calibrate at least once for each system. Here is the procedure:

1. Run the calibration utility for the touch screen
2. Following the instruction to calibrate.
3. Save the registry.
4. Reboot the system.

**Keyboard**

Most Embedded applications don't need a keyboard. You may need to connect a standard keyboard to configure your Embedded system. After that, you may power off the system, remove the keyboard and reboot.

**Software Keyboard**

Run sipselect.exe, and then there will be a "red pen" icon on the right of the shell bar.

To enable software keyboard, you may
1. Single click the icon, wait for the pop-up menu, then click "keyboard". or
2. Double click the icon.

To hide the software keyboard, you may
1. Single click the icon, wait for the pop-up menu, then click "Hide input panel". or
2. Double click the icon.

**Mouse**

PS/2 Mouse is the default Windows CE Mouse device. For the few platforms that do not support a PS/2 Mouse, a Serial Mouse will be the pointing device. Like the keyboard, the system does not need a mouse for most Embedded applications.

**Floppy**

There is no drive letter (A:, B) in Windows CE. The directory name for Floppy drive is \Floppy. Windows CE is different from other Windows operating systems, the Floppy must be mounted before using it.

Mount utility
Advantech has developed the driver and utility with auto mount feature. The system can periodically to check and mount the Floppy or mount by manual. You may use the Floppy mount utility (flmount.exe) to change the polling interval or start/stop the polling.

Note: If there is problem to access the floppy, please check the BIOS setting and cable connection.

**IDE Hard Disk/Flash Disk/CompactFlash Disk**

If the target hardware does not support IDE device, please skip this session. The IDE driver built in for the pre-configured Windows CE Image supports the IDE Interface Hard Drive, Flash disk and CompactFlash ™ Card.

**Directory Name:** There is no drive letter (C:, D: or E:) in Windows CE. The directory name for the IDE disk is:
Primary Master: \DiskA
Primary Slave: \DiskB
Secondary Master: \DiskC
Secondary Slave: \DiskD

**Note:** For 256MB below Advantech PCD-100A, PCD-250A, PCD-350A, PCD-1240V and PCD-1244H (CompactFlash and IDE Flash disks), the BIOS setting must be "Normal" mode. Or the system may not get the correct Cylinder/Head/Sector data and cause errors.

**DiskOnChip**

The M-Systems DiskOnChip driver is built into the pre-configured Windows CE Image if the CPU board has onboard DiskOnChip socket. Please skip this session if the target hardware does not have DiskOnChip socket.
Note: You must not change the memory jumper setting for DiskOnChip, or the system will not work.

**Directory:** There is no drive letter (A:, C: and D:) in Windows CE. The directory name for DiskOnChip is \DiskOnChip.

**Serial Port**

**Serial Port Testing Procedure:**

1. Prepare a Null Modem cable to test RS-232 ports.
2. Prepare another Windows 95/98/NT PC.
3. Start the HyperTerminal.exe (Hypertrm.exe) on Windows 95/98/NT PC, set the baud rate.
4. On the Windows CE Target device

Start the **pegterm.exe**

Make a New Session

Input any number in the Telephone Number.

Select **Force Local**

Click **Configure ...**

Select **Manual Dial** in Port Settings.

Set the same baud rate as in 95/98/NT PC.

1. Type some characters on both keyboards to verify the connection.

**Parallel Port**

Windows CE only comes with PCL printer driver. Most HP printers should support PCL. If your printer does not support PCL, then you have to develop the Windows CE printer driver.

To test the printer port, you may:

1. Connect a printer and use Advantech utility **tstlpt.exe** to print a simple plain text page.

2. Connect a PCL compatible printer and use the Browser to print out the web page.

**Ethernet**

**Network Setting**

If the hardware you have does not have network chip, please skip this session. Windows CE needs you to change the Device Name in the Control Panel before using the network functions.

Please follow the procedure below:

1. Go to **Control Panel** > **Communications** Properties.

2. Change the default "**WinCE**" to any other name. You have to select a unique name in the network.

3. You may change the Network and TCP/IP settings at this time.

(Go to **Control Panel** > **Network**) The default IP setting is to obtain an IP address via DHCP. You may change to static IP.

4. Run **regsave.exe** to save the Registry setting.

5. Reboot the system.

6. You can use **net** command and **UNC** to access Windows 95/98/NT/2000/XP share directories and files. However, Windows CE does not support Windows 95/98/NT/2000/XP to view or access files on Windows CE device. You may develop an application, such as FTP applications to help out with this solution. .

## Microsoft UNC (Universal Naming Convention)

To access files on the network, you may need UNC. It is
"\\" +
Server Name + "\" + Share Name. For more details, please
refer to
Microsoft document.

