

# Nuvoton Nu-Link Debug Adapter User Manual

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### 1 Introduction

*Nuvoton's* Nu-Link Debug Adapter is an USB debugger and programmer based on the SWD (Serial Wire Debug) signal interface and can be applied to the development of Nuvoton NuMicro<sup>™</sup> Family chips. As shown in Table 2-1, there are three types of the Nu-Link Debug Adapter in accordance with different specifications, including Nu-Link-Pro, Nu-Link, and Nu-Link-Me. The three types are called "Nu-Link Adapter" in general if no specific conditions are mentioned.

The Nu-Link Adapter supports ICP (In-Circuit Programming) based on the SWD (Serial Wire Debug) signal interface. The user can employ the NuMicro™ ICP Programming Tool to update chip firmware for mass production. The Nu-Link Adapter also supports the third-party development tools, such as Keil RVMDK, IAR EWARM, and CooCox CoIDE.

For simplicity and clarity, parts of specific terms in this user manual are contracted or abbreviated, as listed in the following table.

Short Name	Full Name
Nu-Link Adapter	Nuvoton Nu-Link Debug Adapter
NuMicro™ Family	Nuvoton NuMicro™ Family
ICP Tool	Nuvoton NuMicro™ ICP Programming Tool
Keil RVMDK	Keil ARM RealView Microcontroller Development Kit (MDK-ARM®)
IAR EWARM	IAR Embedded Workbench for ARM
CooCox CoIDE	CooCox Integrated Development Environment
SWD	Serial Wire Debug
ICP	In-Circuit Programming

### 2 Hardware Specifications

The Nu-Link Adapter provides an USB connector and a SWD signal interface for connecting to the target chip. The user can connect the Nu-Link Adapter to an USB port of a PC to debug and program target chips through the development software tools. As shown in Table 2-1, there are three specifications for the Nu-Link Adapter, in which debugging, Online/Offline Programming, and SWD I/O voltage settings may be supported depending on the specifications (refer to the +Appendix for details).

Type Function	Nu-Link-Pro	Nu-Link	Nu-Link-Me
Debugging	V	V	S D Y
Online Programming	V	V	220
Offline Programming	~	V	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Multi SWD I/O Voltage	~		S.S.
SWD I/O Voltage Support	1.8V, 2.5V, 3.3V, 5.0V	5.0V	3.3V (default), 5.0V (3.3V for On-board version only)

Table 2-1	Nu-Link	Adapter	Function	Comparison
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### 2.1 Nu-Link-Pro

The Nu-Link-Pro is a full-functional debugger and programmer with debugging, online/offline programming, and SWD I/O voltage setting functions. As shown in Figure 2-1, the Nu-Link-Pro includes an USB port that can be connected to a computer host, a set of Status LEDs, an offline programming button, a SWD port that can be connected to a target chip for debugging and programming (the voltage level of the SWD port can be adjusted through software as 1.8V, 2.5V, 3.3V, or 5.0V), a set of SWD I/O voltage LEDs and SWD Power Output LEDs.



### 2.2 Nu-Link

The Nu-Link is a basic debugger and programmer with debugging and online/offline programming functions. As shown in Figure 2-2, the Nu-Link includes an USB port that can be connected to a computer host, a set of Status LEDs, an offline programming button, and a SWD port that can be connected to a target chip for debugging and programming (the default voltage of the SWD port as 5.0V).



Figure 2-2 Nu-Link Configuration

### 2.3 Nu-Link-Me

The Nu-Link-Me is a simple debugger and programmer with debugging and online programming functions, which is only shipped with the NuTiny-SDK kits and can be used stand-alone for developing the customized NuMicro<sup>™</sup> Family system. As shown in Figure 2-3, the Nu-Link-Me includes an USB port that can be connected to a computer host, a set of Status LEDs, a Power Switch to switch the voltage of Nu-Link-Me between 3.3V and 5.0V (the default as 3.3V), a SWD port that can be connected to a target chip for debugging and programming (whose voltage is adjustable with the Nu-Link-Me). A Cortex Debug port is provided in parts of the version only for connecting to Keil's MCBNUC1XX board. The pins of the Cortex Debug port conform to those of the SWD port, except the pin order.



