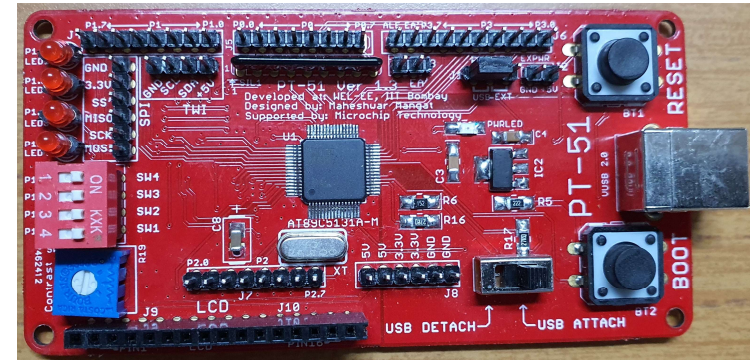
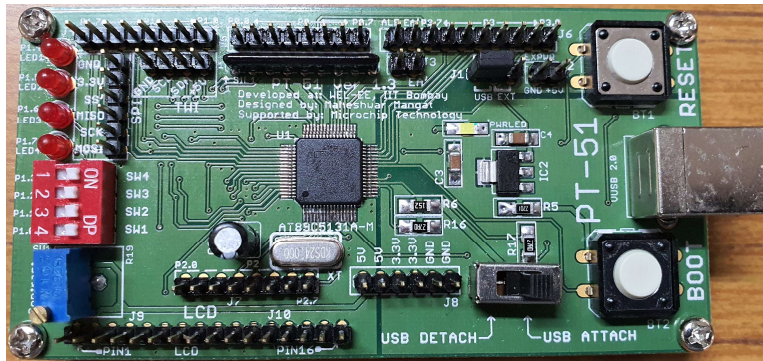


User Manual for PT-51

Maheshwar Mangat (maheshgm@ee.iitb.ac.in / amits@ee.iitb.ac.in)

Introduction



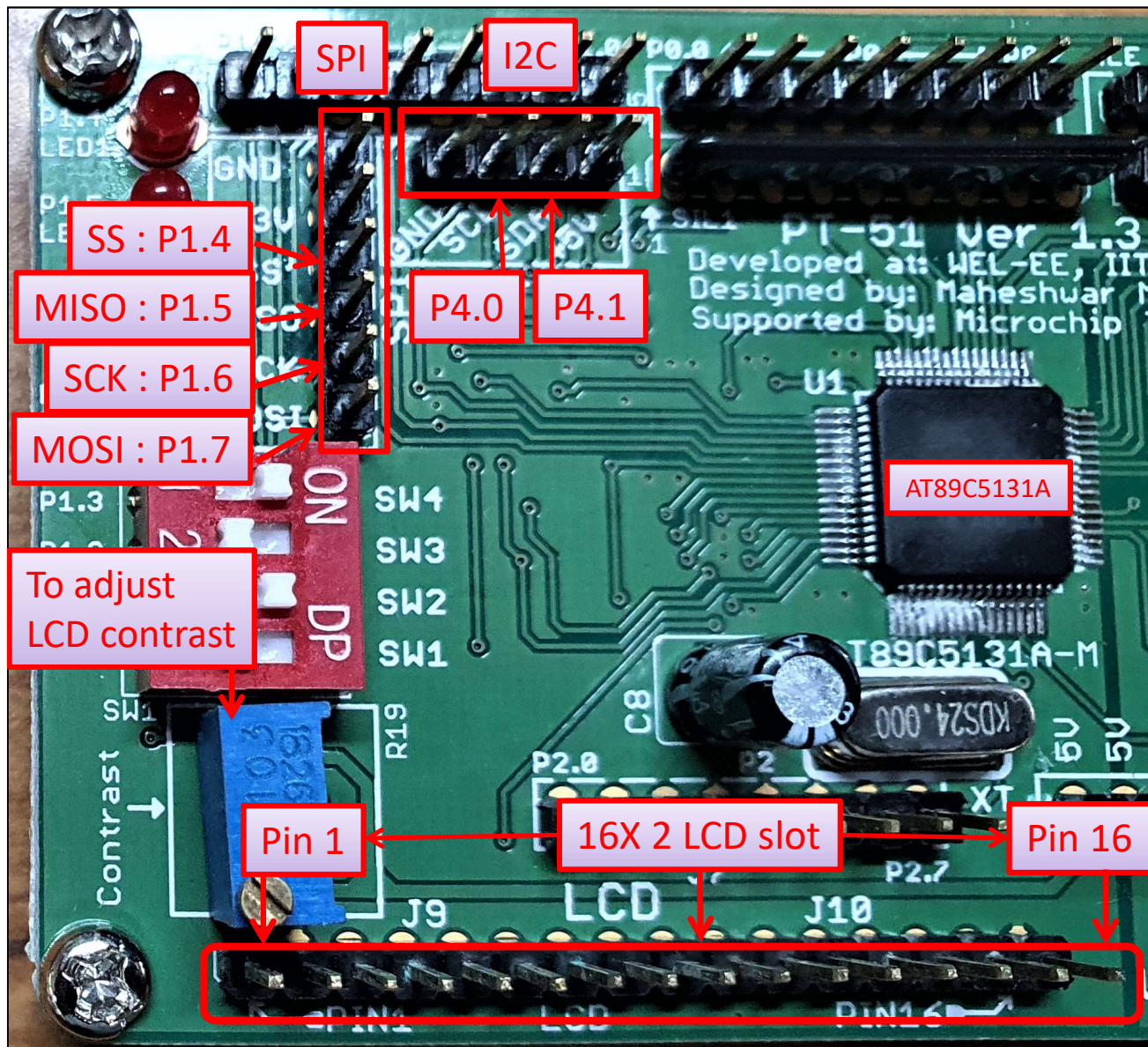
- Pt-51 is the microcontroller board designed, developed at WEL.
- The board is being used for EE337, EDL and other development work since 2012.
- The board was distributed to more than 200 engineering colleges across the country to upgrade their microprocessor lab course.

