NB Information Limited

XTM PC/XT Emulator
For EPOC32

User Guide

Version 1.0

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CONTENTS

1. INTRODUCTION 1

2. START HERE 2

2.1 WHAT YOU NEED 2
2.2 WHY IS IT SO DIFFICULT? 2
2.3 INSTALLING THE EMULATOR 3
2.4 MAKING A DISKETTE IMAGE 3
2.4.1 Starting from scratch 3
2.4.2 Starting with a DOS PC 4
2.4.3 Testing, Testing, Testing 4
2.4.4 Installing the XTM utilities 5
2.4.5 Installing additional software 6
2.4.6 The MAKEDISK utility 6
2.5 COPYING THE DISKETTE IMAGE 6
2.6 STARTING XTM 7
2.7 BACK IT UP 7

3. COMMANDS AND CONTROLS 8

3.1 USING THE KEYBOARD 8
3.2 USING THE PEN OR MOUSE 9
3.2.1 Starting the Mouse Driver 9
3.2.2 Stopping the Mouse Driver 10
3.3 ALTERING THE VIEW 10
3.4 CHANGING IMAGINARY DISKETTE DISKS 10
3.5 REBOOTING THE XT EMULATOR 10

4. USING THE FILE SERVER 12

4.1 THE DEVICE DRIVER 12
4.2 THE REDIRECTOR CONTROL APPLICATION 12
4.2.1 Showing Current Redirections 12
4.2.2 Setting up a New Redirection 13
4.2.3 Deleting a Drive Redirection 13
4.3 COPYING FILES 13
4.4 REDIRECTOR LIMITATIONS 14

5. REGISTERING XTM 15

5.1 INTRODUCTION 15
5.2 FINDING YOUR UNIQUE ID 15

5.3 Registering the Program 15

6. TIPS AND HINTS 16

6.1 Switch Off, Save Power 16
6.2 Snooze, Save Power 16
6.3 Arranging Your Files 16
6.4 More about MAKEDISK images 17

7. PROBLEM SOLVING 18

7.1 Problems running MAKEDISK 18
7.1.1 Sector could not be read 18
7.2 Problems starting XTM 18
7.2.1 Fatal Error: Couldn't start Emulator 18
7.2.2 Fatal Error: Couldn't construct Display 18
7.3 Problems running applications 18
7.3.1 How do I type Alt-[on a Psion Series 5? 18
7.3.2 I have a UK/French/German Series 5 keyboard; some of the keys come out wrong. 19
7.3.3 I tried to run a program under XTM but it crashes. It works fine on my Windows 95 PC in a DOS window. 19
7.3.4 I have a compiled BASIC program which seems to run but then crashes the whole system 19
7.3.5 Problems with communications applications 20
7.4 Registration 20
7.4.1 I tried to register, but it said "Incorrect Registration Code" 20
7.4.2 XTM says "Your test and evaluation period has expired" 20

8. TECHNICAL DETAILS 21

8.1 Basics 21
8.2 CPU Emulation 21
8.3 Memory Map 23
8.4 XTM BIOS Implementation 24
8.5 Video Modes 25
8.6 HP200LX Graphics Support 25
8.7 Serial Ports 27
8.7.1 Serial Port Restrictions 27
8.8 Mouse 28

1. Introduction

XTM is a software emulation of a classic PC/XT computer for the EPOC32 operating system. Within this standard application for your handheld computer you can run any software that would run on a low-end PC clone from the 1980's. XTM provides the following capabilities:

- Full 80186 instruction set.
- CGA display emulation with all text modes, and graphics mode at 320 x 200 and 640 x 200 resolutions.
- Native code BIOS for improved performance.
- Native code support for HP200LX graphics extensions.
- Full access to the EPOC file system.
- Access to the EPOC machine serial port as COM1 (and on Geofox-One access to the PC card slot as COM2).
- PC keyboard mapping, including 12 function keys implemented as screen buttons.
- Built in Pen/Mouse driver.

This means that you can load up your favourite PC operating system and run legacy applications on your handheld machine. We've tested XTM with a number of different operating systems and versions, including MS-DOS and DR-DOS. In the documentation, we have assumed you are running MS-DOS.

The EPOC32 operating system runs on a number of platforms. We've tested XTM on the Geofox-One and the Psion Series 5.

To set up your XTM system will take a little time and patience - please read the next section carefully. When you've done it, you'll have access to literally thousands of applications for the PC platform - all in the palm of your hand.

2. Start Here

2.1 What you need

To set up XTM and run your favourite PC applications, you will need the following:

1. The XTM installation diskette, or the corresponding downloaded ZIP archive unzipped into a directory on your PC.
2. A Geofox-One or Psion Series 5 computer with at least 2.6 megabytes of free space.
3. A PC running Windows 95 or 98 and EPOC Connect or PsiWin connected to your handheld machine.
4. A set of diskettes for the operating system of your choice (such as MS-DOS).
5. An hour or more of spare time.

