

How to Use Boot Assist Module (BAM) on TWR-PXS20 Board

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1 Introduction

Bootloader is a very powerful tool to load new firmware to a microcontroller. Bootloaders can be used for factory programming and firmware updates without having access to the program/debug pins of the microcontroller. The PXS20 microcontroller has a special module called the boot assist module (BAM) that can be used to download code to the microcontroller just after coming out of the factory.

This application note will briefly explain how to use RappID Boot Loader (BL) tool on the TWR-PXS20 board. This procedure can be duplicated on a custom board leaving the correct lines assigned to select between the normal boot and the BAM boot.

2 Boot assistance module (BAM)

Bootloader is a small program running on the microcontroller that allows to get a binary file from the external world and store it into the flash memory of the microcontroller. It must be noted that the BAM is not a code bootloader and provides a method to download a small program into the RAM of the microcontroller and execute it. This code can be a firmware loader or anything that the user wants to store and execute from RAM after power-on sequence. The features of the BAM are as follows:



Boot assistance module (BAM)

- Programmable 64-bit password protection for serial boot mode
- Serial boot option to load the application boot code from CAN or UART bus into SRAM
- Censorship protection for internal flash module
- Detection of the selected baud rate in auto-baud rate mode

The following figure depicts the workflow of the bootloader application using the BAM.

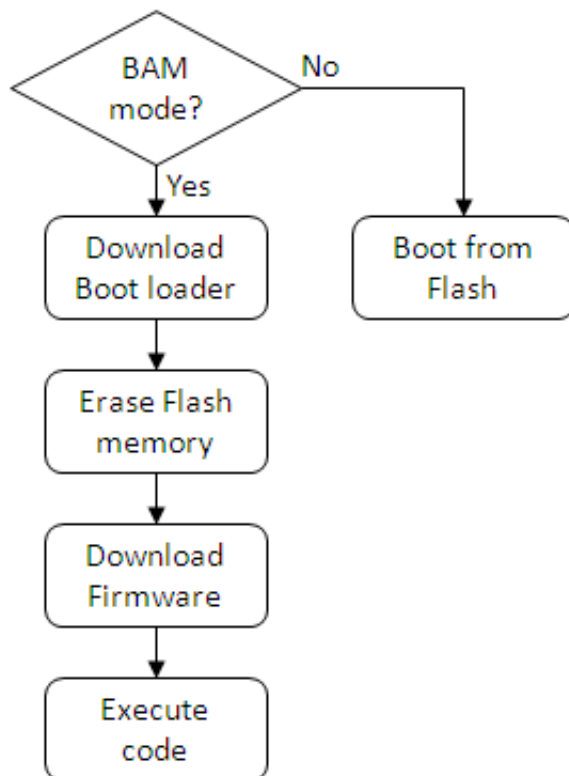


Figure 1. BAM bootloader application flow

Executing BAM

BAM is executed if Serial Boot mode has been selected asserting the Force Alternate Boot Mode (FABM) pin before the reset sequence.

- If FABM is asserted, the hardware will check the ABS pins to determine the desired boot option (CAN or UART). See [Table 1](#).
- If FABM pin is not asserted, the device boots from the first flash memory sector which contains a valid boot signature. See [Table 1](#).
- If no flash memory sector contains a valid boot signature, the device will enter into Static mode.

The following table shows several boot options depending on the status of FABM and ABS pins.

Table 1. Boot mode configuration

FABM	ABS[2,0]	Boot mode
0	Don't care	Internal flash memory
1	00	UART without auto-baud rate
1	01	CAN without auto-baud rate
1	10	Scan of both serial interfaces (CAN and UART) with auto-baud rate

The following figure shows a flowchart depicting the PXS20 boot sequence.

