N32H7xx series Dual-Core Debugging user guide

Introduction

This document is designed for users to quickly understand the usage of Dual-Core Debugging in N32H7xx series microcontrollers (MCUs), in order to guide users to easily understand and resolve issues related to dual-core debugging.

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Content

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1 IAR Embedded Workbench® Environment

1.1 Using CMSIS_DAP

For CMSIS_DAP, IAR provides a method for debugging two cores of different architectures simultaneously. Asymmetric multicore processing (where one core is M7 and the other is M4) can be configured from two different core configurations within the same project or from two separate workspaces.

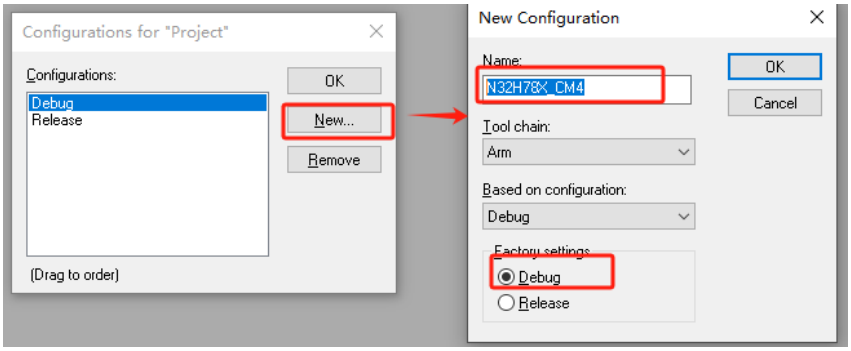
1.1.1 Project Configuration

The following example creates a project and adds separate configurations for the two cores respectively.

1.1.1.1 CM4 Project Configuration

- Open IAR and create a workspace, then save the workspace.
- Create a project and add program files to it.
- Name the Configuration of the newly created Project as debug for easy identification of M4 and M7 configurations. You can create a new Configuration named N32H78x_CM4 via Project → Edit Configurations → New, then switch to the N32H78x_CM4 Configuration and delete the debug/release configuration.

Figure 1-1 Adding M4 Configuration



- Configure the project - Select M4 device: Project → Options → General Options → Target

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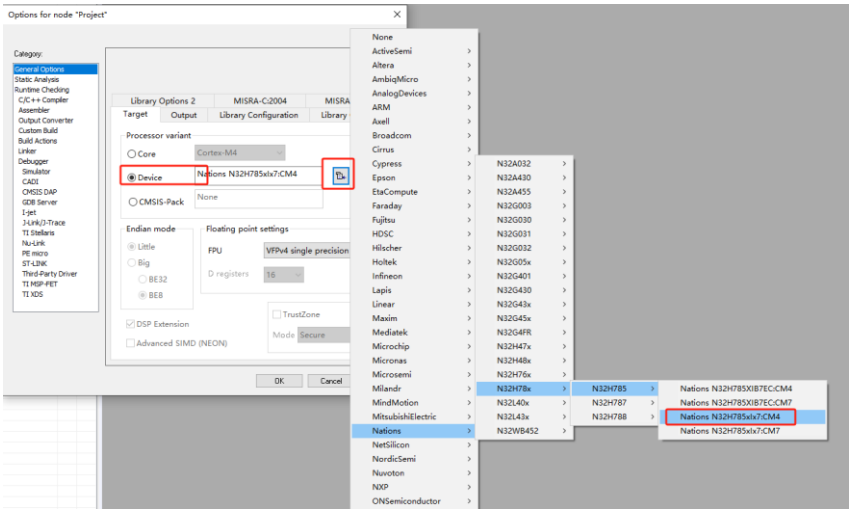
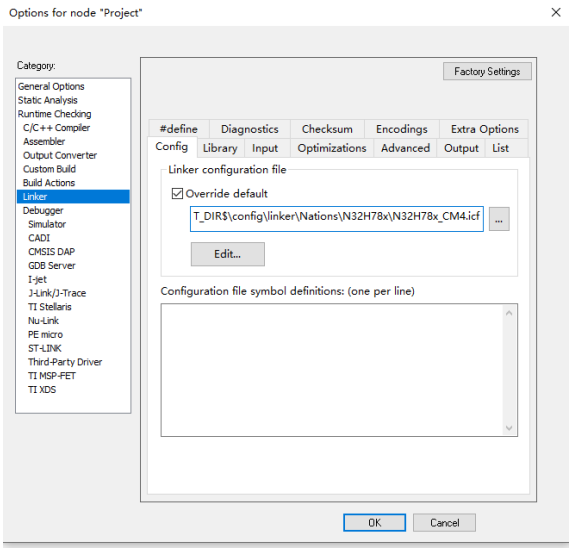
Figure 1-2 Select M4 Device



- Configure the project – Set Linker: Project → Options → Linker → Config. The default setting is the icf file under the IAR path. After checking Override default, you can reselect and edit your own linker file.

Figure 1-3 Setting Linker



- Configure the project – Select debugger: Project → Options → Debugger → Setup. Select CMSIS-DAP for the Driver.