Specifications Board

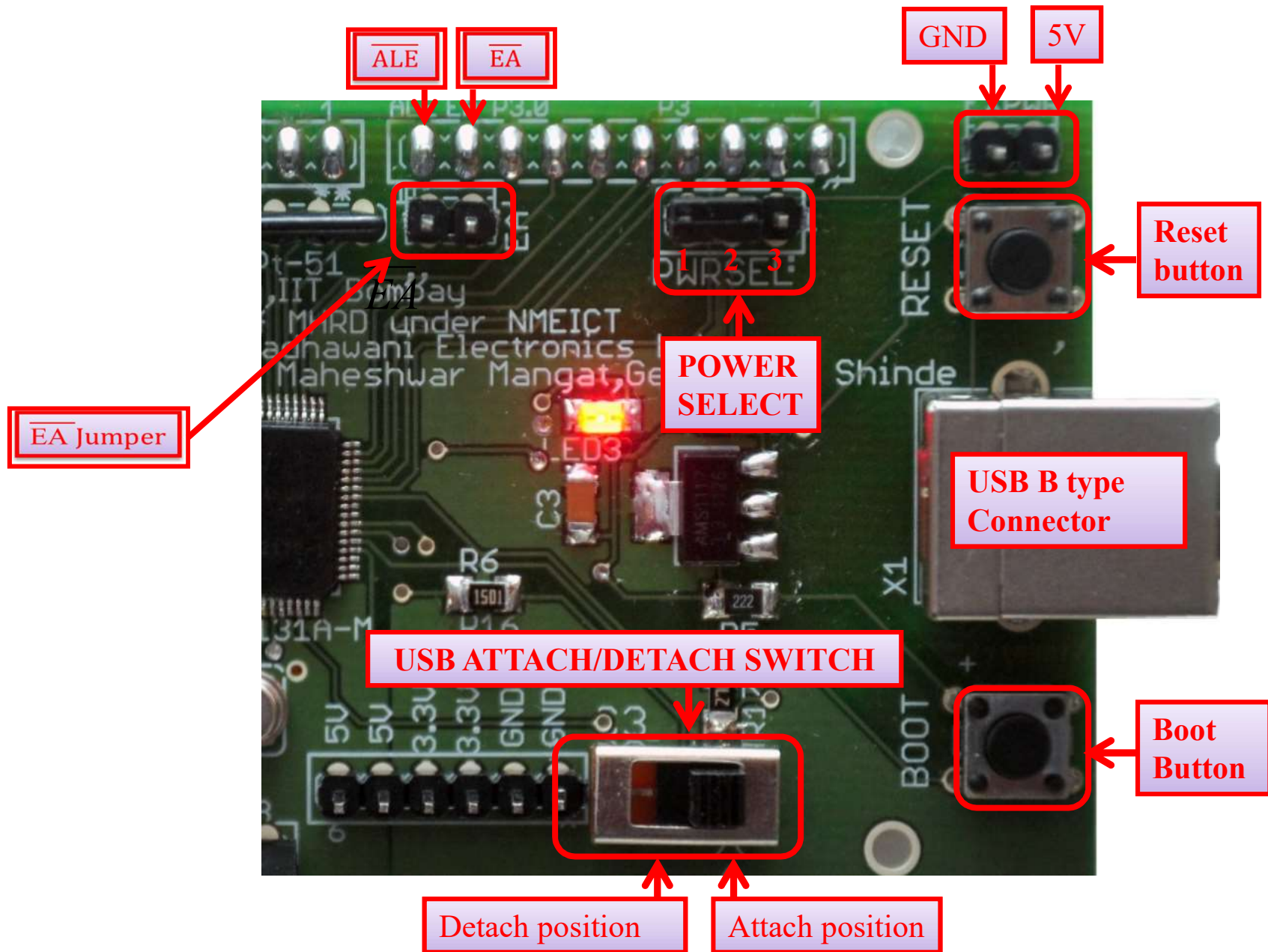
The specifications of the board are :

- Microcontroller : Atmel (now Microchip) AT89C5131A.
- USB powered and programmable
- 24MHz Crystal clock generator.
- On board 4 LEDs and 4 Switches for simple programs.
- Dedicated LCD port.
- Type B USB connector.
- All ports(P0-P3) accessible.
- Separate headers for SPI and I2C