## net command

The net command is helpful to view or access files on
Windows
95/98/NT/2000/XP.
The Help information is available by: net /?

net view <computername> | /DOMAIN: <domainname>
net use [<local name>|*] [<remote name>] [/user:<username>] [/d]

Example:
net view \\MyServer\MyShareDirectory
cd "\\My Server\My Document"
cd \\MyServer\MyShareDirectory

## Audio

If the target hardware does not support audio function,
please skip this session.

You may go to **Control Panel** > **Volume & Sounds** to
control the volume or change the .WAV file for system
events.

**Advantech Audio Recorder Test Utility (record.exe)**



1. Connect the microphone and speaker
2. Run record.exe
3. Select sample rate
4. Record your sound
5. Play the sound

Note: If there is any problem, please check the audio chip IRQ, I/O and DMA BIOS or hardware settings are the same as the Registry settings. For Image size consideration, it may be provided in Floppy, CD rather than Windows CE Image.

**Digital I/O**

If the target hardware does not support Digital I/O function, please skip this session.

You may use _inp(),_inpw(),_outp() and _outpw() functions in your Windows CE application to access the I/O address directly.

**Advantech I/O Port Test Utility (ioport.exe)**

You may use the utility to read and write data of I/O ports and test the digital I/O functions.

### Watchdog timer

If the target hardware does not support watchdog timer function, please skip this session.

You may use _inp(),_inpw(),_outp() and _outpw() function calls in your Windows CE application to access the I/O port to enable/disable the watchdog timer. Different CPU boards may have different ways to enable/disable watchdog timer. For more details, please refer to hardware manual.

### USB

If the target hardware does not support USB, please skip this session.

To enable USB, please follow the procedure:
1. Enable USB in BIOS setting
2. Power off the system
3. Power on the system
4. Plug in USB device like USB mouse

Note:
1. The pre-configured Windows CE Image only includes USB mouse driver.
2. To enable other USB device, you need the Windows CE driver for the USB device. In most case, USB device vendor doesn't provide Windows CE driver. That means you may have to develop the driver.

## IrDA (SIR)

If the target hardware does not support IrDA function, please skip this session.

Please follow the procedure to enable IrDA:
1. Enable IrDA in BIOS setting. Make sure to select half duplex mode.
2. Connect an IrDA Adapter to the CPU board. Example: ACTiSYS ACT-IR210L (http://www.actisys.com)



### Advantech IrDA File Transfer Test Utility:
(IrDA_snd.exe and IrDA_rcv.exe)
Prepare two Windows CE Embedded Systems with IrDA adapters and IrDA function is enabled. Transfer file between two Windows CE devices.

Usage:
IrDA_snd.exe filename
IrDA_rcv.exe filename

Example:
Sending side: IrDA_snd.exe send.txt
Receiving side: IrDA_rcv.exe receive.txt

Note:
When you enable the IrDA, it will use one COM port resource. So the COM port will not be available to connect serial port devices.

**Communication Programs**

Select **Start** > **Programs** > **Communication** to run the programs. The on-line Help information is in **Start** > **Help.** Select **Remote Connections**.

**Remote Networking (remnet.exe)**: See Topics about "Connecting to an ISP", "Connection to a Network" and "Adjusting Remote Connection Properties".
**Terminal (pegterm.exe)**: Select Using Terminal

# Application Programming

### Cross Development

For Windows 98/NT/2000 application programming, the development tool like Visual C++ and application can be on the same PC. So developer can develop, debug and test application on the same PC. However, this is impossible for most embedded system development. Because some embedded systems are headless (no display, keyboard or mouse) or the CPU is not powerful enough to install the development tool. Cross development is the solution. The cross development includes a powerful development host, target embedded system and the cable connection between two system.

### Windows CE Application Cross-Development Environment

**Host:** PC with development tools
**Target:** Your Windows CE Embedded System
**Connection:** Ethernet or serial port connection

**Application Development Tools**
### 1. Visual Studio .NET



You may purchase Microsoft Visual Studio .NET from Microsoft online store or Microsoft local Embedded distributor.
 http://msdn.microsoft.com/vstudio/

### 2. Embedded Visual C++ 4.0

You may purchase Microsoft Embedded Visual C++ 4.0 from Microsoft online store or Microsoft local Embedded distributor. You may also download from the following website.
http://msdn.microsoft.com/vstudio/device/download.asp

### 3. Platform SDK
To develop Windows CE application for Advantech X86 platform, you may now use the standard X86 SDK from Platform Builder 4.0