Figure 2-3 Nu-Link-Me Configuration

### 2.4 Nu-Link-Me (On-board Version)

The main functions of the Nu-Link-Me on-board version, including debugging and online programming, are the same as those of the Nu-Link-Me. The Nu-Link-Me on-board version is provided with all NuMicro<sup>™</sup> Family series. The user does not need to prepare s debugger when using a learning board. The Nu-Link-Me on-board version includes an USB port that can be connected to a computer host, a set of Status LEDs, and a SWD port connected to the chip on the learning board (default) for debugging and programming (external connection is not supported). The SWD port voltage is always 3.3V.

The learning boards that support the Nu-Link-Me on-board version are listed below:

- Nu-LB-NUC140
- Nu-LB-M051
- Nu-LB-Mini51

### 2.5 Nu-Link Adapter Hardware Specifications

The Nu-Link Adapter hardware comparison is shown in Table 2-2.

Device	Description	Nu-Link-Pro	Nu-Link	Nu-Link-Me	Nu-Link-Me on-board ver.
USB	Connected to an USB port of a PC to use the Nu-Link Adapter or download offline programming firmware	~	~	~	~
SWD	Connected to the target chip for debugging and programming	~	~	~	
Status LED	Display the operation status of the Nu- Link Adapter	~	~	~	~
Offline Programming Button	Click this button to proceed with offline programming	~	~		
SWD Power Output LED	Display the power output status of SWD VCC pins	~			
SWD I/O Voltage LED	Display the SWD VCC and I/O voltage	~			
Power Switch	Power switch between the power output of the Nu-Link-Me power (e.g. between the SWD VCC and I/O pins)			<b>√</b> * <sup>1</sup>	
Cortex Debug	Able to connect to Keil's MCBNUC1XX board for debugging and programming			<b>✓</b> * <sup>1</sup>	

Table 2-2 Nu-Link Adapter Hardware Comparison

\*<sup>1</sup>Only supported in parts of the version.

Power Status	Target Syste	SWD Powe	SWI	D I/O V	oltage	LED
	em Power	r Output )	1.8V	2.5V	3.3V	5.0V
SWD port I/O and VCC voltage as 1.8V	-	On	On	SD	N.	25
SWD port I/O and VCC voltage as 2.5V	-	On	On	On	S.	15
SWD port I/O and VCC voltage as 3.3V	-	On	On	On	On	00
SWD port I/O and VCC voltage as 5.0V	-	On	On	On	On	On
SWD port I/O voltage as 1.8V	✔(1.8V)	-	On	-	-	Q
SWD port I/O voltage as 2.5V	✔(2.5V)	-	On	On	-	-
SWD port I/O voltage as 3.3V	✔(3.3V)	-	On	On	On	-
SWD port I/O voltage as 5.0V	✔(5.0V)	-	On	On	On	On

Table 2-3 SWD I/O Voltage LEDs and SWD Power Output LEDs Status List

### Table 2-4 Status LEDs Difference List

Nu Link Adapter Operation Status		Statu	s LED	
	ICE	ICP	Red	Green
Boot	Flash×3	Flash×3	Flash×3	Flash×3
One Nu-Link Adapter selected to connect	Flash×4	Flash×4	Flash×4	On
ICE Online (Not connected with a target chip)	On	Any	-	-
ICE Online (Connected with a target chip)	On	Any	-	On
ICE Online (Failed to connect with a target chip)	On	Any	Flash	On
During Offline Programming	-	On	-	Flash Slowly
Offline Programming Completed	On	-	-	-
Offline Programming Completed (Auto mode)	On	On	-	-
Offline Programming Failed	On	Flash	-	-

### 3 Main Functions

The Nu-Link Adapter provides complete debugging and programming functions for NuMicro<sup>™</sup> Family and supports a number of third-party development tools. The detailed function support is listed in Table 3-1.