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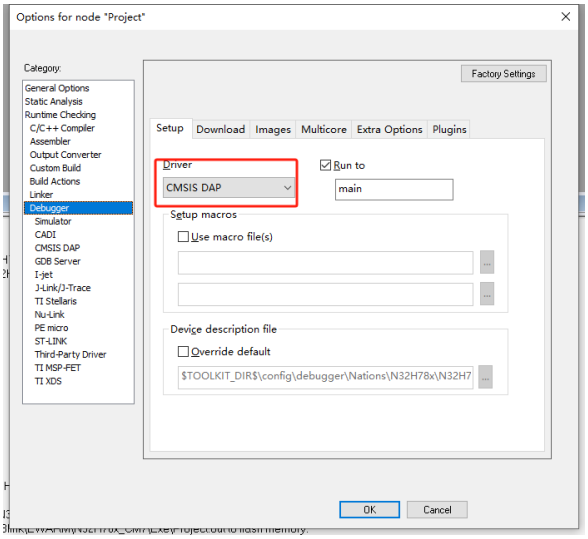
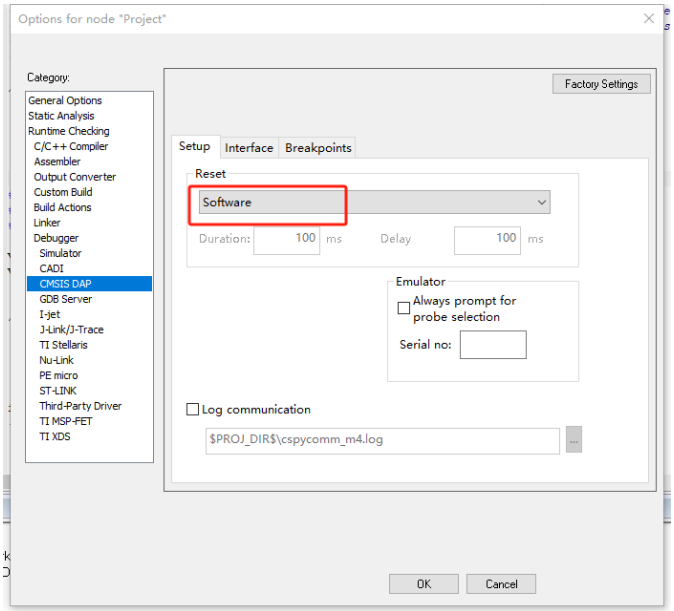
Figure 1-4 Selecting Debugger



- Configure the project – Select reset mode for CMSIS_DAP: Project → Options → CMSIS DAP → Setup. Only software and core reset modes can be selected; system/hardware reset will reset the entire system, resulting in debugger connection failure.

Figure 1-5 Selecting Reset Mode for CMSIS_DAP



- Configure the project – Check Restore software breakpoint at _call_main: Project → Options → CMSIS DAP → Breakpoints

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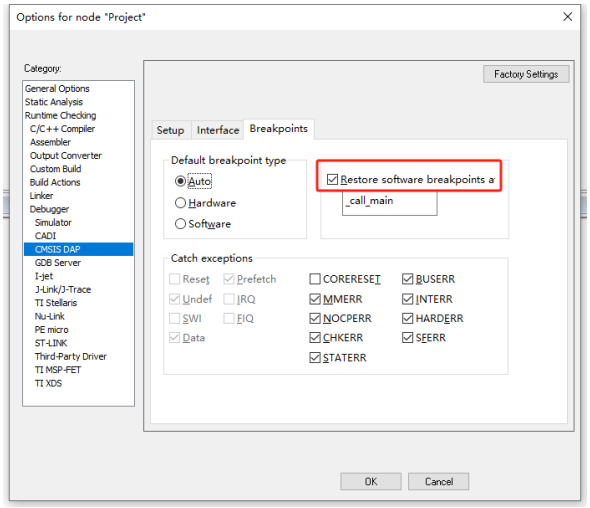
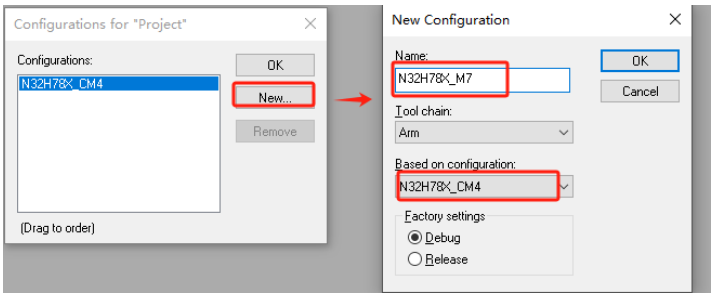
Figure 1-6 Enabling Restore software breakpoint at_call_main



1.1.1.2 CM7 Project Configuration

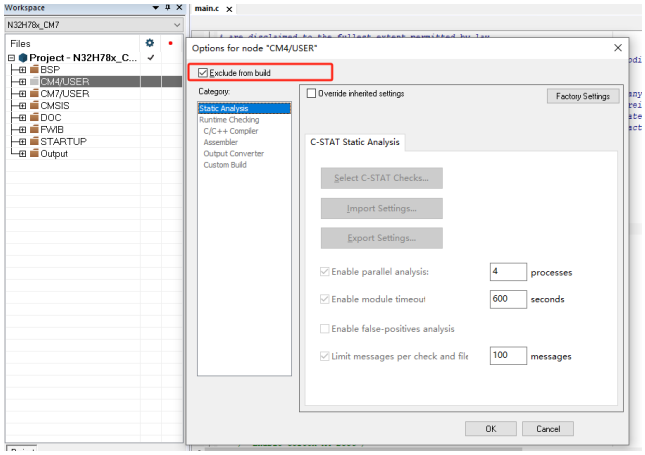
- Add M7 configuration based on the M4 project: Project → Edit Configurations → New. The configuration of the newly created N32H78x_CM7 is identical to that of M4.

Figure 1-7 Adding M7 Configuration



- Add M7 program files. For program files exclusive to M4, you can check Exclude from build in the Options of the corresponding folder or file to exclude them from compilation. Similarly, program files exclusive to M7 can be excluded from compilation in the M4 Configuration.

