

Skit-Mega16

ATmega16 Microcontroller Starter kit

This is a powerful AVR microcontroller starter kit. This kit is based on the ATmega16 microcontroller. This board includes I/O ports, LCD Display Board, an in-system programmer and some interface modules. Learn and Teach with this high-end 8-bit microcontroller kit.

Includes :

- VX-Mega16 Microcontroller board,
- PX-400 ISP programmer with cable
- ZX-LED output module x 3
- ZX-Switch module x 2
- ZX-Speaker module
- +9Vdc adaptor
- CD-ROM and Documentation

1. VX-Mega16 : ATmega16 microcontroller board

1.1 Features

- Support ATmega16/32/8535. On-board includes ATmega16 Flash memory of 16KB (expandable to 32KB with ATmega32)
- Clock rate of 16MHz
- I/O port of microcontroller are in 100 mil socket and INEX's standard PCB-3 pin connector.
- Expanable Display I/O extension board includes the LCD16x2 module, 3 of Push button switch, a Knob and Serial port interface circuit which is placed on top of Main microcontroller board.
- 7-ch. Analog input with 10-bit Analog to Digital Converter
- Support In-system Programming via ISP connector with PX-400 Programmer
- Supply voltage +9V from external. +5V 500mA on-board regulator.

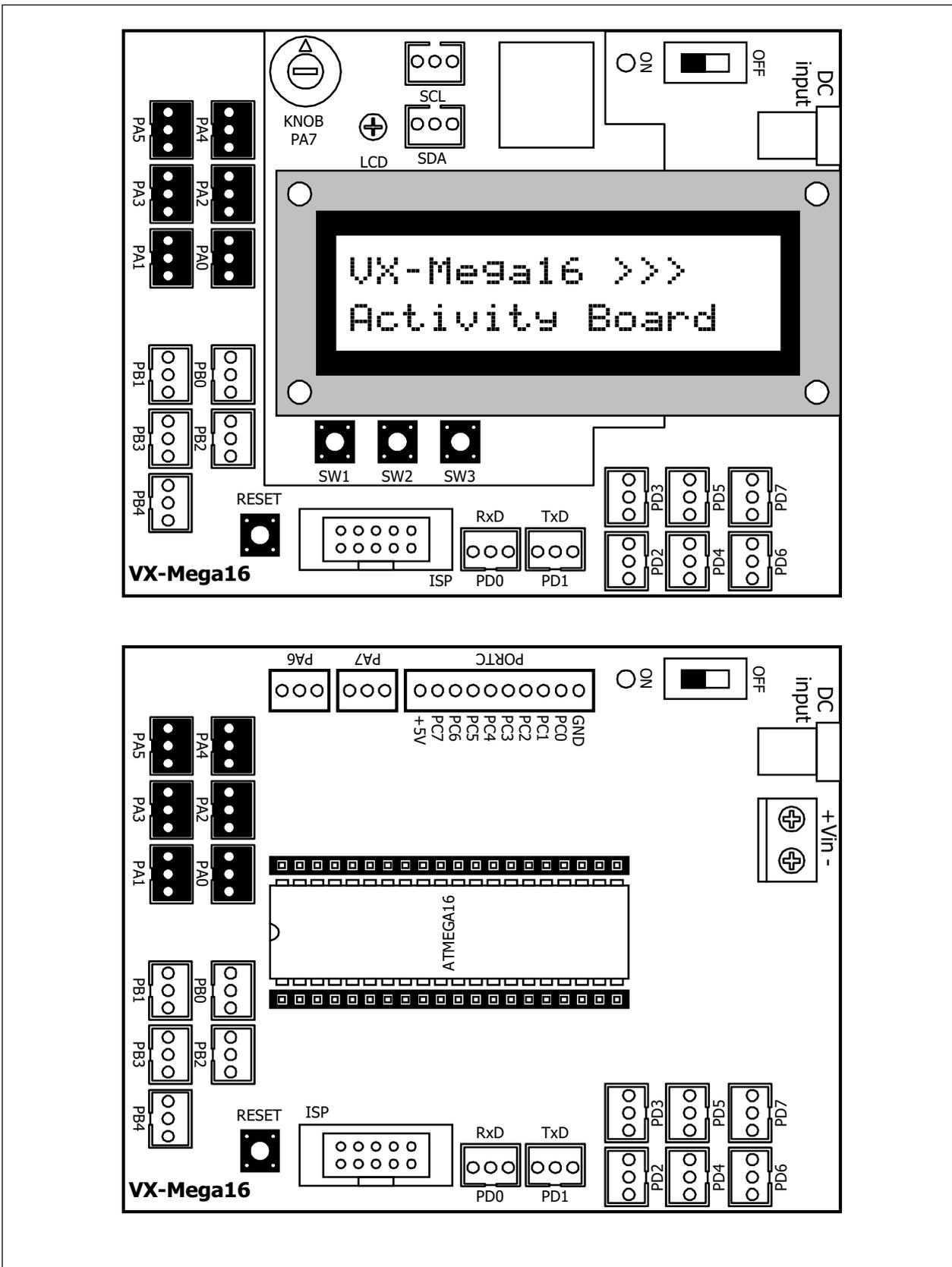


Figure 1 Layout of VX-mega16 microcontroller includes the Display I/O board plugged on-top in above and only the main board's layout in bottom.