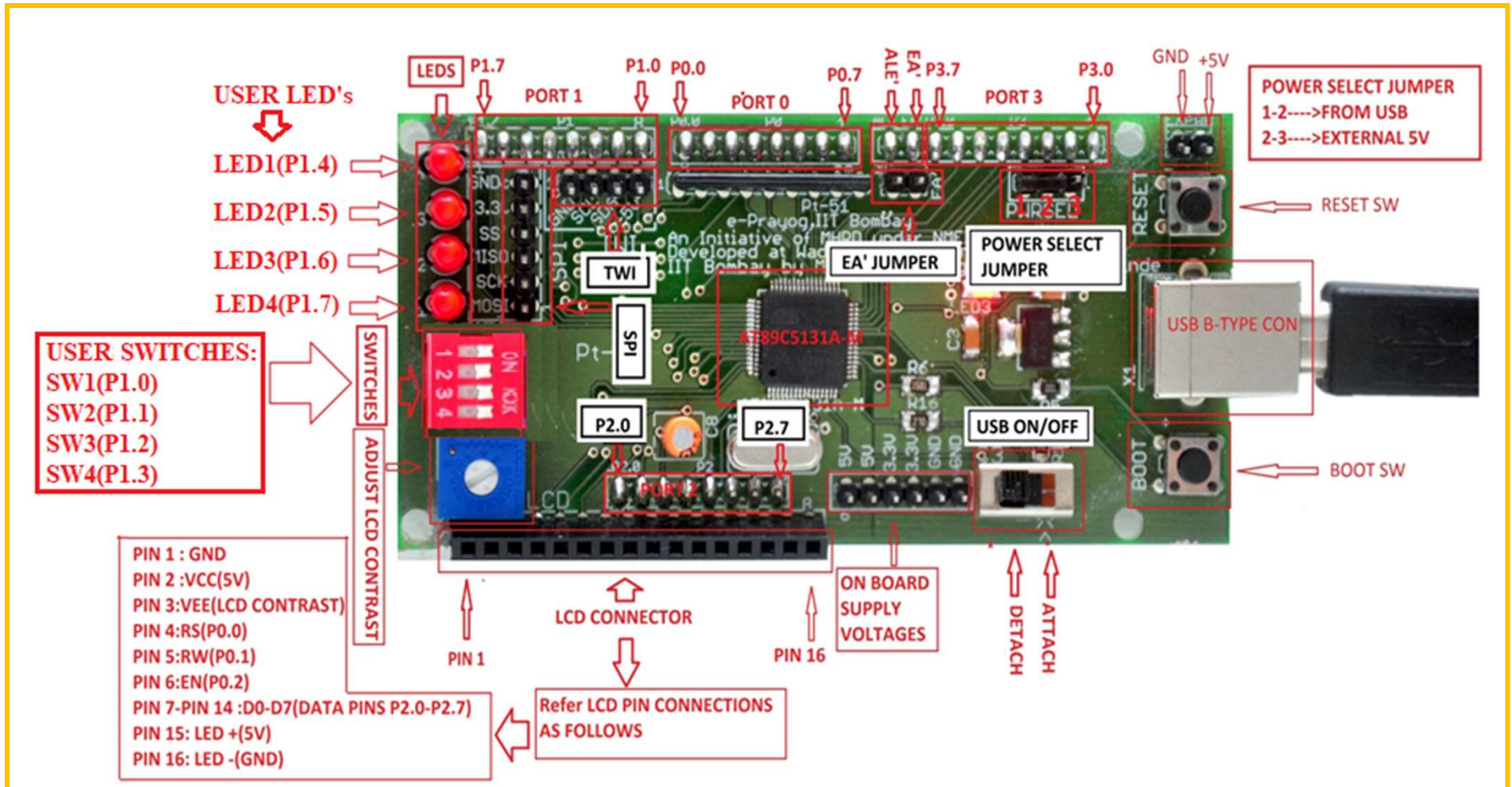
Board Layout : Peripherals/Connectors



Board Layout



Detailed Board Layout



CAUTION!!!!!!

- Note that the certain port pins have been given multiple functionalities and they can be used to perform only one function at a time.
- For example, Port 1 pins have been connected to switches and LEDs. So, when they are used for this function they cannot be used for any other function in your code (SPI or GPIO).

Programming PT-51: Software to be installed

- Ensure that all the following software have been downloaded and installed on your laptop or PC.
 - Keil uVision 4
 - Flip Microchip technology (Ver 3.4.7.112 Windows 7 or higher) [Refer installation procedure given at the end].
 - Device driver for Pt-51 has been installed.

Programming PT-51: About Keil uVision and FLIP

- **Keil uVision** is an IDE (Integrated Development Environment).
- The μ Vision IDE combines project management, run-time environment, build facilities, source code editing, and program debugging in a single powerful environment.
- It integrates all the tools needed to develop embedded applications including a C/C++ compiler, macro assembler, linker/locator, and a HEX file generator.
- Integrated **Debugger** and peripheral **Simulator**.
- **FLIP** : To program the microcontroller's flash memory (program memory) with the HEX file (of Assembly/C program) generated using Keil uVision IDE.

Programming PT-51: Operating modes of PT-51

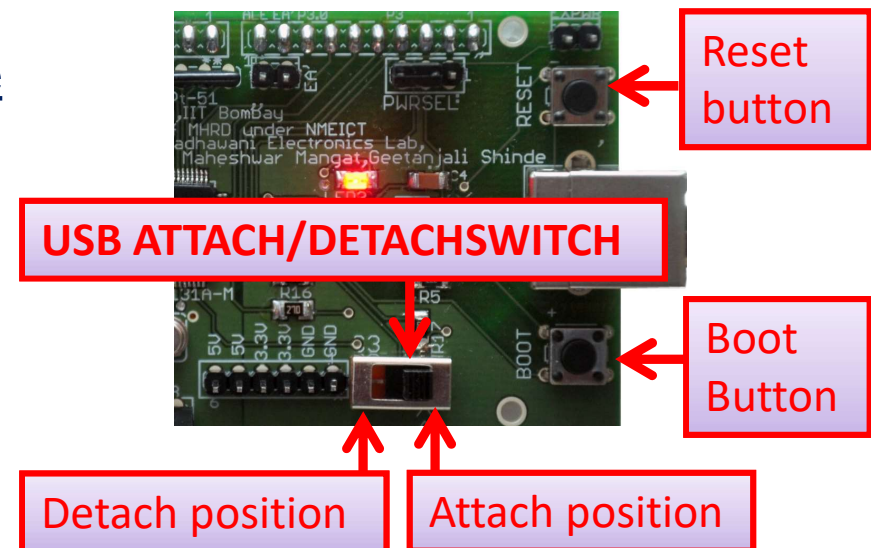
Pt-51 board operates in 2 modes :

- Application mode :
 - The microcontroller runs the code which has been programmed into its flash memory.
 - When Pt-51 is powered up, if any code exists in the flash memory, it directly enters the application mode and runs the program, else it enters the boot loader mode.
 - In this mode, the board doesn't communicate with PC and hence cannot be programmed.
- Boot loader mode :
 - In this mode the board communicates with the PC (FLIP software) and the flash memory of the microcontroller (AT89C5131A) is programmed with the HEX file (Program is loaded into the microcontroller).

