

# Installation, backup and recovery of Windows XP embedded systems

## Introduction

Software of the MEFI control system includes Windows XP embedded, control software (WinCNC and f PLC) and other applications and drivers (drivers for additional devices, CAD/CAM software, etc.). The software is designed to comply with the following conditions:

1. Simple and uncomplicated first installation, requiring minimum attention of the operator (the installation process is not fully automated and require some knowledge of the problems. However, it is assumed, that it will be done only in MEFI. It could be done elsewhere only if the hard disk (or other storage media) has been damaged and no external backup is available.
2. Possibility to recover all data after disk damage. The procedure will be similar to the initial installation process but the manual setup and installation process of additional applications will be done from the backup, saved on external storage media.
3. Possibility of easy recovery back to the manufacture default setting (will be used if extensive and unwanted changes in the system disk occurred).
4. Possibility of simple backup and simple recovery, based on this backup. The backup may be done and saved on external storage media.

## Disk management

The disk is divided into three sections/partitions (see the picture below):

### Recovery

Recovery section. It includes Windows PE that may be run independently and manual or automatic recovery of system or data section may be performed from its environment. Files from the system backup and data files created during the initial system installation are placed in this section and also files including system and data section backup, created after the machine has been installed or even later. This section also contains Windows PE boot data (bootmgr + BCD) and Windows XP embedded data. (ntldr + boot.ini). The Recovery section is hidden in Windows XP embedded. If Windows PE is run from this system, the system will assign the letter X to it.

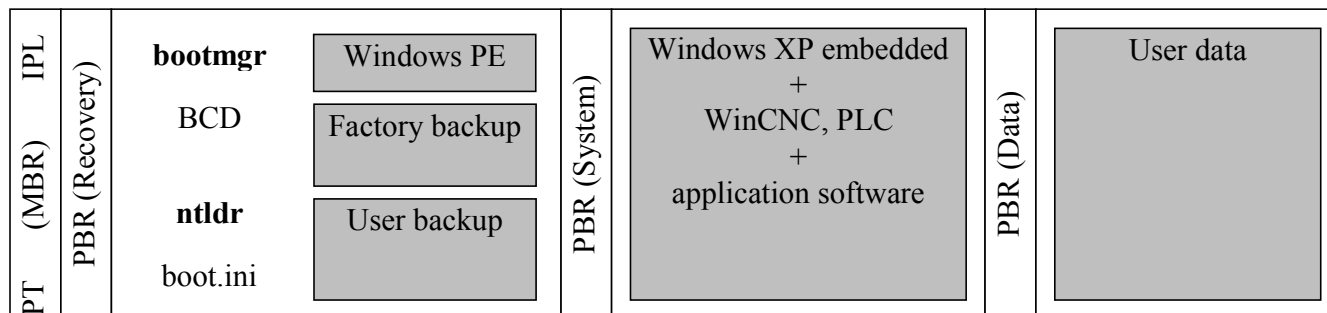
### System

The system section. It includes Windows XP embedded, WinCNC with PLC, or other applications. All contents of this section are protected against recording, done with EWF (Enhanced Write Filter), which is a part of the Windows XP embedded system. No files that require changing may be place in this section because all changes are erased when the system is switched off. The protection against recording works only if Windows XP embedded is operating. The protection against recordings works as follows. Changes done on this disk are recorded only into RAM memory and when Windows is shut off, they disappear. If the changes need to be saved, you must confirm it by using the command „ewfmgr C: -Commit“. In such case, the changes are written on disk during the Windows shut down process. (Permanent recordings of the changes are done during the Windows shut down process!) Windows XP embedded assigns the letter C: to the system section. When you run Windows PE from the Recovery section, the letter C: is also assigned to this section.

### Data

User data section. This section contains mainly directories „Documents and Settings“ and „CNC User Files“, or other directories/folders, where other applications store their data. Windows XP embedded assigns the letter C: to the data section. When you run Windows PE from the Recovery section, the letter D: is also assigned to this section.

