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**Smart Energy: Serial Bootloader User Guide**

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**Introduction**

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The serial bootloader of the PL360G55Cx-EK boards allows the user to load application binaries in the SAMG55J19 using one of the serial interfaces available in the boards.

The package contains all necessary sources to modify and compile the embedded serial bootloader, including the project files for IAR Embedded Workbench<sup>®</sup>.

[Section 1: Overview](#) provides an overview of the serial bootloader and the contents of the package.

[Section 2: Installation and Getting Started](#) gives a brief step-by-step description about how to upload a new firmware application binary.

[Appendix A: Bootloader Commands](#) resumes the supported bootloader commands.

[Appendix B: How to Flash the Serial Bootloader Binary](#) explains step-by-step how to Flash the bootloader in the SAMG55J19.

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**Features**

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- For PL360G55CB-EK and PL360G55CF-EK Boards
- Firmware Programming over UART and USB Serial Interfaces

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## **Table of Contents**

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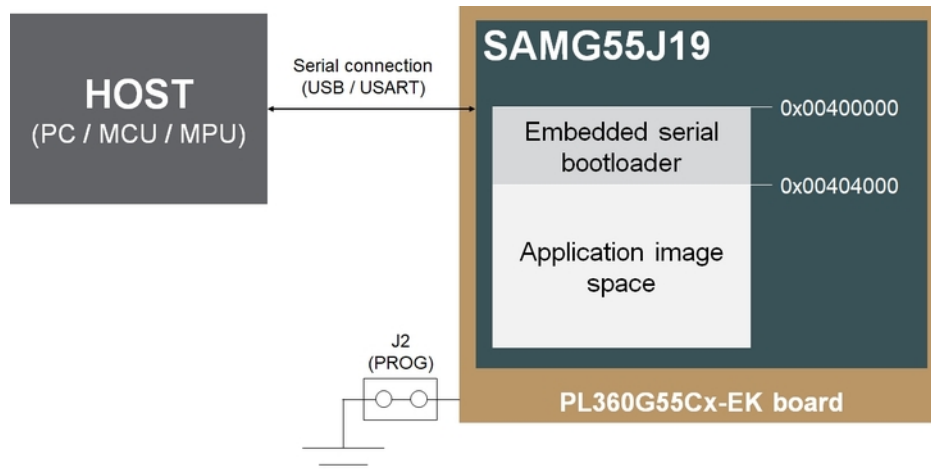
Introduction.....	1
Features.....	1
1. Overview.....	3
1.1. Supported Platforms and Interfaces.....	3
1.2. Package Content and Structure.....	3
2. Installation and Getting Started.....	5
2.1. Serial Interface Connections.....	5
2.2. Loading Application Firmware from a PC Host.....	6
3. Appendix A: Bootloader Commands.....	10
4. Appendix B: How to Flash the Serial Bootloader Binary.....	11
5. Revision History.....	13
5.1. Rev A - 04/2019.....	13
The Microchip Web Site.....	14
Customer Change Notification Service.....	14
Customer Support.....	14
Microchip Devices Code Protection Feature.....	14
Legal Notice.....	15
Trademarks.....	15
Quality Management System Certified by DNV.....	16
Worldwide Sales and Service.....	17

## 1. Overview

The serial bootloader allows the loading of firmware images to a SAMG55J19 device over a serial connection. It is intended for use with Microchip PLC stacks such as G3 and PRIME, but it also can be used with other non-PLC applications.

The embedded serial bootloader preprogrammed in the SAMG55J19 receives an image of the application in binary format (.bin) over one of the serial interfaces and writes it in the application part of the internal MCU Flash. The host may be a PC or another MCU/MPU.

**Figure 1-1. General approach of the Serial Bootloader for SAMG55J19 Programming**



The firmware package provided along with the PL360G55Cx-EK includes a pre-compiled image of the embedded serial bootloader image.

### 1.1 Supported Platforms and Interfaces

The embedded bootloader is supported on PL360G55CF\_EK and PL360G55CB\_EK boards.

The embedded bootloader can work with two serial interfaces of the evaluation kit indistinctly: USB and mikroBUS™ UART.

