# PX-4000 mini-AVR In-System programmer

# 1. Features

• Connects with the computeris USB port.

• Program the AVR microcontroller via ISP connector. Plug ditect to the target board. The ISP cable is not required . Supports Read, Write, Erase and Protection functions.

• Requires +5V power supply from target/master board.

• Operates with the AVR Program software. This software is included in the AVR Studio and can be found in the tools menu and works with the Avr-OspII software as well.

Model Numbers of microcontroller supported in AVR Prog software

AT90S1200, AT90S2313, AT90S2323, AT90S2343, AT90S4433, AT90S8515, AT90S8535, ATmega128, ATmega16, ATmega161, ATmega162, ATmega163, ATmega164P, ATmega165, ATmega168, ATmega32, ATmega64, ATmega8, ATmega8515, ATmega8535,

ATtiny12, ATtiny13, ATtiny15L, ATtiny2313, ATtiny26

Model Numbers of microcontroller supported in Avr-OSP II software

	AT90CAN128, AT90CAN32, AT90CAN64,
	AT90PWM2, AT90PWM3,
4790S8515, AT9	AT90S1200, AT90S2313, AT90S2323, AT90S2343, AT90S4414, AT90S4433, AT90S4434, 20S8515comp, AT90S8535, AT90S8535comp,
	ATmega103, ATmega103comp, ATmega128, ATmega1280, ATmega1281,
	ATmegal6, ATmegal61, ATmegal61comp, ATmegal62, ATmegal63, ATmegal65,
ATmega168, A	.Tmega169,
	ATmega2560, ATmega2561,
	ATmega32, ATmega323, ATmega325, ATmega3250, ATmega329, ATmega3290,
	ATmega406, ATmega48,
	ATmega64, ATmega640, ATmega644, ATmega645, ATmega6450, ATmega649,
ATmega6490,	
	ATmega8, ATmega8515, ATmega8535, ATmega88,
	ATtiny11, ATtiny12, ATtiny13, ATtiny15,
	ATtiny22, ATtiny2313,ATtiny24, ATtiny25, ATtiny26, ATtiny261, ATtiny28,
	ATtiny44, ATtiny45, ATtiny461,
	ATtiny84, ATtiny85, ATtiny861
ncludes :	Programmer box with cable and CD-ROM.



## 1. Install USB driver of PX-4000

(1)Double-click at the USBDriverInstallerV2.0.0.exe file from PX-4000 CD-ROM. The driver installation begins and the Installation complete dialog will appear after finish.

FTDI Dri	iver Installation 🛛 🛛 🔀
<b>i</b>	FTDI CDM Drivers have been successfully installed.
	ОК

#### **Troubleshooting USB Driver Problems**

To use INEX's USB-based products, the proper FTDI USB drivers need to be installed on your computer system first. INEX supports the FTDI USB VCP Drivers for Windows 2000/XP. For other operating systems you may obtain drivers from the FTDI website at http://www.ftdichip.com.

IF, after installing the correct USB drivers for your operating systems, you have problems communicating with your USB device, refer to the troubleshooting advice given below.

#### **Communication Issues**

Most laptop computers and some desktops have issues with USB Latency when it comes to communication. When this happens the port will show up in the list but you may not be able to identify or communicate with your USB Device. This may require the Latency Timer Setting in the Device Manager to be set lower. To lower the Latency Timer settings please follow the steps below. The USB Device should be plugged in to adjust these settings.

#### Reducing The Latency Timer Setting

- Click on your Start Button and select Control Panel
- Open the ëSystemí icon (you may have to be in classic view to see this icon)
- Select the Hardware Tab and click Device Manager
- In the hardware categories you should see a Ports Category, click the plus sign next to it

 $\bullet$  You should see an entry for USB Serial Port (COMx) where x is the COM Port assigned to the USB Adapter

- Click this entry and then click Properties (or double-click the entry)
- Select the Port Settings Tab and click AdvancedÖ
- Under BM Options reduce the setting from 16 down to 1 and click OK
- Click OK on the properties sheet and close the Device Manager window

• If, when you connect your hardware, Windows pops up with a New Hardware Wizard this could be for one of two reasons.

