APPLICATION NOTE

Atmel AVR417: ZLL Gateway Getting Started Guide

32-bit Atmel Microcontrollers

Features

- Atmel® BitCloud® ZigBee® Light Link (ZLL) support
- lwIP TCP/IP stack support
- Light control from web browser

Introduction

ZLL Gateway consists of two parts: Atmel SAM3X-EK and RCB128RFA1 hosted on a Key Remote Board (ZLL Controller for short). SAM3X-EK acts as a bridge between Ethernet and UART. SAM3X-EK receives light control commands from web browser and then sends these commands to ZLL Controller through UART. ZLL Controller controls the different lights following the commands from SAM3X-EK and gets the different lights status through ZLL PAN.

This demo uses ZLL Gateway and two another RCB128RFA1 hosted on a Key Remote Board (light with LCD for short) and a RCB128RFA1 board (light with LED for short) to show the light control via web browser.

This document describes the hardware configuration and firmware download to help users to set up ZLL Gateway demo and launch this demo step by step.

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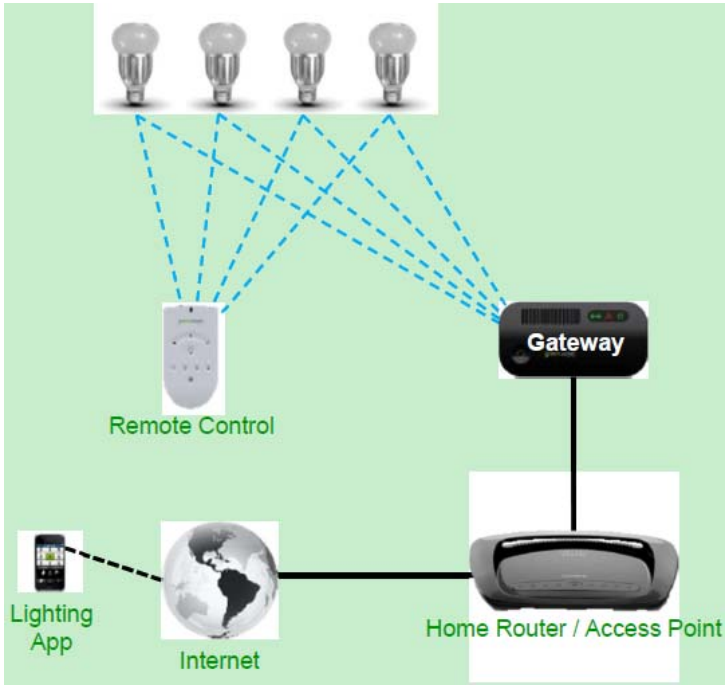
1. ZLL application scenarios

One of ZLL application scenarios is to connect a ZLL gateway to a router to enable control by consumers or managed service providers.

Figure 1-1. ZLL remote access.



This demo demonstrates the ZLL remote access ability through the ZLL Gateway. Users can control different lights using their web browser anywhere.

2. Board overview and configuration

Figure 2-1 shows the Atmel SAM3X-EK board, which is one part of ZLL Gateway. Ethernet connector is used to connect PC and UART connector is used to connect the ZLL Controller.

Figure 2-1. SAM3X-EK board.

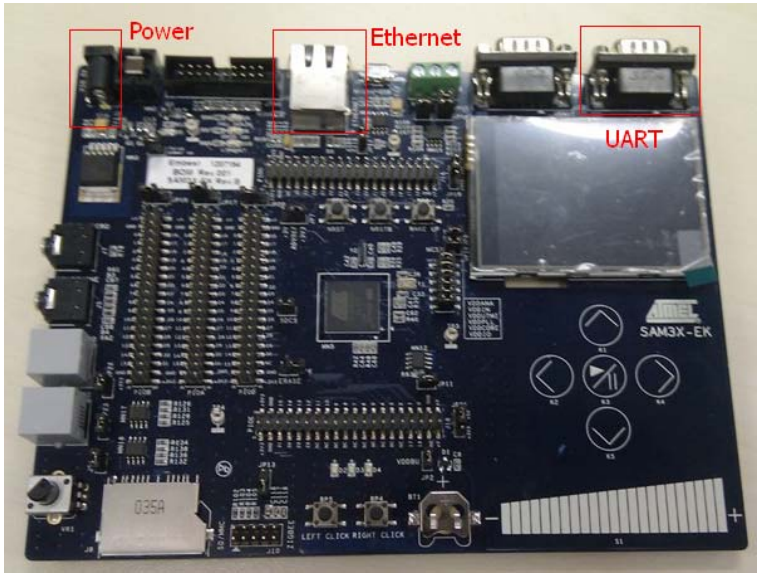


Figure 2-2 shows the Atmel RCB128RFA1 board, not hosted on a Key Remote Board. It acts as a light in this demo (light with LED for short). There is a LED on the back of this board and its on/off state and brightness can be controlled via web browser. To power on this board, shift the red button at the right side of the board.