Software	ICP Tool	Keil	IAR	CooCox
Function		RVMDK	EWARIN	COIDE
Debugging		~	~	~
Breakpoints		~	~~~	~
Direct Register Control Interface		~	20	✓ *1
Semihost		~	14	200
Online Programming	~	~	~	~
Offline Programming* <sup>2</sup>	~			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Software Serial Number	~			N
Wide Voltage Programming*3	~	~	~	
Multi Nu-Link Adapter Support	~	~	~	
Nu-Link Adapter Driver Installation		~	~	

\*<sup>1</sup> Core registers view is supported; peripherals view is not supported.

\*<sup>2</sup> Supported for Nu-Link and Nu-Link-Pro.

\*<sup>3</sup> Supported for Nu-Link-Pro.

### 3.1 Debugging

This section briefly describes the debugging function supported by the Nu-Link Adapter. For more details, please refer to the related user manuals.

#### 3.1.1 Debug Mode

The Nu-Link Adapter supports debugging for the NuMicro<sup>™</sup> Family chips based on the SWD signal interface. The third-party tools that support using the Nu-Link Adapter for chip debugging include Keil RVMDK, IAR EWARM, and CooCox CoIDE. Some more functions supported in Debug mode are described as follows.

#### 3.1.2 Breakpoints

In Debug mode, the user can add breakpoints in the code for debugging. During the real-time simulation of the Nu-Link Adapter, the chip simulation will be stopped at a specific breakpoint. Figure 3-1 shows the breakpoint settings in Keil RVMDK Debug mode. The red labels on lines 052 and 059 indicate the breakpoints inserted; the yellow arrow refers to the code to be executed next and shows the register value of Program Counter (PC) (i.e. "**R15(PC)=0x00000D04**" in the **Registers** pane in Figure 3-1).



Figure 3-1 Setting Breakpoints in Keil RVMDK Debug Mode

### 3.1.3 Direct Register Control Interface

The Direct Register Control Interface can be used to display the register content in a target chip and manipulate the registers. Take Keil RVMDK Debug mode for example, invoke the **Debug** command and select a register from the "function register list" (e.g. ADC, CAN, CLK, etc.) to open the Direct Register Control Interface of the selected register, as shown in Figure 3-2.

e Edit View Project Flash Debug	Pe GCR	SVC	CS Window Help					
Status Bar Toolbars	SCS INT ✓ CLK		》	- 🔒 🌾 🔍 🧕	े 🔗 🍓 🔳 🔧			
isters gidet gidet Grown	ACM ADC CAN FMC GPIC I2S PPUM PS2 PVM RTC SC SPI UAR VUD VUD SPI_FIL SPI_FIL MID 6	<pre>P p , is int , ain.c old , ain.c old</pre>	t temp; MidDid; .h"			CLK Property Property Property Property APBCLK APBCLK CLKSEL0 CLKSEL0 CLKSEL1 CLKSEL1 CLKSEL2 CLKSEL2 CLKSEL2 CLKSEL3 CLKKSEL3 CLKKSEL3 CLKSEL3 CLKSEL3 CLKSEL	Value           0x000001E           0x0000005           0x0000001A           0x0000001A           0x0000001A           0x0000001A           0x0000001A           0x0000001A           0x0000001A           0x0000001A           0x00000000000000000000000000000000000	
mmand				Call Stack + Locals				ņ
* Currently used: 7500 Bytes	(22%)			^ Name	Location/Value	Туре		
m			•	main	0x00001A68	int f() auto - int		



The Direct Register Control Interface for CLK is shown in the left part of Figure 3-3, where the left column shows the register name, and the right column shows the register value. The Direct Register Control Interface for PWRCON is shown in the right part of the Figure 3-3, where the left column shows the function name, and the right column shows the function value.