Programming PT-51: Boot Loader Mode

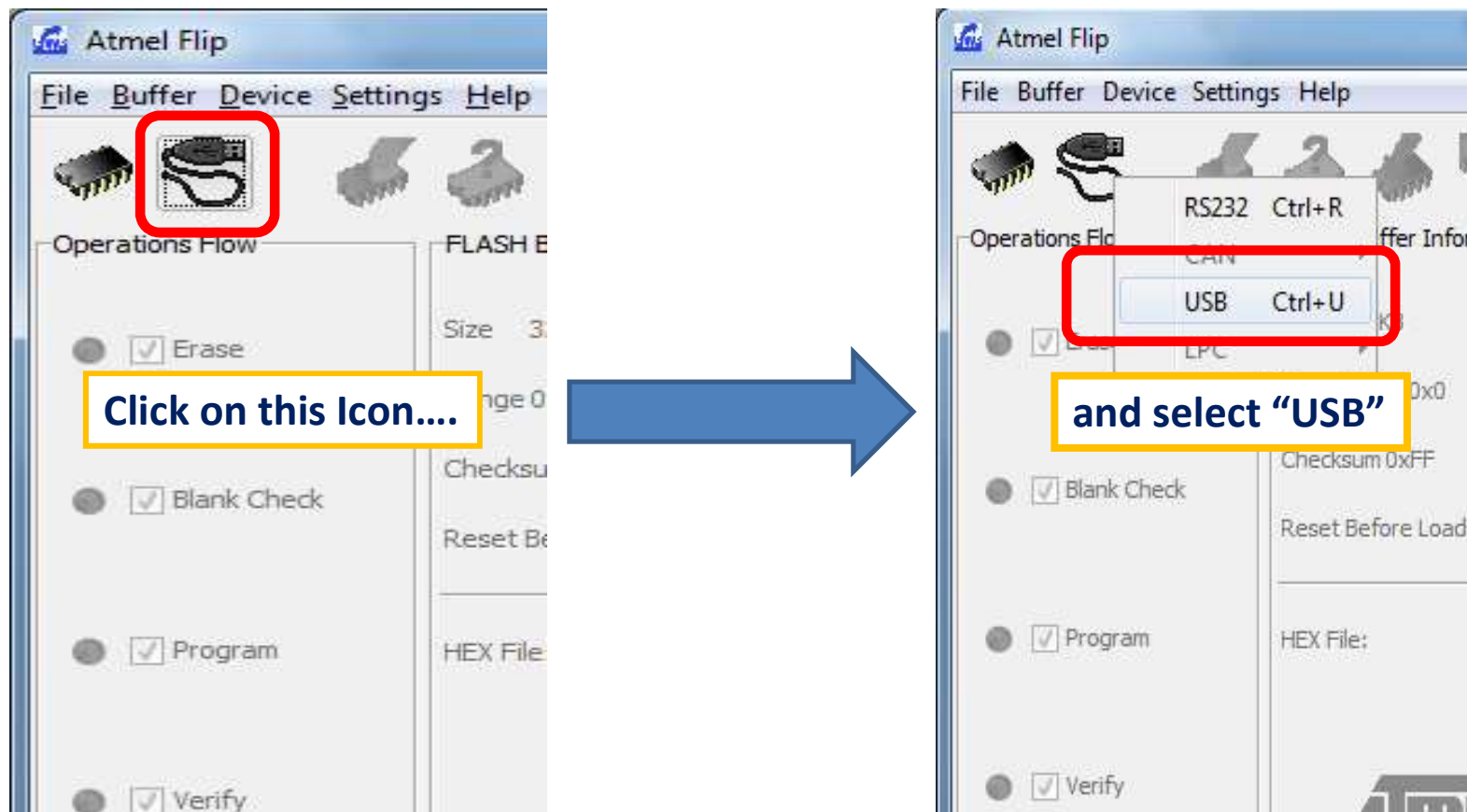
- To load the program in microcontroller, we **must** execute boot loader mode first.
- **Reminder: Make sure that FLIP and Device driver for PT-51 are installed properly.**
- To get into this mode, the following steps must be **followed in the sequence** as given below:
 - Run FLIP Software.
 - Keep USB ATTACH/DETACH switch in detach position
 - Press and hold the “Boot” button.
 - Press and hold the “Reset” button, for a moment and release it, while still holding the Boot button pressed.
 - Release the Boot button.
 - Keep USB ATTACH/DETACH switch in attach position.

(This sequence of steps should be followed every time we want to execute boot loader i.e., to program new HEX file.)