Figure 1-8 Excluding Partial Programs from Compilation



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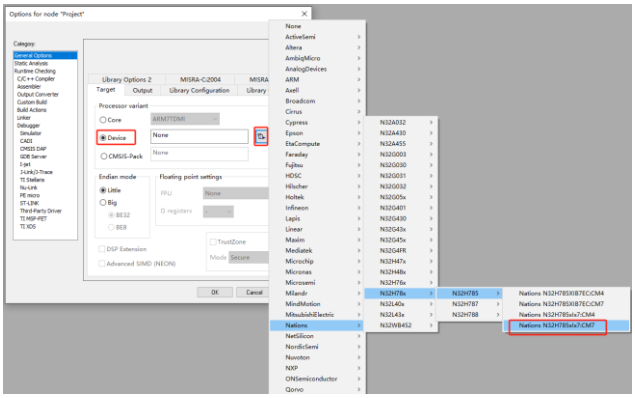
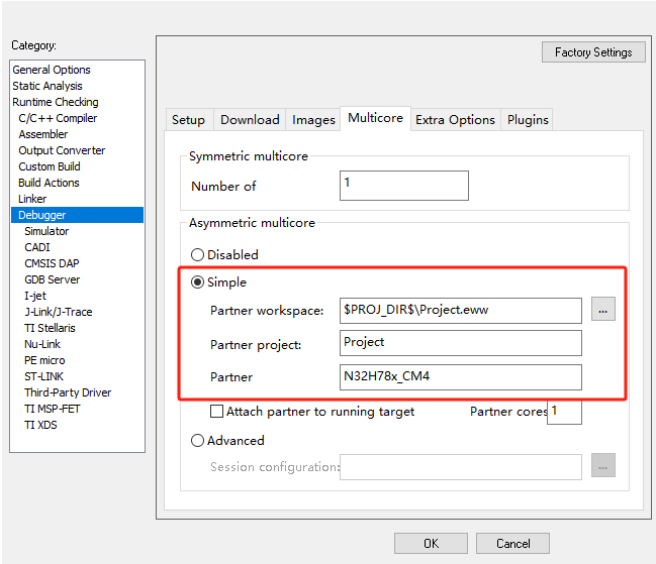
- Configure the project - Select device: Project → Options → General Options → Target

Figure 1-9 Selecting M7 Device



- Configure the project – Set Linker: Project → Options → Linker → Config. The default setting is the icf file under the IAR path. After checking Override default, you can reselect and edit your own linker file.
- Configure the project – Select debugger: Project → Options → Debugger → Setup. Select CMSIS-DAP for the Driver.
- Configure the project – Set multicore: Project → Options → Debugger → Multicore.If only single-core download and debugging for M7 is required, select Disable for Asymmetric multicore. If dual-core download and debugging is required, select Simple for Asymmetric multicore, and set the M4 configuration as the Partner.

Figure 1-10 Setting Multicore



Partner workspace: Specify the path and file of the CM4 IAR project.

Partner project: Specify the name of the CM4 project.

Partner: Specify the name of the sub-project of the CM4 project.

- Configure the project – Set Extra Options: Project → Options → Debugger → Extra Options. Check Use command line options and add --macro_param enable_reset_peripheral=1. Since only software and core reset modes are available (system/hardware reset will reset the entire system and cause debugger connection failure),

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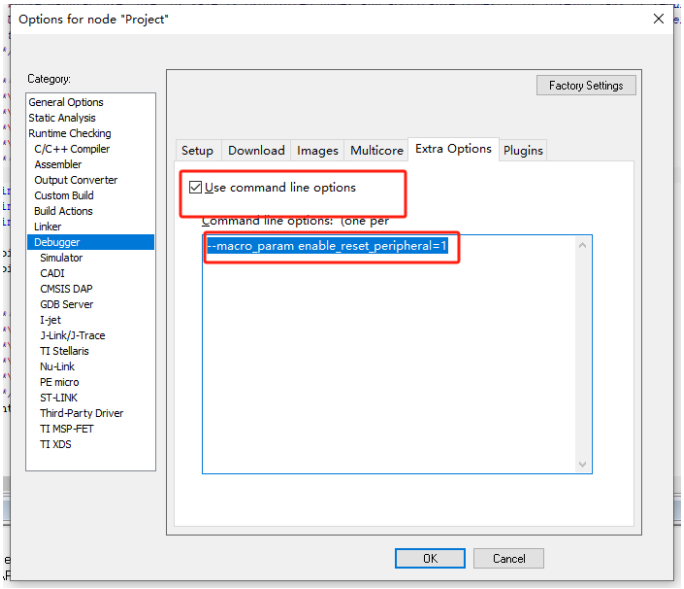
adding --macro_param enable_reset_peripheral=1 allows resetting peripheral registers via RCC before executing the reset.

Figure 1-11 Setting Ectro Options



- Configure the project – Select reset mode for CMSIS_DAP: Project → Options → CMSIS DAP → Setup. Only software and core reset modes can be selected; system/hardware reset will reset the entire system, resulting in debugger connection failure.
- Check Restore software breakpoint at _call_main in Project → Options → CMSIS DAP → Breakpoints.

1.1.2 Download and Debugging

Single-core: Select Disable for Asymmetric multicore, then each core can be downloaded and debugged individually, but the debug window cannot be entered for both cores at the same time.

Dual-core: Select Simple for Asymmetric multicore.

When downloading in the M7 Configuration, the programs for both M7 and M4 will be downloaded;

When debugging in the M7 Configuration, the M4 project will be opened automatically, the debug window will be entered for both cores simultaneously, and breakpoints can be set and debugged for each core separately;

However, compiling in the M7 Configuration cannot compile the M4 program—compilation of the M4 program can only be done in the M4 Configuration.