## Disk management



PT	Partition Table
MBR	Master Boot Record
IPL	Initial Program Loader
PBR	Partition Boot Record
bootmgr	boot manager z Windows Vista (zobrazí startovací menu a podle zvolené položky zavolá další kód, který pokračuje v bootování; využívá BCD)
BCD	Boot Configuration Data (volby pro bootování, ukládá se do souboru \boot\BCD, na základě tohoto souboru se vytváří startovací menu; obdoba boot.ini z Windows před Vistou)
ntldr	Boot manager kombinovaný se zavaděčem z Windows XP, využívá boot.ini
boot.ini	soubor s volbami pro bootování pro ntldr

bootmgr Windows Vista boot manager (displays the start menu and calls additional code according to the selected option that will be used during the booting process; it uses BCD)

BCD Boot Configuration data (booting options are stored in the \boot\BCD\), the start up menu is created based on this file; similar to boot.ini from Windows XP (before Vista)

ntldr Boot manager combined with a loader from Windows XP, it uses boot.ini.

boot.ini File containing booting options for ntldr

Uživatelská data User data

aplikace application

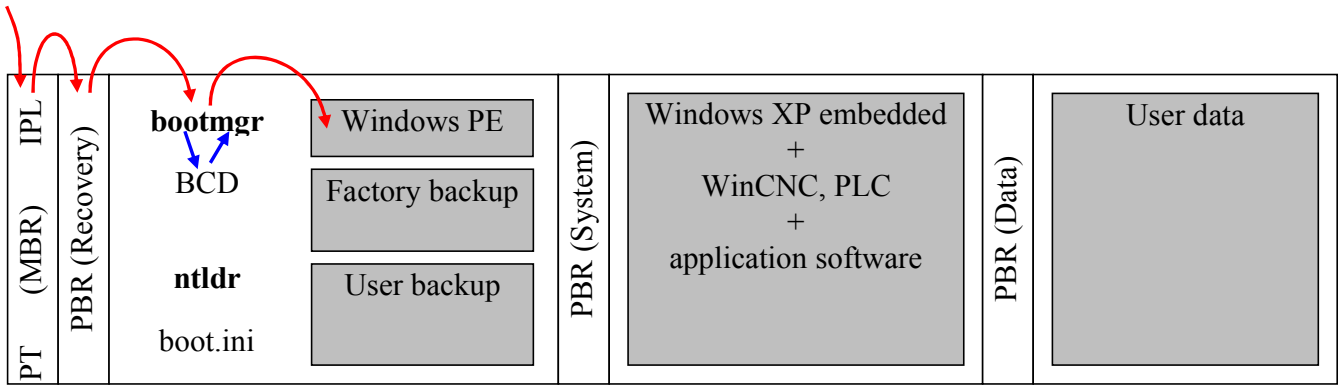
Tovární záloha Manufacturer backup

Uživatelská záloha User backup

### Boot process

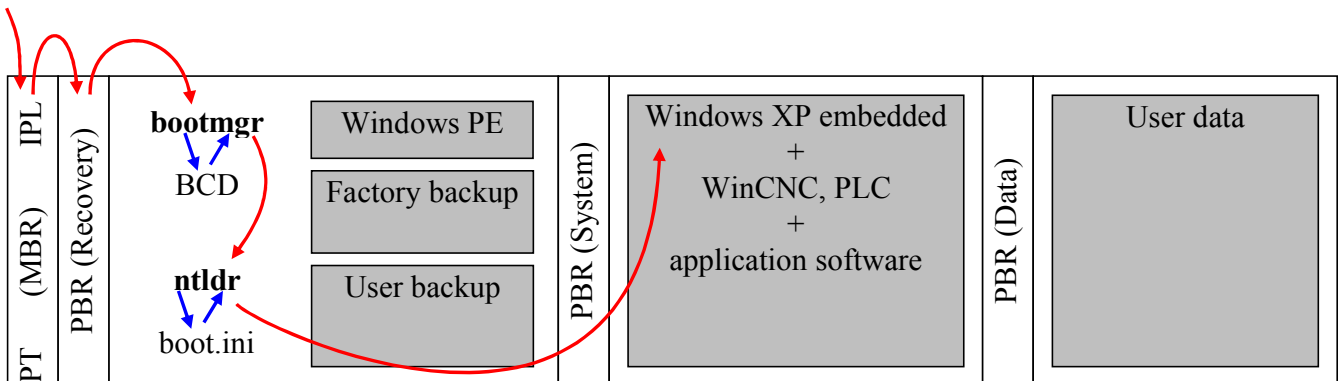
The following picture shows the boot process, after the “Backup and Recovery” is selected from the start menu. BIOS will run IPL, IPL will initiate PBR of the active section (the “Recovery” section is set as the active section) and this will initiate the boot manager. The boot manager will display the start menu, based on items in BCD.