Ideally, you should also have another PC that is already running the operating system noted in item 4 above (such as MS-DOS). This isn't required, but it makes the shuffling of diskettes a lot easier.

In the following discussion we refer to the XTM installation diskette, but you may be installing XTM from a downloaded archive file. The steps are exactly the same, but you need to access the directory on your PC where you unzipped the file instead of the diskette.

2.2 Why is it so difficult?

XTM pretends to be a PC, so to do anything useful you first have to load a PC operating system, like MS-DOS, onto your pretend PC. Loading an operating system onto a real PC is easy - you put a boot diskette in drive A and switch on. Unfortunately your handheld computer doesn't have any diskette drives - not real ones anyway. Instead it has pretend diskette drives which instead of reading and writing to a real diskette, read and write to special files in the EPOC file system. Before we can boot up the emulated PC we have to copy the contents of a real diskette onto one of these special files.

If you use an old enough operating system, it probably fits entirely on one diskette, and so the process is pretty easy. If you're using a later system, it may take several diskettes just for the operating system - MS-DOS 6 for

instance occupies 3 disks. This is a pain in the neck when "inserting a diskette" involves copying the whole thing onto a file on your desktop PC, then downloading the file to your handheld machine. That's why it helps a whole lot if you have a spare PC handy. You can then install the operating system of your choice onto the hard disk of that machine, and then it's easy to create a boot diskette with just the things you want on it.

If you are careful, there is another solution using the desktop PC you already have. The reason you must be careful is because you're going to have to boot your Windows 95 machine with the installation diskette for MS-DOS 6 or DR-DOS or whatever. DON'T LET IT GO AHEAD AND INSTALL ITSELF ONTO YOUR PC! Follow the instructions under "Making a Diskette Image" very carefully.

2.3 Installing the Emulator

First, install the emulator itself onto the handheld machine. This process assumes you have already installed the EPOC Connect or PsiWin software on your PC, including the EPOC Install package, and that the remote link is working OK.

Put the XTM distribution diskette into the Windows PC that is running EPOC Connect or PsiWin, and connect your handheld machine to the PC. Open the diskette in the Windows file explorer, and double click the file called XTM or XTM.SIS. This will automatically install the XTM program to your handheld machine. When it asks if you want to install another program, you probably want to choose "Finish"

Before you can use XTM, you will need to load some boot software onto the handheld too.

2.4 Making a Diskette Image

2.4.1 Starting from scratch

Let's assume you've got a copy of MS-DOS, and it's on three diskettes. Shut down your Windows PC, and then put the set-up disk into your A drive. Power up the PC, and it should boot from the set-up disk. Depending on what version of MS-DOS you're using, it will think for a while, and then it will say something like "This is going to install MS-DOS on your hard disk. Type ENTER to continue or F3 to exit." **CHOOSE THE OPTION TO EXIT!** This will probably chide you that you have not yet installed the software and

say “are you sure?”. Go ahead and exit the install script, which should drop you down to the classic “A:>” prompt.

Most installation procedures have an option to create a minimal start-up disk, which is exactly what we want. You will need to look at the documentation to find out how to do it on your version of the system. On MS-DOS version 6.0 for instance, you would type “SETUP /F”.

The installation procedure will ask you for a blank diskette, and with a certain amount of disk swapping will create a single boot disk. This is exactly what we want.

Please note that the minimum boot diskette created by this process may not have all of the files on it that you will need. In particular, if you have a UK, French or German handheld machine you should make sure that the DOS keyboard driver files are on the boot disk - on MS-DOS these are KEYB.COM and KEYBOARD.SYS. You will need these files to access the local special keys on your keyboard.

2.4.2 Starting with a DOS PC

If you already have a PC running exactly the same version of software that you are installing on XTM, life is much easier. Now, instead of shuffling disks you can format a boot diskette directly, and copy on whatever system files you wanted.

In case you’re still wondering why you can’t just do this from a DOS session on your Windows 95 or Windows 98 PC, remember that most MS-DOS utilities are keyed to a particular version of DOS, and will not run on the wrong version. Windows 95 and 98 will not run on XTM, because they need a 386 or higher CPU, so you can’t make a boot diskette from your Windows system directly. And Windows DOS utilities will not run under older versions of MS-DOS.

2.4.3 Testing, Testing, Testing

What you’ve just made should be a genuine, working, PC boot diskette. Before you spend too much time going much further, it’s probably worth checking to see if it really works. Shut down your PC, and try booting it from the diskette you’ve just made. If it doesn’t work on your real PC, it definitely wouldn’t work on XTM.

Once you're happy that it boots up OK, eject it from the drive, and reboot your PC back into Windows.

2.4.4 Installing the XTM utilities

XTM includes a device driver to let MS-DOS access the whole of your handheld file system. The driver itself is called EPOCFS.SYS, and it has a companion utility called EREDIR.EXE. There is also a utility called XTMMOUSE.EXE which is needed to enable the built-in mouse driver. These files are all on the XTM distribution diskette. Copy the three files from the XTM distribution diskette onto the boot diskette you've just made.