### 1.2 Package Content and Structure

The firmware package contains:

- The embedded bootloader sources, including
  - Source code, configuration and header files
  - IAR™ project
- A pre-compiled firmware image of embedded bootloader
- USB driver for Windows®

Table 1-1 describes the different folders related to the root directory of the package:

**Table 1-1. Serial Bootloader Files and Directories**

Path	Description
\\sam\application\serial_bootloader\	Embedded bootloader source code

.....continued	
Path	Description
\sam\application\serial_bootloader\bin\	Pre-compiled firmware image of embedded bootloader
\sam\application\serial_bootloader \samg55j19_pl360g55cx_ek\	Embedded bootloader configuration files
\sam\application\serial_bootloader \samg55j19_pl360g55cx_ek\iar\	IAR Embedded Workbench project files for embedded bootloader
\common\services\usb\class\cdc\device\	USB driver for Windows

## 2. Installation and Getting Started

Before using the serial bootloader with a PC host, there are some steps to follow:

1. Unpack the package to a folder on the PC hard drive.
2. Connect the PL360G55Cx-EK board to the PC via one of the serial interfaces supported by the embedded serial bootloader, UART or USB.
  - 2.1. For a USB interface, the PC could require the installation of a CDC (Communication Device Class) virtual COM port driver. The package includes an INF file to be used with Microsoft® Windows versions prior to Windows 10 located in:

```
\\common\services\usb\class\cdc\device\
```

3. Install a Terminal Emulator PC application (like TeraTerm, for example).

To interact with the embedded serial bootloader from other MCU as host, it is required to implement a host application which must be able to upload the .bin image following the serial protocol supported by the embedded firmware.

The PL360G55Cx-EK boards are provided with the embedded serial bootloader pre-programmed in the Flash memory.



**Attention:** The use of the jumper ERASE (J3) erases the Flash memory of the SAMG55 microcontroller, including the serial bootloader application.

If the serial embedded bootloader is not present on the SAMG55J19 device, follow the instructions described in section [Appendix B: How to Flash the Serial Bootloader Binary](#).

### 2.1 Serial Interface Connections

The embedded bootloader can work with the mikroBUS UART and the USB interfaces provided by the PL360G55Cx-EK board. The pin assignment of the ports is described in the PL360G55Cx-EK user manual.

Different interfaces and ports can be enabled at the same time. The embedded bootloader scans them sequentially for the required handshake packets until one is found.

#### 2.1.1 USB Interface

The USB interface is enumerated in the PC as a virtual COM port. The default port configuration is shown in [Table 2-1](#).

**Table 2-1. Default COM Port Settings for Embedded Serial Bootloader Host**

Field	Value
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1

.....continued	
Field	Value
<b>Flow Control</b>	None

**2.1.2 MikroBUS UART Interface**

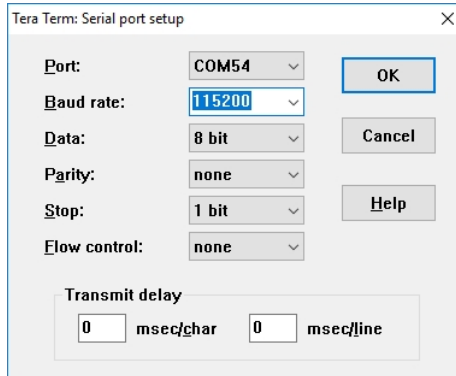
By default, the embedded serial bootloader supports USART4 peripheral of the SAMG55J19 which is accessible in the TXD, RXD and GND pins of the mikroBUS connector in the PL360G55Cx-EK boards. It is the responsibility of the user to ensure a proper connection to the host device.

The COM port settings to use are the same as for the USB interface.