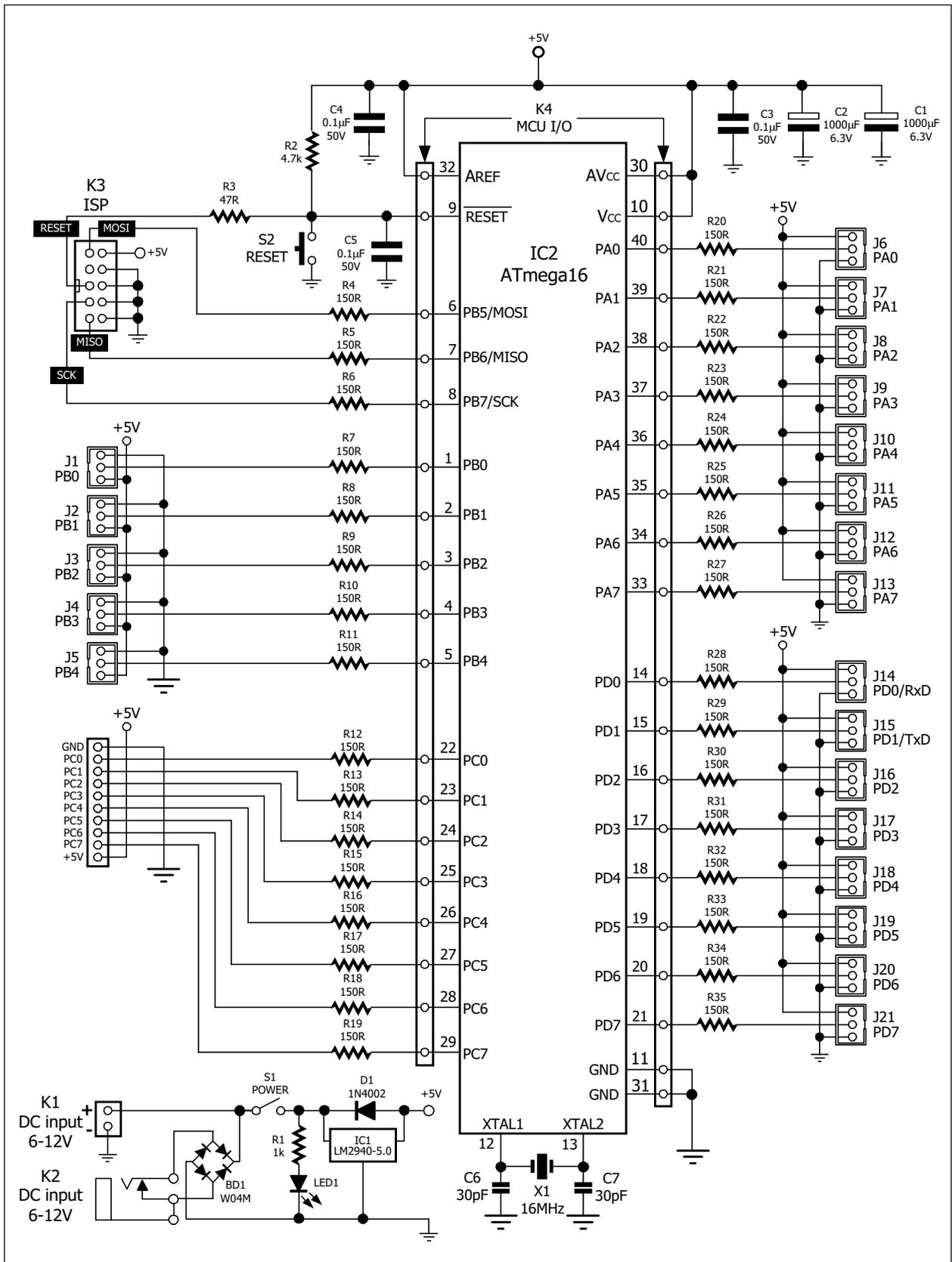


Figure 2 shows the schematic of VX-mega16 main board

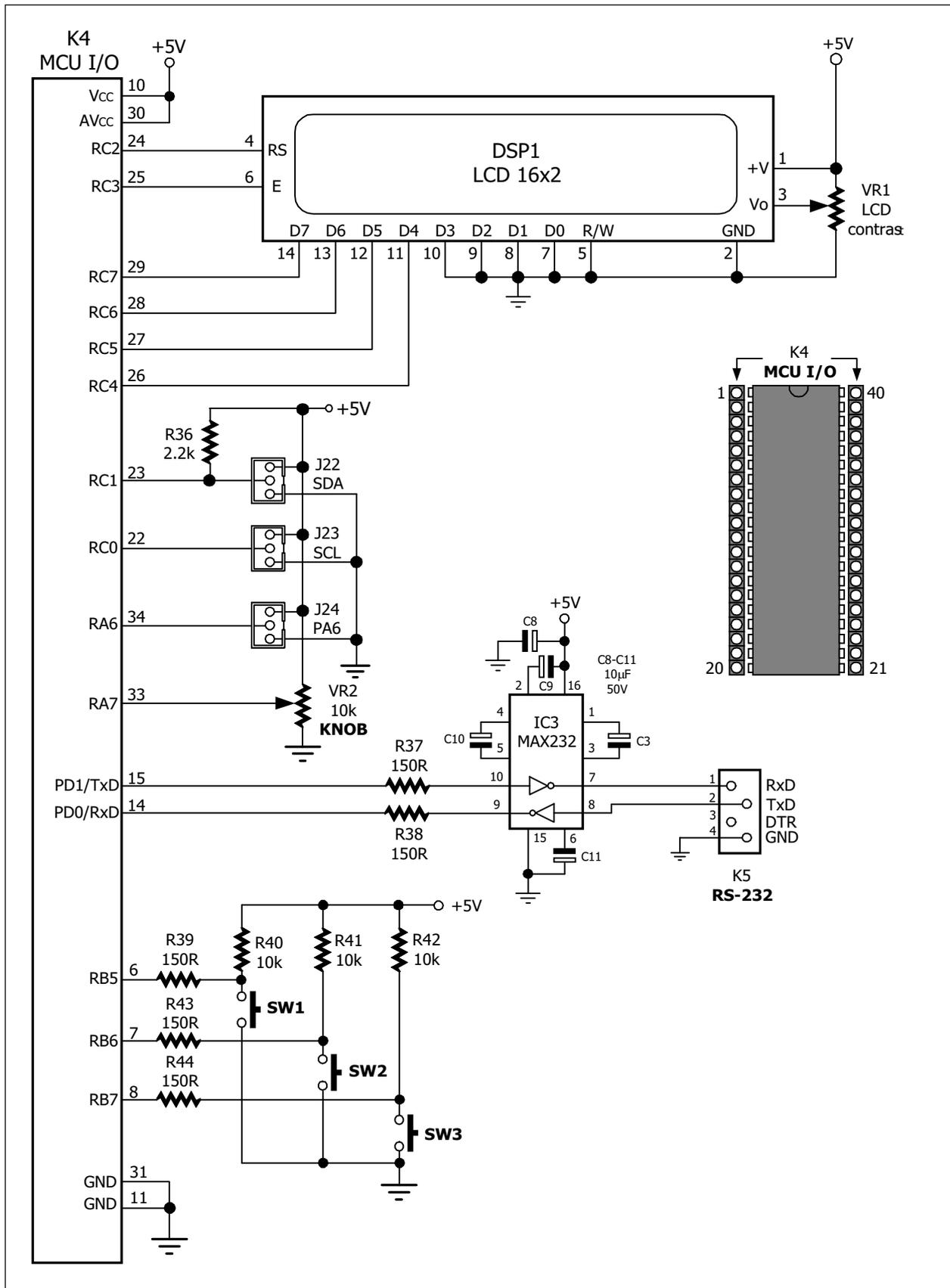


Figure 3 shows the schematic of VX-mega16 display I/O board

1.2 Circuit description

In Figure 2 and 3, this shows the full schematic diagram of both boards in VX-mega16 microcontroller board. The main microcontroller circuit shown in the Figure 2 and Display I/O in Figure 3.

The main device is the ATmega16 microcontroller. It is the AVR microcontroller from Atmel. Operates with 16MHz clock frequency from external crystal. The main board supports all I/O pin at connector K4 and 3-pin PCB connector at J1 to J21.

Wide range DC power supply is +9 to 16V. It has a +5V regulator IC for converting the supply voltage to +5V for all supplying circuits.

Programming the program memory in the ATmega16 must be work via In-System Programming connector (ISP) with external ISP programmer such as INEX's PX-400 and AVRISP programmer. User must purchase separately.

At the Display I/O board, interface with main board with plugable connector K4. Port C of Atmega16 will be assign to LCD pin interfacing. The Display I/O has LCD16x2, 3 of Push button switch with pull-up resistor, one of KNOB or variable resistor for analog source, 2 connectors port for I2C bus supporting, one of PA6 connector and RS-232 serial port interface circuit by MAX232 or ICL232 IC.

User can use only a Main board to experiment and/or plug the Display/I/O board on top of main board for showing the data or mesaage on LCD screen, work with I2C bus device and interface computer via RS-232 serial port (or COM port). The Figure 4 shows the board connection.

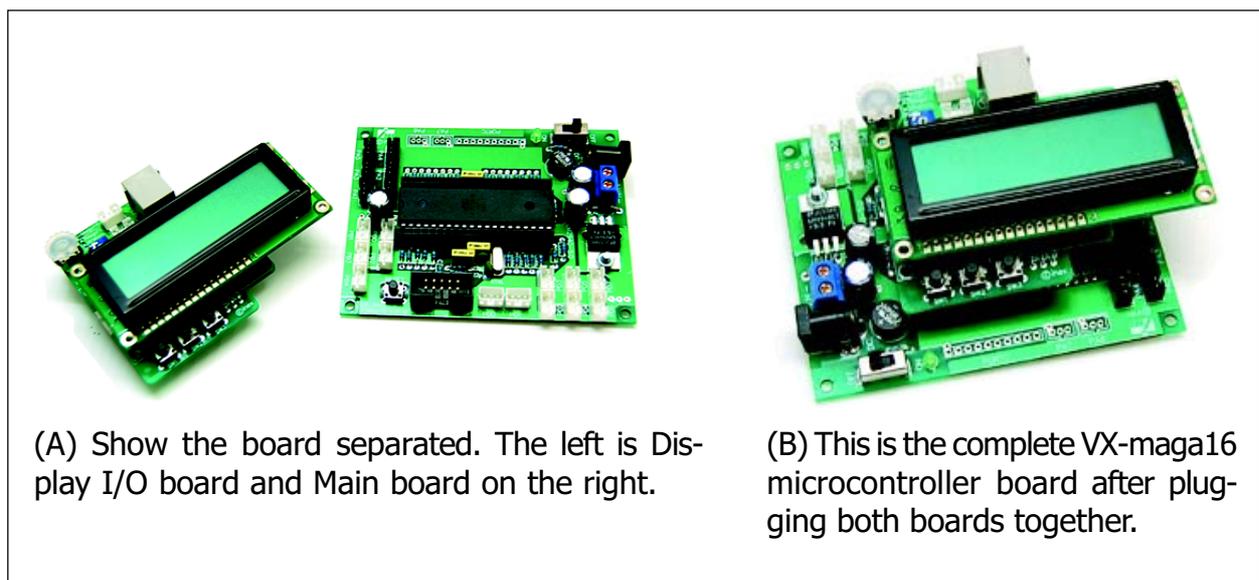


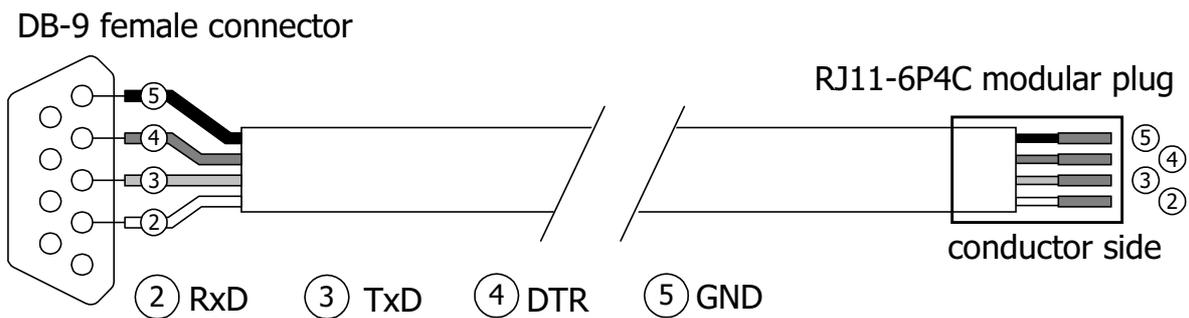
Figure 4 Shows the board connection of VX-mega16 microcontroller board.

1.3 VX-mega16 board's cable assignment

The VX-mega16 board includes some signal cables for the interfacing between the controller board, sensor module and computer. The VX-mega16 comes with CX-4 serial port interface cable and it need some of PCB3AA-8 cable for interconnection to the sensor module and external application board and need a In-System Programming (ISP) cable for interfacing the external programmer. However the ISP cable will supply with the programmer.