Note: The Windows file explorer has an option to hide system files, which includes those with a file extension of SYS. If you've got this option enabled, and you try to copy the files from the distribution diskette under the explorer, EPOCFS.SYS will seem to be missing from your diskette. Either use **View>Options>Show All Files** in explorer, or just pop up a DOS box, and copy the files the old-fashioned way.

In order to use EPOCFS.SYS you must add it to the CONFIG.SYS file on the new boot diskette. You can do that on your handheld machine later, but you may find it more convenient to do it now. Depending on the version of operating system you are using, the file A:\CONFIG.SYS may not exist yet - if it does not exist, create a new one. CONFIG.SYS is just a text file, so open or create it with Windows Notepad, or your favourite text editor. Add the line:

DEVICE=EPOCFS.SYS C:

to CONFIG.SYS on the boot diskette. This will make the DOS C: drive equivalent to the EPOC32 C: drive when you run XTM. Only add the device driver once - if you need more redirections you can add them with the EREDIR utility later.

By the way, if you skipped the testing stage earlier - you are now too late to try it. For reasons that should not be too surprising, the EPOCFS device driver will NOT run on a real PC. If you want to boot from this diskette outside XTM you must first remove the EPOCFS device driver line from CONFIG.SYS.

2.4.5 Installing additional software

As a final action before you package up the contents of the boot diskette, you might want to copy any other of your favourite utilities onto it that fit. This means that as soon as you've got it across to your handheld, you might actually be able to do something useful.

A crucial DOS utility which is not part of the minimal boot set is the foreign language keyboard driver KEYB.COM, and its associated configuration file KEYBOARD.SYS. If you have a UK, French or German keyboard on your handheld machine, you will need these files to correctly map the keyboard.

2.4.6 The MAKEDISK utility

The last thing you need from the XTM distribution diskette is the MAKEDISK utility, which is going to turn the boot diskette we've prepared into a file which XTM can use. Copy the file called MAKEDISK.EXE from the XTM distribution diskette into a directory on your PC hard disk.

MAKEDISK is a DOS program, so you'll need to open an MS-DOS prompt window to run it. Put your boot diskette back in drive A, and type the command:

MAKEDISK A

The MAKEDISK utility will then read the entire contents of the diskette into a file on the hard disk called DRIVEA.DSK. This file will be the same size as the diskette capacity - usually 1.44 megabytes.

2.5 Copying the Diskette Image

All you need to do now is copy your diskette image onto your handheld machine. Connect the machine to the PC in the usual way.

The emulator expects to find the boot image in the file ?:\XTM\DRIVEA.DSK, where the ? represents one of the drives on your handheld machine. If you have a standard machine, that will be drive C, so first create a directory on your handheld machine called C:\XTM. You can do this either at the machine itself, or from the PC using EPOC Connect or PsiWin. If you've got a flash disk in drive D, you can store the image in D:\XTM\DRIVEA.DSK instead.

Then just drag and drop the file called DRIVEA.DSK from wherever it is on your hard disk onto the XTM directory in My EPOC Machine. EPOC

Connect will copy it across to the handheld machine. This is a good time to head off for a cup of tea. The DRIVEA.DSK file is usually 1.44 megabytes, and it will take a long time to copy across the link - usually between 5 and 10 minutes depending on the speed of your PC.

2.6 Starting XTM

At last - you can see it working! On the handheld machine, bring up the Extras bar, where you should find a new icon for XTM. Click on the icon, and you will be rewarded with a very PC-like display which boots and runs your operating system.

In the unlikely event that it doesn't seem to work, please refer to the Problem Solving section later in this manual.

2.7 Back it up

Having got this far, it's a good idea to take a backup of your handheld machine. Again, this will take a while, because it has got some big chunks of data on it, but it is very worthwhile if anything goes wrong.

3. Commands and Controls

3.1 Using the Keyboard

The keyboard of your handheld computer is somewhat different to the keyboard of a PC. What's more, the Geofox-One and the Psion Series 5 are quite different to each other.

The Geofox-One has most of the important PC keys, and they are laid out the same as a PC. The XTM emulator therefore maps the Geofox keyboard one-for-one onto a PC keyboard layout. A program running under the emulator will see keystrokes - including all shift and control key combinations - just as if it were running on a real PC. This includes "chords" where several keys are pressed at once - useful in some games. The only unusual mapping used is that XTM uses the Geofox **Fn** key to simulate the PC **Alt** key. This means that you can run all PC applications that expect the **Alt** key to be used, but also means XTM can not emulate the PgUp, PgDn, Home and End keystrokes (which need the **Fn** key to select them).