### **Detailed Operation:**

Double-clicking a "register value" will open the register control details, as shown in the right part of Figure 3-3.

The "register value" or "control value" can be modified directly. The Nu-Link Adapter will then modify the content of the target chip.

CLK	* 🛛	CLK		
Property	Value	Property	Value	
PWRCON AHBCLK APBCLK CLKSTATUS CLKSEL0 CLKSEL1 CLKDIV	0x0000001E 0x00000005 0x00000001 0x0000001A 0x0000003F 0xFFFFFNF 0	■ PWRCON	0x0000001E 0: 0 = External 4~24 MHz high speed crystal oscillator (HXT) Disabled 1: 1 = External 32.768 kHz low speed crystal oscillator (LXT) Enabled (Normal operation) 1: 1 = Internal 22.1184 MHz high speed oscillator (HIRC) Enabled 1: 1 = Internal 10 kHz low speed oscillator (LIRC) Enabled 1: 1 = Clock cycles delay Enabled 0: 0 = Dirichlard	
← CLKSEL2     ← PLLCON     FRODIV	0x000200FF 0x0005C22E	PWR_DOWN_EN	O = Obsolution     Obsolution     O = Obsolution     Obso	•
HAUDIV     APBCLK1     -CLKSEL3     PWRCON     [Bits 310] RW (@ 0x5000	0 0x0000003F 00200) System Power-down Control Register	XTL12M_EN [Bit 0] RW (@ 0x5000020 External 4~24 MHz High The bit default value is s source is from external 4 Note: This bit is the prot to disable register protect	0) Speed Crystal Enable (HXT) Control (Write Protect) et by flash controller user configuration register CONFIG0 [26:24]. When the default clock ~24 MHz high speed crystal, this bit is set to 1 automatically. ected bit, and programming it needs to write '59h', '16h', and '88h' to address 0x5000_010( tion. Refer to the register REGWRPROT at address GCR_BA+0x100.	D
	Figure 3-3 Direct Register	Control Interf	ace in Keil BVMDK Debug Mode	



#### Semihost 3.1.4

When using the Semihost function, the message of the NuMicro<sup>™</sup> Family microcontroller can be output through UART to the debug window by the Nu-Link Adapter. That is, the message is output without the GPIO. Figure 3-4 shows the debug messages in the "UART #1" form, which are the messages output by the Nu-Link Adapter.

Follow the steps below to use the Semihost.

Step 1: Modify the strings in the "retarget.c" as follows.

#define DEBUG_ENABLE_SEMIHOST	// Add this line
#if defined(DEBUG_ENABLE_SEMIHOS	Τ)
/* The static buffer is used to speed up th	e semihost */
static char g_buf[16];	
static char g_buf_len = 0;	
# if defined(ICCARM)	
	1122

Step 2: Invoke Rebuild to rebuild a project and enter Debug mode.

- Step 3: In Debug mode, invoke View  $\rightarrow$  Serial Windows  $\rightarrow$  UART #1, as shown in Figure 3-4.
- Step 4: Press F5 to program the target chip, and the debug messages are output to the UART #1 form.



Figure 3-4 Semihost Options in Keil Debug Mode

### 3.2 Programming

This section will briefly describe the programming function supported by the Nu-Link Adapter. For more details, please refer to the related user manuals.

#### 3.2.1 Online Programming

Online Programming means that the Nu-Link Adapter can download the firmware of the NuMicro<sup>™</sup> Family single chip to the target chip through software programs, as shown in Figure 3-5.



Figure 3-5 Online Programming Flow Diagram

### 3.2.2 Offline Programming

Offline Programming means that the Nu-Link Adapter can update the firmware of the NuMicro<sup>™</sup> Family single chip directly without accessing software programs (as shown in Figure 3-6). Offline programming is useful for mass production since the original code or firmware file does not need to be delivered and only the Nu-Link Adapter is needed for mass production. In addition, the Nu-Link Adapter supports "Limited Offline Programming," which can effectively control the authorized number of the firmware. For details, please refer to the ICP Tool User Manual.



