Introduction to Microcontrollers using MINI-MAX/AVR-AU & FlowCode®

Quick Start Guide

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1. Overview

Thank you for your purchase of the MINI-MAX/AVR-AU Single Board Computer. MINI-MAX/AVR-AU is a general purpose, low-cost and highly expandable micro-controller system. It is based on the ATMEL AT90USB162 single-chip Flash micro-controller that has a built-in bootloader to download user programs through USB port. Through the boot loader, the MINI-MAX/AVR-AU appears to AVR Studio, FLIP and other development tools as a USB device.

2. Hardware Setup

Place the MINI-MAX/AVR-AU Microcontroller board on a clean, non-conductive surface.

Connect one end of the provided Mini USB cable to USB connector (X1) of MINI-MAX/AVR-AU.

Connect the other end of the Mini USB cable to an available USB port on your PC.



3. Software setup

- FLIP (FLexible In-system Programmer) ATMEL (<u>www.atmel.com</u>) is a software that runs Windows 9x/Me/NT/2000/XP/Vista/Windows7 and Linux x86. FLIP supports in-system programming of Flash devices through RS232, USB or CAN.
- 2.1 FLIP

Download and install FLIP (version 3.4.2 or higher) from ATMEL website:

http://www.atmel.com/dyn/products/tools_card.asp?tool_id=3886

Start FLIP from Programs menu:



FLIP will start and the following window will appear:



If you are using FLIP for the first time, select the AVR microcontroller type.

MINI-MAX/AVR-AU board has ATMEL AT90USB162 microcontroller.

From FLIP Device menu (Device->Select), select AT90UB162 and click OK:

Device S	election	×
2	Select a device	
\checkmark	AT90USB162	A
	AT90USB646	
	AT90USB647	
	AT90USB82	
	ATmega16M1	
	ATmega16U2	
	ATmega16U4	
	ATmega32C1	_
	ATmega32M1	
	ATmega32U2	-
	OK Cancel	

Now, we will prepare the MINI-MAX/AVR-AU board for download. To do this:

Connect the MINI-MAX/AVR-AU board to your computer's USB port as shown in Figure 1 while pressing the BOOT Button.





When MINI-MAX/AVR-AU is connected to the USB port of your computer for the first time, it will be detected as a USB device:



Windows will start the "Found New Hardware Wizard":



Click "No, not this time" option and click Next:

Found New Hardware Wizard	
	Welcome to the Found New Hardware Wizard Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission). Read our privacy policy
	Can Windows connect to Windows Update to search for software? O Yes, this time only O Yes, now and every time I connect a device O No, not this time Click Next to continue.
	< Back Next > Cancel

You will see the following window:

Found New Hardware Wizard	
	This wizard helps you install software for: AT90USB162 If your hardware came with an installation CD or floppy disk, insert it now. What do you want the wizard to do? Install the software automatically (Recommended) Install from a list or specific location (Advanced] Click Next to continue.
	< <u>B</u> ack <u>N</u> ext > Cancel

Select "Install from a list or specific location (Advanced)" option and click Next:

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM)
Include this location in the search:
C:\Program Files\Atmel\Flip 3.4.1\usb
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< <u>B</u> ack <u>N</u> ext > Cancel

Select "Search for the best driver in these locations" option. Using the Browse button, select the directory:

C:\Program Files\Atmel\Flip 3.4.1\usb

Click Next.

Windows will install the ATMEL AT90USB162 USB driver:

Found New Hardware Wizard	
Please wait while the wizard installs the	software
AT90USB162	
libusb0.dll To C:\WINDOWS\system32	
	< <u>B</u> ack <u>N</u> ext > Cancel

Under Windows 7, you may see a message like:

😵 Win	ndows Security X
\bigotimes	Windows can't verify the publisher of this driver software
	Don't install this driver software You should check your manufacturer's website for updated driver software for your device.
	Install this driver software anyway Only install driver software obtained from your manufacturer's website or disc. Unsigned software from other sources may harm your computer or steal information.
•	See <u>d</u> etails

If you see this message, select "Install this driver software anyway" option.

When the operation is finished, click the Finish button:

Found New Hardware Wizard	
	Completing the Found New Hardware Wizard
	The wizard has finished installing the software for:
	AT90USB162
	Click Finish to close the wizard.
	< <u>B</u> ack Finish Cancel

You should see the "Found New Hardware" notification at the bottom right corner of the Windows screen:

🔅 Found New I	Hardware	×		○ ∓
Your new hardware	e is installed and ready to use		Ū	÷
📠 Atmel 🔜 Devic	🦉 untitle 🛛 < 🛒	e ai 💟	0,5	8:49 AM

To make sure that the board was recognized correctly, you can start Windows Device Manager under Control Panel (use Start->Control Panel->System->Hardware->Device Manager under Windows XP; the sequence to start Device Manager may be different for other versions of Windows).