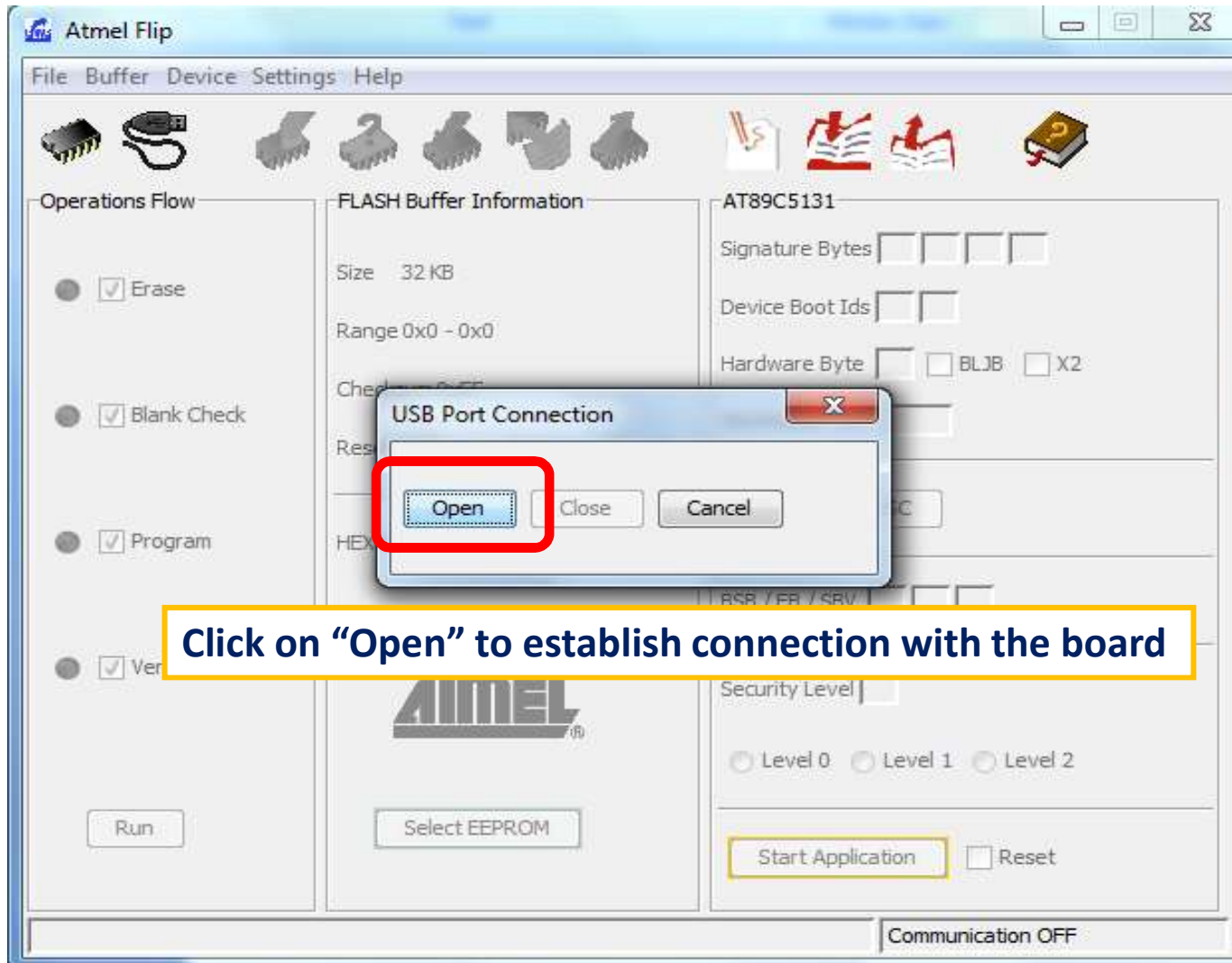


Establish Connection between board and PC: 1

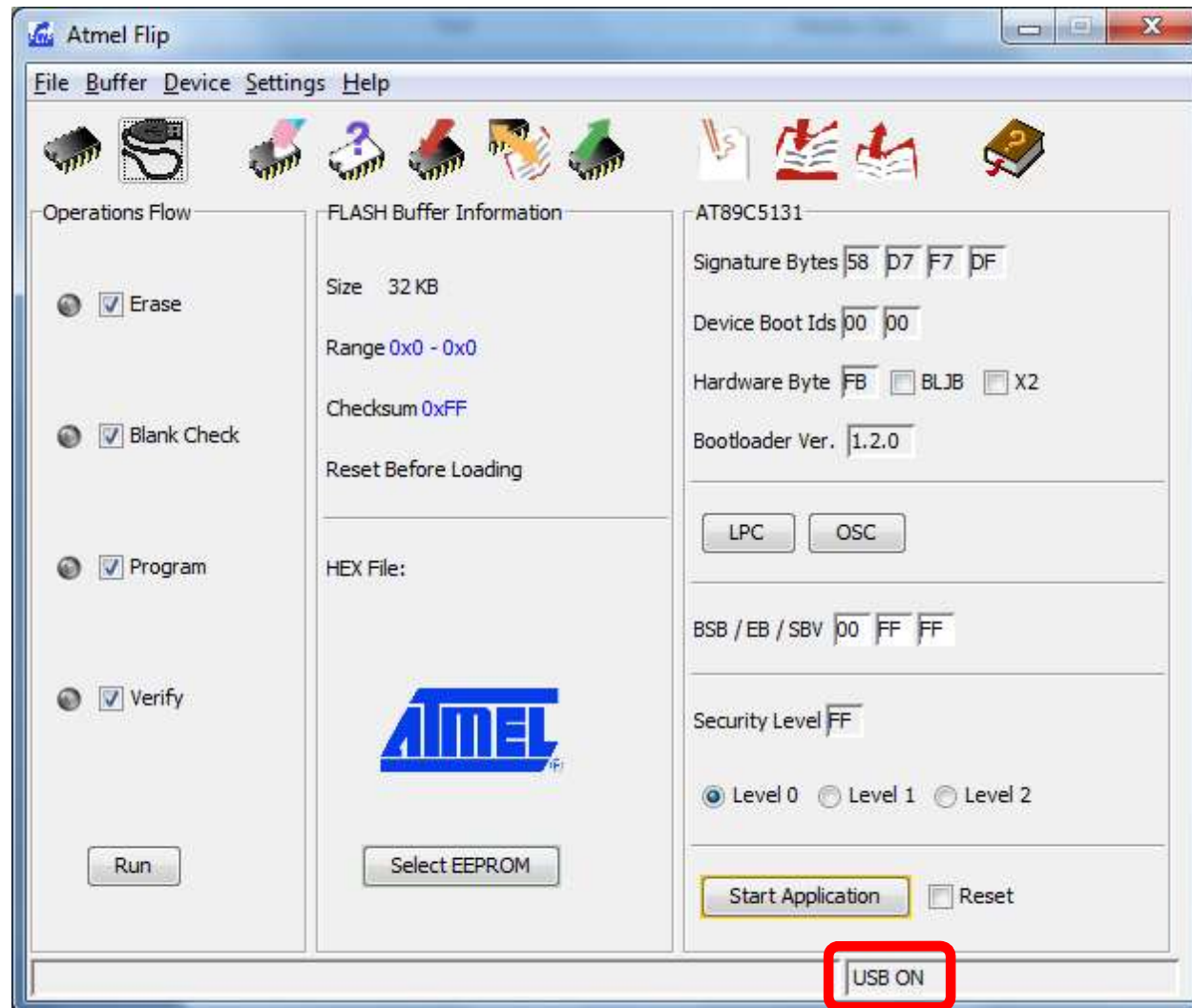
Note: Flip will establish connection with Pt-51 board only when boot loader is executed successfully.