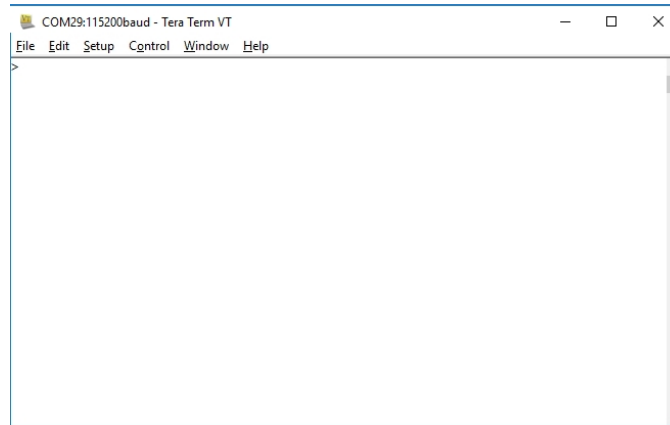
**2.2 Loading Application Firmware from a PC Host**

To program the SAMG55J19 MCU using the serial bootloader, follow these steps:

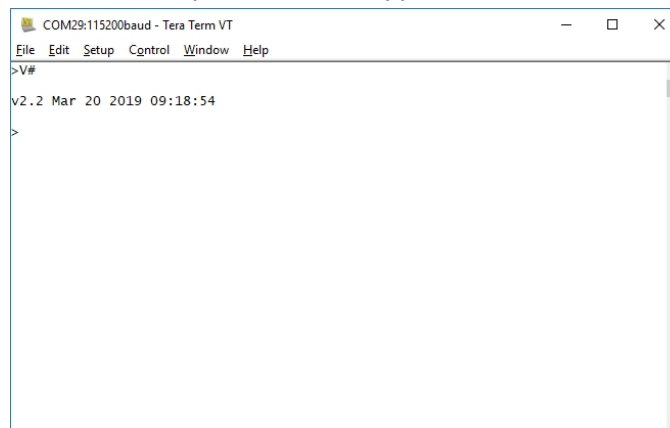
1. Short PROG (J2) header with the provided jumper.
2. Connect the PC to the PL360G55Cx-EK using one of the serial interfaces:
  - 2.1. USB connector of the PL360G55Cx-EK (with the provided USB cable).
  - 2.2. UART pins in the mikroBUS connector of the PL360G55Cx-EK (a USB-UART converter may be required).
3. Open the Terminal Emulator software and configure the serial port to which the target is connected using the parameters detailed in [Table 2-1](#). The USB module of the SAMG55J19 can negotiate the baud rate so a different value can be used. By default, the serial bootloader is started in Terminal mode, so an echo of the received character will be shown in the terminal window automatically; therefore it is recommended to disable the “local echo” option of the terminal emulator software.



4. Type # to check the connection with the serial bootloader firmware. If the connection is established properly, a prompt is shown in the terminal window.



5. The bootloader now is ready to receive commands. For example, type `v#` in the terminal window to get the version information of the bootloader firmware. In case of a typing mistake, use character ESC to re-enter a new command sequence. This is applicable to all commands.

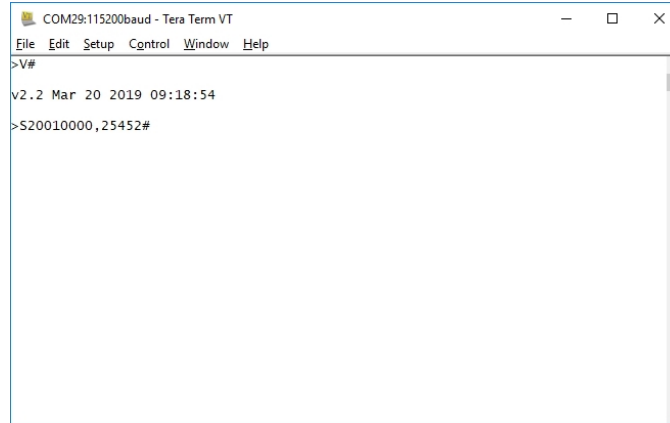


6. To load the application firmware to the SAMG55J19 device, use command `s`. It requires two parameters:
  - RAM address (in hexadecimal format) of a temporal buffer (64 KBytes) to handle the loading process.
  - The size of the application binary file in bytes (in hexadecimal format).