Notes:

1. *Currently, only ULINK is supported for dual-core debugging in this manner;*
2. *At least four wires (RESET, TMS/SWIO, TCK/SWCLK, GND) need to be connected for ULINK download and debugging;*

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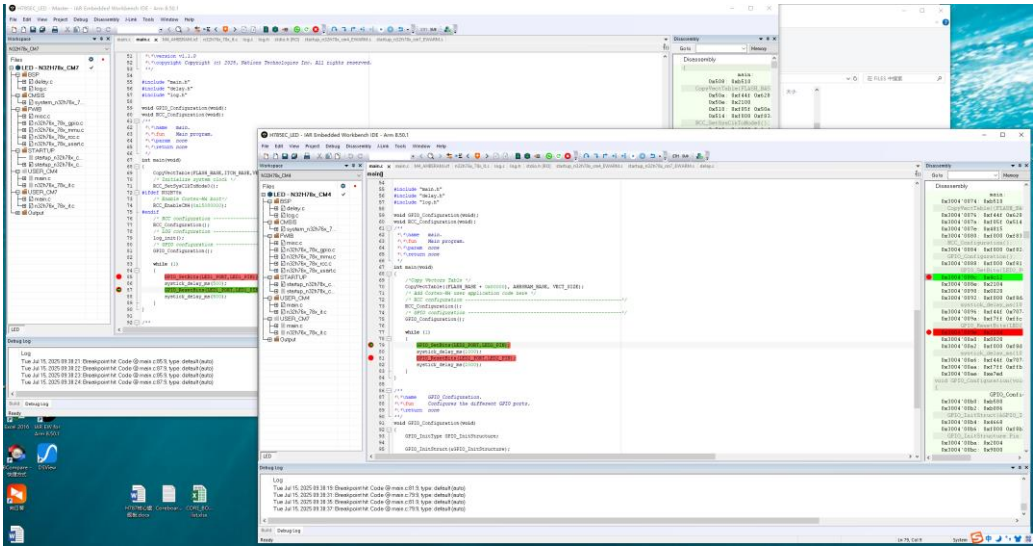
Figure 1-12 IAR Dual-Core Debugging Interface



1.2 Using J-Link

For J-Link, IAR does not support dual-core debugging with Asymmetric multicore. You need to open two IAR windows: one window selects the M7 Configuration, and the other selects the M4 Configuration.

Configuring the J-Link Environment in IAR

1. Install the J-Link driver, and add Nations chips according to the document Process for Adding Nations Chips to JLink Tools.
2. Copy the JLinkDevices.xml file (with Nations chips added) and the Devices folder to the IAR installation path:\Embedded Workbench 9.30\arm\bin

1.2.1 Project Configuration

Based on the project created in the above CMSIS-DAP process, both M4 and M7 Configurations need to select J-Link/J-Trace as the Driver in Project → Options → Debugger → Setup → Driver.The reset executed during J-Link download is not related to the reset mode selected in Options → J-Link/J-Trace, nor will it execute the processes in IAR's mac/dmac files. It only executes the reset process defined in the script file:\Embedded Workbench 8.4\arm\bin\Devices\Nationstech\N32H78x_CM7/4.jlinkscript.

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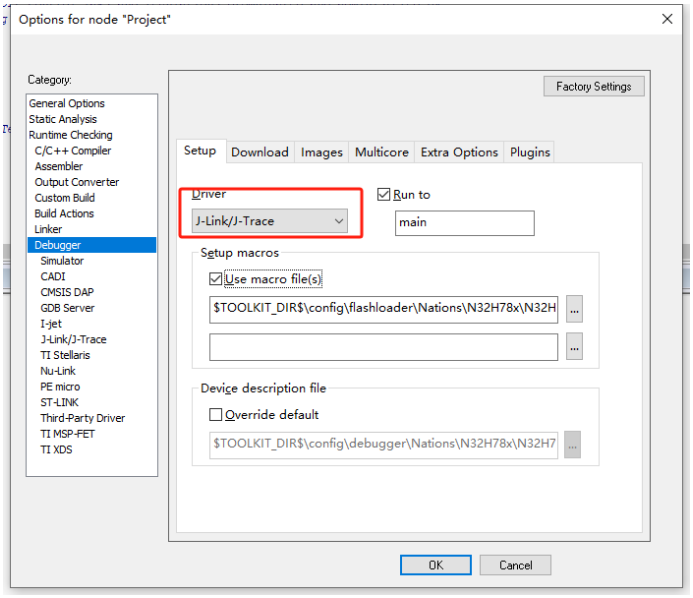
Figure 1-13 Selecting J-Link in Debugger



- Check Restore software breakpoint at _call_main in Project → Options → J-Link/J-Trace → Breakpoints

1.2.2 Download and Debugging

For J-Link download and debugging, two IAR windows need to be opened. The debugging steps are as follows:

1. Open the M7 project code and select the M7 Configuration; then open the M4 project code and select the M4 Configuration. Compile and download the code to the chip for each core respectively.
2. Click the debug button for the M7 project code, and let the code run to the line below RCC_EnableCM4(0x15080000) to ensure that the M4 core has been correctly released and is running;
3. Then start the debug session for the CM4 project—the CM4 core will automatically reset and execute to the main() function;

Notes:

Debugging of the CM4 core can only be started after it is released by the CM7 code.

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2 Keil MDK-ARM Environment

As mentioned above, the N32H78x microcontroller integrates a multicore system that includes the Arm® Cortex®-M7 and Cortex®-M4 processors mentioned in the introduction.

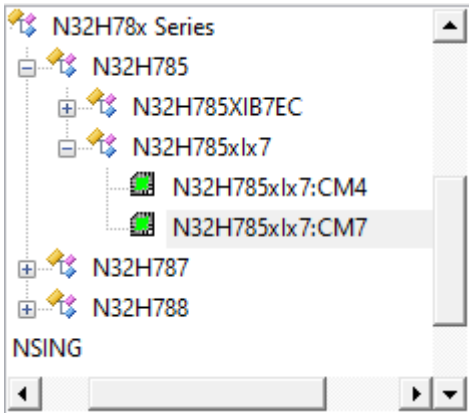
2.1 Using CMSIS-DAP

The following example creates a project and adds separate configurations for the two cores respectively.