The Series 5 keyboard makes many compromises on layout in order to get larger keys into a smaller space. It uses the **Fn** key as an extra shift key to access additional characters, and the assignment of punctuation keys around the keyboard is different to a standard PC layout. The XTM emulator therefore cannot directly map keyboard scan codes into the PC equivalent - an extra translation stage is needed. For most applications this is fine, but there are two important restrictions. Firstly it mean that you will not be able to run programs that need to differentiate between multiple keys pressed as "chords". Some games depend on this and can't be used on a Series 5. Secondly, XTM uses the **Fn** key to simulate pressing a PC **Alt** key, but the Series 5 needs the **Fn** key to generate many characters. Many **Alt** key combinations are therefore not accessible from the Series 5 keyboard.

XTM translates **Fn + LetterKey** into **Alt + LetterKey** for all alphabetic characters on the Series 5 keyboard that are not otherwise used with the **Fn** key. That generally means the letters toward the left of the keyboard. Many PC programs use **Alt + LetterKey** to activate menu bar functions. If the letter you wanted to use was not available, another letter will generally activate the menu bar, and allow subsequent navigation using the arrow keys. For example, MSD.EXE requires you to type **Alt + U** to access the Utilities menu. Unfortunately **Fn + U** on a Series 5 is used for something else, so

XTM can't treat it as **Alt + U**. What you can do instead is type **Fn + F** to get onto the menu bar through the File menu, and then use the cursor keys to get to the Utilities menu.

Neither the Geofox-One nor the Series 5 has function keys, so these are emulated as a row of buttons along the top of the screen. Clicking the screen button has exactly the same effect as pressing the equivalent key on a PC. Combinations such as holding down **Alt + Shift** and clicking the screen button have the expected effect.

Finally, remember that PC keyboard layouts are different depending on what country you are in. The emulation generally reflects the keyboard in your handheld machine, and unless it is a US keyboard you will probably have to run a DOS utility in your AUTOEXEC.BAT that maps the keyboard accordingly. For UK keyboards for example, you would run:

KEYB UK

3.2 Using the Pen or Mouse

XTM includes a Mouse Driver which is compatible with many DOS applications. It translates pen taps (Psion) or mouse pad taps (Geofox) into mouse clicks. Applications which use the mouse to select menu items, click on OK buttons, and other simple functions can be used with the handheld pen or mouse in the usual way.

The EPOC32 pen based interface is not like a real mouse in that there is no translation of mouse motion - if you are not actually touching the screen, XTM doesn't know where the "mouse" is. Because of this, many programs, particularly games and graphics programs, don't work well with the pen based mouse driver; some don't work at all. We therefore provide a way of turning the mouse driver on and off, so that you can tailor the system to suit the program you are running.

3.2.1 Starting the Mouse Driver

To start the built-in mouse driver, simply type:

XTMMOUSE START

at the command prompt. You should see an output something like this:

```
Mouse control utility for XTM v1.0
Mouse driver version 1.0 activated
```

If you always want the mouse to be available, you could include this command in your AUTOEXEC.BAT file.

The XTMMOUSE command with no parameters toggles the state of the mouse driver, so if the mouse driver was currently off, the command:

XTMMOUSE

will also turn on the driver.

3.2.2 Stopping the Mouse Driver

To stop the built-in mouse driver, simply type:

XTMMOUSE STOP

at the command prompt. You should see an output something like this:

```
Mouse control utility for XTM v1.0
Mouse driver stopped
```

The XTMMOUSE command with no parameters toggles the state of the mouse driver, so if the mouse driver was already on, the command:

XTMMOUSE

will also turn off the driver.

3.3 Changing Imaginary Diskette Disks

Occasionally you might need to change which diskette is in the drives emulated by XTM. The diskette drive is mapped onto a file in the EPOC32 file system, and if you have the images of several diskettes you can swap from one diskette to another, just like on a real PC.

Select the pop-up menu bar and choose the Change Diskette menu item. It will ask you to choose whether you want to change drive A or drive B. Choose whichever you want, and then select the file corresponding to the diskette from the dialogue box that appears.

3.4 Rebooting the XT Emulator

You can reboot the emulator at any time by clicking on the Reboot button at the top of the screen. This has exactly the same effect as pressing the reset button on the front panel of a real PC - a useful feature that the original PC/XT didn't have!

3.5 Altering the View

XTM allows you to alter the way it maps the emulated CGA text colours onto your grey LCD screen. Select View from the pop-up menu bar to choose which of four styles you prefer.

There are 16 colours on a real CGA display, although the 16 colours are actually made up of 8 “normal” colours, and the same eight colours in “bright” mode. The colours are:

Normal	Bright
Black	Grey
Blue	Bright Blue
Green	Bright Green
Cyan	Bright Cyan
Red	Bright Red
Magenta	Bright Magenta
Brown	Bright Yellow
Grey White	Bright White

Most PC applications use only the normal colours in the left hand column. This is a snag when it’s mapped to the LCD display in your handheld, because there is not enough contrast between the colours. We therefore provide special “bright” mode that artificially brightens the white text colour to make it stand out better.

You can also choose to display text screens inverted, either using the standard colour map, or the brighter version. The View menu does not alter the display in graphics mode. Changing the colour mapping from the View menu has no effect on the programs running in the emulator.