### 3.2.3 Software Serial Number (SN)

The Software Serial Number (SN) function provided by the ICP Tool enables users to specify the value in the "**Increase SN from**" and "**Write address in flash**" fields for the target chip during online/offline programming. Take the NUC140VE3CN chip for example, the user can specify a set of "Increased Serial Number (SN)" and "Write Address" to any of APROM, LDROM, and Data Flash, and the written Serial Number (SN) will be automatically incremented (as shown in Figure 3-7).



### Figure 3-7 Software Serial Number (SN) Settings

### 3.3 Wide Voltage Programming

The Nu-Link-Pro supports the wide voltage programming function, by which the development software tool can adjust the SWD port voltage as 1.8V, 2.5V, 3.3V, or 5.0V. As shown in Figure 4-2, the pins that can be controlled include VCC, ICE\_DAT, ICE\_CLK, and /RESET.

Also, as shown in Figure 2-1, the Nu-Link-Pro provides a set of SWD I/O Voltage LEDs and SWD Power Output LEDs for checking the SWD port voltage. Refer to Table 2-3 for more details about the LED status,

#### 3.4 Installing the Nu-Link Adapter Driver

The Nu-Link Adapter supports a variety of functions and third-party software tools (e.g. Keil RVMDK and IAR EWARM). After the software programs are installed, the drivers are also required. You can use the following links: <u>Nu-Link Adapter Driver for Keil RVMDK</u> and <u>Nu-Link Adapter Driver for IAR</u> <u>EWARM</u> to install the latest version. For details about software setup, please refer to section 4.2.

### 4 Installation and Setup

This chapter introduces how to connect the Nu-Link Adapter to a computer, and how to set the thirdparty tool to use the Nu-Link Adapter as a debugger and a programmer.

### 4.1 Connecting to the Nu-Link Adapter

As shown in Figure 4-1, the Nu-Link Adapter is a bridge between an USB and the SWD interface, by which software tools can debug and program the target chip through an USB. The user can plug the Nu-Link Adapter into an USB port of a PC directly or connect using the USB connector.

Through a SWD port, the Nu-Link Adapter can supply power (1.8V, 2.5V, 3.3V, or 5.0V) to a target circuit board. The maximum is 5V/500mA. Refer to Table 2-1 for detailed specifications.



Figure 4-1 Nu-Link Adapter Connection Diagram

#### SWD Connector:

The SWD connector, which can be applied to all of the NuMicro<sup>™</sup> development tools and evaluation boards, is a 100 mil (2×5) female header, as shown in the left of Figure 4-2.

### Cortex Debug Connector:

The Cortex Debug connector, which can be applied to Keil's MCBNUC1XX board, is a 50 mil (2×5) male header, as shown in the right of Figure 4-2.



Figure 4-2 SWD and Cortex Debug Connector Pin Diagrams

### 4.2 Software Setup

This section briefly describes required software settings for connecting to the Nu-Link Adapter. For detailed software operation, refer to the related user manuals.

### 4.2.1 ICP Tool

- Step 1: Download and install <u>Nuvoton NuMicro™ ICP Programming Tool</u>.
- Step 2: Open the ICP Tool, specify the **UI language** and **target chip**, and then click **Continue**, as shown in Figure 4-3.

ogramming Tool 1.18	×	
Select UI language: English Select target chip: NUC100 series	•	A PE
Quit	Continue >> Supporting Forum http://www.nuvoton-m0.com	

Figure 4-3 Startup Screen of ICP Tool

Step 3: In the ICP Tool window, the connection status is shown as "Disconnected" since the ICP tool has not been connected with the Nu-Link Adapter, as shown in Figure 4-4.