2.1.1 CM7 Project Cofiguration

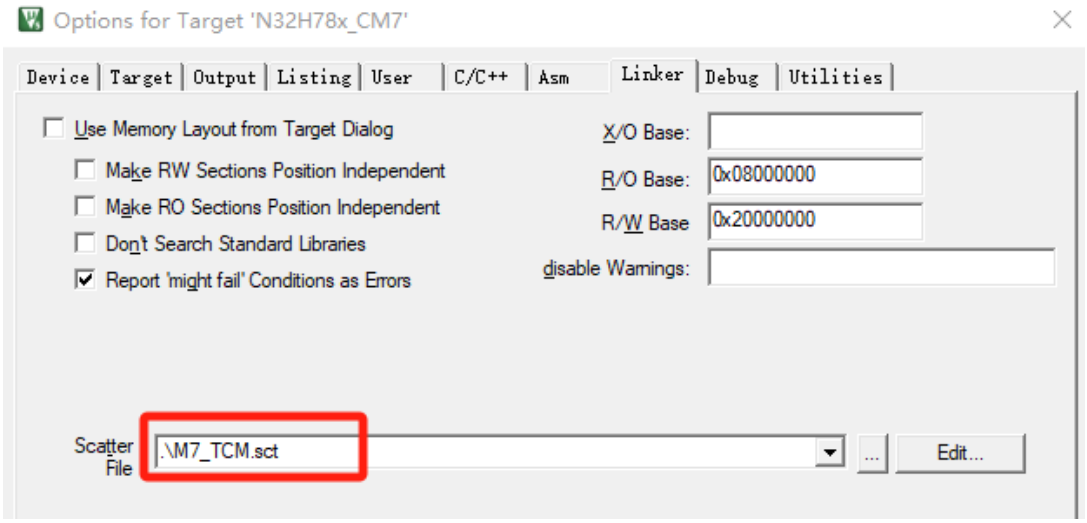
- Open the Keil project and create a new project;
- Configure the project - Select M7 device: Project → Options for Target → Device

Figure 2-1 Selecting M7 Device



- Configure the project - Select scatter loading: Project → Options for Target → Linker.

Figure 2-2 Selecting Scatter Loading File



- Configure the project - Select CMSIS-DAP debugger: Project → Options for Target → Debug.

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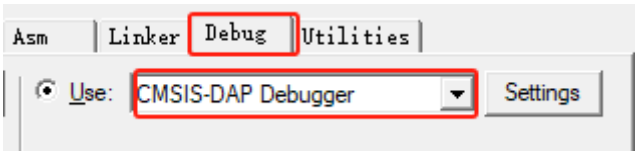
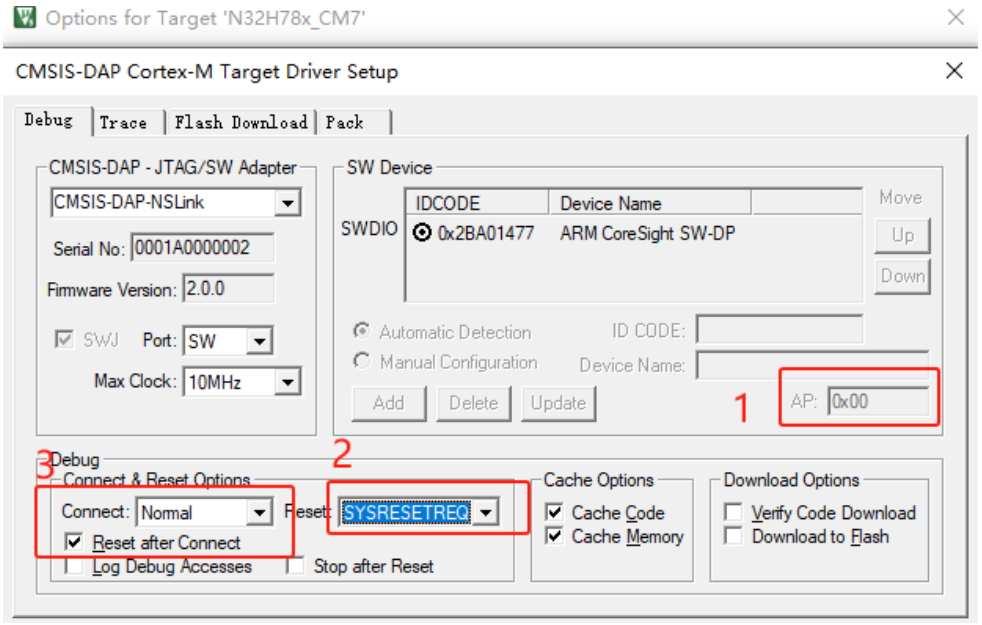
Figure 2-3 Selecting Debugger



- Configure the project - Debug Settings.

Figure 2-4 Debugger Setting



1. Select the Access Ports: set AP0 to CM7 and AP2 to CM4;
2. Select the same download options as those in the window;

- Auto Detect: The system selects the most appropriate reset mode for the target device.
- Hardware Reset: Executes a hardware reset by triggering the hardware reset signal.
- System Reset Request: Executes a software reset by setting the SYSRESETREQ bit. The Cortex-Mx core and on-chip peripherals will be reset.
- Vector Reset: Executes a software reset by setting the VECTRESET bit. Only the core will be reset.

3. Select the Connection and Reset options:

- Normal: Stops the CPU at the currently executing instruction after connection.
- Pre-reset: Executes a hardware reset before connecting to the device.
- Under Reset: Keeps the hardware reset signal active when connecting to the device.