4. Using the File Server

4.1 The Device Driver

The EPOCFS.SYS device driver that you loaded in the CONFIG.SYS file is a small resident program that collects DOS file redirector calls and sends them to a native EPOC32 file server. As far as DOS is concerned, it thinks it is talking to a network file server.

Just like any other DOS networking program EPOCFS lets you create remote drives, and accesses to files and directories on those drives are redirected to the server. In this case though, the server is your own handheld computer.

When you launch EPOCFS from your CONFIG.SYS file with a directory name parameter, it allocates the first free drive letter, and points that drive at the directory you specified. Because XTM doesn't have any hard drives, the first free drive letter is C:. If you use the command

DEVICE = EPOCFS.SYS C:

you will make the DOS directory C:\ point to the EPOC32 directory C:\. In other words, you've made your PC emulator map C: directly onto the same drive in your handheld.

You don't have to do it that way - you could try

DEVICE = EPOCFS.SYS C:\DOCUMENTS

instead, which will mean that the top level of C: in your DOS session appears to be the Documents directory of your handheld.

If you want to map more drives, such as directories on a flash disk, you need to use the EPOC redirector control application, EREDIR.

4.2 The Redirector Control Application

The redirector control application lets you set up new drive mappings, delete the ones you've got, or just show the current settings.

4.2.1 Showing Current Redirections

To show all the current drive redirections, simply type:

EREDIR

at the command prompt. You should see an output something like this:

```
Current Drive Redirections:
C:  = EPOC32\C:\
```

4.2.2 Setting up a New Redirection

To add a new redirection - for example to access a directory on a flash card - you would use the following syntax:

EREDIR D: EPOC32\D:\MYFILES

where the first parameter is the drive letter you want to map, and the second parameter is the path name in the host system you want to map it to, prefixed by EPOC32\.

4.2.3 Deleting a Drive Redirection

To unmap one of your drive redirections, use the following syntax:

EREDIR DEL D:

where the first parameter is DEL and the second parameter is the drive you want to unmap.

4.3 Copying Files

Because the EPOCFS redirector provides access to the underlying EPOC32 file system, XTM does not include any dedicated file copying routines to move files to and from your PC. To move a file from your desktop PC to your XTM environment, simply use your existing EPOC Connect or PsiWin software to drag and drop the file onto your handheld machine. Copy it into a directory which you have made accessible to XTM as described above, and you can immediately use it within XTM.

Any DOS file that you have stored in the EPOC file system can be copied back to your desktop PC by the same method.

One thing you need to watch out for is files which get converted by EPOC Connect or PsiWin into EPOC32 formats. If you are using a DOS word processor, spreadsheet, or database program with XTM, you may need to alter the conversion settings. Otherwise, when you drag and drop a file from your PC to your handheld machine, you may find that it has been converted into something the native DOS program doesn't recognise.

4.4 Redirector Limitations

The EPOC32 file system uses long file names, but the DOS environment is still restricted to 8 character names with 3 character extensions. The redirector can't map long filenames, and any file name that is too long for the DOS 8+3 character format is simply ignored. You therefore cannot access files or directories in the EPOC file system from within DOS if they have long file names.

5. Registering XTM

5.1 Introduction

Although XTM is available for free evaluation, if you decide you want to keep it and use it, you must purchase a license from NB Information Limited. Details of ordering arrangements can be found on the NB Information web site at **www.nb-info.co.uk**.

XTM is licensed to an individual handheld computer. In order to purchase a license you must tell us what your computer's Unique ID is. We will then provide you with a Registration Code which unlocks any copy of XTM installed on that machine.

5.2 Finding your Unique ID

Every Psion Series 5 or Geofox-One has a unique machine identity number. To find yours, go to the System screen, pop up the Menu bar, and select Information and then Machine. Your machine's Unique ID is a string of numbers and letters of the form 1000-1234-5678-9ABC.

5.3 Registering the Program

When you buy a license from us, you will receive an 8 or 9 digit Registration Code. To register your copy of XTM you need to run it, and then pop up the Menu bar. Choose Tools and then Registration, and type your Registration Code into the dialogue box. When you click OK, the program validates your Registration Code - if the code is incorrect it will tell you.

If the code was correct then XTM continues running, but in future when you launch the program it will identify itself in the little information box as a Registered Copy.

6. Tips and Hints

6.1 Switch Off, Save Power

All the time it is loaded, even when it's just sitting at the A:\> prompt, XTM is running the CPU. This will quickly run down your batteries if you're not careful - battery consumption with XTM running in the foreground is more than twice the normal current. When you are not using XTM, you should save your files, and then exit by clicking on the top right button. This is like switching off your PC. Next time you run XTM it will boot up the operating system again, and you can carry on from there.

6.2 Snooze, Save Power

OK, so you're three hours into a DOS game or a major project, and you really don't want to have to shut down XTM. You need to use the handheld for something else though, and you don't want it to eat up the batteries. When you switch to another task, XTM automatically goes into snooze mode. It still runs the emulated CPU, but only very slowly. In this low power mode, the emulator draws very little extra current from the batteries.

