

AN14648

MCX W72 In-System Programming Utility

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Application note

Document information

Information	Content
Keywords	AN14648, MCX W72, FRDM-MCXW72 board, in system programming (ISP), ISP mode
Abstract	This document provides steps to boot the MCX W72 MCU into ISP mode and establish various serial connections to communicate with the MCU.



1 Introduction

The MCX W72 microcontroller (MCU) contains a read-only memory (ROM) bootloader, which is a boot code resident in the ROM. The ROM bootloader begins its execution when the Arm Cortex-M33 core is released from reset. The bootloader can follow different paths. One of them is the In-System Programming (ISP) path. To make the bootloader follow the ISP path, the ISP utility is used. The ISP utility operates over a serial connection on the MCU. To upload/download the application code using the bootloader, use host-side tools.

The document provides steps to boot the MCX W72 MCU in ISP mode and establish various serial connections to communicate with the MCU. For demonstrating the ISP functionality, the FRDM-MCXW72 board is used as the MCX W72 MCU platform. For simplicity, the MCX W72 MCU is referred to as the target MCU at some places in the document.

2 Entering ISP mode

The MCX W72 device has two different ways of entering ISP mode. One using the designated button in the FRDM-MCXW72 board, which asserts the appropriate signal for the ROM bootloader to boot in ISP mode while powering the board. The MCX W72 device can also follow the ISP path using the software method, which can be used at any time while the MCU is running.

2.1 ISP entry via hardware

To make the bootloader follow the ISP path (to boot the MCX W72 MCU in ISP mode), the `BOOT_CFG` (PTA4) pin of the MCU must be active. To activate this pin and boot the target MCU in ISP mode, follow these steps:

1. Disconnect the FRDM-MCXW72 board from all power sources.
2. Keep the SW3 (ISP) button pressed, while connecting the board to the host computer USB port, using the J10 USB type-C connector.
3. Release the SW3 (ISP) button. The MCX W72 will boot in ISP mode.
4. Connect any external power supply, if needed.

2.2 ISP entry via software

To enter ISP mode using software, the `FORCECFG` bit from the `CMC[FM]` register must be asserted followed by an SW reset. Once the device resets, it enters ISP mode.

3 Software and tools

For the current document:

- The blhost utility of the SPSDK software is used. The I2C or SPI protocols are selected as the communication interface.
- The standalone blhost application is used when the CAN interface is selected as the communication interface, since the current version of SPSDK does not yet support CAN.

[Table 1](#) shows the versions of the tools used for the current document.

Table 1. Tool versions

Tool versions	
Tool	Version
SPSDK	2.6.0
Blhost	2.6.7

3.1 BusPal

BusPal is an embedded software tool available as a companion to the Blhost application. It acts as a bus translator between blhost and the target device. It connects to the blhost application over a UART connection, and connects to the target device over an I2C, an SPI, or a CAN connection. It assists the blhost application in performing commands and responses from the target device.

The source code for BusPal is provided with the Kinetis bootloader release. The source code is only available for selected platforms, but it can be customized to run on other platforms.

For more details on the BusPal software tool and the MCU bootloader for NXP MCUs, refer to the following link:

<https://www.nxp.com/design/design-center/software/development-software/mcuxpresso-software-and-tools-/mcu-bootloader-for-nxp-microcontrollers:MCUBOOT>

4 Establishing communication

This section describes how to establish communication between the host computer and the target MCU using the UART, I2C, SPI, or CAN interface. A host-side command-line tool (for example, blhost) can be used to communicate with the target MCU directly over a UART connection. However, to enable I2C, SPI, or CAN communication between the host computer and the target MCU, you must create a bridge (for example, BusPal) using an external device, along with a host-side command-line tool (for example, blhost).

Use one of the following NXP MCUs to create a BusPal bridge:

- MKL25Z
- MKV46
- MK65F
- MCXW71
- MCXA156

To learn more about BusPal devices and on how to program the BusPal firmware, refer to the following link:

<https://mcuxpresso.nxp.com/appcodehub?search=ap-frdm-mcx-buspal>

Note: The current document only includes examples with MKL25Z, MCXW71, and MCXA156 MCUs used as BusPal bridge devices.

4.1 Using UART interface

To communicate with the target MCU using the Universal Asynchronous Receiver/Transmitter (UART) interface, no external hardware or modifications are needed. To establish a UART connection between the host computer and the MCX W72 MCU (FRDM-MCXW72 board), boot the MCU in ISP mode as explained in [Section 2](#). The target MCU starts receiving ISP commands using the host-side tool.

[Figure 1](#) shows the response from the target MCU after running the ISP command using the UART interface.

```
C:\nxp>blhost -p COM177 get-property 1
Response status = 0 (0x0) Success.
Response word 1 = 1258488064 (0x4b030100)
Current Version = K3.1.0
```

Figure 1. Running ISP command using UART interface

4.2 Using I2C interface

To communicate with the target MCU using the Inter-Integrated Circuit (I2C) interface, create a BusPal bridge (using an external device) between the host computer and the target MCU. Devices, such as an NXP MCU MCXW71 or MCXA156, can be used as a BusPal bridge device for I2C communication.

To establish an I2C connection between the host computer and the target MCU while using an MKL25Z MCU (FRDM-KL25Z board), MCXW71 (FRDM-MCXW71 board), or an MCXA156 MCU (FRDM-MCXA156 board) as a bridge device, follow these steps:

1. Boot the target MCU in ISP as explained in [Section 2](#).
2. Set up an I2C connection between the FRDM-MCXW72 board and the FRDM-KL25Z / FRDM-MCXW71 / FRDM-MCXA156 board, as described in [Table 2](#).