- Configure the project - Flash Download Settings.

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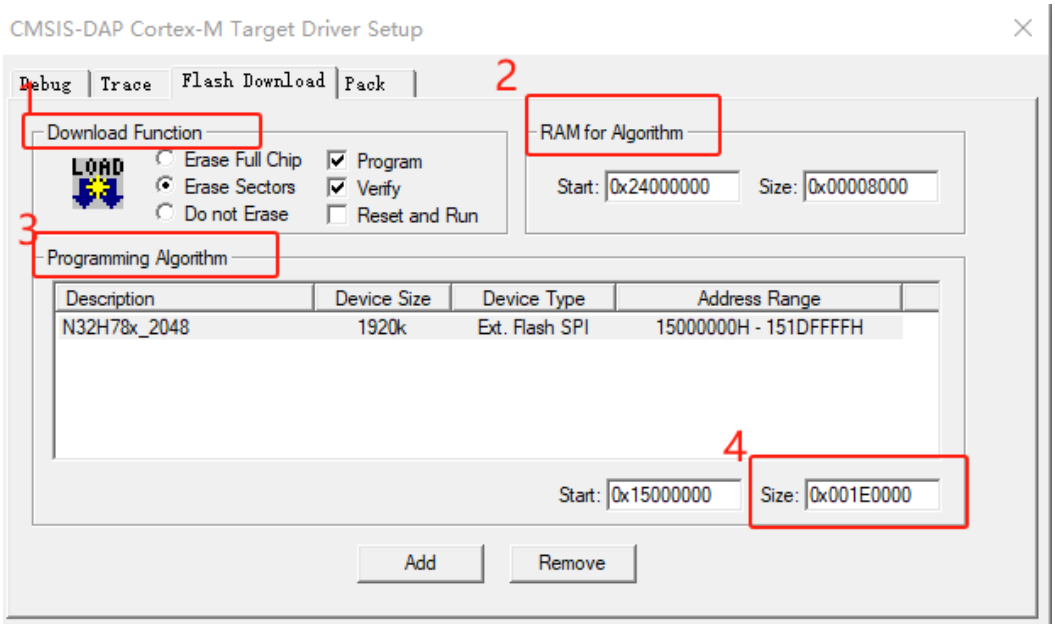
Figure 2-5 Flash Download

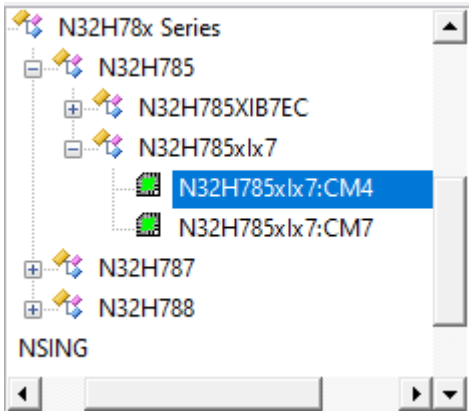


1. Download Function:
2. RAM for Download Algorithm: Defines the address space used to load and execute the programming algorithm. Typically, this address space is located in on-chip RAM;
3. Programming Algorithm: Included download algorithms
4. Note: This address is the maximum available address of the flash. The FLASH usage plan of the N32H78x chip can be configured according to your actual usage. For example:CM7 occupies the address range: 0x15000000 - 0x15080000, CM4 occupies the address range: 0x15080000 – 0x151E0000.

2.1.2 CM4 Project Configuration

- Open the Keil project and create a new project;
- Configure the project - Select M4 device: Project → Options for Target → Device

Figure 2-6 Selecting M4 Device



- Configure the project - Select scatter loading: Project → Options for Target → Linker.

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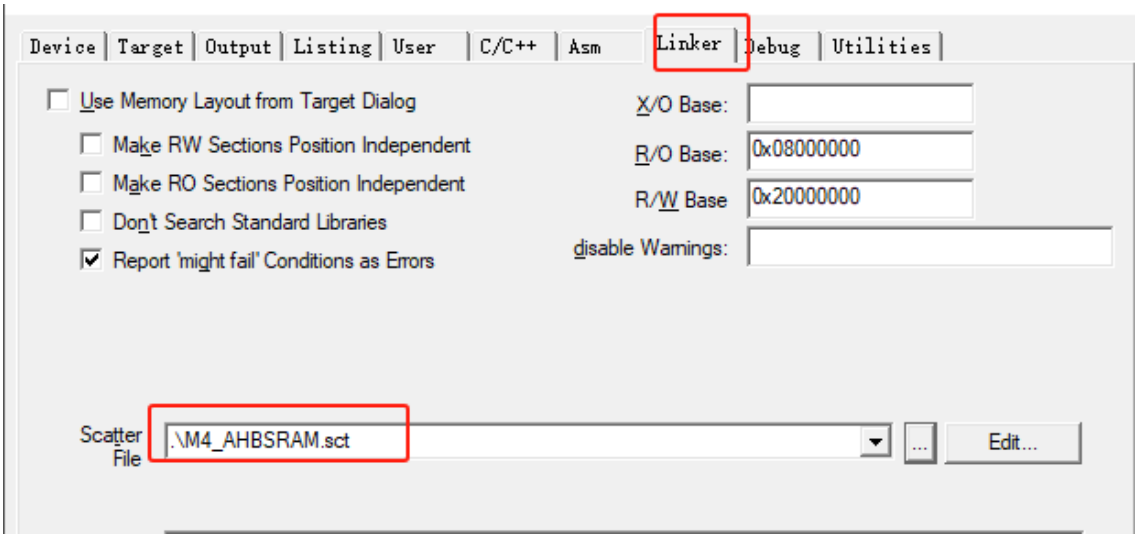
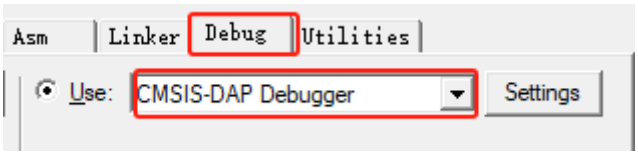
Figure 2-7 Selecting Scatter Loading File