- The driver did not register during installation. If this is the case then simply follow the new hardware wizard by following the default selections and selecting automatic installation.

- There is a problem with either the Interface and/or the computer. If you continue to have problems please contact our Tech Support Department.

(2) Connect USB plug pf PX-4000 to computer's USB port. Wait a moment. The blue LED indicator will lit. Now the PX-4000 ready to use.

(3) Check the COM port address by clicking at Start  $\rightarrow$  Control Panel  $\rightarrow$  System

(4) Select the Hardware tab and click on the Device Manager button.



(5) Check the hardware listing. At the Port item, you will found **USB Serial port (COM x)**.Normally the address will be COM3 or higher. Note this COM port address to use with the programmer software later.



## 2. Software Installation

Programming in the AVR microcontroller development is in both C and Assembly languages. The software that are installed for programming are the following :

(1) AVR Studio : This software tool is developed by Atmel Corporation. AVR Studio is a Development Tool for the AVR microcontrollers. AVR Studio enables the user to fully control execution of programs on the AVR In-Circuit Emulator or on the built-in AVR Instruction Set Simulator. AVR Studio supports source level execution of Assembly programs assembled with the Atmel Corporationís AVR Assembler and C programs compiled with IAR Systemsí ICCA90 C Compiler for the AVR microcontrollers and WinAVR open-source C Compiler. AVR Studio runs under Microsoft Windows95 and Microsoft Windows NT. Now Windows XP SP2 is recommended. Free download this software at www.atmel.com.

(2) WinAVR : WinAVR is a set of tools for the C compiler, these tools include avrgcc (the command line compiler), avr-libc (the compiler library that is essential for avrgcc), avr-as (the assembler), avrdude (the programming interface), avarice (JTAG ICE interface), avr-gdb (the de-bugger), programmers notepad (editor) and a few others.

These tools are all compiled for Microsoft Windows and put together with a nice installer program. Free download of the updated version is located at : http://sourceforge.net/projects/winavr/.

User will need to install AVR Studio first and WinAVR after which. AVR Studiois mechanism integrates automatically with WINAVR. With this feature, it assist the user in the development of C language and programming on AVR Studio which is much easier and more powerful compared to WinAVR. The compiled file is a HEX file in which case, the user has to download it into the program memory of the AVR microcontroller Board.

(3) Programmer software : This software is used to download the compiled .HEX file to the AVR Microcontroller. Included in PX-4000 programmer is the AVRProg and AVR-OSP II. All software can work with PX-4000 via Computer USB port.

(3.1) **AVR Prog** is Atmelis software and an add-in feature in AVR Studio.

(3.2) **AVR-OSP II** is created by Mike Henning. Download the latest version at http://esnips.com/web/AtmelAVR

## 2.1 Installation of AVR Studio (based-on Window XP)

2.1.1 Insert the PX-4000 CD-ROM and look for this file in the AVR Studio directory; *aStudio4b460.exe*. Double-click on this file.

2.1.2 Enter the Installation Wizard. Click on the Next button to continue.



2.1.3 In the license agreement window, Select the box : I accept the terms of the license agreement and Click on the Next button.

Welcome to AVR Studio from Atmel Corporation. AVR Studio is a Development Tool for the AVR family of microscontrollers. The AVR Studio is fine of charge and may be finely copied and distributed in its original form. AVR Studio mobile the use to buily concret execution of programs on the AVR In:Circuit Emulator or on the included AVR Instruction Set Simulator. AVR Studio supports source leve execution of Assembly and CD-Fragoman assembled with the AMR InCircuit AVR Studio num under Microscit Vindows 59, Vindows 99, Vindows NT, Microsoft Windows 2000 and Windows XP AVR Studio community developing. In order to get latest upgrades of AVR Studio, please vinit our web alter www.athencom and check out the AVR page.	( m )
	~
Laccept the terms of the license agreement     Erint	
California and a second balance of the formation of the second se	

2.1.4 Choose Destination Location windows will appear. You can change the path by clicking on the **Change** button and setting a new path. After this, click on the **Next** button.