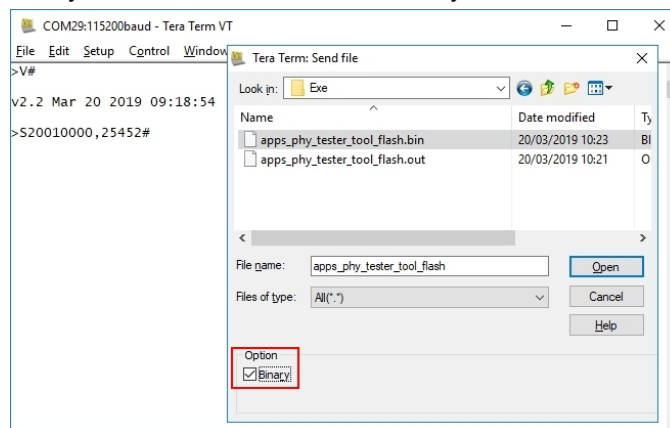
In the example, the buffer is located in the position `0x20010000` (the RAM memory of the SAMG55J19 starts at `0x20000000`).

The size of the application binary file used in this example is `152658` bytes (`0x25452`).

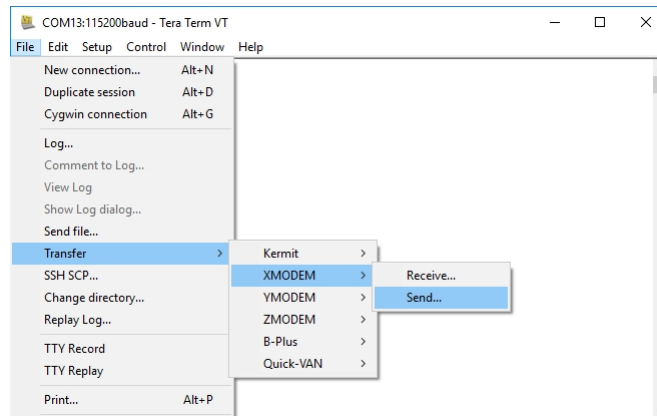
Type `s20010000,25452#` in your terminal window. The prompt automatically goes down to the next line signaling that it is waiting for the file transfer process.

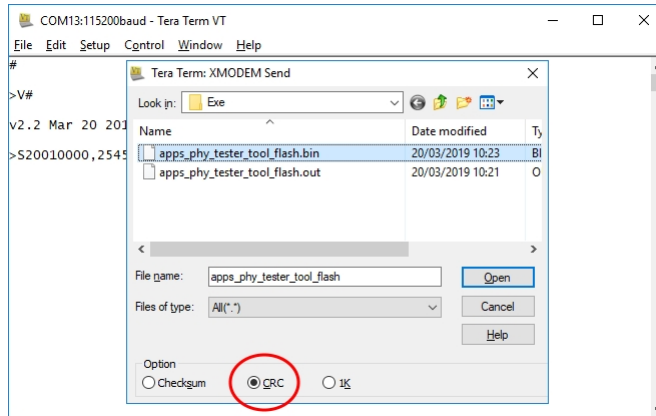


7. Send the application binary file to the SAMG55J19 in binary format.

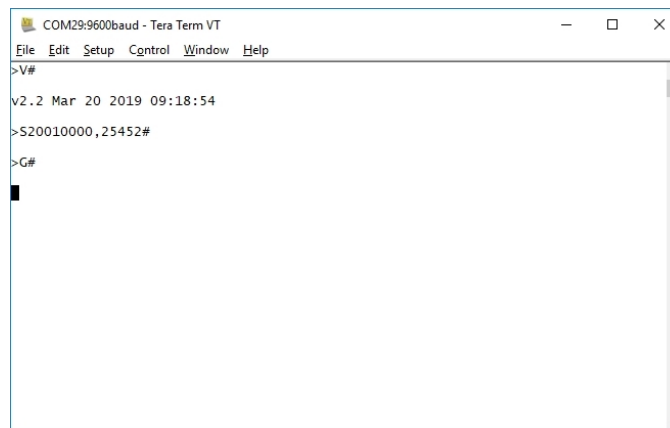


For using the UART interface, it is required to select XMODEM-CRC protocol to transfer the binary file:





8. When the upload process is complete, the prompt appears again.
9. Type command G# in the terminal window to start the application.