Table 2. I2C connection setup

Signal	Target MCU		MKL25Z BusPal	MCXW71 BusPal	MCXA156 BusPal
	MCU pin	FRDM-MCXW72 connector	FRDM-KL25Z connector	FRDM-MCXW71 connector	FRDM-MCXA156 connector
LPI2C_SCL	PTB5	J2, pin 1	J1, pin 14	J2, pin 1	J5, pin 5
LPI2C_SDA	PTB4	J2, pin 2	J1, pin 16	J2, pin 2	J5, pin 6

After following the above steps, the target MCU starts receiving ISP commands using the host-side tool. [Figure 2](#) shows the response from the target MCU after running the ISP command using the I2C interface.

```
C:\nxp>blhost -b i2c -p COM132 get-property 1
Response status = 0 (0x0) Success.
Response word 1 = 1258488064 (0x4b030100)
Current Version = K3.1.0
```

Figure 2. Running ISP command using I2C interface

4.3 Using SPI interface

To communicate with the target MCU using the Serial Peripheral Interface (SPI), create a BusPal bridge (using an external device) between the host computer and the target MCU. Devices, such as an NXP MCU MCXW71 or MCXA156, can be used as a BusPal bridge device for SPI communication.

To establish an SPI connection between the host computer and the target MCU while using an MKL25Z MCU (FRDM-KL25Z board), MCXW71 (FRDM-MCXW71 board), or an MCXA156 MCU (FRDM-MCXA156 board) as a bridge device, follow these steps:

1. Boot the target MCU in ISP as explained in [Section 2](#).
2. Set up an SPI connection between the FRDM-MCXW72 board and the FRDM-KL25Z / FRDM-MCXW71 / FRDM-MCXA156 board, as described in [Table 3](#).

Table 3. SPI connection setup

Signal	Target MCU		MKL25Z BusPal	MCXW71 BusPal	MCXA156 BusPal
	MCU pin	FRDM-MCXW72 connector	FRDM-KL25Z connector	FRDM-MCXW71 connector	FRDM-MCXA156 connector
LPSPi_PCS0	PTB0	J2, pin 8	J2, pin 6	J2, pin 8	J6, pin 3
LPSPi_SIN	PTB1	J2, pin 6	J2, pin 8	J2, pin 7	J6, pin 6

Table 3. SPI connection setup...continued

Signal	Target MCU		MKL25Z BusPal	MCXW71 BusPal	MCXA156 BusPal
	MCU pin	FRDM-MCXW72 connector	FRDM-KL25Z connector	FRDM-MCXW71 connector	FRDM-MCXA156 connector
LPSPISCK	PTB2	J2, pin 5	J2, pin 12	J2, pin 5	J6, pin 4
LPSPISOUT	PTB3	J2, pin 7	J2, pin 10	J2, pin 6	J6, pin 5

```
C:\nxp>blhost -b spi -p COM132 get-property 1
Response status = 0 (0x0) Success.
Response word 1 = 1258488064 (0x4b030100)
Current Version = K3.1.0
```

Figure 3. Running ISP command using SPI interface

After following the above steps, the target MCU starts receiving ISP commands using the host-side tool. [Figure 3](#) shows the response from the target MCU after running the ISP command using the SPI interface.

4.4 Using CAN interface

To communicate with the target MCU using the Controller Area Network (CAN), create a BusPal bridge (using an external device) between the host computer and the target MCU. For CAN communication, only MCXW71 and MCXA156 MCUs can be used as a BusPal bridge device.

To establish a CAN connection between the host computer and the target MCU while using an MCXW71 (FRDM-MCXW71 board), or an MCXA156 MCU (FRDM-MCXA156 board) as a bridge device, follow these steps:

1. Boot the target MCU in ISP as explained in [Section 2](#).
2. Set up a CAN connection between the FRDM-MCXW72 board and the FRDM-MCXW71 / FRDM-MCXA156 board, as described in [Table 4](#).

Table 4. CAN connection setup

Signal	Target MCU		MCXW71 BusPal	MCXA156 BusPal
	MCU pin	FRDM-MCXW72 connector	FRDM-MCXW71 connector	FRDM-MCXA156 connector
CAN0_TX	PTC4	J10, pin 1	J21, pin 1	J22, pin 2
CAN0_RX	PTC5	J10, pin 2	J21, pin 2	J22, pin 4

After following the above steps, the target MCU starts receiving ISP commands using the host-side tool. [Figure 4](#) shows the response from the target MCU after running the ISP command using the CAN interface.

```
C:\nxp>blhost.exe -b can -p COM109 get-property 1
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'get-property'
Response status = 0 (0x0) Success.
Response word 1 = 1258488064 (0x4b030100)
Current Version = K3.1.0
```

Figure 4. Running ISP command using CAN interface

5 Revision history

Table 5. Revision history

Document ID	Release date	Description
AN14648 v.2.0	10 December 2025	Initial public release
AN14648 v.1.0	15 April 2025	Initial NDA release

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Contents

1 Introduction2

2 Entering ISP mode2

2.1 ISP entry via hardware2

2.2 ISP entry via software2

3 Software and tools2

3.1 BusPal3

4 Establishing communication3

4.1 Using UART interface3

4.2 Using I2C interface4

4.3 Using SPI interface4

4.4 Using CAN interface5

5 Revision history6

Legal information7

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