Figure 2-2. RCB128RFA1 (light with LED).

Figure 2-3 shows RCB128RFA1 hosted on a Key Remote Board. There are three pieces of this board in this demo. One of these boards is part of the Gateway (ZLL Controller for short). It is used to receive commands from the Atmel SAM3X-EK and execute these commands through ZLL PAN. Two other of these boards act as lights (light with LCD for short). Lights state can be projects to the LCD screen on the Key Remote Board. So we can easily see the light on/off state and brightness value. To power on this board, shift the red button at the right side of the RCB board.

Figure 2-3. Atmel RCB128RFA1 (ZLL Controller or light with LCD).

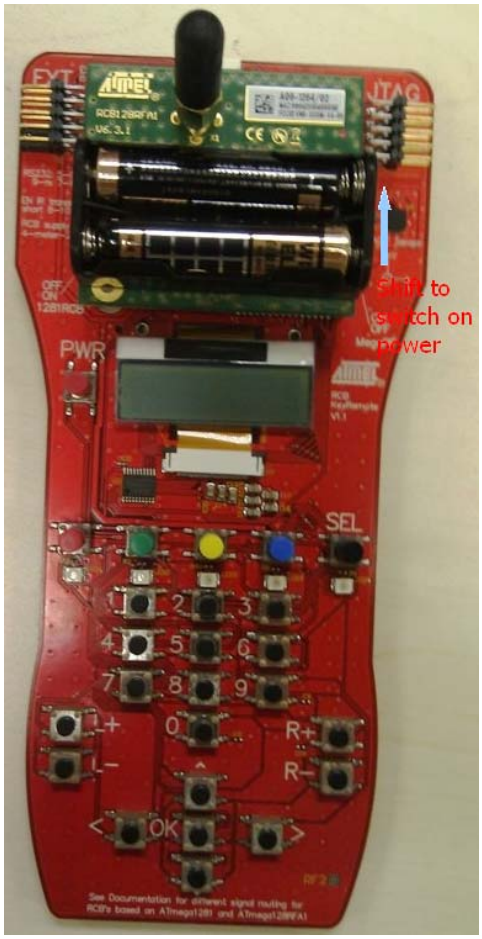


Figure 2-4 shows the ZLL Gateway. It consists of the Atmel SAM3X-EK and ZLL Controller. These two boards are connected by a serial cable. This cable, one side connects to UART connector (J11) on SAM3X-EK and the other side connects to the port marked EXT on Key Remote Board as shown on Figure 2-5.

Figure 2-4. ZLL gateway (Atmel SAM3X-EK + ZLL Controller).

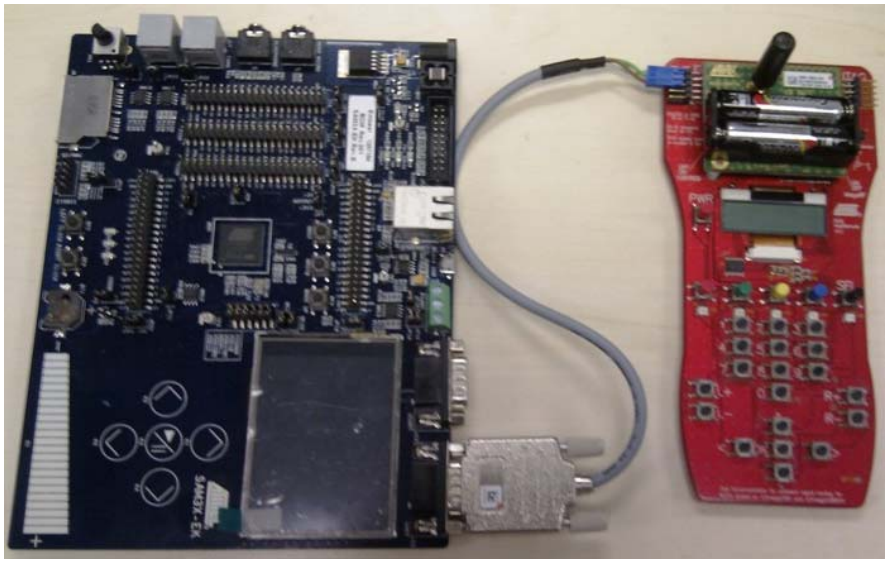
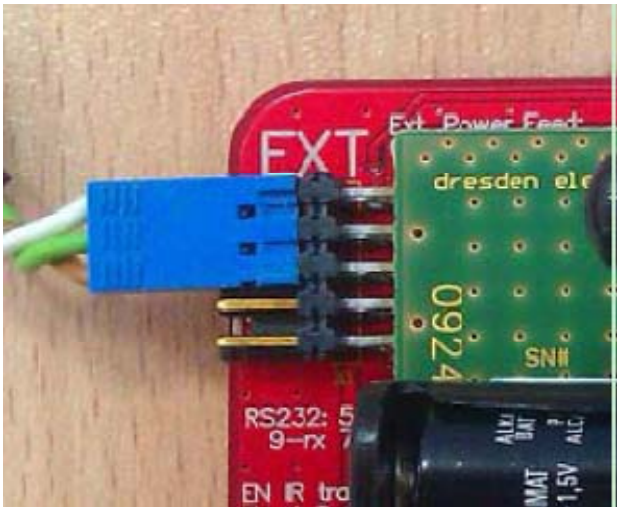