10. If the loaded application is running in the SAMG55J19, remove the jumper PROG (J2) and reset the board.

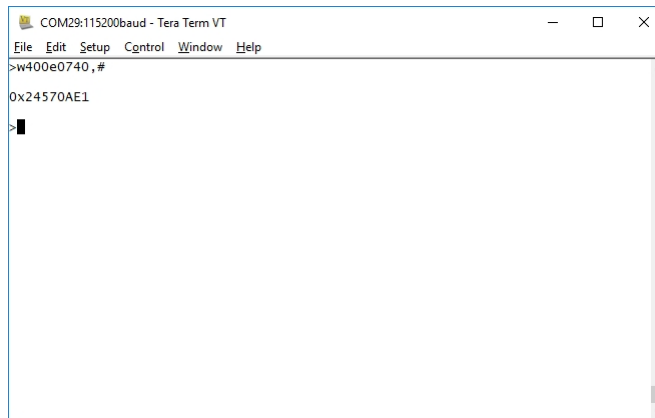
### 3. Appendix A: Bootloader Commands

The command interpreter allows the host to send or receive data to/from the target. The supported bootloader mnemonics commands (case sensitive) are given in the table below:

**Table 3-1. Bootloader Commands**

Command	Action	Argument(s)	Example
N	Set Normal Mode	No argument	N#
T	Set Terminal Mode	No argument	T#
o	Read a byte	Address,#	o200001,#
h	Read a half word	Address,#	h200002,#
w	Read a word	Address,#	w200000,#
S	Send a file	Address,#	S200000,#
R	Receive a file	Address,NbOfBytes#	R200000,1234#
G	Go	No argument	G#
V	Display version	No argument	V#

For example, to read the Chip ID register which is located in the memory address 0x400E0740:



## 4. Appendix B: How to Flash the Serial Bootloader Binary

If the serial embedded bootloader is not present in the SAMG55J19 device or it needs to be upgraded, connect a JTAG adapter (for example, [Atmel-ICE](#) or [SAM-ICE™](#)) to the JTAG connector (J7) in the PL360G55Cx-EK board and then program the SAMG55J19 with the binary image (.bin) of the embedded bootloader via the JTAG interface.



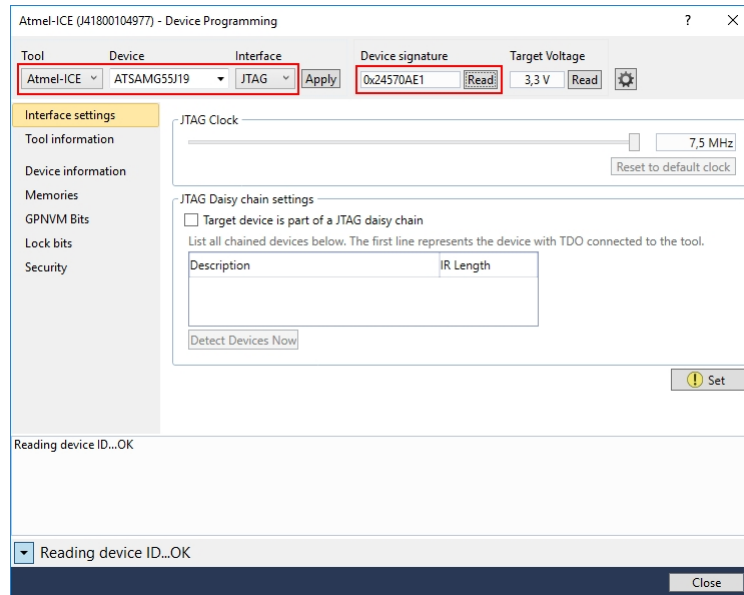
**Attention:** To use the ARM® Multi-ICE or Atmel SAM-ICE, a JTAG adapter for 20 to 10 pins is necessary.

