User Manual

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G32R5xx Keil Debug Tool User Manual

Version: V1.2

1 Introduction

Due to the chip characteristics of the G32R5xx series MCU, certain debug data streams must be configured before debug. For example, it is necessary to set the BOOT address and DCSM configuration. “keil_dbg_tool” automates these setting processes and ensures correct configuration of the debug environment.

Note: G32R501 projects use “r501_dbg.ini”; G32R502 projects use “r502_dbg.ini”. If a G32R502 example MDK directory is missing the ini, copy “utilities/keil_dbg_tool/r502_dbg.ini.template” to “<example>/project/MDK/r502_dbg.ini”. The current SDK does **not** ship “r501_dbg.ini.template”; G32R501 examples usually already include “r501_dbg.ini”. Then reference “.\r501_dbg.ini” or “.\r502_dbg.ini” under Options for Target → Debug → Initialization File. Device selection and the ini file name must match the target MCU.

Read this instruction document before using the “keil_dbg_tool”.

Operating environment of the tool:

- Windows 10/11

For daily use, the delivered “keil_dbg_tool.exe” under “utilities/keil_dbg_tool/” is sufficient; a separate Python install is **not** required. A local Python 3.11 environment is needed only when running the tool from source.

Contents

2 About Tool

The keil_dbg_tool tool provides a command line interface for users. Its main function is to automatically modify the debugging initialization scripts (INI file) in MDK-ARM by parsing AXF (ELF) files and INI setting files. These INI files set the key stack pointer (SP) and program counters (PC), in addition to BOOT configuration and DCS key configuration.

keil_dbg_tool is responsible for parsing the stack pointer (SP) and program counter (PC) in AXF files, and modifying the content of the target INI files accordingly. This tool can automate and simplify the environment configuration process during debug, especially suitable for complex G32R5xx series MCU.

3 Supported Commands

The following are the command line parameters supported by keil_dbg_tool and the corresponding descriptions:

```
keil_dbg_tool -a <axf(elf) file path> [-r] -d <output debug file path> [-v]
```

- -a <axf file path>: The path of the AXF (ELF) file.
- -d <parsed debug file path>: The path of the parsed debug INI file.
- -r: (Optional) During debugging, each reset will skip the boot code and directly set the SP and PC of the current firmware.
- -v: Display the version and the build date.
- -h: Display the help information.

4 Use Examples

Parse AXF files and configure debug INI files:

```
keil_dbg_tool -a project.axf -d project_dbg.ini
```

Display the version and the build date:

```
keil_dbg_tool -v
```

5 INI File Examples

The basic content of the INI file used for debug sequences is as follows:

```
FUNC void DCS_KEY_Setup()
{
// DCS Zone1 CSM
_WDWORD(0x50024020, DCS_ZONE1_CSM0);
_WDWORD(0x50024024, DCS_ZONE1_CSM1);
_WDWORD(0x50024028, DCS_ZONE1_CSM2);
_WDWORD(0x5002402C, DCS_ZONE1_CSM3);
// DCS Zone2 CSM
_WDWORD(0x500240A0, DCS_ZONE2_CSM0);
_WDWORD(0x500240A4, DCS_ZONE2_CSM1);
_WDWORD(0x500240A8, DCS_ZONE2_CSM2);
_WDWORD(0x500240AC, DCS_ZONE2_CSM3);
}
FUNC void Set_SP_PC_Setup(void)
{
SP= 0x20004000;
PC= 0x000009F0;
xPSR |= (1 << 24);
}
FUNC void Setup(void) {
Init_CPU();
Set_SP_PC_Setup();
}
FUNC void OnResetExec (void) {   // Executes upon software RESET
DCS_KEY_Setup();
Setup();                     // Setup for running
}
DCS_KEY_Setup();
LOAD %L INCREMENTAL
Setup();
//g, main
```

The DCS_KEY_Setup function is used to set the key for DCS (Device Configuration and Security Module). Safe zones for DCS protection and configuration devices:

- Zone1 and Zone2: G32R5xx MCU usually has two DCS zones. Each zone has its own key configuration.

- Key setting: Codes such as “_WDWORD(0x50024020, 0xFFFFFFFF);” write key values to specific DCS registers. The register addresses and key values are defined by the chip manuals. The values “0xFFFFFFFF” and “0xFFFFFFDC” in the example are specific key values.

6 How to Use

To use keil_dbg_tool in MDK-ARM, add a custom post-build step. The following is an example of how to modify INI files after a project is built.