Figure 2-5. Serial cable attached to key remote board.



3. Quick-start

3.1 Preprogrammed firmware

The demo kits are preprogrammed with pre-built firmware. This firmware will show how to control lights via web browser.

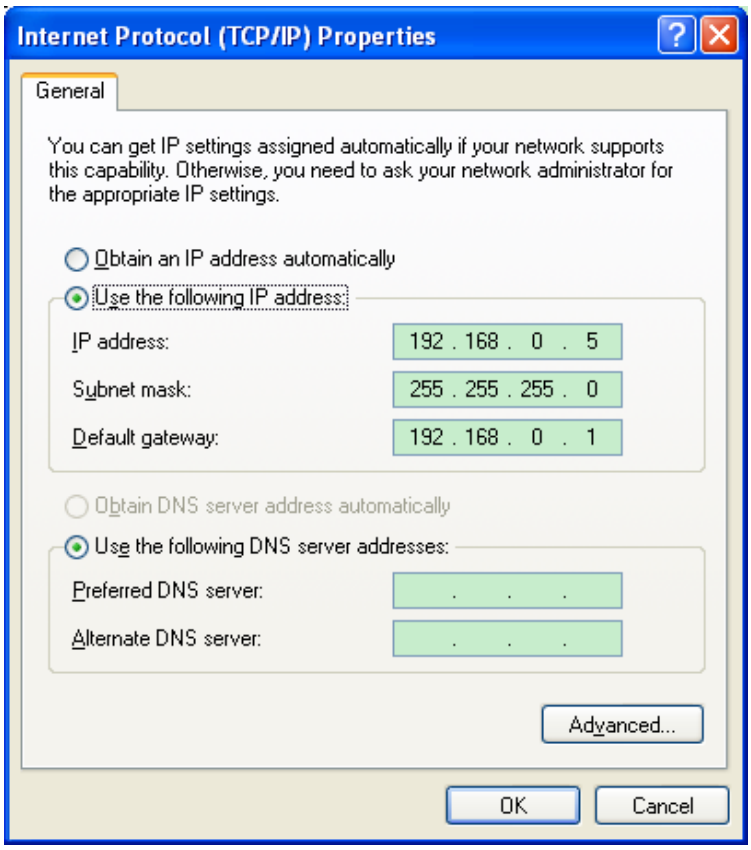
The Atmel SAM3X-EK runs the lwIP TCP/IP stack with static IP. The IP address is 192.168.0.2. The ZLL Controller, light with LED and light with LCD run the BitCloud ZigBee Light Link software.

3.1.1 Step-by-step guide

To launch the demo, follow these steps:

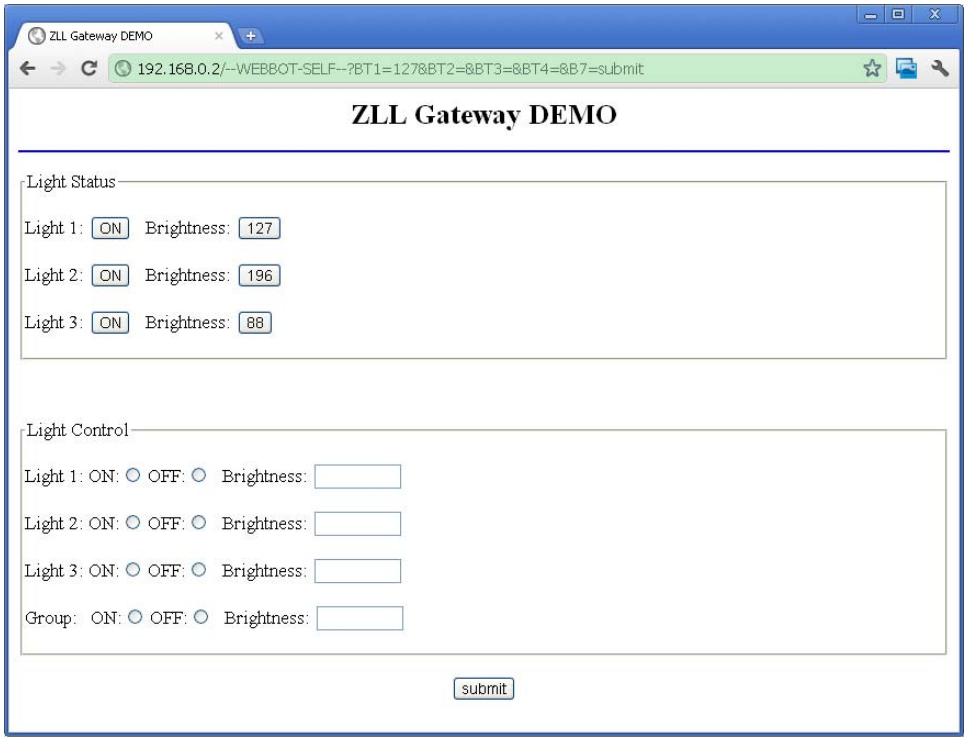
1. Connect Ethernet cable between SAM3X-EK and PC.
2. Connect serial cable between SAM3X-EK and ZLL Controller.
3. Power on SAM3X-EK board.
4. Power on light with LED and light with LCD by shifting the red button at the right side of the board.
5. Power on the ZLL controller.
6. Configure your PC IP address to make sure the board and PC on the same network segment.