The pre-compiled binary image of the embedded serial bootloader included in the firmware package is located in the folder:

```
\sam\application\serial_bootloader\bin\
```

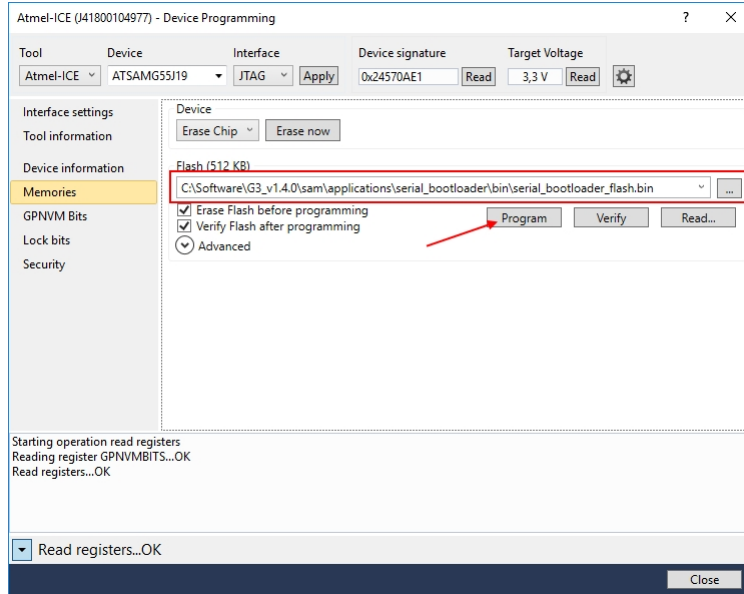
To Flash the bootloader binary using an Atmel-ICE and Atmel Studio 7, follow these steps:

1. Connect Atmel-ICE to the JTAG interface of the PL360G55Cx-EK board and power up the board.
2. Launch Atmel Studio 7 and open the **Device Programming** window (Menu Tools/Device Programming).
3. In the comboboxes, select the tool **Atmel-ICE**, device **ATSAMG55J19** and interface **JTAG**. The communication with the microcontroller can be checked reading the device signature.

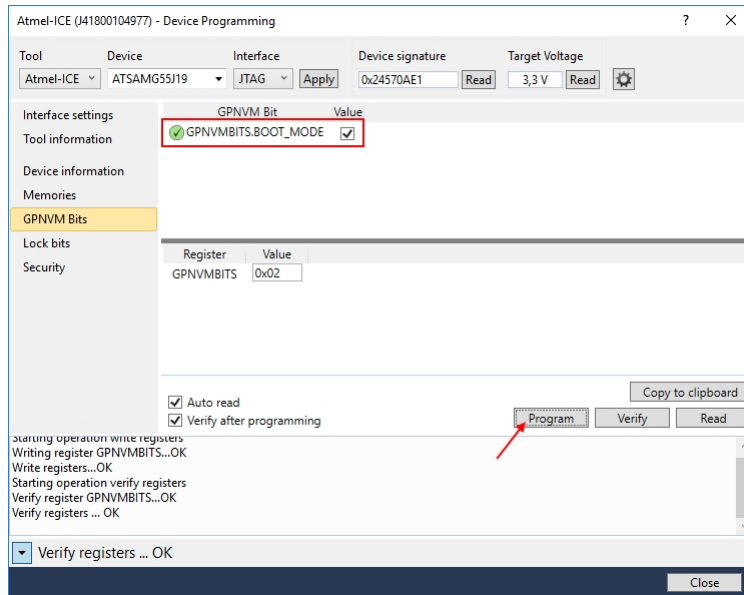


4. In the **Memories** tab, select the binary file of the serial bootloader to Flash and press the **Program** button.

Appendix B: How to Flash the Serial Bootloader ...



5. In the **GPNVM Bits** tab, enable the check of the bit GPNVMBITS.BOOT\_MODE and press the **Program** button.



6. Now the bootloader binary is loaded and running in the SAMG55J19.

**5. Revision History**

**5.1 Rev A - 04/2019**

Document	Initial release.
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