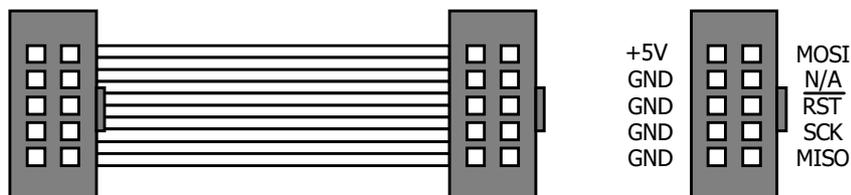
1.3.1 CX-4 serial port cable

This is used to connect between the computer's RS-232 serial port and the target or external device such as a Microcontroller board, eg. The VX-mega16 controller board. The connector's end uses a DB-9 female connector, and the other end uses a Modular plug RJ-11 6P4C (6-pins form and 4-contacts) Its Length is 1.5 meters. In the kit, this cable is used to connect between the RS-232 serial port. The wire assignment is shown in the diagram below.



1.3.2 ISP cable

This is a 10-wire ribbon cable. Both ends are attached to the female 10-pin IDC header. It is used for interfacing between the ISP programmer box and Microcontroller board at ISP connector. This ISP cable's assignment is compatible with Atmel's programming tools standard. The wire assignment can be shown in the diagram below.



About software tools in the flash programming of microcontroller, you can use 2 Software : AvrProg and Avr-OSP III. In flash programming, you must connect the VX-mega16 board with PX-400 programmer and Serial port (or USB if using UCON-232S) and apply the supply voltage ready first. After that open the programmer software.

You can see how to use these software in the PX-400 programmer documentation.

2. PX-400 Serial port In-System Progrmmer Box

2.1 Features

- Connects with the computer's serial port via RS-232. If the computer has only a USB port, a USB to SERIAL converter can be used. The UCON-232S is highly recommended for this purpose.
- Program the AVR microcontroller via ISP cable. 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-Ospll 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,
AT90S1200, AT90S2313, AT90S2323, AT90S2343, AT90S4414, AT90S4433, AT90S4434,
AT90S8515, AT90S8515comp, AT90S8535, AT90S8535comp,
ATmega103, ATmega103comp, ATmega128, ATmega1280, ATmega1281,
ATmega16, ATmega161, ATmega161comp, ATmega162, ATmega163, ATmega165,
ATmega168, ATmega169,
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

2.2 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 Corporation's AVR Assembler and C programs compiled with IAR Systems' 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 Studio's 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-400 programmer is the AVRProg and AVR-OSP II. All software can work with PX-400 via Computer serial port.

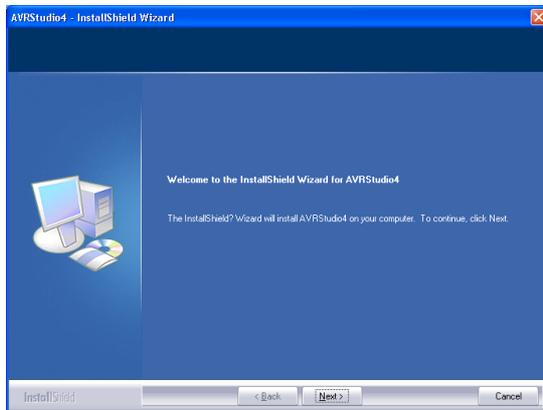
(3.1) **AVR Prog** is Atmel's software and an add-in feature in AVR Studio.

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

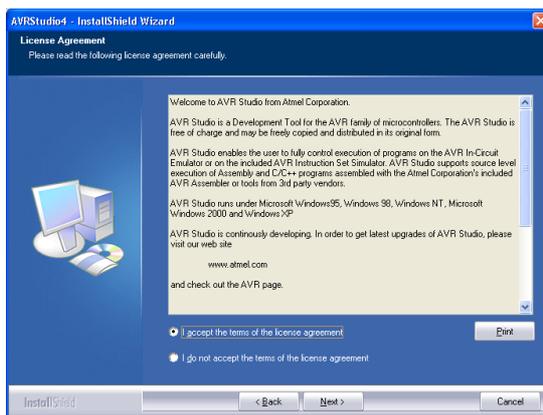
2.2.1 Installation of AVR Studio (based-on Window XP)

2.1.1.1 Insert the PX-400 CD-ROM and look for this file in the AVR Studio directory; *aStudio4b460.exe*. Double-click on this file.

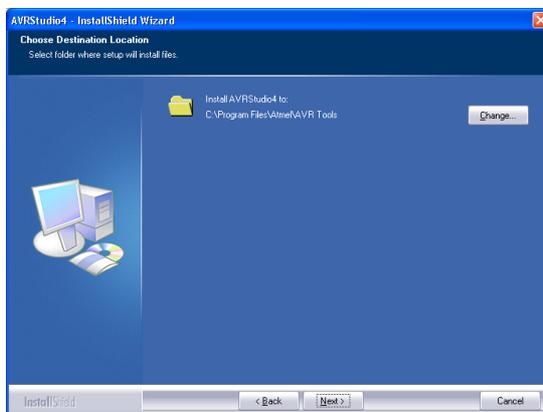
2.1.1.2 Enter the Installation Wizard. Click on the **Next** button to continue.



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



2.1.1.4 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.

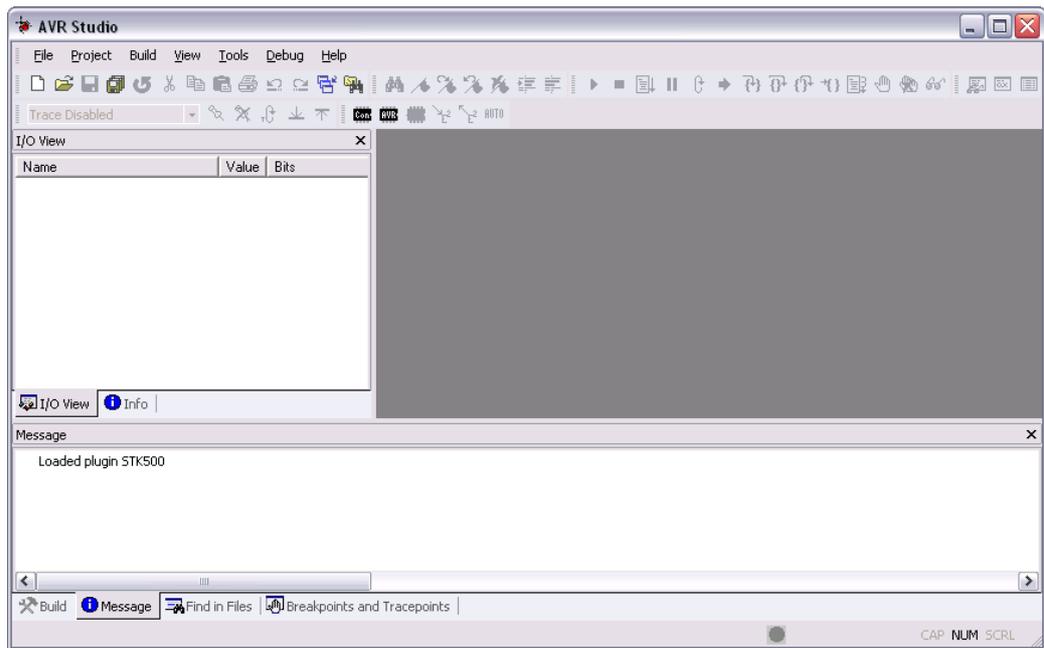


2.1.1.5 The Driver USB Upgrade window will now appear. Click on the **Next** button to pass this step.

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

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

2.1.1.8 To Launch the AVR Studio program, click on **Start → Programs → Atmel AVR Tools → AVR Studio 4**. The main window of the AVR Studio program will appear.



2.2.2 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.

2.2.2.1 Insert the PX-400 CD-ROM, and find the installation file of WinAVR; *WinAVR-20050214-install.exe* (or the newer version if appear). Double-click this file.

2.2.2.2 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.



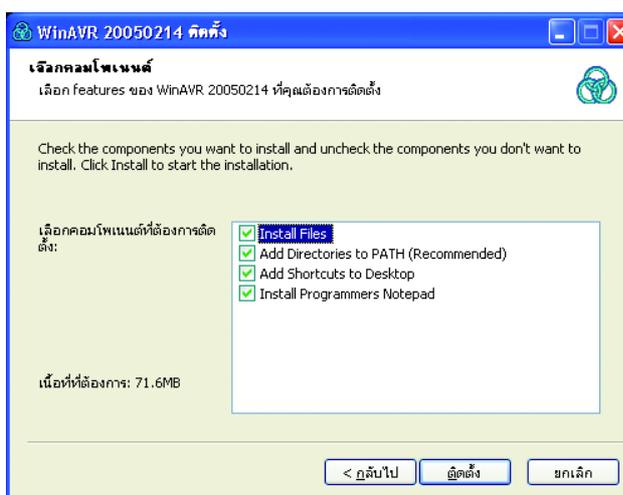
2.2.2.3 The Welcome installation software window appears and shows the installation information. Click on the **Next** button.



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

2.2.2.5 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.

2.2.2.6 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.



2.2.2.7 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.

2.2.3 Installation of Programmer software

2.2.3.1 AVR Prog

It will install ready after instaaaltion AVR Studio.