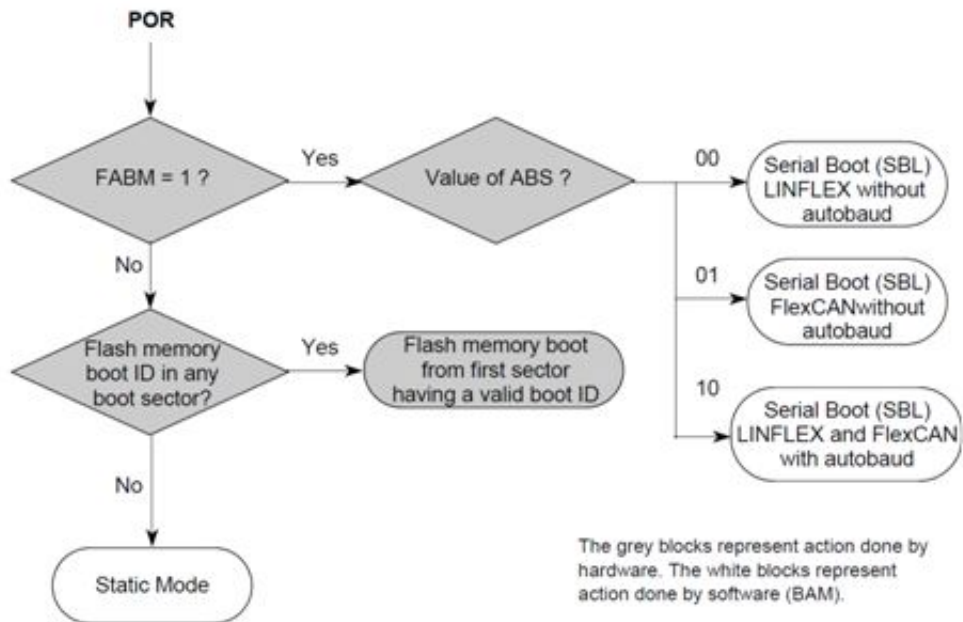


Figure 2. Boot mode selection

3 RAppID Boot Loader (BL) utility

Freescale provides a PC-based graphic application that enables the BAM of the PXS20 and other microcontrollers that have the BAM.

RAppID BL utility can be used for application factory programming since it is an easy-to-use and free-of-charge tool.



Figure 3. RAppID boot loader utility

For more information regarding RAppID tools and downloading the RAppID boot loader utility, visit the RAppID web page, <http://www.freescale.com/RAPPID>.

4 Tower system setup

TWR-PXS2010 board has the UART0 mapped to the onboard RS485 transceiver and to the UART0 standard lines of the tower primary board. This will allow to use any tower peripheral module that has the UART0 enabled to download the code using the BAM.

This application note will use the TWR-IND-IO board that has a USB-to-serial (USB2SER) IC provided by Freescale. This USB2SER provides a USB-to-serial bidirectional bridge allowing the communication between the PXS20 microcontroller and the RAppID BL utility using an USB port.



Figure 4. TWR-PXS2010 with TWR-IND-IO

The following figure shows USB2SER integrated on the TWR-IND-IO board.