Figure 3-1. PC IP address configuration.



7. Launch your web browser and type the board's IP address (192.168.0.2).
8. ZLL Gateway Demo webpage will be shown in the web browser and lights can be controlled through this webpage.

Figure 3-2. Lights control web page.



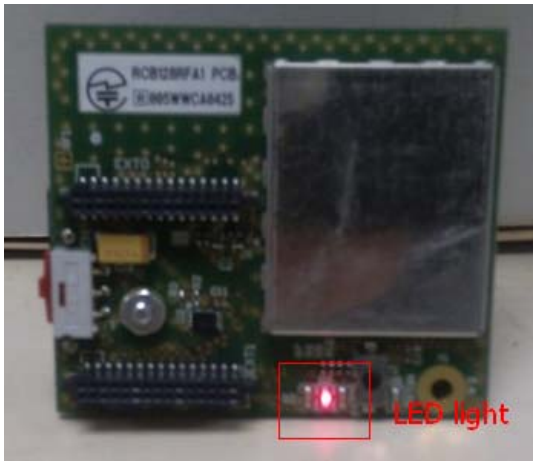
3.2 Lights' functions

A light device indicates its light status via LEDs on the RCB board or via the LCD screen on the Key Remote Board when RCB is attached to the Key Remote Board.

RCB board's LEDs are turned on when light is on and turned off when light is off.

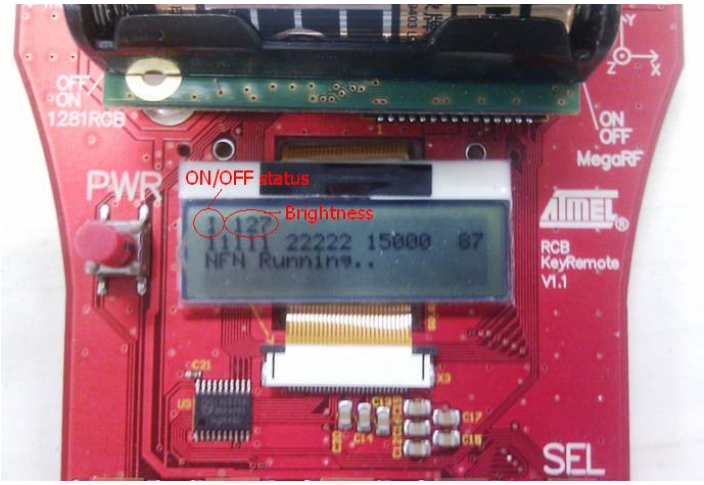
When the light's bright level changes LEDs brightness also changes.

Figure 3-3. Light with LED status.



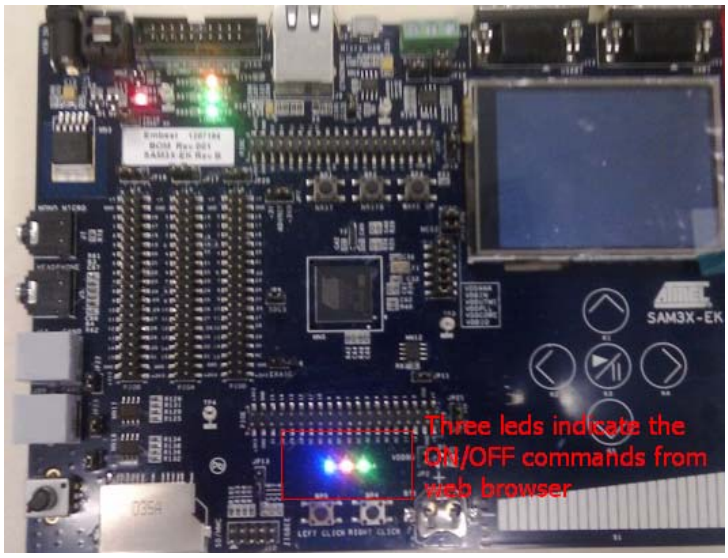
RCB with Key Remote Board projects its light status to the LCD screen on Key Remote Board as shown on Figure 3-4.