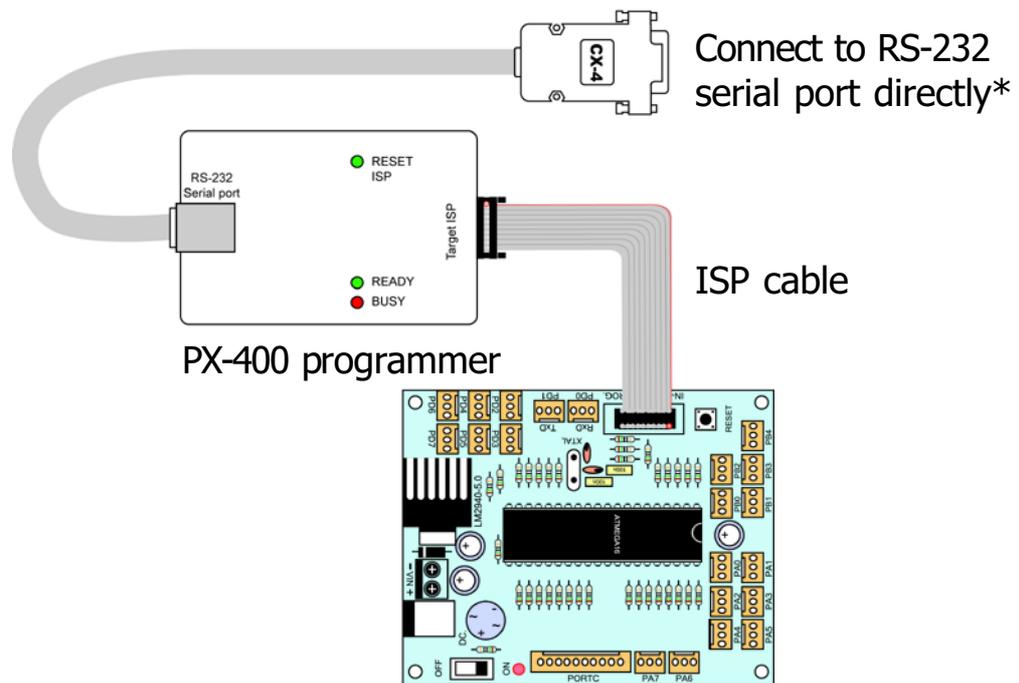
2.2.3.2 Avr-Osp II 4.00 (or the latest version)

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 Programmer software

3.1 AVR Prog

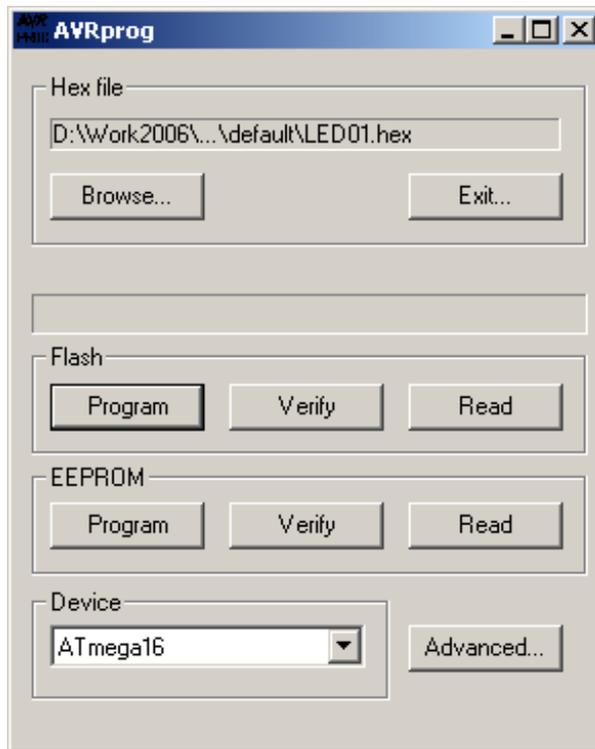
3.1.1 Connect the PX-400 to Computer serial port and Target microcontroller board with ISP cable. Apply the supply voltage.



AVR microcontroller Target board
Must apply the supply voltage at the target board and connect all device ready before open the software.

* If computer has not serial port, suggest to use USB to Serial port converter to connect with computer. The UCON-232S is recommended.

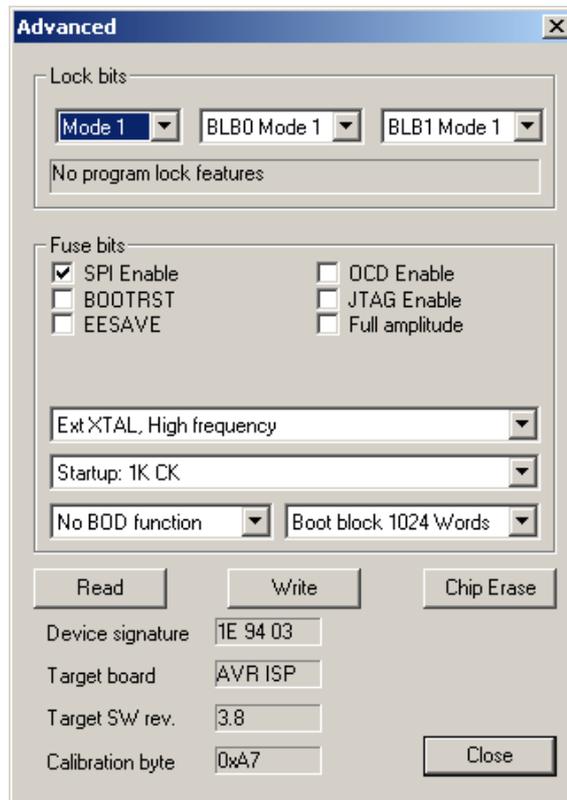
3.1.2 Open the Window explorer. Enter to find the AVR Prog execute file as : **C:\Program file\ATMEL\AVR tools\AvrProg\AvrProg.exe**. Double clicc at this file. The programmer's window will appear.



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



3.1.4 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.



3.1.5 Setting the configuration bit :

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

3.1.5.2 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.

3.1.5.3 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**).

3.1.5.4 Click **Write** button to store Configuration information.

3.1.5.5 Click **Chip Erase** button for erasing the Program memory

3.1.5.6 Click **Close** button for finishing the Configuration setting.

3.1.6 Open the HEX file by click at **Browse...** button.

3.1.7 Click **Program** for programming the HEX file to the microcontroller's program memory. The Busy red LED on PX-400 programmer lights until finish it will off. At the Progress bar on AVR Prog software will show the status until finish too. Target microcontroller will run immediatly.

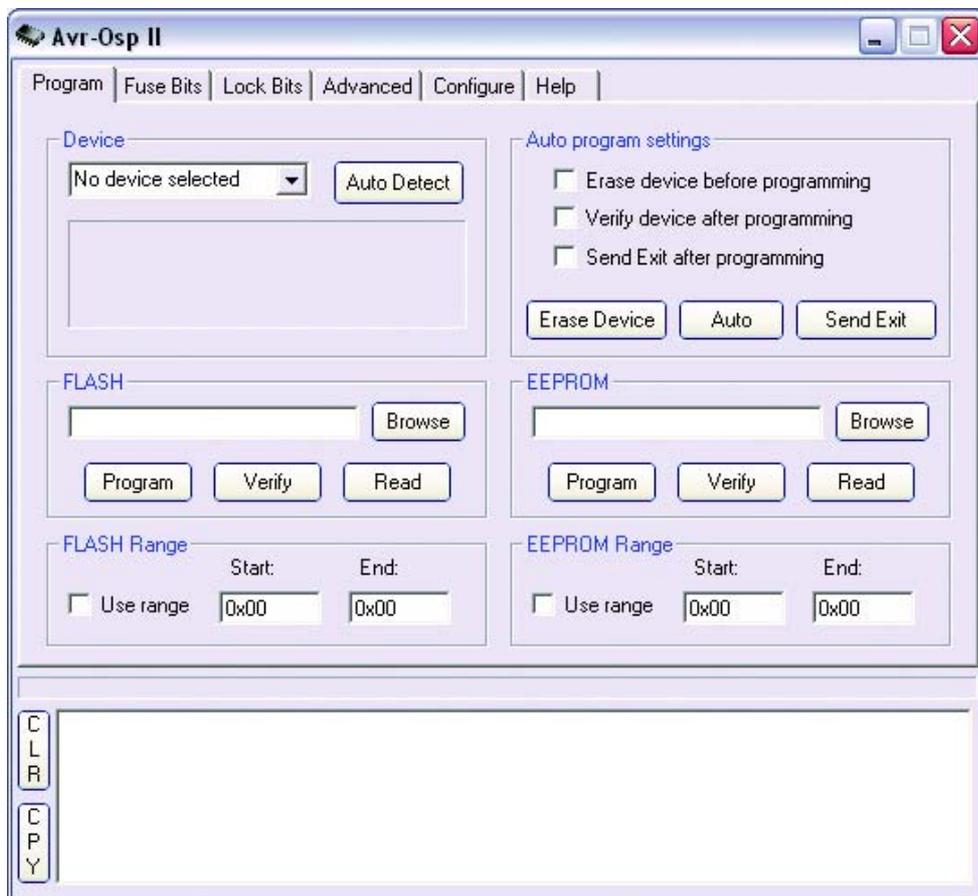
The PX-400 programmer has 2 LED indicators as :

1. The green LED for Ready status: Inform that it is ready and supply voltage status.
2. The red LED for Busy status: Lets the user know the programmer is still working. When red Busy LED light is blinking or on, the green Ready LED must be off.