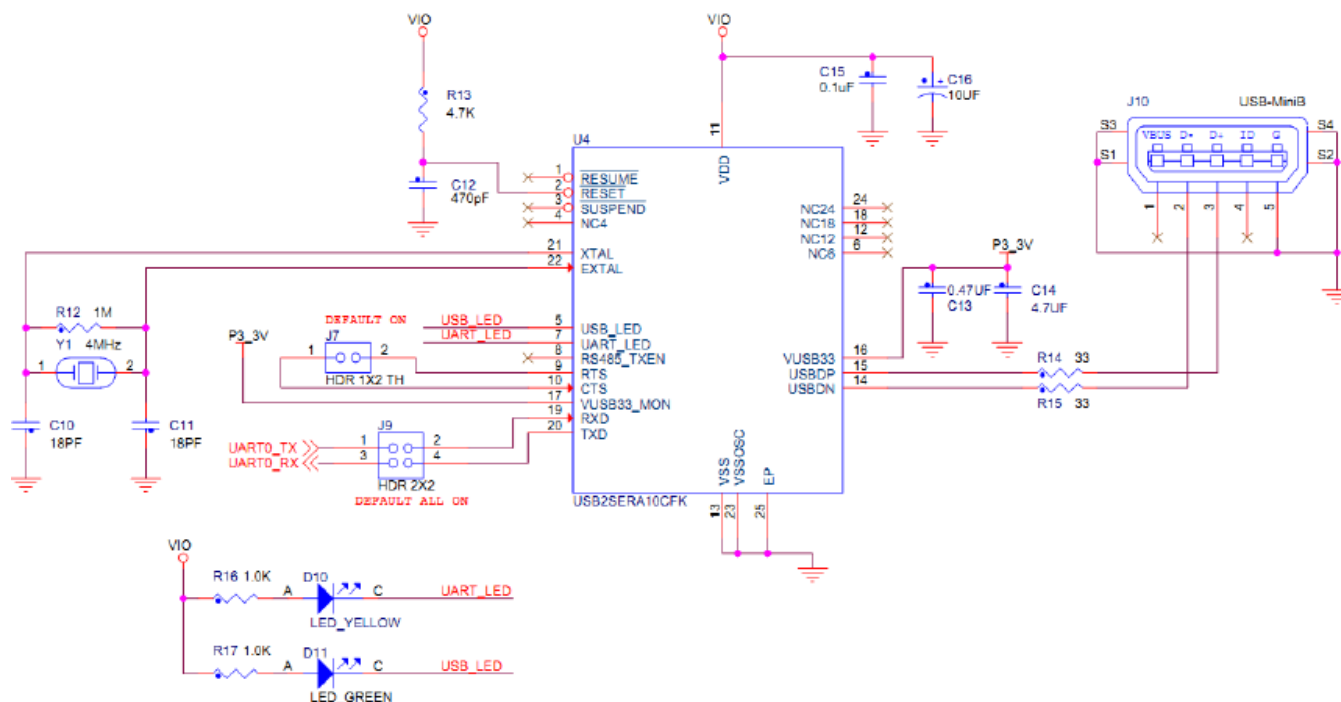


Figure 5. USB2SER implementation on TWR-IND-IO board

NOTE

Check that jumpers on J9 connector on the TWR-IND-IO board are properly setup to allow the serial communication between the USB2SER and the microcontroller.

1. On TWR-PXS2010 board, J3 and J4 jumpers must be modified to enable the BAM module of the PXS20 microcontroller.
The following table shows the appropriate configuration for jumpers J3 and J4 to allow PXS20 microcontroller to enter into BAM mode using auto-baud rate configuration.

Table 2. Jumper configuration on TWR-PXS2010

Jumper	Position
J3	1-2, 5-6
J4	2 connected to J3-4

The following figure shows how the jumper headers physically appear on the board.

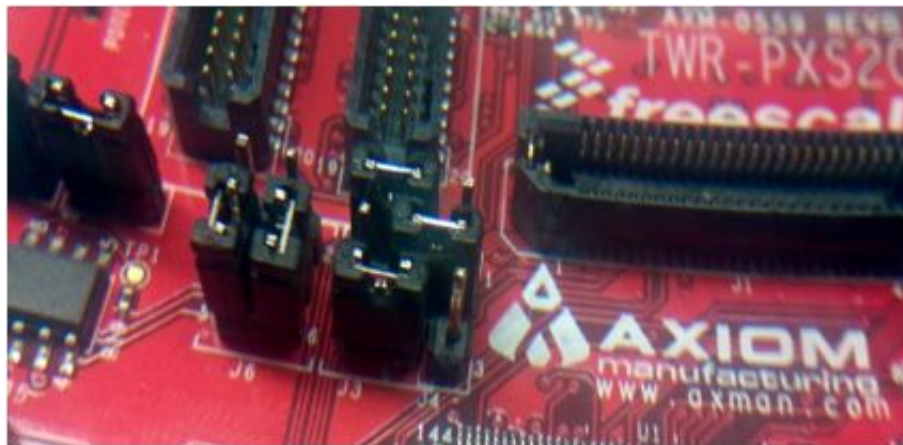


Figure 6. TWR-PXS2010 jumper configuration for BAM

2. Connect the USB cables, one on the TWR-ELEV board to power-up the board and the second one to the TWR-IND-IO board.
3. Finally, turn on the tower board using the switch located at the bottom of the TWR-ELEV primary board.

NOTE

Make sure that USB2SER drivers are installed properly. If the USB2SER was installed correctly, one USB CDC device can be found under the Ports section on the Windows Device Manager, as shown in the figure below.