Status								
Connect	Disconnected	ł						
Part No.								
Load file								
LDROM	File name:	C:\Users\S	LTsai\De	sktop\Firmwa	re\ICE_IS	P.bin		
		File not load	LS					
APROM	File name:	C:\Users\S	LTsai\De	sktop\Firmwa	re\NUC1>	x_ICE_M0	.bin	
		File not load	L					
Data Flash	File name:	C:\Users\S	LTsai\De	sktop\Firmwa	re\NUC1>	x_ICE_M0	_cks.bin	
		File not load	L					
Configurations bits			-					
Setting	Config 0:	0xFFFFFFFF	Confi	g 1: OxFF	FFFFFF	- Selec	t -	
File data		On-board	Flash		Offline F	lash		
File data LDROM APRON	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info
File data	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits
File data LDROM APRON	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits 16 bits
File data LDROM APRON	1   Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits 16 bits 32 bits
File data	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits 16 bits 32 bits
File data	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits 16 bits 32 bits
File data	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash APROM	Data Flash	Info 3 bits 16 bits 32 bits Refresh
File data LDROM APRON	1 Data Flash	On-board	Flash APROM	Data Flash	Offline F	lash	Data Flash	Info 3 bits 16 bits 32 bits Refresh

Figure 4-4 ICP Tool Main Window

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- Step 4: Click **Option** in the **Program** section of the *ICP Tool Window* to open the *Program Option* form, as shown in Figure 4-5.
- Step 5: In the **Nu-Link Pro IO Voltage** section, specify the power voltage of the SWD port for the target chip, and then click **OK**. To use the offline programming function, the Offline Programming mode option needs to be selected, as shown in Figure 4-5.

Operation		
📝 Erase	A	
V Program	100 M	
Verify		
🕅 Write software serial nu	umber	
📝 Reset chip after program	mming	
Offline programming mo	ode	
Software serial number (SN)		
Increase SN from	0x 0AB40000	
Write address in flash	0x 00100010	
Options for offline programmi	ing mode	
Use password for offline	e data	
Enter password		
Repeat password	-	
📝 Limit the number of offlir	ne programming	
Max number	100	
Auto-programming (	Test before use!)	
Nu-Link-Pro 10 Voltage		
Power control is used on Nu power is not detected.	u-Link-Pro, and is valid only if targe	ţ
1.8V	/ 🧿 3.3V 💮 5.0V	

Figure 4-5 ICP Tool Programming Options

- Step 6: Return to the *ICP Tool window*, and then click the **Connect** button. Go to Step 5 if more than two Nu-Link Adapters are connected with the host. Go to Step 6 if only one Nu-Link Adapter is connected with the host.
- Step 7: If two Nu-Link Adapters have been connected with the computer, a message appears and asks to select one from the two adapters. Clicking **OK** will connect the selected adapter with the host, as shown in Figure 4-6. When a Nu-Link Adapter is selected for connection, the Status LED starts blinking. For the blinking details, refer to the Status LED description of the "Select a Nu-Link Adapter to connect with the host" in Table 2-4.

Select one Nu-Link	
ID: 18000021	-
D: 7788624d	TI S

Figure 4-6 Select One Nu-Link Adapter

Step 8a: After the **Connect** button is clicked, the ICP Tool will be connected with the Nu-Link Adapter, and a SWD port will be detected. Figure 4-7 shows that the ICP Tool has been connected with the Nu-Link Adapter and a target chip is detected. At this time, the user can start programming the target chip.





Step 8b: Figure 4-8 shows that the ICP Tool has been connected with the Nu-Link Adapter with no target chip detected. The ICP tool will continue detecting the target chip until the **Stop Check** button is clicked. At this time, the user cannot program any chip, but can use the offline programming to save the offline programming information in the Nu-Link Adapter.