After selecting the “Backup and Recovery” the Windows PE boot file (\Windows\system32\boot\winload.exe) is initiated and own operating system of Windows PE is installed.



Uživatelská data	User data
aplikace	application
Tovární záloha	Manufacturer backup
Uživatelská záloha	User backup

The following picture shows the boot procedures after you have selected the "CNC" option from the start menu (the start item is selected automatically, when few seconds of the timeout period has passed). In the same way as described earlier, the BIOS will run IPL, IPL will initiate PBR of the active section the "Recovery" and this will initiate the boot manager. After you have selected the "CNC" option, the boot manager and the Windows XP loader ntlldr. is initiated. This time, this may display other start menu, based on the contents of the boot. ini. file. However, this file contains one item only and therefore the ntlldr will load the operating system Windows XP embedded from the second file.



Uživatelská data	User data
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### Creation of bootable USB Recovery flash disk

This procedure creates a USB flash disk that may be used to boot and completely install (or recover) Windows XP embedded system or other tools as well. To create bootable USB flash disk you will need the "Recovery" CD.

## Step 1: Prepare a USB flash disk that you will use for the boot procedure

Note: There are several procedures how to create a bootable USB flash disk but not all will work at all times. The reason for this is, that the USB flash disk may contain (or may not contain) information that helps the system recognizes it as an external storage disk. The procedure described here should work in all situations, but it must be done from the Windows PE system.

Caution: When using the below described procedure, keep in mind that Windows system does not treat the USB flash disk as an external storage disk and uses cache memory instead. Due to this, (if the USB flash disk gets disconnected without shutting it down safely – function "Safely remove hardware"), it is probable that all data will be lost!

1. Run the Recovery CD from any computer.
2. Connect the USB flash disk.
3. Type this following command in the command line:  
`diskpart`
4. Select the desired disk to continue. This is done with command:  
`select disk n`  
n is the letter of the USB disk. Overview of all disks connected to your computer may be displayed with command:  
`list disk`
5. Remove the original disk contents (warning, all data on the disk will be lost!):  
`clean`
6. Create a primary partition on the disk:  
`create partition primary`
7. Set the partition you just created as primary:  
`active`
8. Format the partition (e.g. with file system NTFS):  
`format fs=NTFS label="Recovery" quick`

## Step 2: Transfer all data from the Recovery CD on the flash disk

All data from the Recovery CD will be copied on the flash disk. The copying may be done on any computer, For example: In Windows XP explorer.

## First installation of operating system software

Procedure that describes the first installation of operating system software. It includes (besides others) installation of Windows XP embedded system and its first configuration, installation of additional drivers, installation of WinCNC and creation of manufacture default settings backup. This procedure is used to create operating system if irreversible damage of the disk occurs and external backup is not available.

### Step 1: Installation of Windows XP embedded

These steps will prepare (divide) the hard disk (it will be divided in three partitions and formatted....). Then the Windows PE system, used for recovery and backup, as well as Windows XP embedded will be loaded.

1. Set the BIOS system (see the manual supplied with your motherboard). Make sure to select boot from USB CD-ROM or USB flash memory.
2. Boot from the installation medium (CD, USB flash) used for the applicable hardware configuration of the operating system (one folder usually contains files for several configurations). The application "Setup and Recovery Wizard" will initiate automatically.
3. Press the "Setup/Full recovery" button to start the installation process. You must select the applicable hardware configuration for the applicable operating system from the listing at the beginning of the installation. The entire process last several minutes...or more. It depends on how quickly the data on the installation media are read, as well as on the speed of the operating system.
4. After the installation process is over, close the installation progress window by pressing the "OK" button and restart the operating system by pressing the "Restart" button. Before restarting, make sure to remove the installation media, or change the order of the boot devices to boot from the disk. Note: The record about the installation process is stored in file "Setup\_FullRecovery.log" in root directory of the

system disk (X:). Because during the installation process, run from the installation media, the system uses RAM memory as the system disk, all data in RAM will be lost after restart.

## **Step 2: Installation of drivers, application and WinCNC. Primary configuration.**

In this step you must install all drivers and applications that are not part of the image of the Windows XP embedded system and you must also perform first or primary configuration according to customer requirements. Some drivers and applications are not included in the installation image, because they cannot be installed due to various reasons or that are usually installed as an option, or according to specific customer needs, or they are often changed (e.g. revisions of WinCNC that are released every few days and would not be wise to include them in the installation disk or storage media). However, installation programmes used to install majority of drivers and application are included on the installation media in folder "DriversAndApp". Some applications on the installation media may be outdated and therefore it may be better if you download their current versions from Internet server at: [www.mefi.cz](http://www.mefi.cz) (for example: WinCNC) or directly from the application manufacture webpage.