Establish Connection between board and PC: 2



Establish Connection between board and PC: 3

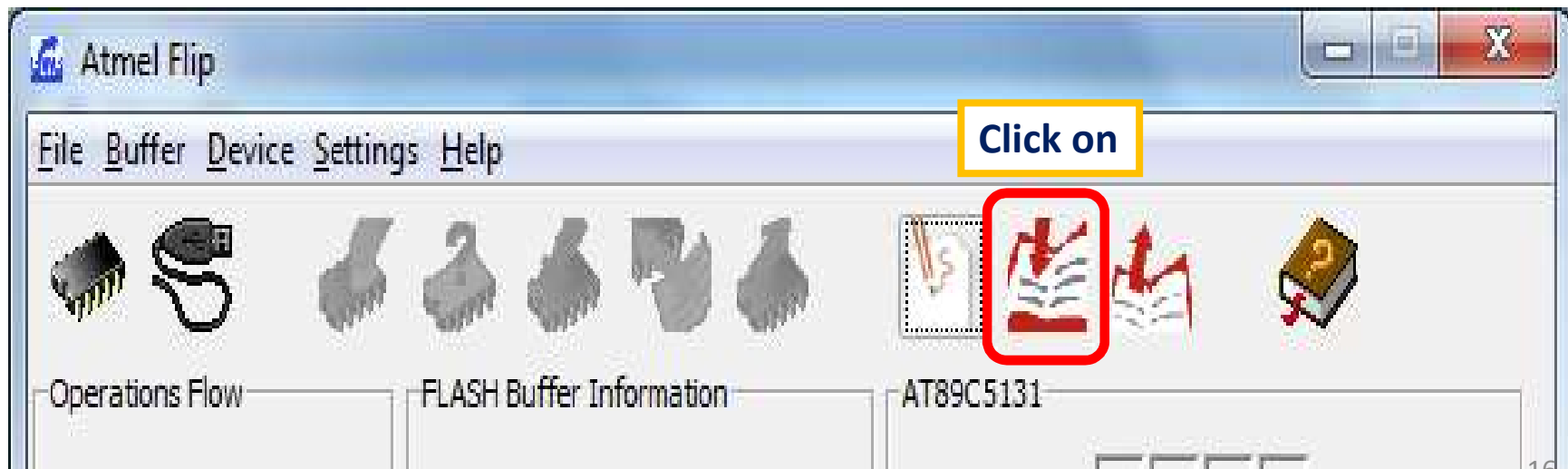


Indicates that connection has been established.