Figure 3-4. Light with LCD status.



Three LEDs on the Atmel SAM3X-EK can also indicate the light control command from web browser. These LEDs only have ON/OFF state. Their brightness can't be changed.

Figure 3-5. Three LEDs on SAM3X-EK indicate light control command.



4. Programming the kit

There are four pre-built firmware images in this kit. They are for the Atmel SAM3X-EK, ZLL controller, light with LED and light with LCD respectively.

4.1 Programming via the Atmel Studio 6.0

4.1.1 Prerequisites

To program the device, Studio 6.0 must be installed. Studio 6.0 install package can be got from Atmel official website.

Here is the download link:

http://www.atmel.com/tools/atmelstudio.aspx

Atmel SAM-ICE™ is needed to download pre-built image for SAM3X-EK.

One of programming tools, such as Atmel JTAGICE3, AVR® JTAGICE mkII, AVR ONE! and AVR Dragon™, is needed to download pre-built image for ZLL Controller, light with LED and light with LCD.

4.1.2 Programming with SAM3X-EK

To program the SAM3X-EK, follow these steps:

1. Connect SAM-ICE to SAM3X-EK JTAG connector.
2. Power on SAM3X-EK.
3. Open Atmel Studio 6.0.
4. In Studio, open the Tools -> Device Programming dialog.
5. Choose SAM-ICE for Tool, ATSAM3X8H for Device and JTAG for Interface, then click Apply button.
6. Click Device signature and Target Voltage Read button to test if the JTAG ICE connect is ok or not.
7. Select the Memories tab and then select the pre-built hex image (SAM3X-LwIP.hex) in the Flash section.
8. Click Program.

The pre-built image is now downloaded to the board.

Figure 4-1. Programming with SAM3X-EK.

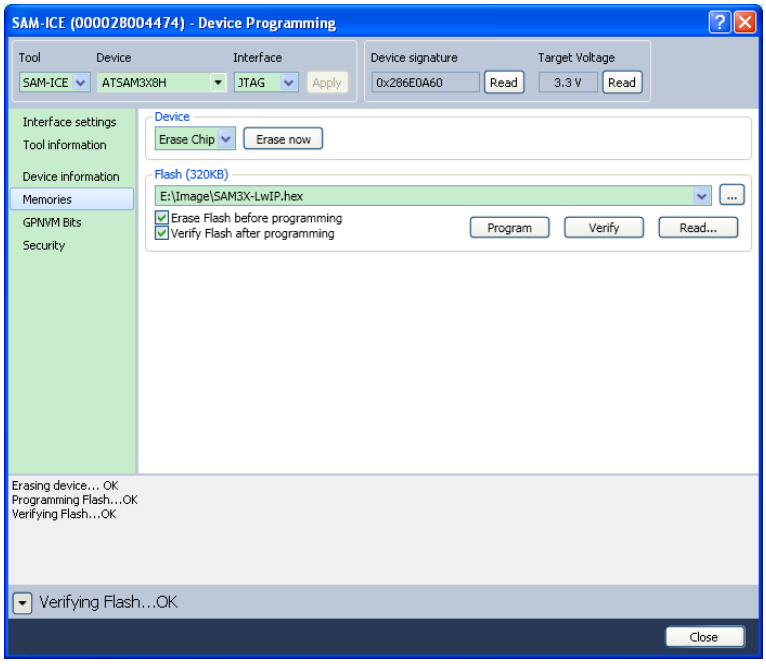


Figure 4-2. SAM-ICE connected with SAM3X-EK.