6.1 Add Custom Post-build Steps

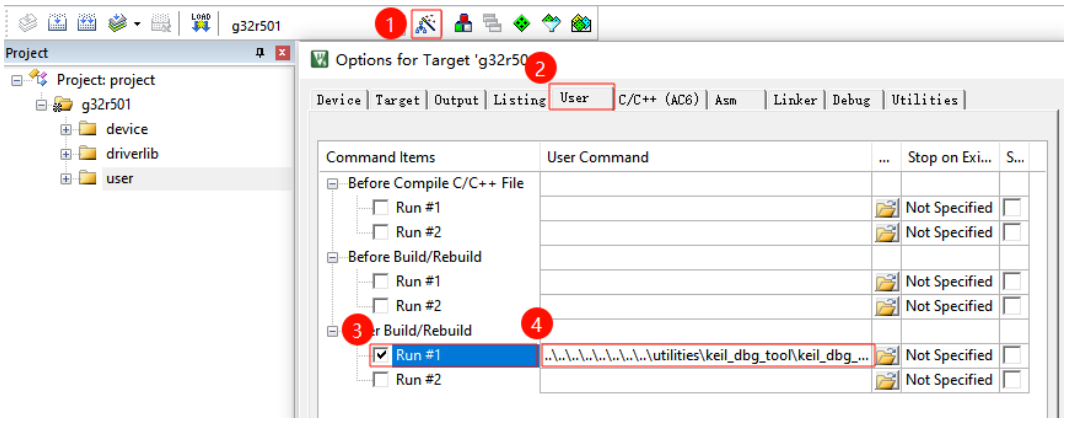
Add the custom post-build steps in MDK as follows:

1. Place “keil_dbg_tool.exe” in a known location in the project directory structure (for example, the “utilities\” directory).
2. Open the MDK project.
3. Enter the project settings window: Click “Project” in the menu bar or select “Options for Target” from the toolbar.
4. Select the “User” tab.
5. Add custom post-build steps: Locate “After Build/Rebuild”, select “Run #1” or “Run #2”, and enter the corresponding command.
6. Save configuration: Click “OK”.

The UI for adding a custom post-build step is as shown in Figure 1.

Note: The following UI uses a G32R501 example (target name commonly “g32r501”) as reference. When developing G32R502, select the matching G32R502 device in Device / Target, replace “g32r501” with “g32r502” in paths, and use “r502_dbg.ini” as the MDK debug initialization file.

Figure 1 How to Add Custom Post-build Steps



One of the following conditions must be met when using the tool:

- The path should not contain any spaces.
- If the path contains spaces, enclose the path in English double quotation marks (").

Examples of incorrect and correct paths are as follows:

- Incorrect path:

```
fromelf --bin --output $Loutput.bin
#L ..\..\..\..\..\..\..\..\utilities\keil_dbg_tool\keil_dbg_tool -r -a #L -d .\r501_dbg.ini
```

- Correct path:

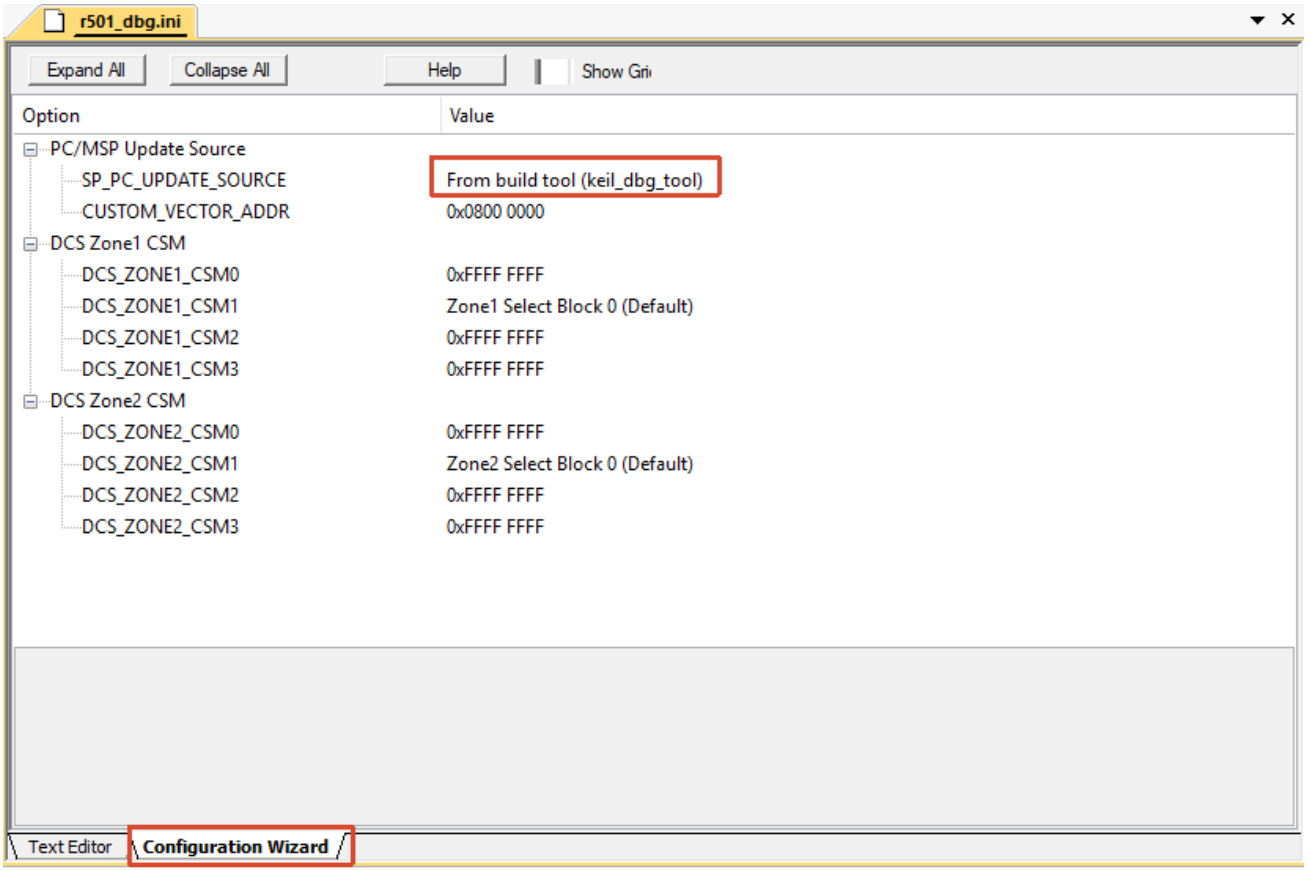
```
fromelf --bin --output "$Loutput.bin"
"#L" ..\..\..\..\..\..\..\..\utilities\keil_dbg_tool\keil_dbg_tool -r -a "#L" -d .\r501_dbg.ini
```