3.2 Using Avr-Osp II software

3.2.1 Connect the PX-400 to Computer serial port and Target microcontroller board with ISP cable. Apply the supply voltage.

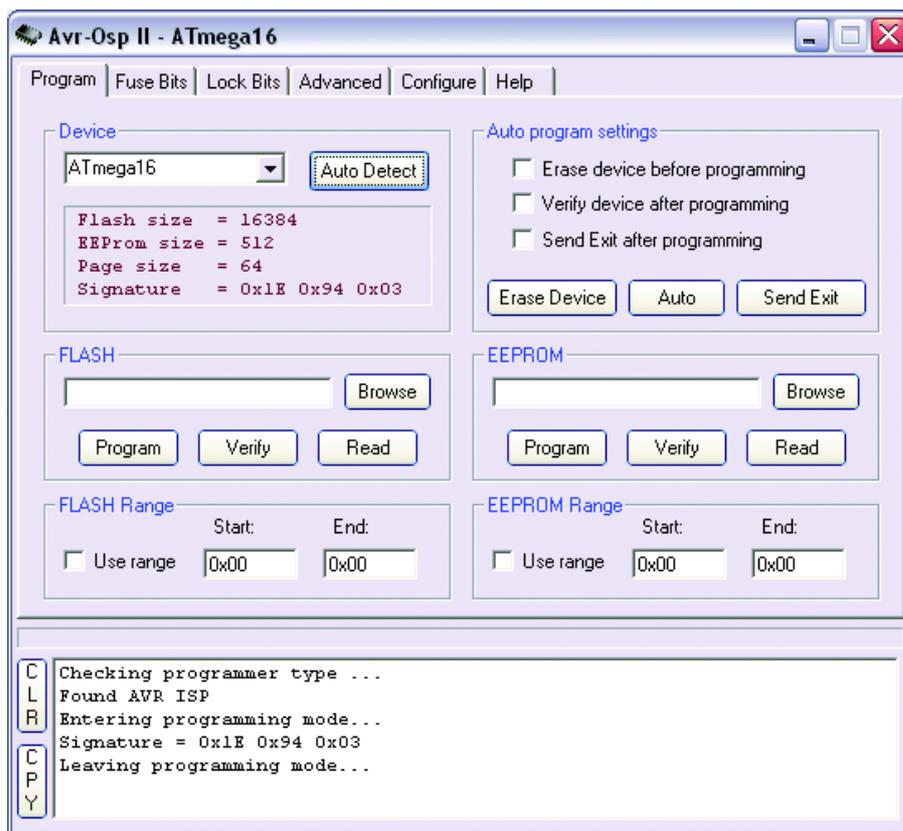
3.2.2 Open Avr-Osp II software by double-click on AvrOspII.exe file. The main window will appear.



3.2.3 Select the Configuration tab to select the communication port and baudrate. You need to set it to **115,200 baudrate** only. The port is selected to **Auto**.



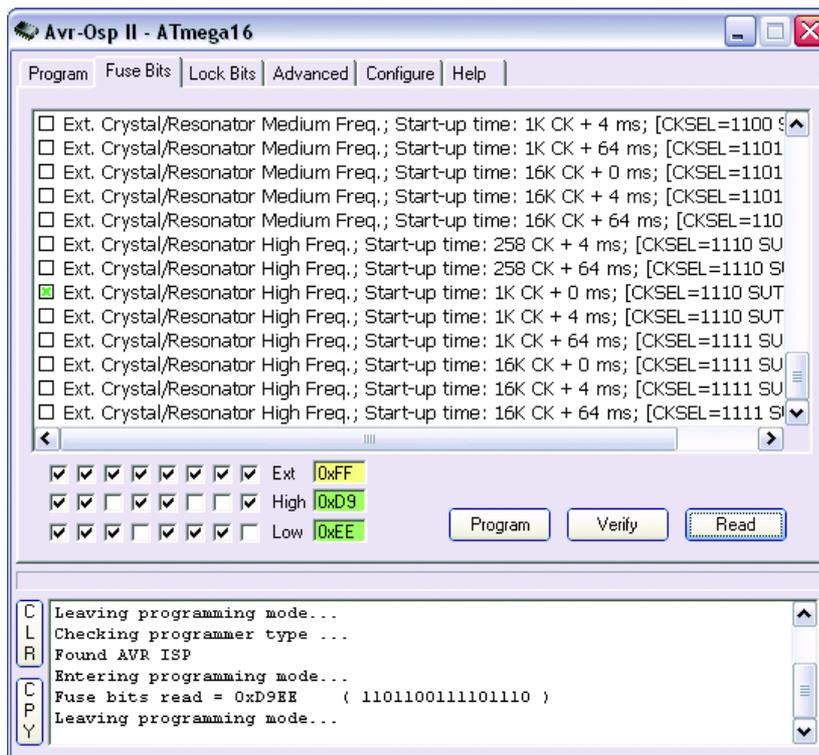
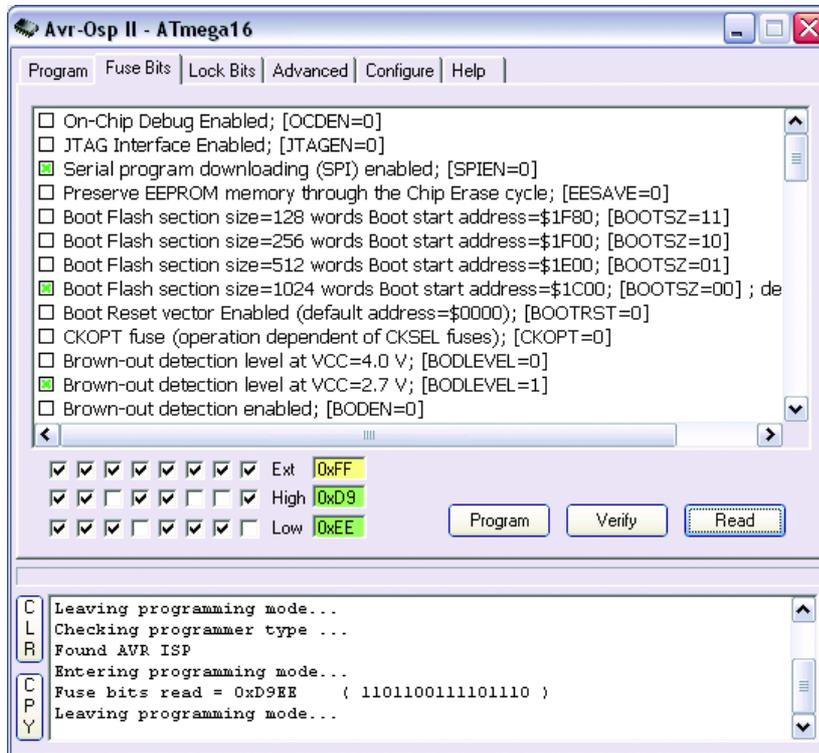
3.2.4 Back to main window by selecting the **Program** tab. Click **Auto Detect** button in **Device** box. Wait a moment to see the operation at **Status** box.



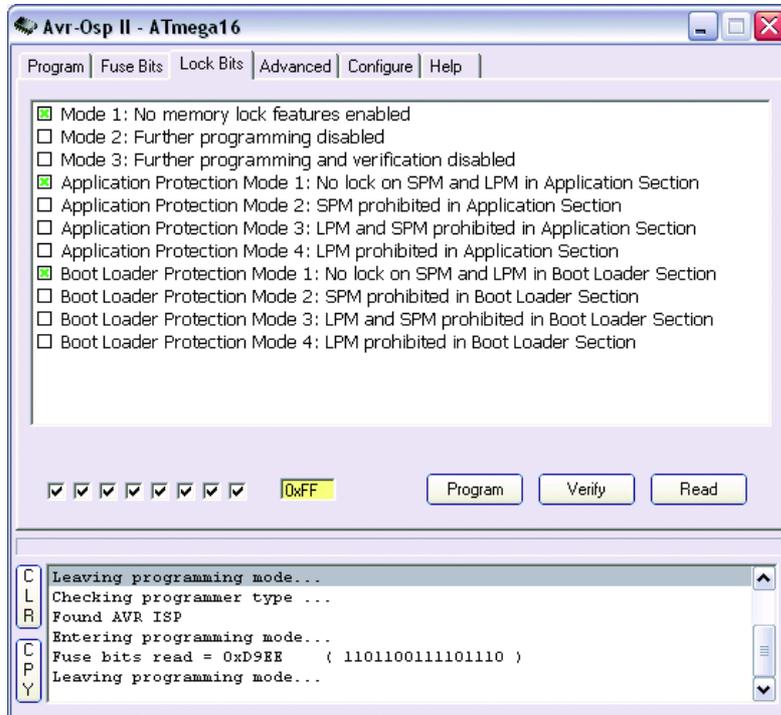
A Device box will show the number of AVR microcontroller with some information. At the same time, the Status box will display much status and information