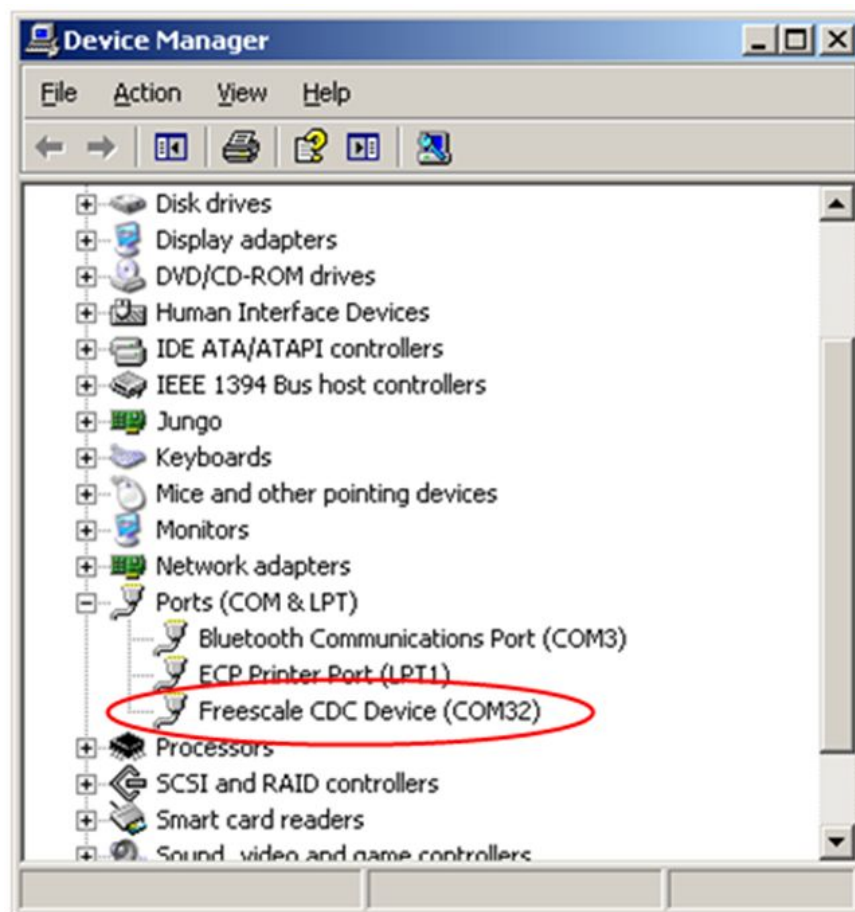


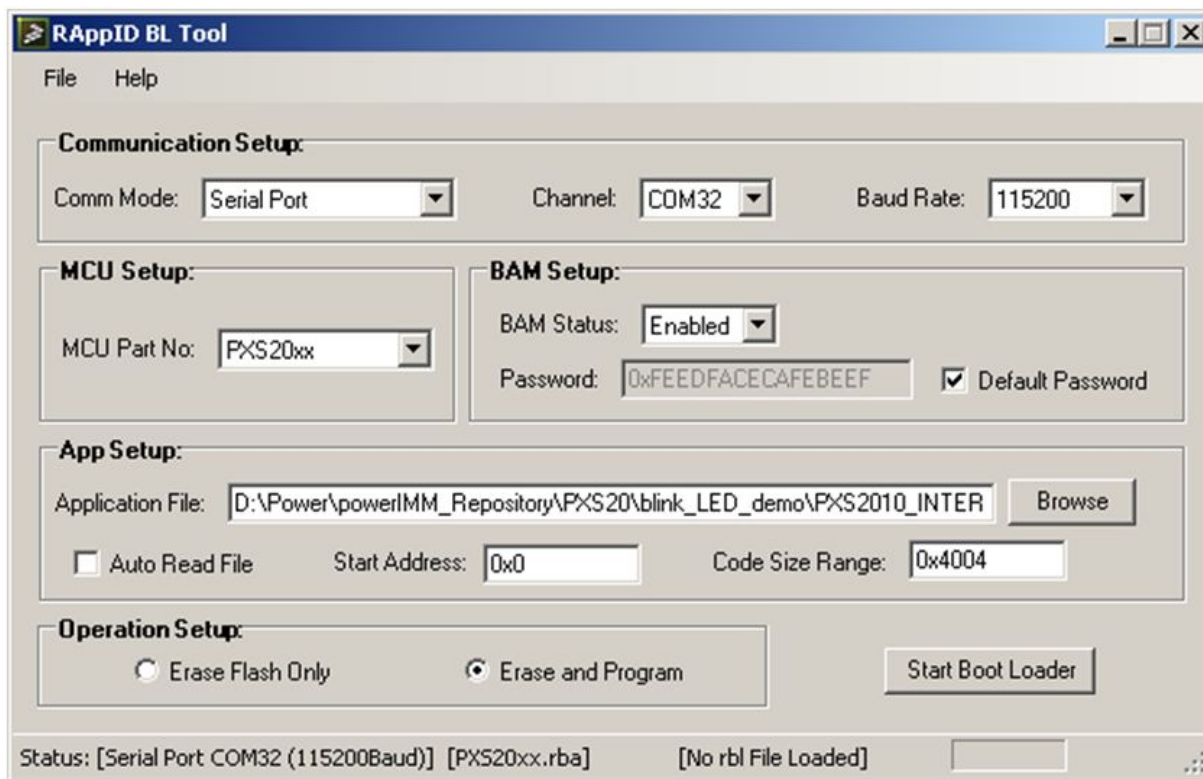
Figure 7. Windows Device Manager

5 Firmware download using RAppID BL tool

The RAppID BL tool is very simple to work with. The following steps will guide users to download firmware using RAppID.

- Just select the appropriate configuration on each field on the graphical interface.
 - Comm Mode: Communication interface for the bootloader
In this case, Serial Port is selected.
 - Channel: The serial port available
In this case, COM32 is assigned to the TWR-IND-IO board.
 - Baud Rate: Baud rate for the serial port
In this case, auto-baud rate is used.
 - MCU Part No: Target MCU
In this case, PXS20xx is the target MCU.
 - BAM Status: Enabled
 - Password: Specify the access password
In this case, use the default password, so just select the Default password checkbox.
 - Application File: The S19 or MOT file to download to the microcontroller

Figure 8. RAppID BL tool interface



- Once the configuration is completed, press the Start Boot Loader button and the following message will appear on the screen asking for a reset sequence of the microcontroller.