2.1.5 The Driver USB Upgrade window will now appear. Click on the **Next** button to pass this step.

2.1.6 In the begin installation window, click on the **Install** button to start installation.

2.1.7 After the installation is complete, click on the **Finish** button to end the installation of AVR Studio.

2.1.8 To Launch the AVR Studio program, click on Start  $\rightarrow$  Programs  $\rightarrow$  Atmel AVR Tools  $\rightarrow$  AVR Studio 4. The main window of the AVR Studio program will appear.

* AVR Studio		_ 🗆 🔀
Eile Project Build <u>Vi</u> ew <u>T</u> ools <u>D</u> ebug <u>H</u> elp		
□☞日創びよ陶陶器シュ管陶  ぬん% % % 準定  ▶ = 国 Ⅱ () → 3	₽} ₹} ₹} [}	∄⊕∰64′  ፼⊠⊡
Trace Disabled 🔹 🛠 🏷 上 木 🛛 🗰 🗰 🗰 と と 💵		
I/O View X		
Name Value Bits		
		×
		^
Loaded plugin 51x500		
		>
Ruid OMessage Rind in Files Breakpoints and Tracepoints		
		CAP NUM SCRL

#### 2.2 Installation of WinAVR

Please note that installation of WinAVR is done after the installation of AVR Studio. Please ensure this is being done before proceeding.

2.2.1 Insert the PX-4000 CD-ROM, and find the installation file of WinAVR; *WinAVR-* 20050214-install.exe (or the newer version if appear). Double-click this file.

2.2.2 Installation language dialog box will appear for selection the language of this installation. Select your preferred language from the sliding bar. After that click on the **OK** button.

Installer	Language 🛛 🔀
8	Please select a language.
	Thai
	OK Cancel

2.2.3 The Welcome installation software window appears and shows the installation information. Click on the **Next** button.



2.2.4 In the License agreement window, Click on the I agree button.

2.2.5 Choose Install Location window appears. User can change the path and the folder for the installation of WinAVR by clicking at the Browse button and selecting the respective folder. The proposed folder is *C:\WinAVR*. After selection, click **Next** button to continue to the next step.

2.2.6 In the Choose Components window, select the components which you want to install or follow according to the below diagram. Click on the **Install** button to begin the installation.

🛞 WinAVR 20050214 ติดตั้ง		
เจีอกคอมโทเนนต์ เลือก features ของ WinAVR 20050214 ที่คุณต้องการตัดตั้ง		
Check the components you wan install. Click Install to start the ir	t to install and uncheck the components you don't want to stallation.	
เลือกคอมโพเนนต์ที่ต้องการตัด ตั้ง:	Install Files.     Add Directories to PATH (Recommended)     Add Shortcuts to Desktop     Install Programmers Notepad	
เนื้อที่ที่ต้องการ: 71.6MB		
(< กลับไป ) ฏิตตั้ง ยกเล็ก		

2.2.7 The installation process starts and reports the status back on the screen. The User needs to wait until the installation is complete. Click on the **Finish** button to end once its done.

### 2.3 Installation of Programmer software

#### 2.3.1 AVR Prog

It will install ready after instaaaltion AVR Studio.

#### 2.3.2 Avr-Osp II 4.00 (or the latest version)

Copy the file AvrOspII\_400.zip into the harddisk. Decompress the .zip file to AvrOspII\_400 folder. It contains 3 main files ; AvrOspII.exe, AvrOspII.ini and Devicelist.dat

## 3. Using AVR Prog software

The AVR Prog software can interface with COM port not higher COM4. Thus, use must mae sure the USB serial port address of PX-4000 not higher than COM4. If higher, please do following procedure.

(1) Connect the PX-4000 to Computer USB port and wait Blue LED indicator on.

(2) Check the COM port address by clicking at Start  $\rightarrow$  Control Panel  $\rightarrow$ System

(3) Select the Hardware tab and click on the Device Manager button.