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

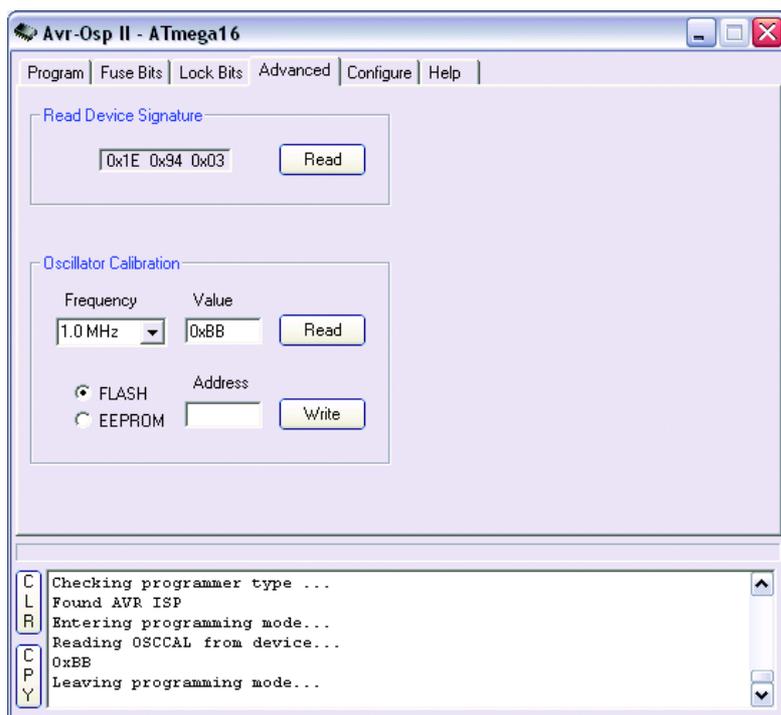
3.2.5 Select the **Fuse Bits** tab for reading the Configuration or Fuse bit of the AVR microcontroller. Two parameters must not be change. See the figure below.



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



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



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

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

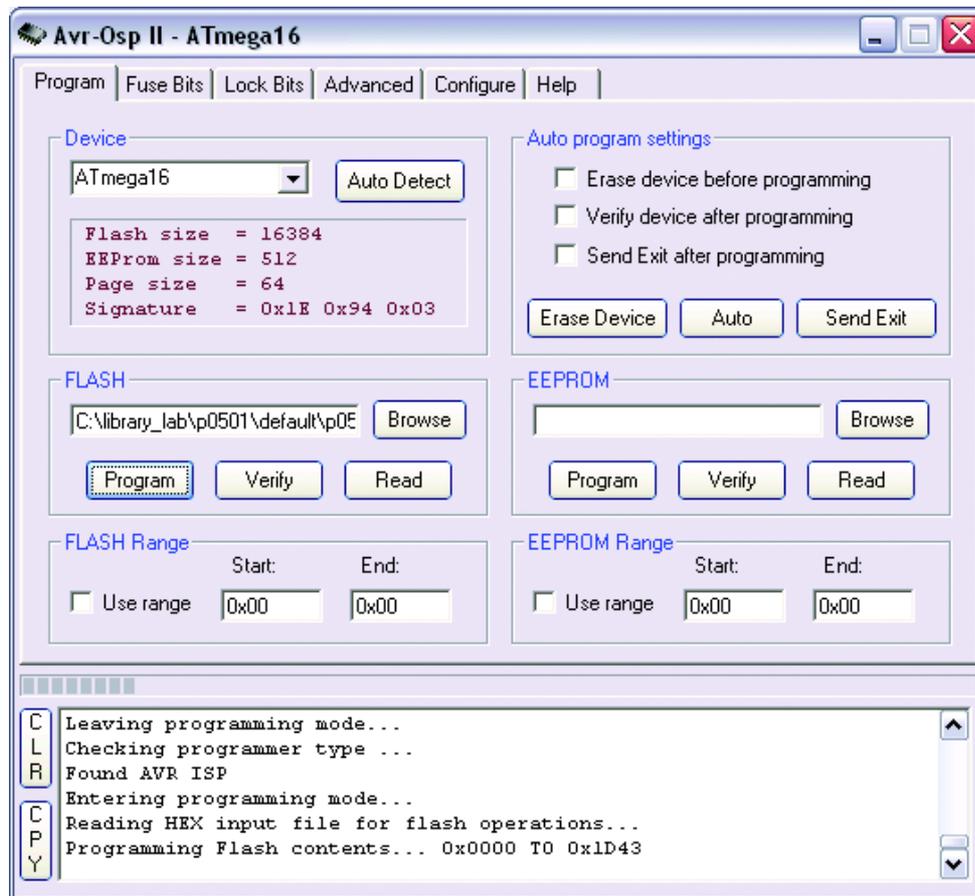
3.2.9.1 Erase device before programming

3.2.9.2 Verify device after programming

3.2.9.3 Send Exit after programming

Suggest to select **Erase device before programming** choice at least.

3.2.10 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.

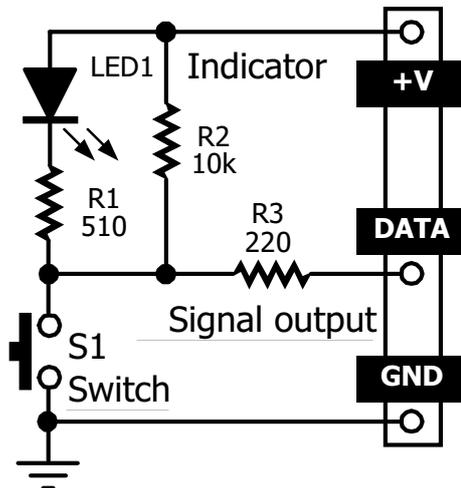


3.2.11 The limitation of Avr-Osp II (in V4.00) *is not being able to save the HEX file into the haddisk and it cannot show the HEX data that it has programmed.*

4. ZX-SWITCH : Switch/Touch sensor module

The technical features of this module is :

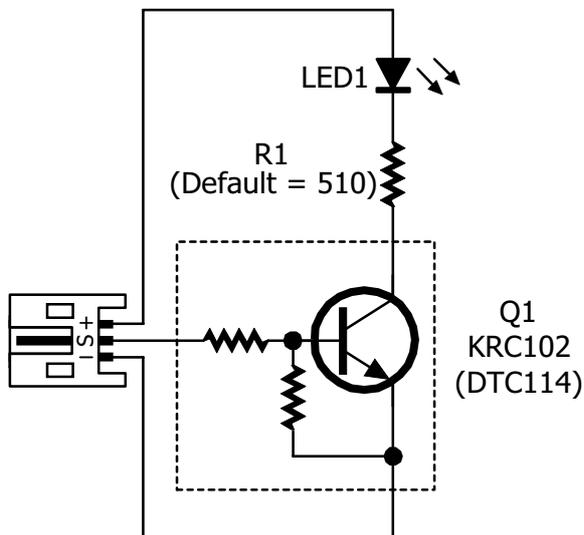
- Use the high-quality push-button switch with square knob.
- If the switch is not pressed, DATA will have a logic value of "1" . Once the switch is pressed, DATA will be connected to ground, and will result in a logic value "0".
- Get the supply voltage from the Master/Main microcontroller board.
- The supply voltage range is +3 to +6V.
- A LED indicator.
- INEX Standard 3-pin PCB connector. Confort to use with INEX boards.



5. ZX-LED : Single LED output module

The technical features of this module is :

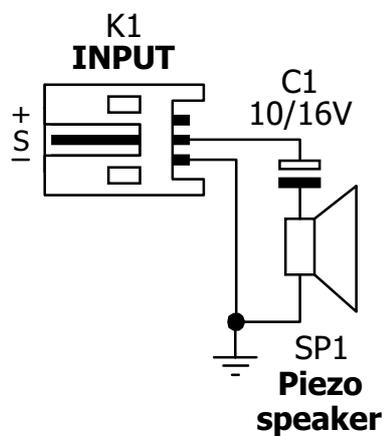
- 8mm. Single LED
- Active with logic "1" include driver on-board.
- Suitable supply voltage +3 to 5Vdc
- Interface with microcontroller and logic circuit.
- INEX Standard 3-pin PCB connector. Comfort to use with INEX boards.
- Available 5 colors (Red/Green/Yellow/Blue/White)



6. ZX-SPEAKER : Piezo speaker module

The technical features of this module is :

- 32Ω impedace Piezo speaker.
- Support signal in frequency range 1kHz to 3kHz.
- The supply voltage range is +3 to +6V.
- INEX Standard 3-pin PCB connector. Confort to use with INEX boards.



7. C programming development with AVR Studio and WinAVR compiler

In actual fact, writing of the C program for the microcontroller is not the actual code that is sent to the microcontroller's program memory. The real data is in the machine code which is being compiled from the written C code and compiled with the C Compiler software.

The steps in C programming development are as follows:

- (1) Write the C programs with the text editor / Project IDE that is provided.
- (2) Compile the C code into assembly Code for the microcontroller
- (3) The Assembly Code will be converted into Machine Code into HEX file format.
- (4) Download this code into the program memory of the microcontroller
- (5) Run the microcontroller. Go back to step 1 if you have errors.

Steps (2) and (3) will not be shown as the C Compiler will do all of these in its background.

After installing AVR Studio and WINAVR software, the library files are required to be copied in order to support the VX-Mega16. The library files are contained in the CDROM that is included in this kit.