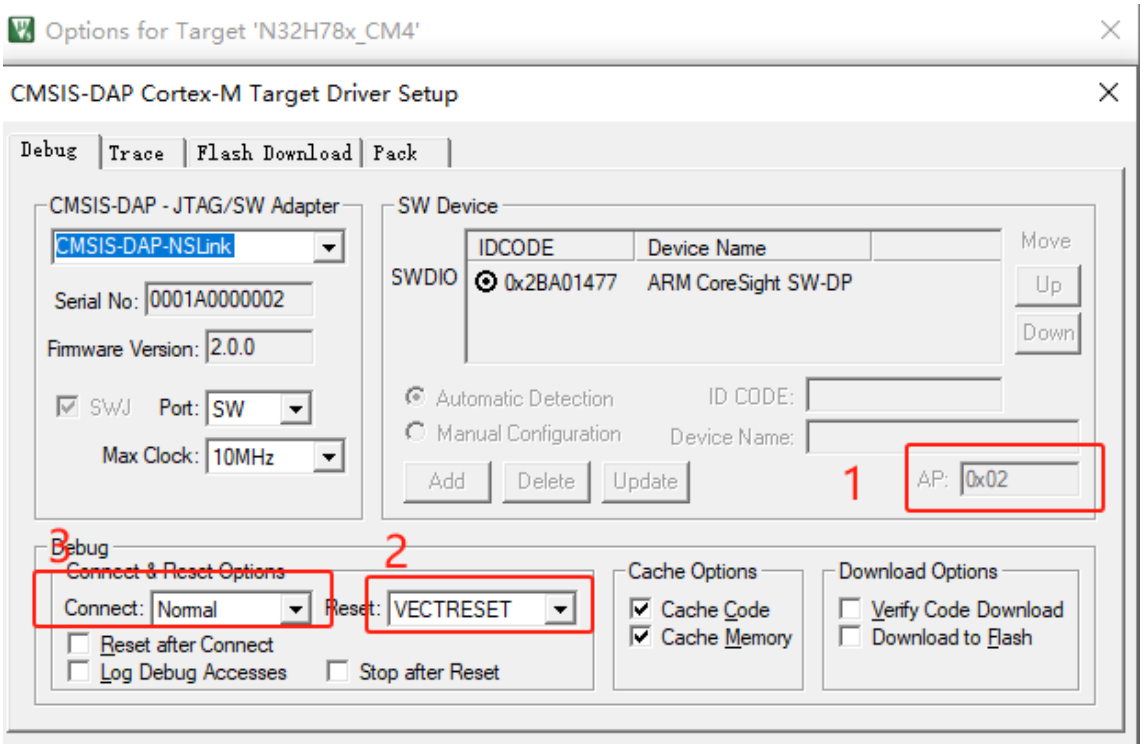
- Configure the project - Select CMSIS-DAP debugger: Project → Options for Target → Debug.

Figure 2-8 Selecting Debugger



- Configure the project - Debug Settings.

Figure 2-9 Debug Setting



1. Select the Access Port: set AP2 to CM4;
2. Select the same download options as those in the window; Note: Select VECTRESET for M4.

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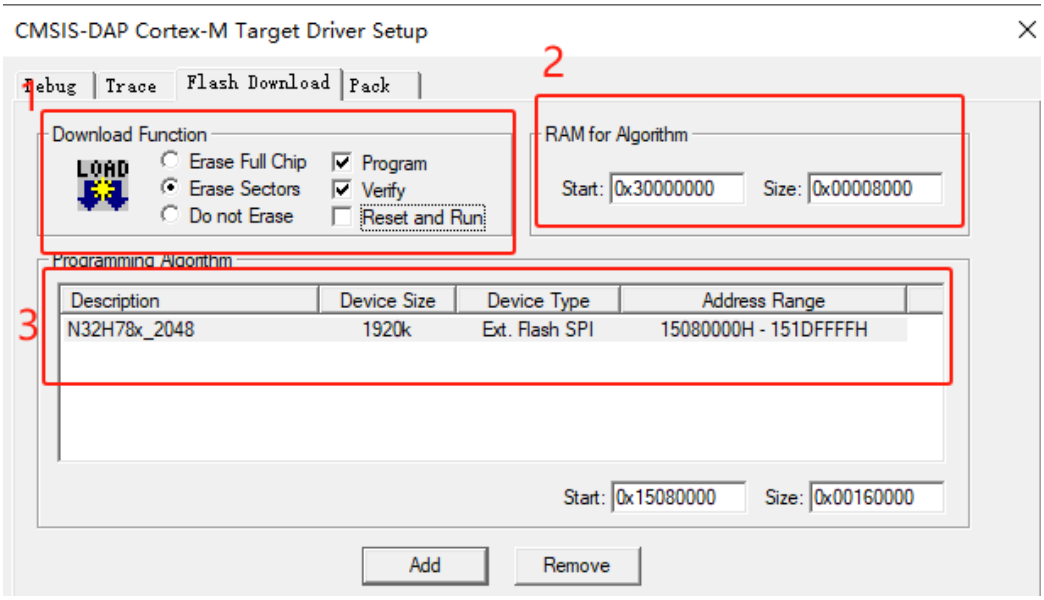
3. Select the Connection and Reset options:

- Configure the project - Flash Download Settings.