(4) Check the hardware listing. At the Port item, you will found **USB Serial port** (COM x).If COM port is higher than COM4 (this example is COM10), please click on the right-button mouse and select to **Properties** 



(5) The USB Serial Port (COM10) Properties window will appear. Select the Port Setting tab and set all value following the figure below and click on the Advance button

USB Serial Port (COM10) Properties		? 🗙
General Port Settings Driver Details		
Bits per second:	9600	•
Data bits:	8	•
Parity:	None	v
Char Line		
Stop bits:		
Flow control:	None	~
	vanced . Bestore De	afaulte
		siduits
	ОК	Cancel

(6) The Advanced Setting for COM10 will appear. Click on the **COM Port Number** box to change to **COM4** or another port in range **COM1** to **COM4**.

Advanced Settings f	for COM10			? 🗙
COM Port Number:	СОМ10			
USB Transfer Sizes	COM1 (in use) COM2 (in use) COM3 (in use)			Cancel
Select lower setting Select higher setting	COM4 COM5 (in ukg) COM6 COM7	hance problems at low b hance.	aud rates.	Defaults
Receive (Bytes):	COM8 COM9 COM10	96		
Transmit (bytes):	COM11 COM12 COM13	96		
Select lower setting	COM14 COM15 COM16	se problems.	Miscellaneous Options	
	COM17		Serial Printer	

(7) Set the value following the figure below. Especially at the Latency Timer (msec) suggess to set to 1 and check the box at Serial Enumerator. Click OK button.

Advanced Settings for COM10		? 🔀
COM Port Number: COM4  USB Transfer Sizes Select lower settings to correct performance problems al Select higher settings for faster performance. Receive (Bytes): 4096  Transmit (Bytes): 4096	low baud retes.	Cancel Defaults
BM Options Select lower settings to correct response problems. Latency Timer (msec): Timeouts Minimum Read Timeout (msec): U	Miscellaneous Options Serial Enumerator Serial Printer Cancel If Power Off Event On Surprise Removal Set RTS On Close Disable Modem Dtrl At Startup	9 

(8) Back to the USB Serial Port Properties. Now the COM port number at the title bar will change to COM4. Click on the **OK** button.

USB Serial Port (COM4) Properties	? 🔀
General Port Settings Driver Details	
Bits per second:	9600
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None
Adv	vanced Restore Defaults
	OK Cancel

(9) Remove the PX-4000 and plug again. Check the USB Serial port address. The new address must be COM4. Now the PX-4000 ready for using with AVR Prog. software.

board

3.1 Connect the PX-4000 to Computer USB port and Target microcontroller board. Apply the supply voltage.

Connect to USB port	
PX-4000	
Apply the supply voltage	
	E Car Car Car Co
	Dole for ADC equilibrium
	X-Mega16 or another AVR

3.2 Open the Window explorer. Enter to find the AVR Prog execute file as : C:\Program file\ATMEL\AVR tools\AvrProg\AvrProg.exe. Double clikc at this file. The programmer's window will appear.

AVR Hall AVRprog	
Hex file	
D:\Work2006\\default\LED01.he	×
Browse	Exit
- Flash	
Program Verify	Read
EEPROM	
Program Verify	Read
Device	
ATmega16 💌	Advanced

3.3 If the connection fail, the warning dialogue box below will appear.

AvrProg	×
1	No supported board found! AVRprog version 1.40
	ОК

3.4 If all is correct, Click at the Advanced... button at the main AVR Prog window to set the configuration. Setting this will be done only once. Changing of the configurations can be done subsequently as well. The Advance window will appear.

Advanced	×
Lock bits	
Mode 1	BLB0 Mode 1 💌 BLB1 Mode 1 💌
No program lock fe	eatures
- Euse bite	
SPI Enable	CD Enable
EESAVE	Full amplitude
Ext XTAL, High fr	equency 💌
Startup: 1K CK	<b>_</b>
No BOD function	Boot block 1024 Words
Read	Write Chip Erase
Device signature	TE 94 03
Target board	AVR ISP
Target SW rev.	3.8
Calibration byte	0xA7 Close

3.5 Setting the configuration bit :

3.5.1 Set the Lock Bit to Mode 1 if you need to read the protected code after programming.

3.5.2 Check the box SPI Enable (DO NOT UNCHECK !!!!)

**If unchecked**, the programming process will still continue. The programmed AVR microcontroller will run but you will not be able to RE-PROGRAM THE CHIP WITH THE AVR SOFTWARE. The only solution is to Re-program this bit with a High-Voltage Programmer such as ALL-11, AVR ISP Mark II etc.