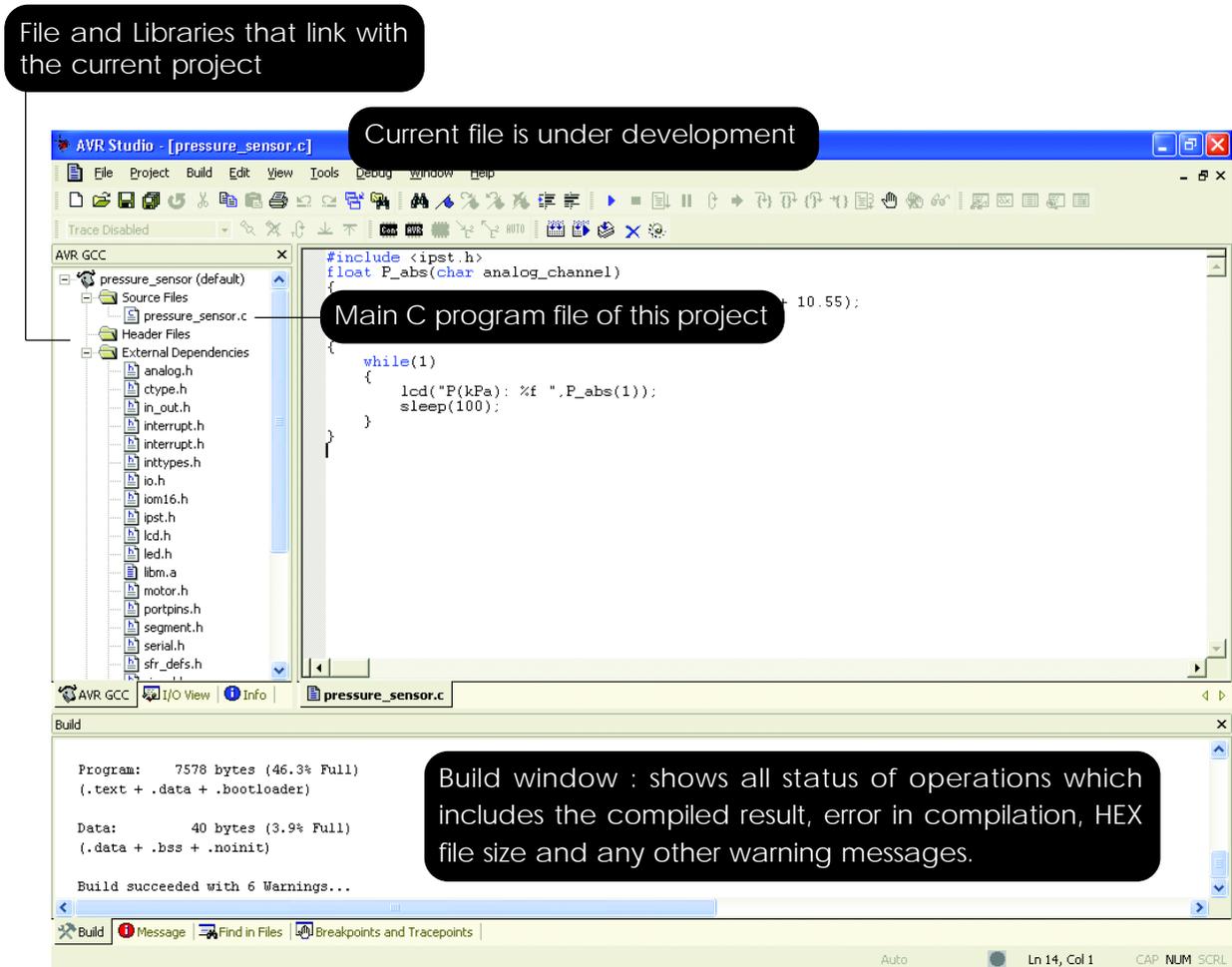
In the C programming development platform in AVR Studio, developers need to compile it into project file format. After the codes are being compiled into HEX file using the same name as the project filename, the file is needs to be downloaded into the ATMEGA8 Microcontroller.

For example :

Name the project file to ***test_segment***. After compiled, the result file is ***test_segment.hex***

7.1 The AVR Studio V4.0 windows details

The figure below shows the main components in the main window of the AVR Studio software.



7.1.1 File menu

Includes the command as follows :

New File	Create empty text file
Open File	Open a file in text editor or an object file for debugging
Close	Close the active text file
Save	Save current text file
Save As...	Save current text file under given name
Save All	Save all files and project settings
Print	Print active text file
Print Preview	Preview active text file
Print Setup	Setup printer
Exit	Exit AVR Studio, project are saved when exiting.

7.1.2 Project menu

Includes the command as follows :

Project Wizard	Open the project wizard. You must close the current project first.
New Project	Open the new project dialog. You must close the current project first.
Open Project	Open a new project, either an APS project file or an object file.
Save Project	Save the current project with all settings
Close Project	Close the current project
Recent Projects	Show a list of recent project, select one to open
Configuration Options	This option is only available when the project is a code writing project. E.g. an assembler or AVR GCC project. This command open the configuration dialog for the current project.

7.1.3 Build menu

Includes the command as follows :

Build	Build the current project
Rebuild All	Rebuild all the modules in the project
Build and run	Build, and if error free , start debugging session
Compile	Compile the current source file
Clean	Clean the current project
Export Makefile	Save the current settings in a new make file

7.1.4 Edit menu

Includes the command as follows :

Undo	Undo last editor action
Redo	Redo any undo action
Cut	Cut and copy selected text from editor
Copy	Copy selected text from editor
Paste	Paste any text from clipboard to the editor
Toggle Bookmark	Toggle bookmark on/off at the selected line in the editor
Remove Bookmarks	Remove all bookmarks
Find	Open a find dialog to search through the current source file.
Find in Files	Open a find in files dialog to search through all project files.
Next Error	Locate and jump to the next build error if any
Show whitespace	Toggle on/off whitespace markings
Font and color	Open a font dialog to view/edit font settings in the source editor

7.1.5 View menu

This menu includes the command as follows :

Toolbars	Sub menu toggles toolbars on/off, access to customize-dialog. Described here
Status Bar	Toggle status bar on/of (status bar is the line in the bottom of the screen)
Disassembler	Toggle on/off the disassembly window
Watch	Toggle on/off the watch view
Memory	Toggle on/off the memory view
Memory 2	Toggle on/off the memory view 2
Memory 3	Toggle on/off the memory view 3
Register	Toggle on/off the register view

7.1.6 Tools menu

This is the hardware interfacing command menu. AVR Studio can interface many hardware for development. For the VX-Mega16 board, developers must select the AVRprog. This is the operating software for the PX-400 Serial Port In-System Programmer box.

Developers must connect the PX-400 box to their COM port before open the AVRprog software.

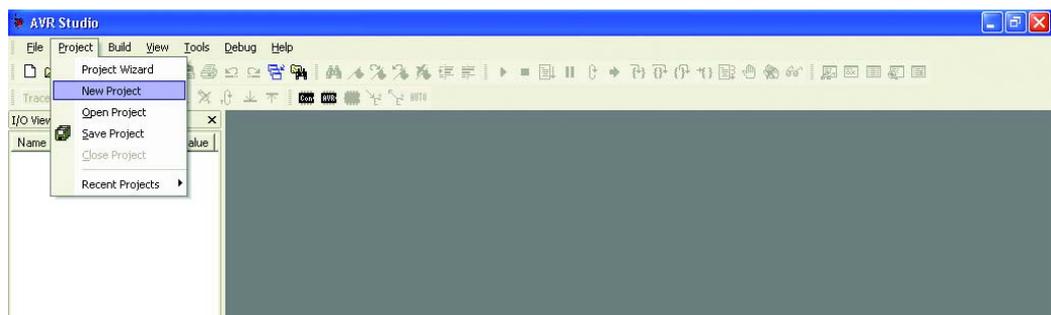
7.1.7 Debug menu

This menu have many commands that relates to the program simulation and debugging. The VX-Mega16 board does not require much usage of this feature.

7.2 Building C project file in AVR Studio

7.2.1 Open the AVR Studio. If there is any project running, developers can close by select the menu **Project → Close Project**

7.2.2 To create the new project. Select the command at menu **Project → New Project**.

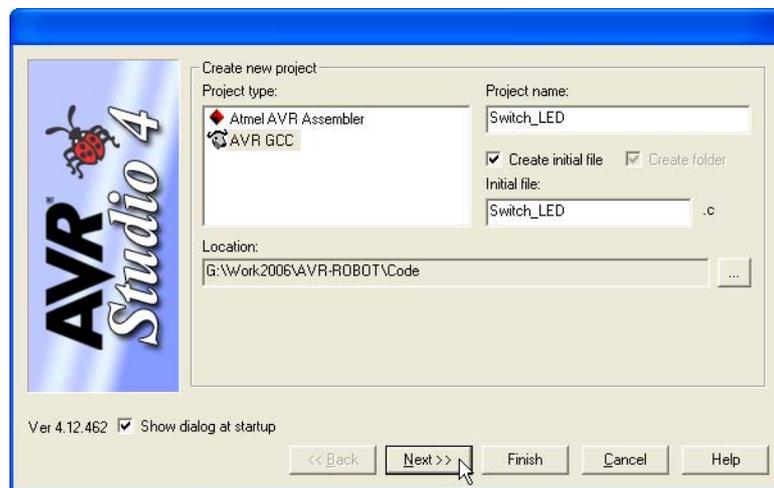


7.2.3 The properties project window will appear. Set the parameter as follows :

7.2.3.1 Click on this to select AVR GCC item within **Project type**: for select type of project file to program in C.

7.2.3.2 Set the project name as **Switch_LED** (an example name). This will cause the initial file section to be created. This project has a main C program file called, **Switch_LED.c**.