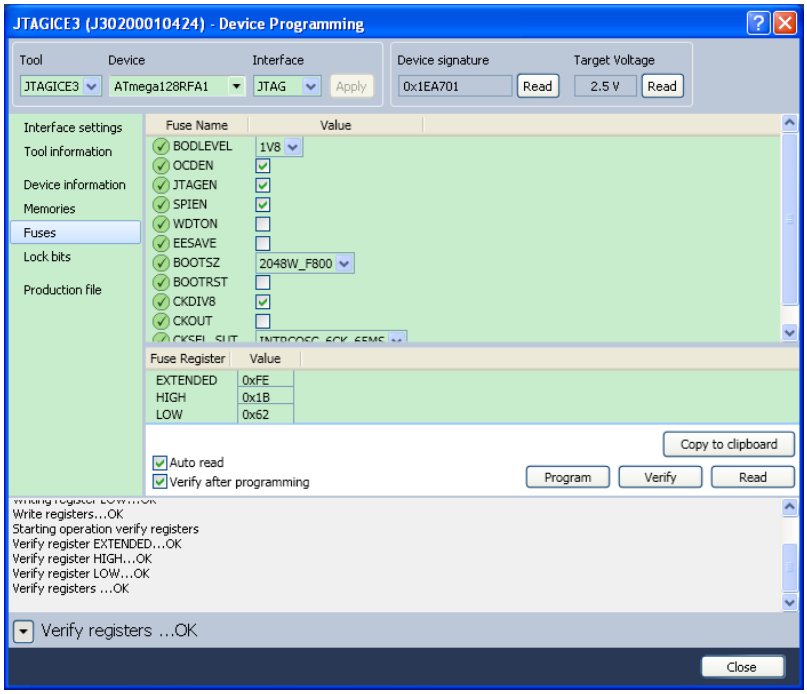
4.1.3 Programming with RCB128RFA1

There are three pre-built firmware image for the Atmel RCB128RFA1. ZLLController.hex, ZLLDemo_ATmega128RFA1_Light_LCD.hex and ZLLDemo_ATmega128RFA1_Light_LED.hex are for ZLL controller, light with LCD and light with LED respectively.

To program the device, follow these steps:

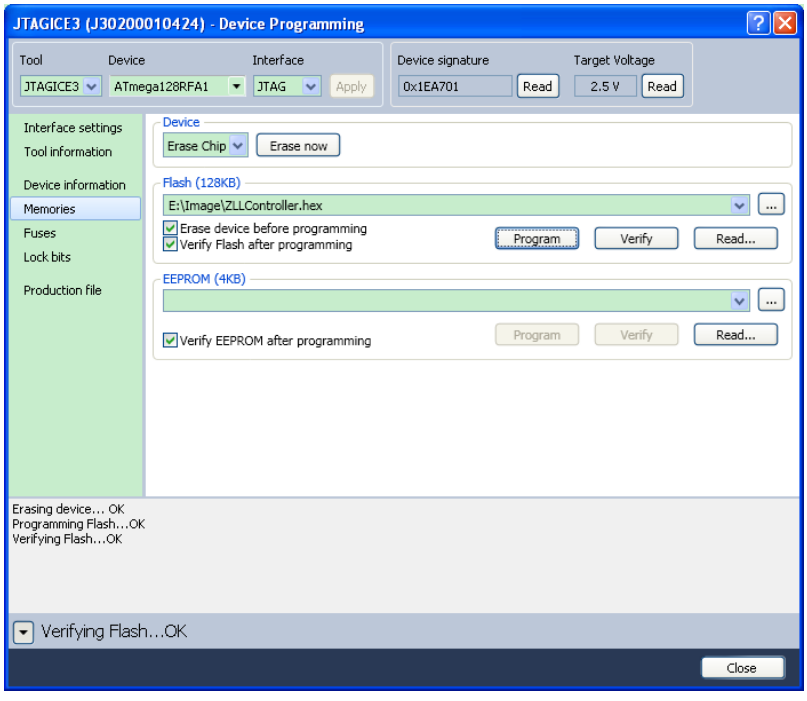
1. Connect the programming tools (here the Atmel JTAGICE3 is used) to the connector marked with JTAG on Key Remote Board.
2. Power on the RCB128RFA1 by shifting the red button at the right side of the board.
3. Open Atmel Studio 6.0.
4. In Studio, open the Tools -> Device Programming dialog.
5. Choose JTAGICE3 for Tool, ATmega128RFA1 for Device and JTAG for Interface, then click Apply button.
6. Click Device signature and Target Voltage Read button to test if the JTAG ICE connect is ok.
7. Click on Fuses tab and make sure that device fuses are set as specified in Table 4-1.
8. If fuses are set incorrectly, select the correct fuses setting, and then click Pragram.

Figure 4-3. Device fuses setting.