3.5.3 Set to Oscillator mode. Normally this will set to Ext XTAL. High frequency in connection to the external crystal to clock source. (Important; do not remove or change unless are using another clock source).

3.5.4 Click Write button to store Configuration information.
3.5.5 Click Chip Erase button for erasing the Program memory
3.5.6 Click Close button for finishing the Configuration setting.

3.6 Open the HEX file by click at Browse... button.

3.7 Click Frogram for programming the HEX file to the microcontroller's program memory. The Busy red LED on PX-4000 programmer lights until finish it will off. At the Progess bar on AVR Prog software will show the status until finish too. Target microcontroller will run immediatly.

The PX-4000 programmer has indicators as :

1. The LED is green for Ready status: Inform that it is ready and supply voltage

status.

2. The LED is red for Busy status: Lets the user know the programmer is still working.

## 4. Using Avr-Osp II software

4.1 Connect the PX-4000 to Computer serial port and Target microcontroller board with ISP cable. Apply the supply voltage.

4.2 Open Avr-Osp II software by double-click on AvrOspII.exe file. The main window will appear.

FLASH Browse	Erase Device Auto Send Exit EEPROM Browse
Program     Verify     Read       FLASH Range     Start:     End:	Program Verify Read EEPROM Range Start: End:
Use range 0x00 0x00	Use range 0x00 0x00

4.3 Select the Configuration tab to select the communication port (this software can support COM port up to COM16) and baudrate. You need to set it to **115,200 baudrate** only. The port is selected to **Auto**.

🏷 Avr-Osp II		
Program   Fuse Bits   Lo	ock Bits Advanced Cor	nigure   Help
Port AUTO -	Baud 115,200 💌	<ul> <li>Restore current settings on startup</li> <li>Prompt before programming fuses</li> </ul>

4.4 Back to main window by selecting the **Program** tab. Click **Auto Detect** button in **Device** box. Wait a moment to see the operation at **Status** box.

🕏 Avr-Osp II - ATmega16 📃 🗖	
Program   Fuse Bits   Lock Bits   Advanced   Configu Device ATmega16 Auto Detect Flash size = 16384 BEProm size = 512 Page size = 64 Signature = 0x1E 0x94 0x03	Ire Help Auto program settings
FLASH Program Verify Read FLASH Range	EEPROM Program Verify Read EEPROM Range
Start: End:	Start: End:
C C C C C C C C C C C C C C	Status box

A Device box will show the number of AVR microcontroller with some information. At the same time, the Status box will display much status and information

- Checking programmer type...
- Found AVR ISP
- Entering programming mode
- Signature = xxxx xxxx xxxx
- Leaving programming mode

4.5 Select the **Fuse Bits** tab for reading the Configuration or Fuse bit of the AVR microcontroller. Two parameters must not be change. See the figure below.

🕏 Avr-Osp II - ATmega16 📃 🗆 🔀	
Program Fuse Bits Lock Bits Advanced Configure Help	
<ul> <li>On-Chip Debug Enabled; [OCDEN=0]</li> <li>JTAG Interface Enabled; [JTAGEN=0]</li> <li>Serial program downloading (SPI) enabled; [SPIEN=0]</li> <li>Preserve EEPROM memory through the Chip Erase cycle; [EESAVE=0]</li> <li>Boot Flash section size=128 words Boot start address=\$1F80; [BOOTSZ=11]</li> <li>Boot Flash section size=256 words Boot start address=\$1F00; [BOOTSZ=10]</li> <li>Boot Flash section size=512 words Boot start address=\$1E00; [BOOTSZ=01]</li> <li>Boot Flash section size=1024 words Boot start address=\$1C00; [BOOTSZ=00]; de</li> <li>Boot Reset vector Enabled (default address=\$0000); [BOOTST=0]</li> <li>CKOPT fuse (operation dependent of CKSEL fuses); [CKOPT=0]</li> <li>Retrum-out detection level at WCG=40.W: [ROOTEL=0]</li> </ul>	- Donít remove and change !!!
Brown-out detection level at VCC=2.7 V; [BODLEVEL=3] Brown-out detection level at VCC=2.7 V; [BODLEVEL=1] Brown-out detection enabled; [BODEN=0]	
רא איז איז איז איז איז איז איז איז איז אי	
C Leaving programming mode C Leaving programmer type Found AVR ISP Entering programming mode C Fuse bits read = 0xD9EE (1101100111101110)	
Leaving programming mode	