Occasionally a DOS program will get confused by this process, because it will think it is in a weird time warp. It is therefore always a good idea to save your work before switching to another task.

6.3 Arranging Your Files

You can't boot XTM from the internal drive of your handheld computer - you must have a diskette image file to boot from. These files are a fixed size, and depending on how you created it, the file is probably 1.44 megabytes long. It will be the same size even if the diskette it emulates isn't actually full. This is wasteful of space, especially if you've got other DOS files stored elsewhere on your C: drive.

Try to cram as many of your files onto the diskette image as you can, because this will save you space overall.

6.4 More about MAKEDISK images

The MAKEDISK utility that you use to make the initial boot image will try to make an image from any normal sized PC disk. It can read from disks of 360 kilobytes, 720 kilobytes, 1.2 megabytes, 1.44 megabytes and 2.88 megabytes. The emulator will correctly recognise each of these sizes when it boots from drivea.dsk. This means that you are not restricted to having a 1.44 megabyte boot image on your handheld machine.

In order to take advantage of these different sizes, you must first have the ability to make a valid boot disk of that size. To make a 1.2 megabyte or 360 kilobyte disk image you will need a 5.25 inch disk drive. Most modern PC's can use only 1.44 megabyte or 720 kilobyte diskettes in their 3.5 inch drives. Still, if you are short of space on your handheld machine, making a smaller boot diskette image may be very worthwhile.

7. Problem Solving

7.1 Problems running MAKEDISK

7.1.1 Sector could not be read

MAKEDISK prints an analysis of the diskette drive and media before it starts copying. If this doesn't match what is in the drive the diskette is probably incorrectly formatted.

If it does match, there is probably a bad sector on the diskette - try running SCANDISK on it.

7.2 Problems starting XTM

7.2.1 Fatal Error: Couldn't start Emulator

The most likely is that you have not provided a DOS boot disk image in "C:\XTM\DRIVEA.DSK". See section 2 for instructions.

If you do have the boot disk image, the next most likely problem is that your handheld machine does not have enough free memory to run the program. On the System screen menu, choose the item View and then Show Disk Gauge. If there's less than a megabyte before you run XTM, it will not be able to allocate the memory it needs for the PC address space - which is a megabyte. If you are close to having enough space, try closing other open applications, which will free up some memory. Otherwise, you will need to delete some other files or applications to make room.

7.2.2 Fatal Error: Couldn't construct Display

Again, memory problems are the most likely culprit. See comments above.

7.3 Problems running applications

7.3.1 How do I type Alt-[on a Psion Series 5?

There are some obvious restrictions mapping a PC keyboard of up to 102 keys onto the Series 5 keyboard with only 53 keys. We put 12 extra keys as on-

screen buttons, and try to use the main keyboard as labelled. An important PC key that is missing on the Series 5 is the **Alt** key. We use the **Fn** key as an **Alt** key, but that only works for Series 5 keys which do not need to use it as **Fn**. You can therefore only use **Alt** (=**Fn**) on the alphabetic keys toward the left of the keyboard, and Alt-[is not available.

7.3.2 I have a UK/French/German Series 5 keyboard; some of the keys come out wrong.

XTM translates UK, French and German Psion keyboards into the corresponding UK, French or German PC keyboard. Just as on a real PC, you must load a local language keyboard driver to access all the keys correctly. Under MS-DOS this would usually involve running KEYB UK/FR/GR from your AUTOEXEC.BAT file.

There are still a couple of keys on the Series 5 which are Psion specific, and there is no equivalent key on the PC keyboard. These keys are ignored by XTM.

7.3.3 I tried to run a program under XTM but it crashes. It works fine on my Windows 95 PC in a DOS window.

Unfortunately, a DOS window on a Windows 95 PC is a long way from running real MS-DOS on XTM, and many things behave differently as a result. For example, you can run 32 bit programs in a Windows 95 "DOS box" which real MS-DOS wouldn't even recognise. If your desktop machine is a 80486 DX or Pentium based PC it will include a floating point coprocessor, which is not present in XTM.

Before you go much further, you should try to run your program on a real DOS system. If it works on a PC under DOS, but not on XTM, let us know what the program is, what exactly happens, and we'll see if we can come up with a solution for you.

7.3.4 I have a compiled BASIC program which seems to run but then crashes the whole system

Certain BASIC compilers use 8086 software interrupts to access internal functions. In extreme cases the BASIC run-time system trashes all interrupts from 0x80 to 0xED, and they are not restored when the BASIC program exits. Unfortunately, XTM uses a couple of software interrupts in this range to

access the EPOC file system. Not surprisingly, XTM crashes next time anything tries to access drive C: after such a program has run.

Restricting the system to emulated diskettes, and not using EPOCFS.SYS will allow such programs to run, but you will have to reboot the system before you can access the EPOC file system.