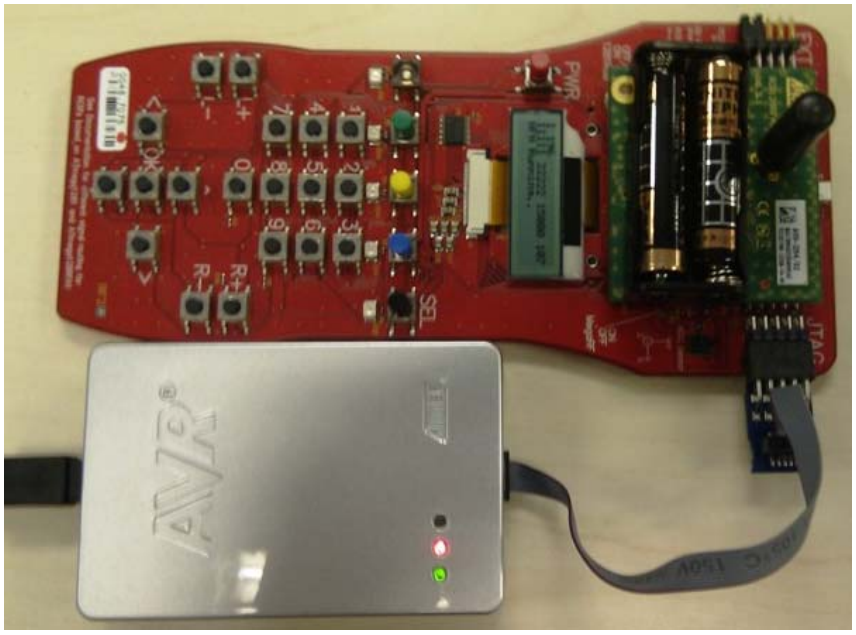
9. Select the Memories tab and then select the pre-built hex image (ZLLController.hex in case for programming ZLL controller) in the Flash section.
10. Click Program button.

Figure 4-4. Programming with Atmel RCB128RFA1.



The pre-built image is now downloaded to the board.

Figure 4-5. Atmel JTAGICE3 connect with key remote board.



In order to download firmware image to light with LED, this light board needs to be attached to a Key Remote Board. Using the JTAG connector on Key Remote Board, firmware image can be downloaded to light with LED board.

Figure 4-6. Attached light with LED board to key remote board.

4.1.3.2 Touch link with ZLL controller

Touch link need to be done after all the firmware images be downloaded. Get one of the lights closely (10-20cm range) to the ZLL controller and press PWR button on the ZLL controller board for more than three seconds. The ZLL controller sends an identify command to the light, which will blink three times with its LED or LCD screen. The touch link procedure may abort if the LED or LCD screen doesn't blink three times while the PWR button is released. Get another light closely to the ZLL controller and repeat the touch link again after previous light touch link is ok.

4.1.3.3 Fuse bits settings

The recommended fuse bits settings are shown in Table 4-1.

Table 4-1. Fuse bits for the Atmel ATmega128RFA1.

Option	Required value
BODLEVEL	1V8
OCDEN	Enabled
JTAGEN	Enabled
SPIEN	Enabled
WDTON	Disabled
EESAVE	Disabled
BOOTSZ	Boot Flash size = 2048 words Start address = $F800
BOOTRST	Disabled
CKDIV8	Enabled
CKOUT	Disabled
SUT_CKSEL	Int. RC osc.; Startup time: 6CK + 65ms
Resulting bytes:	
Ext	0xFE
High	0x1B
Low	0x62

4.2 Programming Atmel SAM3X-EK via Atmel SAM-BA

SAM-BA® can be used to download binary image to SAM3X-EK board for those who don't have the Atmel SAM-ICE.

4.2.1 Prerequisites

To download the binary image without SAM-ICE, SAM-BA must be installed. The install package can be found in Atmel official website.

Here is the download link:

http://www.atmel.com/tools/ATMELSAM-BAIN-SYSTEMPROGRAMMER.aspx

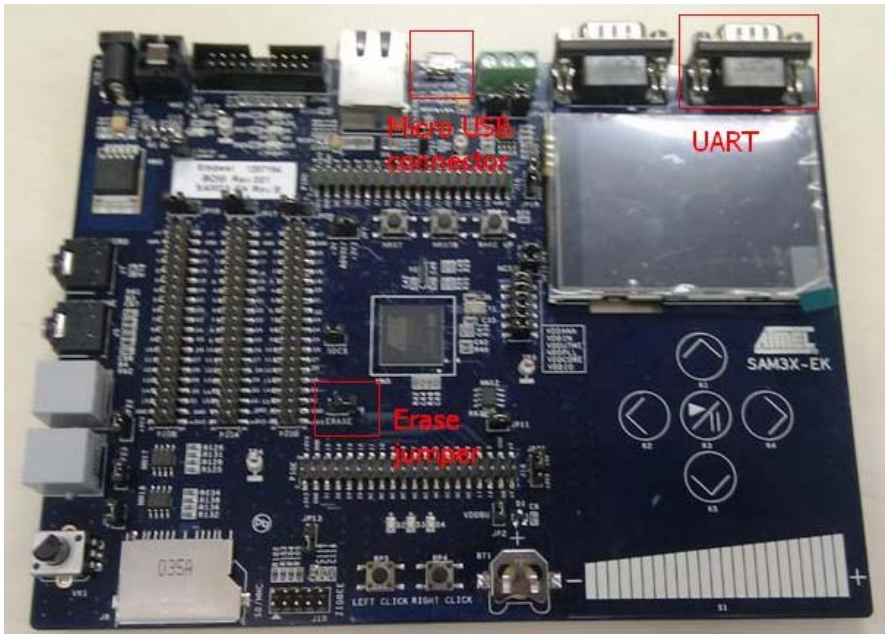
A Micro-USB cable or a serial cable is needed to connect the SAM3X-EK board with SAM-BA.