4.6 If you require Code protection, select the **Lock Bits** tab. Select the bit for reading protection after programmed already.

🕏 Avr-Osp II - ATmega16 📃 🗌 🔀		
Program   Fuse Bits Lock Bits   Advanced   Configure   Help		
<ul> <li>Mode 1: No memory lock features enabled</li> <li>Mode 2: Further programming disabled</li> <li>Mode 3: Further programming and verification disabled</li> <li>Application Protection Mode 1: No lock on SPM and LPM in Application Section</li> <li>Application Protection Mode 2: SPM prohibited in Application Section</li> <li>Application Protection Mode 3: LPM and SPM prohibited in Application Section</li> <li>Application Protection Mode 4: LPM prohibited in Application Section</li> <li>Boot Loader Protection Mode 2: SPM prohibited in Boot Loader Section</li> <li>Boot Loader Protection Mode 2: SPM prohibited in Boot Loader Section</li> <li>Boot Loader Protection Mode 4: LPM prohibited in Boot Loader Section</li> <li>Boot Loader Protection Mode 4: LPM prohibited in Boot Loader Section</li> </ul>		
Program     Verify     Read		
C Leaving programming mode C Leaving programmer type R Found AVR ISP		
Entering programming mode Fuse bits read = 0xD9EE ( 1101100111101110 ) Leaving programming mode		

4.7 Select the **Advance** tab for checking the Signature of microcontroller by clicking at the **Read** button in **Read Device Signature** box for interfacing confirmation.

🕸 Avr-Osp II - ATmega16 📃 🗖	×
Program   Fuse Bits   Lock Bits   Advanced   Configure   Help	
Read Device Signature	
Oscillator Calibration       Frequency     Value       1.0 MHz     0xBB       Read       FLASH     Address       EEPROM     Write	
C Checking programmer type Found AVR ISP Butering programming mode Reading OSCCAL from device OXBB Lesuing programming mode	-

4.8 Back to **Program** tab, select the HEX file in **Flash** box.

4.9 At **Auto Program Setting** box, user can set the automatic programming to 3 steps as :

4.9.1 Erase devive before programming

4.9.2 Verify device after programming

4.9.3 Send Exit after programming

Suggess to select Erase devive before programming choice at least.

4.10 User can start the programming 2 methods. First, click at **Program** button in **Flash** box or click the **Auto** button in the **Auto program setting** box. The progress bar will active and **Status box** reports the operation status together.

🖘 Avr-Osp II - ATmega16 📃 🗖 🔀		
Program   Fuse Bits   Lock Bits   Advanced   Configure   Help		
Device ATmega16 • Auto Detect Flash size = 16384 EEProm size = 512 Page size = 64 Signature = 0x1E 0x94 0x03	Auto program settings Erase device before programming Verify device after programming Send Exit after programming Erase Device Auto Send Exit	
FLASH C:\library_lab\p0501\default\p0E Program Verify Read	EEPROM Browse Program Verify Read	
FLASH Range     Start:     End:       Use range     0x00     0x00	EEPROM Range Start: End: Use range 0x00 0x00	
C       Leaving programming mode         C       Checking programmer type         Found AVR ISP       Entering programming mode         Reading HEX input file for flash operations         P         Y		

4.11 The Avr-Osp II (in V4.00) cannot show the HEX data that it has programmed.



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