You will see an entry called "Atmel USB Devices" under the Device Manager:



Click on the + sign to the left of "Atmel USB Devices" entry. This will expand the entry and show the "AT90USB162" entry:



At this point, the MINI-MAX/AVR-AU board is ready to accept programs.

3.3 FlowCode

FlowCode is one of the world's most advanced, yet easiest to use graphical programming languages for AVR microcontrollers such as the one on your MINI-MAX/AVR-AU board. The great advantage of FlowCode is that it allows users with little or no experience to create complex electronic and robotic systems.

To use FlowCode with MINI-MAX/AVR-AU board, either the Home or Professional license of FlowCode is required. This can be purchased from:

http://www.bipom.com/products/us/3313879.html

Demo version of FlowCode is limited to a single microcontroller and will not work with MINI-MAX/AVR-AU.

Installing FlowCode

Install FlowCode following the instructions that came with your FlowCode CD.

Running FlowCode Example Programs

FlowCode4 is a flowchart driven program that allows the user to create a microcontroller program simply by creating a flowchart. Tools located in the program will compile the flowchart and download the hexadecimal program to the microcontroller chip.

Follow the steps below to check if you can build and download FlowCode programs to the board:

1. Make sure that the board is powered and connected to the PC as described in the section **Installing the Hardware**.

Run FlowCode from Windows Start Menu:



When FlowCode starts, it asks to Create or Open project:



Select "Open an existing FlowCode flowchart". Click OK.

Go to folder c:\bipom\devtools\FlowCode\minimaxavrau\examples\io and select the FlowCode project io.fcf_avr. Click Open.

🛃 Open								×
G → 📙 🕶 Computer 🕶 OS	(C:) - bipom	n ▼ devtools ▼ Flowcode ▼ minimaxavrau ▼ example	s ▼ io		👻 🔯 Search	n io		2
Organize 🔻 New folder						-		0
📃 Desktop		Name ^	Date modified	Туре	Size			
i Downloads Brecent Places		🛃 io.fcf_avr	11/18/2010 6:20 AM	Flowcode_AVR Doc	4 KB			
 Libraries Documents Music Pictures 								
as Subversion								
🜏 Homegroup								
in Computer								
💩 OS (C:)								
👢 Apps								
l backup								
📙 bipom								
el del	v							
File <u>n</u> ame:	io.fcf_avr			2	Flowcode	for AVR file	es (*.fcf	•
					Open		Lancel	

The following FlowCode screen appears:



FlowCode display the flowchart for the program as well as the pinout of AT90USB162 chip:



Let's analyze the program:



Each FlowCode program starts with a BEGIN statement and ends with an END statement. This program implements an infinite loop. Statements between While 1 and Loop execute forever.

Output statements write values to AT90USB162 microcontroller's ports. For example:

Output

writes a value 0 (logic low) to port C7.

Output → C2

writes a value of 1 (logic high) to port C2.

FlowCode has built-in statements to generate delays.



This program runs forever, writes 0 to ports C7, C2 and D0, then waits 1 second, then writes 1 to ports C7, C2, D0, waits another 1 second and then does the same sequence again and again.



Simulation

You can run this program in simulation mode. Simulation does not download the program to the board. Instead, the program is executed in FlowCode in simulated mode. In other words, AT90USB162 microcontroller's instructions are simulated by the PC.

To start the simulation, click the Step Into button:



FlowCode will put a red circle around the first statement:



This is a cursor that shows where the program execution stops in simulation.

Click the Step Into button again. Program execution moves to the next statement:



By continuing to click Step Into button, you can single step through the whole program and see the simulated statements execute.

To watch what the program is actually doing, we can connect some simulated LED's to microcontroller ports. For example, we can assign:

Red LED to Port D0 Yellow LED to Port C7 Green LED to Port C2

To add LED's, first stop the simulation using the Stop Simulation button on the toolbar:



When Simulation is stopped, you will see a message box:



Close this message box.