7.2.3.3 Select the project's path in Location: Example is **G:\Work2006\AVR-ROBOT\Code**. After this, click on the **Finish** button.

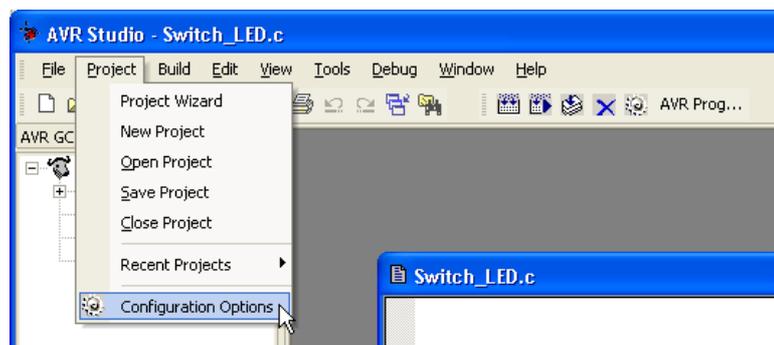


7.2.4 The **Switch_LED** project environment will be created as shown in the diagram below.

The folder **Switch_LED** will be created in **G:\Work2006\AVR-ROBOT\Code**. In the same folder the file **Switch_LED.aps** and main C program file **Switch_LED.c** will be created.

7.2.5 Next step is to determine the microcontroller information and path of all the library file which is being used in this project.

7.2.5.1 Select the command at **Project → Configuration Options**

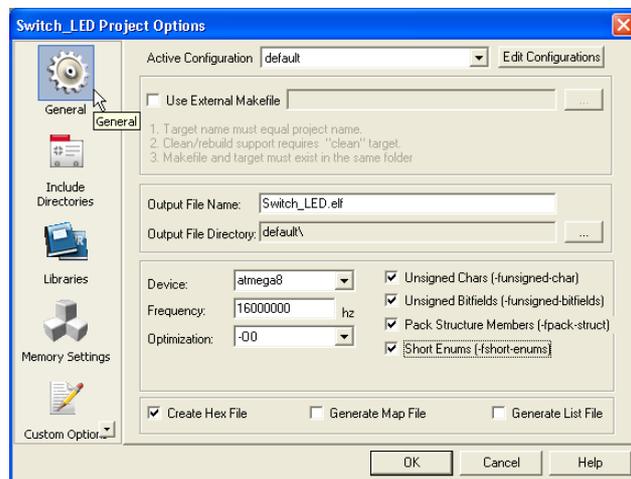


After that the window **Switch_LED Project Options** will appear for setting the properties. See the left of this window. Developers will found 5 icons as :

- General
- Include Directories
- Libraries
- Memory Settings
- Custom Options

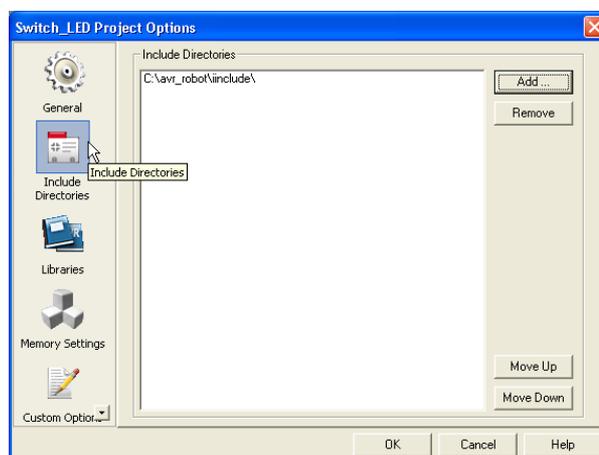
7.2.5.2 At General icon, determine all data follows

- Device : **atmega16**
- Frequency: **16000000 Hz**

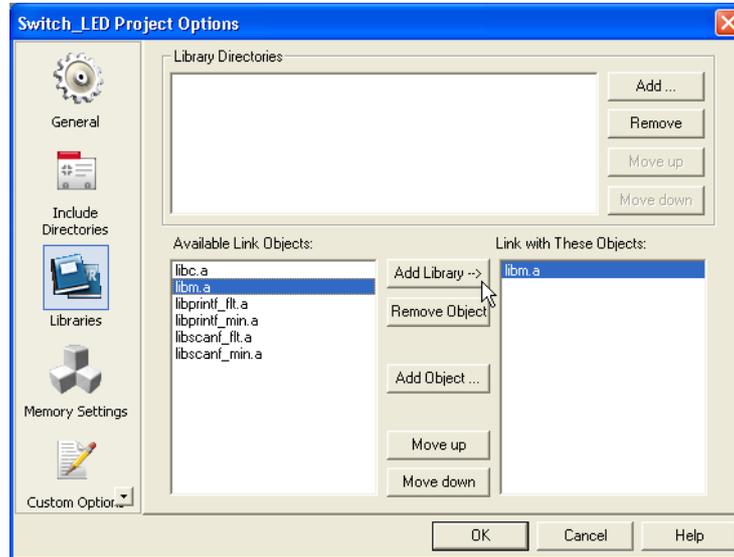


7.2.5.3 Click on this icon and the Include Directories for determining the path of library file. Find and select the library file and click on the **Add** button. For example is **C:\AVR_ROBOT\include**. After determining the path, you will found the list for selection.

7.2.5.4 Select the icon **Libraries** to links to all the libraries with the main file.



7.2.5.5 At the box , **Available Link Objects:**, click to select the item **libm.a** and click the **Right Arrow** button to copy the item **libm.a** which appears at the Link with These Objects window. Click the **OK** button to finish.



7.2.6 Next, write the C code in the **Switch_LED.c** file. This file controls the microcontroller to On and off the LED when the switch is pressed. The details & codes of this file is shown in the Listing 3-1.

7.2.7 Compile the target file to **Switch_LED.hex** by selecting the command at the menu Build → Build or press F7 button or click at  button.

The status of this operation will be shown at the Build or Output window at the bottom of the main window of the AVR Studio as shown in the diagram.

If any error occurs, such as an illegal command or a link error, the Build Output window will appear. Developers need to edit the program, pfix all errors and re-comple the code until it is correct and the HEX file is being compiled properly.

After compilation, the file **Switch_LED.hex** will be made and stored in the folder of that project file. For example : The result file **Switch_LED.hex** is stored at the folder **Switch_LED.hex** is stored at **G:\Work2006\AVRROBOT\Code\Switch_LED\default**.

7.3 How to develop the previously project file

Developers can open the previously project file for editing or improvement. Enter to menu **Project** → **Open Project** and select the path that store the target project file. The project file is saved as .aps file

Example : If would like to open the **Switch_LED** project file, select to **Project** → **Open Project** and access to the path or folder which contains the **Switch_LED.aps** file. Open this file for editing. Developers can save with the same name or different.

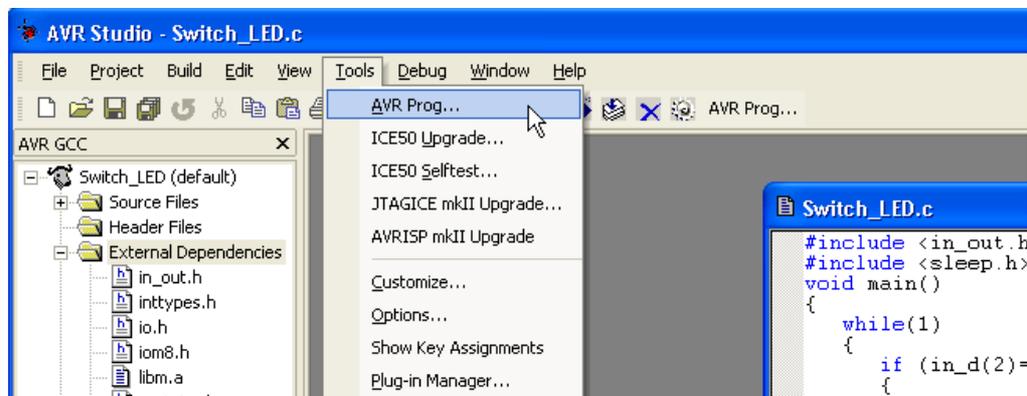
7.4 Downloading and Testing the program

The next step after compiling the project file is to download the HEX file to MicroCamp controlelr board. In this example the result file is saved as **Switch_LED.hex**. The step of downloading and testing are as follows :

7.4.1 Turn on the POWER switch. The green LED at ON labeled is on.

7.4.2 Connect the download cable (ISP cable) from the PX-400 programmer box to the In-System Prog. (ISP) connector on MicroCamp controller board.

7.4.3 Switch to AVR Studio program, select the command at menu **Tool** → **AVR Prog...**



7.4.4 The AVRprog window will not appear.

7.4.5 At the AVRprog window, click on the Browse button to find the path of **Switch_LED.hex** file for selection the HEX file require to download.

7.4.6 Click at the Program button in the Flash command. The **Switch_LED.hex** file will now be downloaded into the ATmega16 microcontroller in the VX-Mega16 board.

7.4.7 When the download is finished, the program will run automatic.



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