Project <u>C</u> hips	<u>T</u> ool <u>L</u> anguage	
NUVC	Ton	
Status		
Ctop obook	Nu-Link-Pro connected (ID: 7788b24d)	



Step 9: Click the **Disconnect** button if programming is not needed (as shown in Figure 4-7). Or click the **Stop Check** button to disconnect the ICP Tool with the Nu-Link Adapter and leave the Nu-Link Adapter unused (as shown in Figure 4-8). As such, the Nu-Link Adapter can be connected with another tool.



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#### 4.2.2 Keil RVMDK

- Step 1: Install <u>Keil RVMDK</u>. Before setting the Nu-Link Adapter, make sure the <u>Nu-Link Adapter</u> <u>Driver for Keil RVMDK</u> has been downloaded and installed such that the Keil RVMDK can recognize the Nu-Link Adapter.
- Step 2: Open the Keil RVMDK and open the project to be set.

#### **Debugger Settings:**

Step 3: Invoke Project  $\rightarrow$  Options for Target  $\rightarrow$  Output, and enable the Debug Information option, as shown in Figure 4-9.

Select Folder for <u>O</u> bjects <u>N</u> ame of E	xecutable: Smpl_Start_Kit
Crgate Executable: \obj\Smpl_Start_Kit     Debug Information     Create HEX File     Browse Information     Create Library: \obj\Smpl_Start_Kit_LIB	☐ Create Batch File
C Create Library: .\obj\Smpl_start_Kt.LIB	

Figure 4-9 Enable Debug Information for Keil RVMDK

Step 4: Invoke Project  $\rightarrow$  Options for Target  $\rightarrow$  Debug, and make sure the Use: <sup> $\Gamma$ </sup> Nuvoton Nu-Link M0 Debugger option is checked, as shown in Figure 4-10.

C Use Simulator Setting □ Limit Speed to Real-Time	s 🕼 Use: Nuvoton Nu-Link M0 Debugger 💌 Se
Image: Very start         Image: Very start	Load Application at Startup     I     Run to mail     Initialization File:
Restore Debug Session Settings Breakpoints   Toolbox Watch Windows & Performance Analyzer Memory Display	Restore Debug Session Settings ↓ Breakpoints ↓ Toolbox ↓ Watch Windows ↓ Memory Display
CPU DLL: Parameter:	Driver DLL: Parameter:
Dialog DLL: Parameter:	Dialog DLL: Parameter:

Figure 4-10 Keil RVMDK Debugger Selection

Step: 5: Click the **Settings** button to open the *Debug* form, as shown in Figure 4-11. Refer to Table 4-1 for each setting description. The setting options shown in the *Debug* form may vary depending on the type of the Nu-Link Adapter used.

N	Ju-Link Pro	Nu-Link & N	u-Link-Me
Debug	×	Debug	×
Nu_Link Pro Driver Version: 5320 Device Family: Contr Device ID: 0BB Port: SW Max Clock: 11MF	Chip Select Chip Type: NUC1ox Reset Options Reset: Autodetect Download Options F Verify Memory Code	Nu_Link       Driver Version:     5320       Device Family:     Cortex-M       Device ID:     0BB11477       Port:     SW       Max Clock:     1MHz	Chip Select Chip Type: NUC1x Reset Options Reset: Autodetect Download Options FV Verify Memory Code
Power Control 10 Voltage C 1.8v C Supporting Forum http://www.nuvoton-m0.com	2.5v (~ 3.3v (~ 5v Cancel OK	Supporting Forum http://www.nuvoton-m0.com	Cancel OK

Figure 4-11 Nu-Link Adapter Parameter Settings

Debug Function	Description
Driver Version	Display the Nu-Link Adapter driver version in the host
Chip Type	Specify the Target chip type
Reset	Select Auto detect to reset the target chip
IO Voltage	Specify the SWD port I/O voltage for the target chip; options include 1.8V, 2.5V, 3.3V, and 5V

#### Programmer Settings:

Step 6: Invoke Project  $\rightarrow$  Options for Target  $\rightarrow$  Utilities, select "Nuvoton Nu-Link M0 Debugger" when the Use Target Driver for Flash Programming option is enabled, and then select the Update Target before Debugging option, as shown in Figure 4-12.