Select Outputs->LED from the menu:



This will insert an LED in the output panel at the bottom of the FlowCode window:



Select Outputs->LED twice more to add 2 more LED's. Organize the Led's side by side by moving them with the mouse:



Now we will assign microcontroller ports to LED's. Right click on left-most LED and select Connections from the menu:



Assign Port D0 to left-most LED:

Specify Component Pin Connec	tions		×
Pin Name	Port	Bit	
JED	PORT D	0	
Connect to: Port PORT) 💌 Bit	0	
Status:			
Pin LED is connected OK.			
? <u>K</u> ey Mappings			Done

Click Done.

Similarly, assign Port C2 to right-most LED by right clicking on the LED and selecting Connections from menu:

Specify Component Pin Connec	tions			X
Pin Name	Port	Bit		
J LED	PORT C	/		
Connect to: Port PORT (C 🗾 Bit	7	_	
Status:				
Pin LED is connected OK.				
? <u>K</u> ey Mappings				<u>D</u> one

Similarly, assign Port C7 to middle LED by right clicking on the LED and selecting Connections from menu:

Specify Component Pin Connec	tions		×
Pin Name	Port	Bit	
JED	PORT C	2	
Connect to: Port PORT C	C ▼ Bit	2	
Status:			
PINLED IS connected OK.			
? <u>K</u> ey Mappings			Done

Now, assign colors to LED's. Left-most LED will stay red so no need to change that (red is default color for the LED objects).

Right click the middle LED and select Properties:



On the Properties window, click on the 3 dots next to Ext Properties:



Edit Component Properties window will appear:

Edit Component Pr	operties			×
LED				
v4.1.2		Circle		•
	LED Color:	Red		•
		Active High		•
I	LED Size:	24 x 2	24	
	•		• •	
ОК	Cancel	Apply	H	Help

Change the color of the LED to yellow:

Edit Component Properties		X
LED		
v4.1.2	Circle	•
LED Color:	Yellow	•
	Active High	•
LED Size:	24 _X 24	
	0	
_		,
OK Cancel	Apply	Help

Click OK.

Do the same for right-most LED. In other words, right click on right-most LED, select Properties, select Ext Properties, change color to green:

Edit Component Prope	erties				×
LED					
v4.1.2	Ci	rcle			•
LE	ED Color: G	reen			•
	A	ctive Hig	ıh		•
LEC) Size: 2	24 x	24		
	•		Þ	•	
ОК	Cancel	Appl	y	Help))

Click OK. Now we should have a red, a yellow and a green LED as shown:

Panel		
This is a fre	ee/demo version of Flowcode	
http://w	vww.matrixmultimedia.com	
<u></u>	<u> </u>	
🦱	👝 👝	
🕶	🕶 🕶	

Run the program by clicking on Run Simulation button:



You should now see all 3 LED's blink once per second. ${f J}$

Creating FlowCode programs

🛃 Flowcode		
File View Help		
New	Ctrl+N	💡 🕨 II 🔳 🗺
Open	Ctrl+O	
Import		POutputs - 🙀 Comms
Print Setup		
1 C:\Users\\counter1.fcf_avr		
2 C:\bipom\\tb1\tb1.fcf_avr		
3 C:\bipom\\relay4b.fcf_avr		
4 C:\bipom\\relay4.fcf_avr		
5 C:\bipom\\io\io.fcf_avr		
6 C:\Users\\Demo Mode.fcf_avr		
7 balloon14au.fcf_avr		
8 C:\Users\\Demo Mode.fcf_avr		
Exit		
ф		

Select the Target (the microcontroller). MINI-MAX/AVR-AU board uses AT90USB162 microcontroller:

Choose a Target		
Choose a target for this flowchart:		
AT90S8535 AT90USB1286 AT90USB1287		
AT90USB162 AT90USB646 AT90USB647		
AT90USB82 ATMEGA103 ATMEGA128		
2	ок	Cancel

This creates a work area to create your graphical programs using flowcharts. Each new program opens with a **Begin** and **End** symbol.



Different operational icons are placed in the flowchart by clicking on the desired operation, holding down the left mouse button, dragging the icon to the desired place in the flowchart and releasing the left mouse button:



Save the program and compile. During compiling, a message box will indicate progress:

Now the program is ready to download to the MINI-MAX/AVR-AU board.

To download the program to the board, start FLIP:

Put the board in program mode. To do this:

- Push the BOOT button on the board
- Push the RESET button (while still holding BOOT button)
- Release the RESET button
- Release the BOOT button



During download, a window will indicate progress:



Download typically takes 2-3 seconds. As soon as the download completes, the program starts running on the MINI-MAX/AVR-AU board.