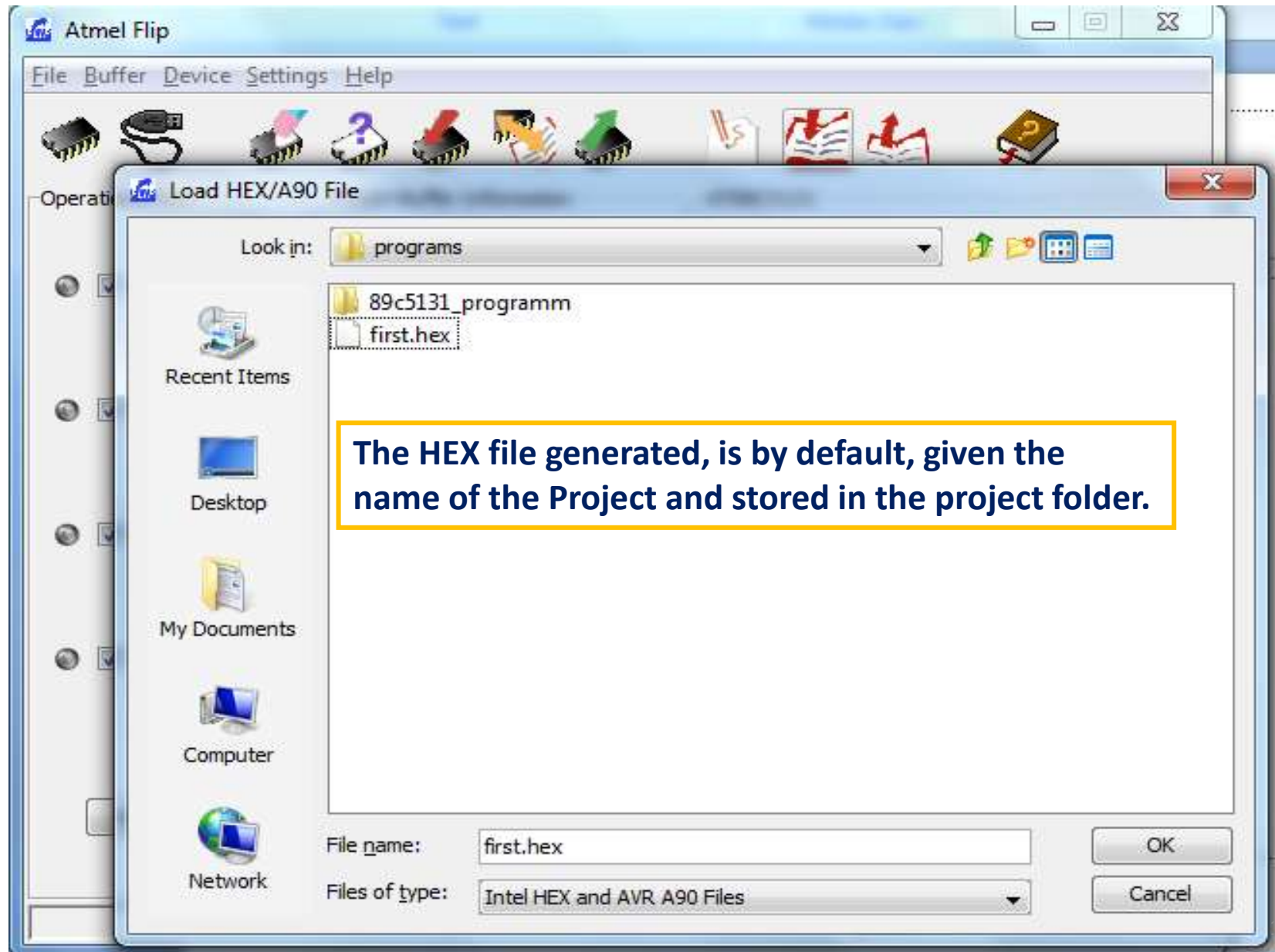
Load Hex File: 1



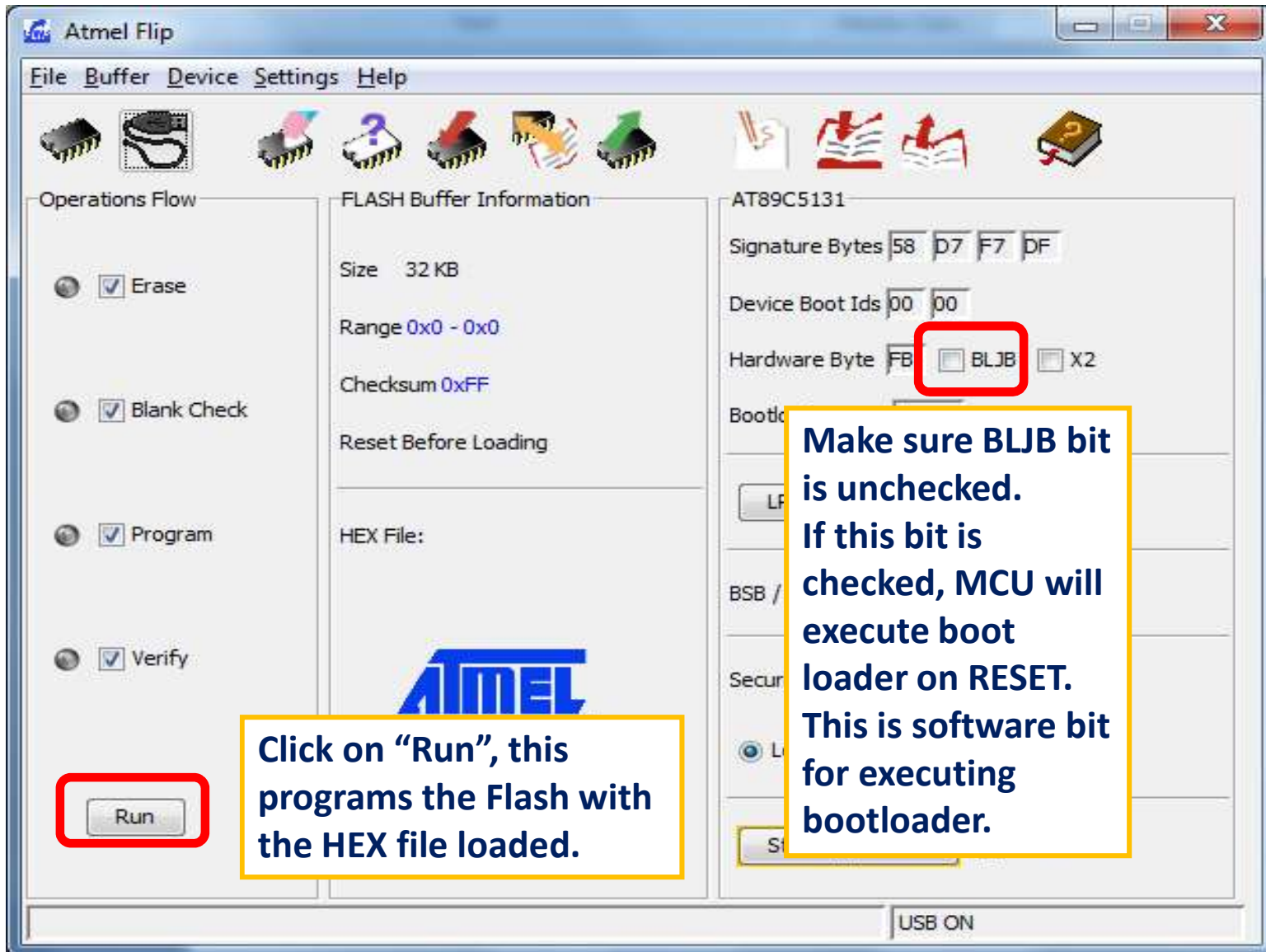
OR



Load Hex File: 2



Programming Hex File: 1



The screenshot shows the Atmel Flip software interface. The 'Operations Flow' section on the left has several options checked: Erase, Blank Check, Program, and Verify. The 'FLASH Buffer Information' section shows a size of 32 KB, a range of 0x0 - 0x0, and a checksum of 0xFF. The 'Hardware Byte' section shows 'FB' and 'BLJB' (which is unchecked and highlighted with a red box) and 'X2'. The 'Run' button is highlighted with a red box. A yellow box contains text explaining the BLJB bit.