4.2.2 Step-by-step guide

To download firmware image to SAM3X-EK, follow these steps:

1. Connect the erase jumper at JP6 on SAM3X-EK board and then power on.
2. Power off and disconnect the erase jumper.
3. Connect the Micro-USB cable to Micro-USB connector at J3 or serial cable to UART at J11.

Figure 4-7. Erase jumper, Micro-USB and UART connector on the Atmel SAM3X-EK.



4. Open Atmel SAM-BA.
5. Choose the connection type and board, and then click Connect button.

Figure 4-8. Launch SAM-BA.

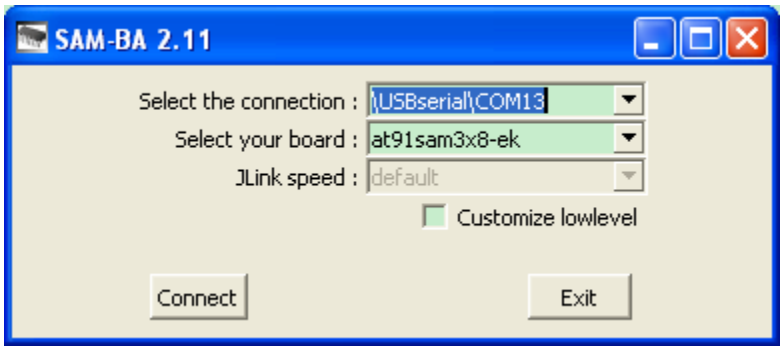
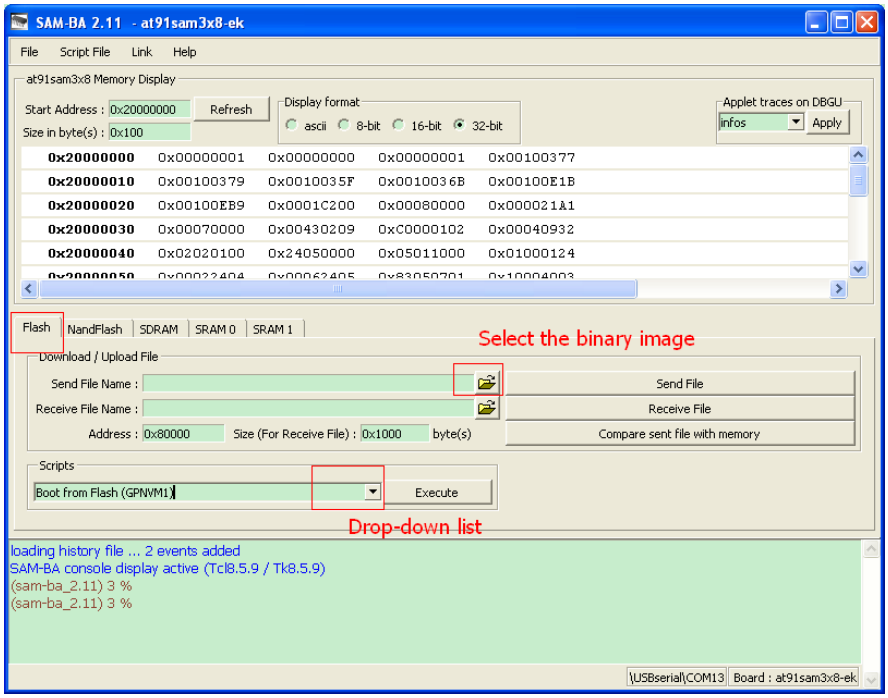


Figure 4-9. Atmel SAM-BA connected with the Atmel SAM3X-EK.



6. In the SAM-BA connected dialog, click the drop-down list in Scripts section, select “Enable Flash access”, and then click Execute button.
7. In the Send File Name section, select the binary image (SAM3X-LwIP.bin) and then click Send File button.
8. A lock region dialog may pop up, click NO button.
9. In the Scripts section, click the drop-down list, select “Boot from Flash (GPNVM1)”, and then click Execute button.
10. Close SAM-BA and power off the board.

The pre-built image is now downloaded to the board.

5. Revision History

Doc. Rev.	Date	Comments
42057A	12/2012	Initial document release

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