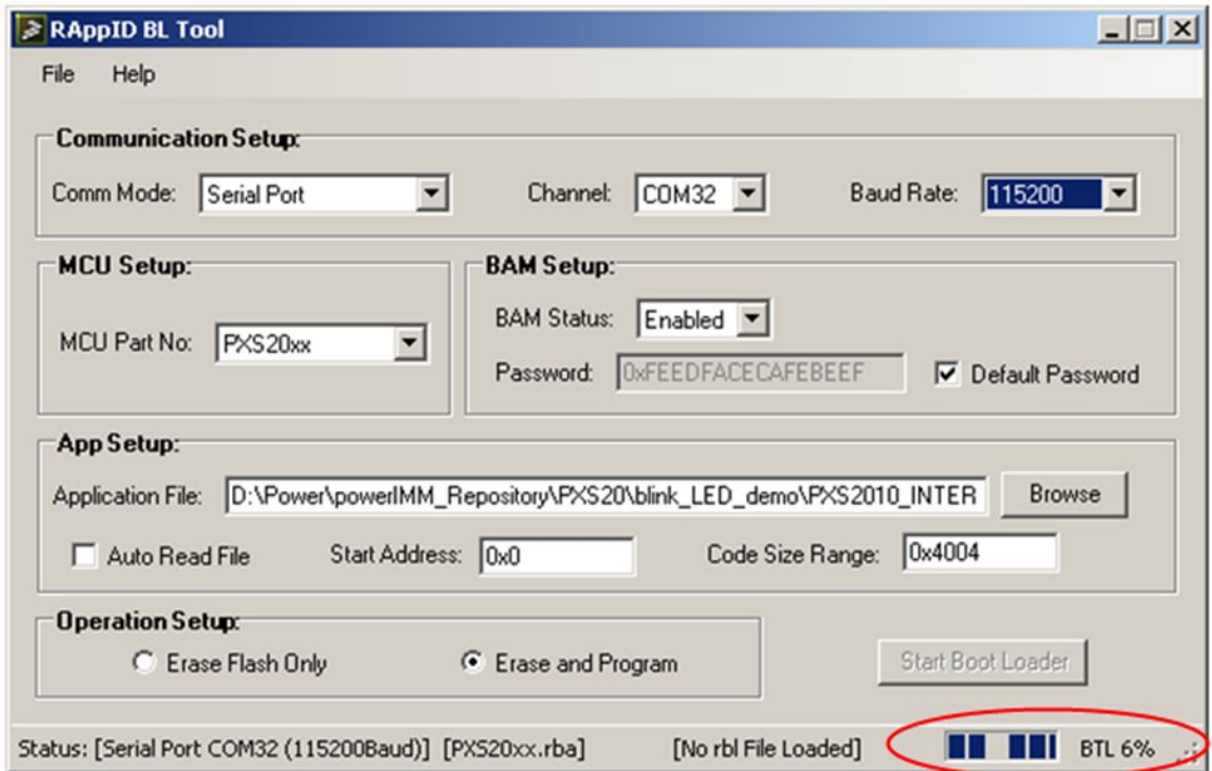


3. Press the RESET button of the TWR-PXS2010 board and the OK button to start the firmware download process.

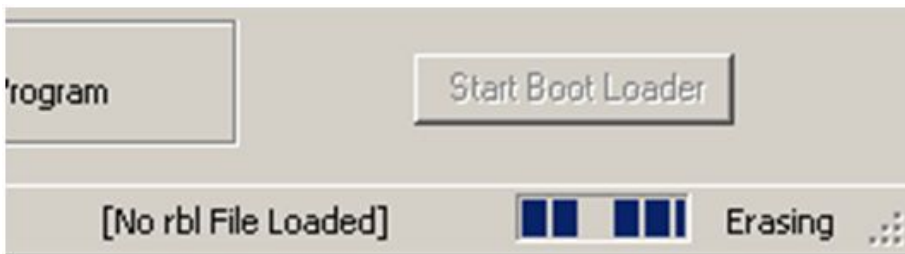


Figure 9. TWR-PXS20 RESET button

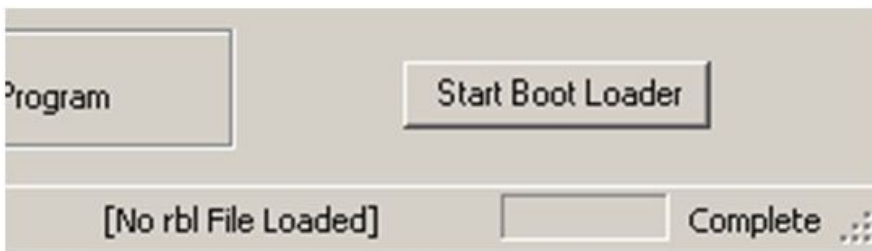
4. If hardware setup and the GUI configuration are correct, the graphical interface at the bottom right will show the percentage of bootloader firmware downloaded.



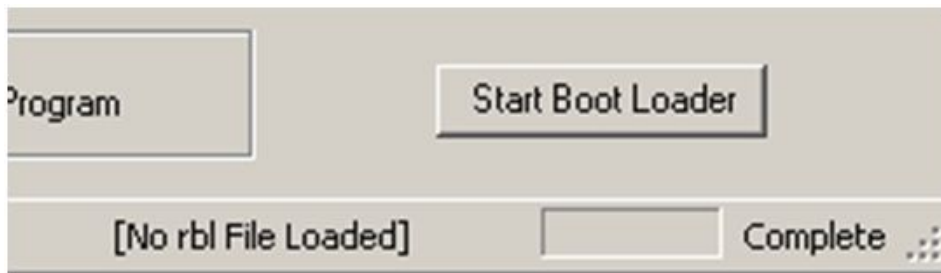
- After it reaches 100%, the boot loader tool will show that the flash erase is in process.



- Once the microcontroller flash has been erased, the MCU proceeds to download the application firmware and the graphical interface shows the percentage of the progress.



- Finally, the graphical interface informs that the new firmware has been downloaded successfully to the flash memory of the microcontroller.



To execute the application previously downloaded using the RappID boot loader tool, please return the J4 and J3 jumpers to the default position, as shown in the table below.

Table 3. Default jumper configuration on TWR-PXS2010

Jumper	Position
J3	2 connected to J4-1 4 connected to J4-2 6 connected to J4-3

The following figure shows the default jumper configuration that is required to run the application previously stored in the flash memory using the BAM tool.



Figure 10. Default jumper configuration

6 Conclusion

The BAM module of the PXS20 microcontroller together with the RappID BL tool is a very good option for application factory programming because it provides an easy way to download code using a serial interface instead of a full JTAG interface.

See the PXS20RM: PXS20 Reference Manual available on <http://www.freescale.com/PXS20>, for more details of the BAM module.

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