Figure 2-10 Flash Download



2.2 Download and Debugging

For CMSIS-DAP download and debugging, two Keil windows need to be opened. The debugging steps are as follows:

1. Open the M7 project code and select the M7 Configuration; then open the M4 project code and select the M4 Configuration. Compile and download the code to the chip for each core respectively.
2. Click the debug button for the M7 project code, and let the code run to the line below RCC_EnableCM4(0x15080000) to ensure that the M4 core has been correctly released and is running;
3. Then start the debug session for the CM4 project, reset the CM4 core to the first line of code, and then step through the code to the main() function;

Notes:

After the CM4 core is reset, it can only be debugged step-by-step to the main() function. If a software breakpoint is set inside the main() function, it will not take effect. This issue is caused by Keil MDK534 failing to update the breakpoint address.

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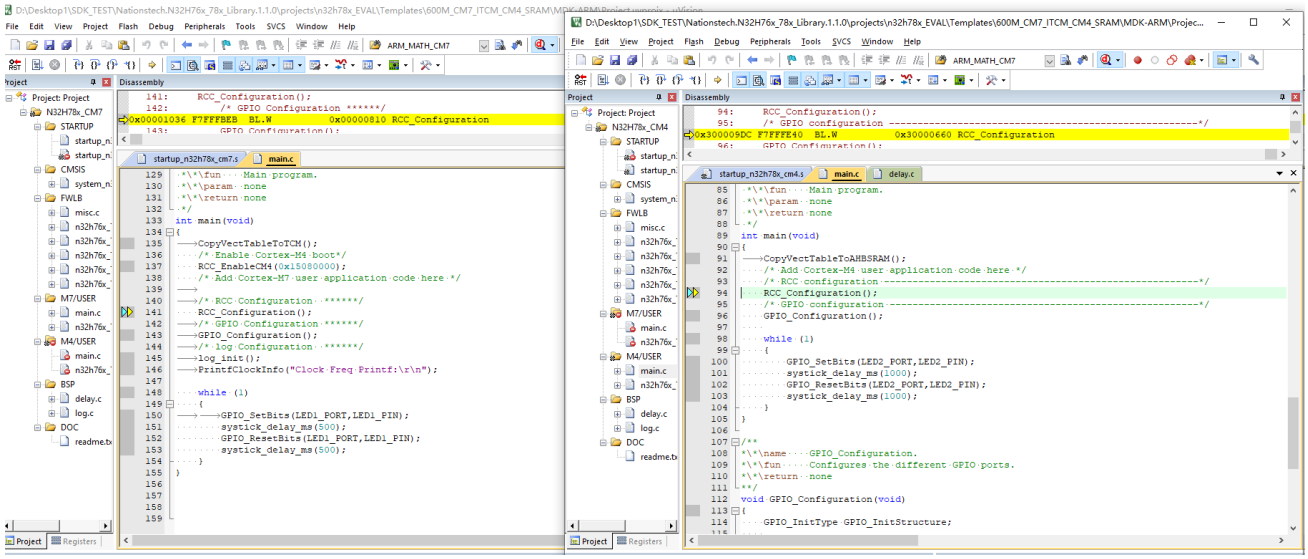
Figure 2-11 keil Dual-Core Debugging Interface



Notes:

1. *The CM4 core can only start debugging after being released by the CM7 code;*
2. *A system reset of the CM7 core will cause the CM4 core (which is in the debug interface) to disconnect from the debug session;*

2.3 Using J-Link

For J-Link, Keil does not support dual-core synchronous debugging. You need to open two Keil windows: one window selects the M7 Configuration, and the other selects the M4 Configuration.

2.3.1 J-Link Environment Configuration

1. Install the J-Link driver, and add Nations chips according to the document Process for Adding Nations Chips to JLink Tools.
2. For J-Link versions V7.7 and above, no special addition is required during installation—it can be used directly after installation.
3. For J-Link versions below V7.7, need to add the JLinkDevices.ref file to the directory: .\Keil_v5\ARM\Segger. In this file, simply specify the installation path of J-Link, for example: "C:\Program Files\SEGGER\JLink\".

2.3.2 CM7 and CM4 Project Configuration

Based on the project created in the above Keil CMSIS-DAP process, both M4 and M7 Configurations need to select J-Link/J-Trace Cortex in Project → Options for Target → Debug.

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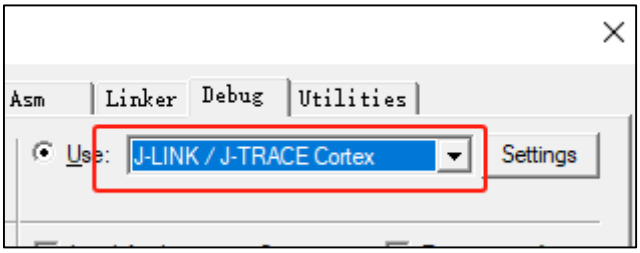
Figure 2-12 Selecting Debugger



The reset executed during J-Link download is not related to the reset mode selected in Options → J-Link/J-Trace → Settings — it only executes the reset process defined in the script file:\C:\Program Files\SEGGER\JLink\Devices\Nationstech\N32H78x_CM7.jlinkscript.

2.3.3 Download and Debugging

The steps are identical to those of CMSIS-DAP under Keil; for details, refer to Section 2.2 Download and Debugging.

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3 Notes on Debugging Issues

3.1 Summary of Common Issues

If users encounter failure to download or enter debugging, the following two solutions are available:

1. Power cycle the chip (power off and then power on again).
2. If the above solution does not resolve the issue, use the Nations host computer to pull up the BOOT pin, erase the user code, and then power on the chip again.

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4 History versions

Version	Date	Notes
V1.0.0	2025-7-10	Initial version

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