7.3.5 Problems with communications applications

The timing characteristics of the emulated serial I/O ports is very different to a real PC. Many programs which expect particular behaviour will be confused by XTM. Sometimes this can be improved by running the serial port at a lower bit rate. For more details, see section 8.7.

7.4 Registration

7.4.1 I tried to register, but it said “Incorrect Registration Code”

Check that the Unique ID that we listed with your Registration Code matches what it says in the registration dialogue box. It is possible that we transcribed it wrongly from your order, which would generate a mismatched Registration Code. If there is a mistake, contact us for a new Registration Code.

7.4.2 XTM says “Your test and evaluation period has expired”

You need to buy a license for XTM to continue using the program. If your copy has completely expired you will not even be able to run it to type in the registration code.

Change the date on your handheld computer to a time in the past before XTM expired, type in your Registration Code, and then you can re-set the date correctly.

8. Technical Details

8.1 Basics

XTM should make your PC operating system and applications believe that they are running in a rather slow PC/XT based computer. The machine looks to the software like an 80186 computer with two diskette drives, a CGA display, an AT style keyboard, and one or two serial ports.

If you're running off the shelf software, and not trying to do anything obscure, you should never need to know any more than that. If you're interested in the details of the emulator, read on.

8.2 CPU Emulation

The CPU emulator implements the complete Intel 80186 instruction set, including so-called "undocumented" instructions. The 80186 is an enhanced version of the 8088 used in the original IBM PC. It implements all of the instructions of the 8088 and many 80286 extensions, but does not include any of the 80286 memory management functions.

Conventional software should find no differences whatsoever in running under XTM compared with running on a real 8088. There are however a small number of practical differences as follows:

1. After certain instructions, Intel documents certain condition codes as undefined. These may behave differently under XTM.
2. On a real 8088, fetching or storing to a 2 byte memory location where the lower byte is the last byte in a 64k segment will always wrap the upper byte address to the bottom of that segment. XTM will access the two bytes at contiguous locations, therefore overflowing the 64k segment boundary. Since other x86 processors will crash the program in these circumstances we do not believe any commercial software relies on this behaviour.
3. Similar to the previous point, if valid instruction codes run right up to and across the end of a 64k code segment, the emulator will keep executing off the end of the code segment, rather than wrapping the instruction pointer. It is very unlikely that any commercial software would rely on the wrap-around effect of the instruction pointer in a real 8088.

4. There is little correlation between instruction execution times on a real 8088 or 80186 and the XTM CPU. Most XTM instructions execute slower than a 4.77MHz 8088. Some however are quicker.

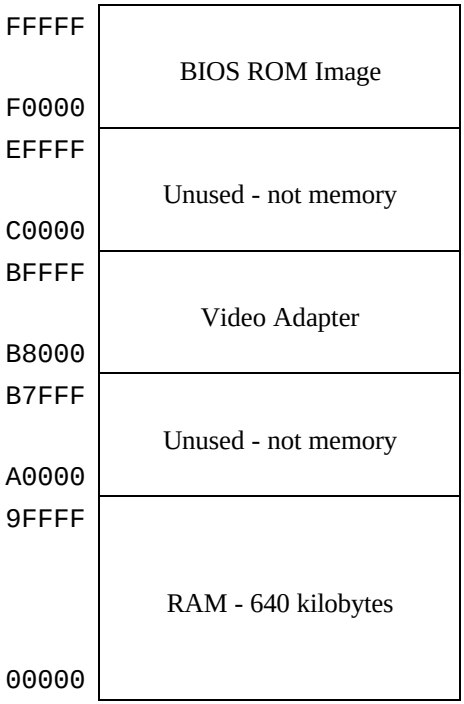
Notwithstanding the comments about accesses across segment boundaries, the XTM CPU does correctly implement the overall address space wrap-around of a real 8088. That is to say, address FF00:1100 and 0000:0100 are both the same place.

8.3 Memory Map

The XTM memory map is a conventional PC/XT layout, as shown below.

Note that the BIOS ROM image is implemented in RAM, and therefore an errant program can corrupt what would in a real PC be read-only memory. The ROM contents are recreated every time the emulator is rebooted.

XTM Memory Map



8.4 XTM BIOS Implementation

The BIOS implementation is a reasonable subset of the full BIOS in a real PC. Most of the work of the BIOS is performed by native EPOC32 code for performance reasons. The following BIOS calls are implemented:

Interrupt	Function	Subfunction
10h	Video	00h - Set Video Mode
		01h - Set Cursor Type
		02h - Set Cursor Position
		03h - Read Cursor Position and Type
		05h - Set Display Page
		06h - Scroll Page Up
		07h - Scroll Page Down
		08h - Read Character and Attribute
		09h - Write Character and Attribute
		0Ah - Write Character Only
		0Eh - Write Teletype Mode
		0Fh - Read Video State
11h	Equipment Flags	N/A
12h	Memory	N/A
13h	Diskette	00h - Controller Reset
		01h - Read Diskette Status
		02h - Read Diskette Sectors
		03h - Write Diskette Sectors
		04h - Verify Diskette Sectors
		08h - Read Drive Parameters
		15h - Read Drive Type
		16h - Get Change Line Status
14h	Serial	00h - initialise port
		01h - send byte