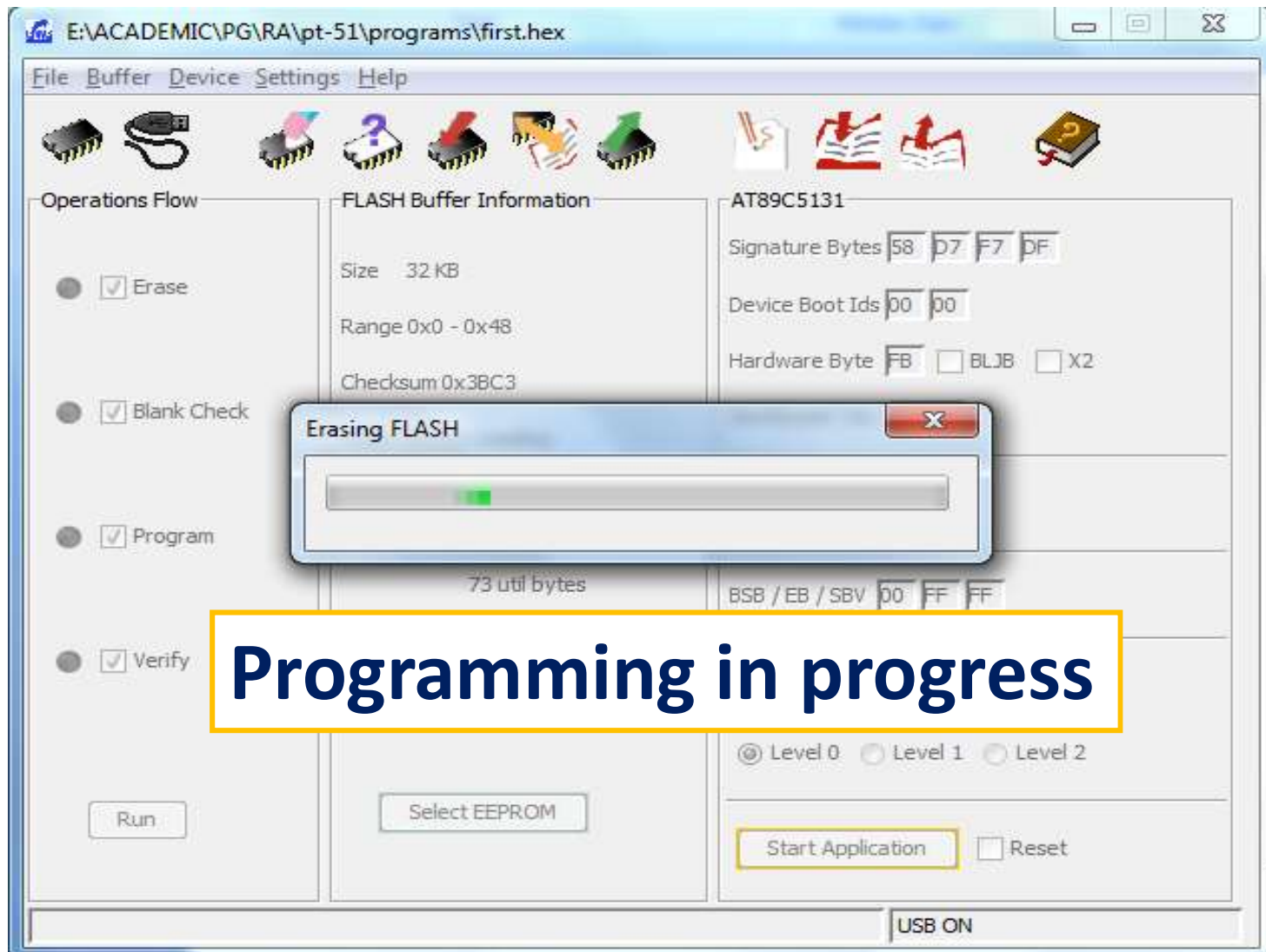
Click on "Run", this programs the Flash with the HEX file loaded.

Make sure BLJB bit is unchecked. If this bit is checked, MCU will execute boot loader on RESET. This is software bit for executing bootloader.

ATMEL

USB ON

Programming Hex File: 2



Programming Hex File: 3

The screenshot displays a software window titled "E:\ACADEMIC\PG\RA\pt-51\programs\first.hex". The interface includes a menu bar (File, Buffer, Device, Settings, Help) and a toolbar with various icons. The main area is divided into several sections:

- Operations Flow:** A vertical list of four steps, each with a green circular indicator and a checked checkbox:
 - Erase
 - Blank Check
 - Program
 - Verify
- FLASH Buffer Information:** Displays details for a 32 KB flash buffer, including range (0x0 - 0x48), checksum (0x3BD3), and a "Reset Before Loading" option. The HEX File is identified as "first.hex".
- Device Settings:** Shows the device as "AT89C5131" with various configuration options like Signature Bytes (58 D7 F7 DF), Device Boot Ids (00 00), Hardware Byte (FB), and Bootloader Ver. (1.2.0).

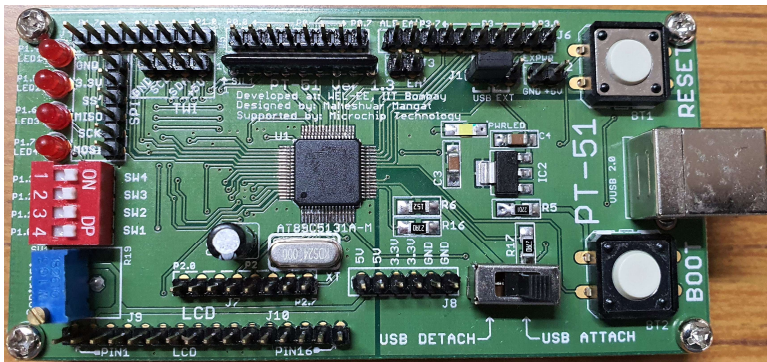
A yellow callout box with blue text states: "Green and red indicate the success and failure of a process, respectively." The status bar at the bottom of the window shows "Verify PASS" and "USB ON".

To execute the code on Pt-51

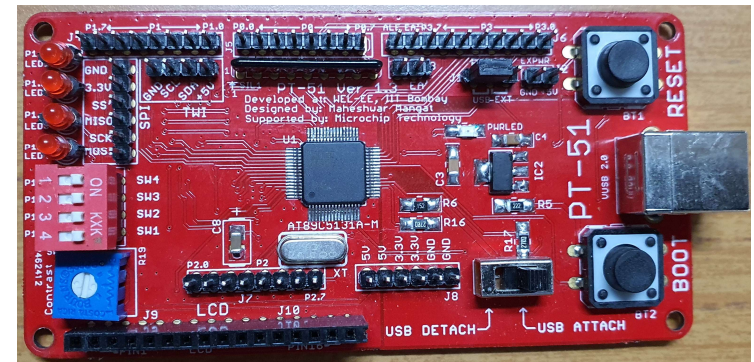
- On successful programming of the Flash, to execute the code,
 - Press and release the “Reset” button.
 - To program a different program on the board, repeat the steps by first entering into the boot loader mode.

New Versions of PT-51 Board (Ver 1.3)

- Only Layout changes i.e., component placement changes are done in Ver 1.3.
- Electrical connections are same across all version of PT-51.



PT-51 Ver 1.3 (Green)



PT-51 Ver 1.3 (Red)