# Development Host System Requirement

| Minimum Requirements | |
|---|---|
| **Processor** | Personal computer (PC) with a Pentium II-class processor, 450 megahertz (MHz) |
| **Operating System** | Microsoft Windows NT® 4.0 or later operating system |
| **Memory** | **Microsoft Windows® XP Professional**<br>160 megabytes (MB) of RAM<br><br>**Windows 2000 Professional**<br>96 MB of RAM<br><br>**Windows 2000 Server**<br>192 MB of RAM<br><br>**Windows NT 4.0 Workstation**<br>64 MB of RAM<br><br>**Windows NT 4.0 Server**<br>160 MB of RAM |
| **Hard Disk** | **Standard Edition**<br>2.5 gigabytes (GB) on installation drive, which includes 500 MB on system drive<br><br>**Professional and Enterprise Editions**<br>3.5 GB on installation drive, which includes 500 MB on system drive |
| **Drive** | CD-ROM or DVD-ROM drive |
| **Display** | Super VGA (800 x 600) or higher-resolution monitor with 256 colors |
| **Mouse** | Microsoft Mouse or compatible pointing device |

## Development Host Installation

1. Install Windows NT 4.0 + Service Pack 5 or later, or Windows 2000/XP
2. Install Microsoft Visual Studio .NET or eMbedded Visual C++ 4.0
3. Install Standard X86 Platform SDK

For more information about application programming with Windows CE .NET, please refer to the document **"Advantech Windows CE .NET Application Hand on Lab."**

## Q&A

**I have purchased Windows CE License from Microsoft Distributor. Am I authorized to use Advantech Windows CE OS release?**

Every Advantech Windows CE OS binary contains some Advantech intellectual properties that are not automatically licensed to Windows CE licensee. Customers have to be licensed by Advantech independently to utilize Advantech Windows CE OS release. Normally Advantech grant customer the right to use Advantech intellectual properties that come with Advantech Windows CE OS release if he purchases Windows CE license from Advantech.

**Why are the Inbox and Pocket Word missing?**

Because most of the Embedded applications do not need Inbox and Pocket Word. So, we choose Full version as the default Windows CE license. For Microsoft Inbox and Pocket Word applications, the license " Professional Version License" is needed.

**When I copied files to the root directory or \Windows directory and reset the system, they all disappeared. Why?**

The Windows CE uses the RAM based File system. So, directories such as Root and \Windows are actually loaded in RAM. For x86 platform, there is no battery to backup the data in RAM. The data will be lost after power is off. If you need to store your files, you may have to copy them to the following storage devices:
Floppy, DiskOnChip or IDE Flash disk/CompactFlash ™ Card/Hard Drive

**Does Advantech offer Windows CE system integration service?**

Yes, we can provide the complete Windows® CE Embedded

System based on your requirements. You simply choose the Advantech hardware and Windows® CE configuration, we build the customized Windows® CE Image. The Windows® CE Embedded systems we ship to you will include Advantech hardware, Flash disk with pre-installed Windows® CE Image and Windows® CE license.

Our Windows® CE experience and strong customer focus enables us to understand your requirements and specifications. By utilizing the core technology and intellectual property derived from our past projects, we may already have the solution to your toughest problems solved before we even start. By using these proprietary technologies as a foundation to your solution, we can minimize the actual custom work - saving you time and money.

With this total solution, you can focus on what is most important to you – your creative application.

**What do I do to get a Windows CE device driver for my add-on module?**
Windows CE is tied directly to the hardware, so many of the standard PC peripherals requiring drivers have been left out. Advantech has developed hardware-specific drivers for on-board functions such as network, VGA, I/O ...of its specific single board computers. All these drivers are well ported into the Windows CE image file to be shipped together with the single board computer or Panel PC.

Windows CE is different than Windows 98 or NT in that you can get the driver from the chip or board vendors and install the device drivers. In most cases, the Windows CE image needs to be re-built with the add-on PC/104, ISA or PCI devices' Windows CE drivers. Usually, the add-on devices do not come with a Windows CE driver. So, you may have to develop or purchase one from a third party.

## Appendix

### 1. Null Modem Cable pin-out (DB-9 to DB-9)

| 1 and 6 short | 4 |
|---|---|
| 2 | 3 |
| 3 | 2 |
| 4 | 1 and 6 short |
| 5 | 5 |
| 7 | 8 |
| 8 | 7 |

Please make sure your Null Modem cable pin-out is correct, or the ActiveSync connection will fail.

### 2. Windows CE .NET related links.

**Advantech Embedded Software Home Page**
http://www.advantech.com/embeddedsw/

**Microsoft Windows CE .NET Software Developer Documentation**
http://msdn.microsoft.com/library/wcedoc/wceintro/cestart.htm

**Microsoft Windows CE .NET Home Page**
http://www.microsoft.com/windows/embedded/ce.net/default.asp