Note: The number of "..\" levels depends on example depth: single-core ".../project/MDK" to the SDK root is commonly 8 levels; dual-core ".../cpu0|cpu1/project/MDK" is commonly 9 levels. Use a path that resolves to "utilities/keil_dbg_tool". For G32R502 projects, change "-d" to ".\r502_dbg.ini".

7 Configuration Wizard

"r502_dbg.ini" (and template "r502_dbg.ini.template") supports the Keil **Configuration Wizard**. Open the ini in µVision, then switch to the **Configuration Wizard** tab at the bottom of the editor to configure debug parameters graphically. The UI is shown in Figure 2 (screenshot uses "r501_dbg.ini" as an example; "r502_dbg.ini" works the same way).

Figure 2 Configuration Wizard Settings UI



7.1 PC/MSP Update Source

The key item is "SP_PC_UPDATE_SOURCE":

- **0 (From build tool):** After each build, "keil_dbg_tool" writes SP/PC back into the ini from the firmware vector table. This is the recommended default for evaluation-board examples.
- **1 (Custom vector address):** The Debugger reads the vector table from "CUSTOM_VECTOR_ADDR" (offset 0 = MSP, offset 4 = PC). Typical values: CBUS Flash "0x08000000", ITCM RAM "0x00000000" (choose by device and linker script).

When you need a fixed vector base for PC/MSP, or do not want the tool to overwrite SP/PC in the ini on every build, set "SP_PC_UPDATE_SOURCE" to 1 and set "CUSTOM_VECTOR_ADDR" correctly.

DCS Zone1/Zone2 CSM and related key items can also be edited in the Wizard; they must

match the actual device keys.

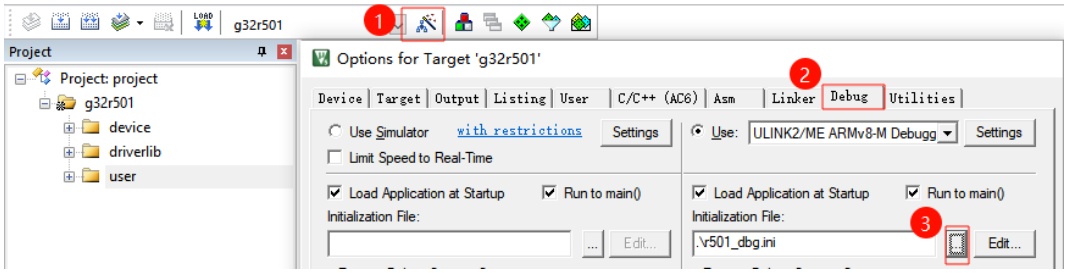
7.2 Debug Script Selection

After the corresponding debug script is modified, configure the project so that MDK runs the script during debug:

1. Open the MDK project.
2. Enter Options for Target.
3. Select the “Debug” tab.
4. Add the debugging script: use “…” and select the matching “.ini” file.
5. Save configuration: Click “OK”.

Debug script selection is shown in Figure 3.

Figure 3 Selecting Debug Scripts



8 Revision

Table 1 Document revision

Date	Version	Description
2025.1	1.0	● Initial release
2025.4	1.1	● In “Add Custom Post-build Steps”, note that paths with spaces require double quotes
2026.8	1.2	● Applicable products listed as G32R501 and G32R502 ● Added “r502_dbg.ini” and G32R502 project configuration notes ● Added “r502_dbg.ini” Configuration Wizard and “SP_PC_UPDATE_SOURCE” description ● Corrected r501 template path wording

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