1. Depending on your monitor, set the display resolution (usually 1024x768 pixels) and other parameters if needed. If the image of Windows XP embedded does not contain drivers for your graphic card, you must install them first.
2. Calibrate the Touch Screen (if you have the display panel that will be used by the system available) and set the double click area on the touch screen to maximum („Start“ – „All Programs“ – „MicroTouch MT 7“ – „Control Panel“, on bookmark "Touch settings" in area "Double-click", set the moveable rider for the "Double-click area" to maximum).
3. Local and regional settings. Display dialog window "Regional and Language Options" (e.g. by pressing Start – „Control Panel“ – „Switch to Classic View“ – „Regional and Language Options“). On the "Regional Option" bookmark in "Standards and formats", select the language for number, time, date etc. formatting and in the part "Location", select the geographic location of the operating system (country or location where the system will be used). On the "Languages" bookmark you may add additional keyboard layout, (by pressing the "Details" button). Here you must set the user interface language ("Language used in menus and dialogs").
4. Install the WinCNC (if possible, download the most updated version from [www.mefi.cz](http://www.mefi.cz)) and also if available, the required PLC (PLC installation must be designed for the version of the WinCNC you have installed). Enter password in the registry of WinCNC (option "Password0" type REG\_SZ in key „HKEY\_LOCAL\_MACHINE\SOFTWARE\MEFI\WinCNC\Persistent\Channels\Channel0>Passwords“).
5. Set the WinCNC as shell. This may be done by creating the "Shell" item, type REG\_SZ in key „HKEY\_CURRENT\_USER\Software\Microsoft\Windows NT\CurrentVersion\Winlogon" in Windows registry and by setting the value to "%SystemRoot%\Shell.cmd". This item may be simply created by clicking on the file WinCncAsShell.reg in the main directory of the installation media.
6. Activate the Enhanced Write Filter. First, you must restart your system. After reboot, the WinCNC will run automatically and you must open the command line by running it from the software menu "System" – „External tools" – „Command Line". In the command line you type "ewfmg C: -enable". Now you must turn your system off, using the command "Switch off" in the WinCNC software menu.

## **Step 3: Creating backup of manufacture default settings**

These steps will help you create a backup file that may be used later to "restore" the operating system setting back to its initial default setting - as set by the manufacturer in the factory.

1. Select the "Backup and Recovery" option during the boot process.
2. The application "Setup and Recovery Wizard" will initiate automatically.
3. By pressing the "Factory Backup" button you will start the backup creation process.

## **Operating system software backup**

This will help you to create backup of your operating system. This procedure is used to create operating system backup if software damage of the disk occurred. The backup should always be created before the machine is delivered to the customer (after debugging process of PLC and necessary configuration is finished), or later if

software changes or changes in the operating system will be performed. The backup should be stored on external storage media, in case the disk in the control system is physically damaged. As an option, you may store it in the Recovery section in the operating system, because you will have it available there at all times and when system software or data damage occurs. Procedure:

1. Select the “Backup and Recovery“ option during the boot process.
2. The application “Setup and Recovery Wizard” will initiate automatically.
3. By pressing the “Backup“ button you will start the backup creation process.
4. Select whether you want to create backup of the System section or the Data section.
5. Select location where you want to store the backup files. The backup creation process lasts several minutes.

## **Recovery of manufacturer default settings**

This process will recover the operating system back to its initial settings as set by the manufacturer in the factory. This process will overwrite the entire system and data sections with the backup files and data!

Procedure:

1. Select the “Backup and Recovery“ option during the boot process.
2. The application “Setup and Recovery Wizard” will initiate automatically.
3. Recovery process from the backup file is initiated by pressing the “Restore to Factory defaults“ button.

## **Restoration from the backup file**

This process will restore the operating software system back to settings used before the backup was created.

This process will overwrite the entire system and data sections with the backup files and data! Procedure:

1. Select the “Backup and Recovery“ option during the boot process.
2. The application “Setup and Recovery Wizard” will initiate automatically.
3. The recovery process from the backup file is initiated by pressing the “Restore from Backup“ button