		02h - receive byte 03h - read status
16h	Keyboard	00h - Read Keyboard 01h - Check Status 02h - Get Shift Flags 05h - Store Key Code 10h - Read Extended Keyboard 11h - Check Extended Status 12h - Get Extended Shift Flags
19h	Reboot Machine	N/A
1Ah	Time	00h - Get Ticks 01h - Set Ticks 02h - Get Time 04h - Get Date

8.5 Video Modes

XTM implements all video modes of a CGA adapter. These are:

Mode	Type	Resolution
0	Text	40 x 25 monochrome
1	Text	40 x 25 colour
2	Text	80 x 25 monochrome
3	Text	80 x 25 colour
4	Graphics	320 x 200, 4 colours
5	Graphics	320 x 200, 4 grey scales
6	Graphics	640 x 200, monochrome

8.6 HP200LX Graphics Support

XTM includes a native code implementation of the graphics functions provided on the Hewlett-Packard palmtop computers through Interrupt 5Fh. Functions implemented are:

Function	Description	Restrictions (if any)
00h	Set Mode	Only mode 6 (640 x 200) supported
01h	Set Fill Pattern	
02h	Get Info	
03h	Set Origin	
04h	Set Clip Region	
05h	Draw Rectangle	
06h	Draw Line	
07h	Set Pixel	
08h	Move Pen	
09h	Set Pen Colour	
0Ah	Set Replace Rule	
0Bh	Set Line Type	
0Ch	Get Pixel	
0Dh	Get Image	
0Eh	Put Image	
0Fh	Write Text	Rotated text not supported
10h	Get Font	3 built-in fonts provided (8x8, 11x10, 12x16)
11h	Set Font	
12h	Scroll	
13h	Set Info	
14h	Set Defaults	

Because XTM does not implement many other hardware and software features of the Hewlett Packard palmtop machines, the Interrupt 15h installation check function does NOT identify XTM as an HP machine. Applications written for the HP machines that check this function may not run under XTM, even though the Interrupt 5Fh services are present.

8.7 Serial Ports

XTM supports one serial port on the Psion Series 5, and two serial ports on the Geofox-One. COM1 corresponds to the main serial port, whilst COM2 on the Geofox maps onto the PCMCIA modem slot.

The serial ports can be accessed either by using the BIOS interrupt 14h services, or by directly writing to the emulated hardware. The serial ports emulate Intel 8250A devices.

8.7.1 Serial Port Restrictions

There are a number of differences between serial ports on a real PC and the XTM emulation.

1. The biggest restriction on serial communications is the fact that XTM is slower than most real PCs. Although the XTM serial ports can be set to speeds of 115200 bits per second, not many applications will be able to keep up with receiving data at that speed.
2. On a real PC, software which directly programs the UART chip can set any bit rate it wants. EPOC32 only supports the following bit rates: 50, 75, 110, 134, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19200, 38400, 57600 and 115200 bps. Any other figures set by your PC software will be rounded up to the nearest EPOC bit rate.
3. The XTM serial ports will always obey hardware flow control on output, using the Clear To Send (CTS) signal. That is, XTM will not transmit characters when the CTS signal is off, even if your DOS program tries to ignore CTS. This is so that hardware flow control works fast enough for external devices like modems and printers, even though the emulator response to modem signals is rather slow. The side effect is that simple serial cables which ignore the CTS pin will not work. If you are not using CTS for flow control you must strap it high by connecting it to RTS, or some other convenient signal.
4. The XTM serial port modem signals have significant timing differences compared with real PC ports. The delay between setting a bit in the UART and the corresponding serial port wire changing state in a real PC is a few microseconds. In XTM the same period could be 2 milliseconds. The delay between a change of state in an external modem pin and the corresponding change being observed in the UART is a few microseconds on a real PC. In XTM, the same change can take 50 milliseconds to be

reported. Many direct-connect communications packages which use the modem control lines to handshake between two PC's will therefore not work on XTM.

8.8 Mouse

The XTMMOUSE utility is not the mouse driver. The driver is embedded in the native BIOS code and is merely enabled or disabled by the XTMMOUSE utility. Most of the work of the Mouse Driver is done in native EPOC32 code for performance reasons.

The mouse driver implements all of the standard mouse functions. It processes but ignores parameters associated with controlling physical mice, and it processes but ignores commands to set the on-screen mouse pointer, since this is implemented by your pen or EPOC32 mouse pointer.

XTM emulates a subset of a Microsoft bus mouse interface and generates interrupts on IRQ 5. Although diagnostic programs may identify the hardware as a bus mouse, the data available through this interface is not compatible with a real bus mouse, therefore other mouse drivers cannot be used with XTM.