# nuvoton

	voton Nu-Link M0 Debug	er 🔹 Settings	Update Target	before Debugging
Init File:	Voton na Bilk no bobag		Edit.	
Use External T	ool for Flash Programming	3		
Command:				
Arguments:				
Г	Run Independent			

Figure 4-12 Keil RVMDK Programmer Selection

Step 7: Click the **Settings** button to open the *Flash Download* form, as shown in Figure 4-13 where the user can specify the options before or after programming with the Nu-Link Adapter.

Flash Download for N	UC1xx		×			
Flash Select Flash Select:	RAM for Algorithm           Start:         0x20000000           Size:         0x1000	Download Function	<ul> <li>Program Flash</li> <li>Verify Flash</li> <li>Reset and Run</li> </ul>			
Programming Algorithm	Device Type Device Size ONCHIP Flash 128K	Address Range 00000000H - 0001FI •	Flash Breakpoint ✓ Enable Flash BP Config0/1 Configure			
Cancel						

Figure 4-13 Nu-Link Adapter Programming Settings

#### 4.2.3 IAR EWARM

- Step 1: Install <u>IAR EWARM</u>. Make sure that <u>Nu-Link Adapter Driver for IAR EWARM</u> has been downloaded and installed before setting the Nu-Link Adapter such that the IAR EWARM can recognize the Nu-Link Adapter.
- Step 2: Open IAR EWARM, and open the project to be set.
- Step 3: In the **Target** tab of the **General Options** page (through invoking **Project**  $\rightarrow$  **Options**), click the button in the right of the **Device** option (make sure the **Device** option is enabled), and select "**Nuvoton**  $\rightarrow$  **Nuvoton NUC100** series" as the target chip (NUC100 series is this case), as shown in Figure 4-14.

Category:					
C/C++ Compiler Assembler					
Output Converter	larget	Output	Library Configuration	Library Options	MISRA-C *
Build Actions	Process	or varia	ut		
Linker	O Corr	. 17	ortex-M0 -		
Simulator		• [2			<b>`</b>
Angel	Dev	ice 1	Juvoton NUC100 series (	NUC100, 📆	J
GDB Server					
IAR ROM-monitor					
J-Link/J-Trace	Endian	mode	FPU		
TI Stellaris FTDI	◎ <u>L</u> itt	le	None	*	
Macraigor	O Big				
PE micro	01	BE <u>3</u> 2			
RDI	01	BE8			
SI-LINK					
Inird-Party Driver					

Figure 4-14 IAR EWARM Target Chip Selection

#### Debugger and Programmer Settings:

Step 4: In the **Setup** tab of the **Debugger** page, select **Third-Party Driver** as the driver, as shown in Figure 4-15.

Category:	Factory Settin
General Options	
C/C++ Compiler Assembler	
Output Converter	Setup Download Images Extra Options Plugins
Custom Build	Driver
Build Actions	
Debugger	Third-Farty Driver
Simulator	Setup macros
Angel	Use macro file(s)
GDB Server	
IAR ROM-monitor	
TI Stellaris ETDI	
Macraigor	Device description file
PE micro	Override default
RDI	\$TOOLKIT_DIR\$VCONFIGVdebugger\Nuvoton\tionuc100_v1.do
ST-LINK	
Third-Party Driver	

Figure 4-15 Set IAR EWARM as Third-Party Driver for Debugger & Programmer

Step: 5: In the **Download** tab of the **Debugger** page, make sure that the **Use flash loader(s)** option is selected, as shown in Figure 4-16.

Category:		Factory Settings
Seneral Options C/C++ Compiler Assembler Output Converter Custom Build Build Actions Linker	Setup Download Images Extra Options Plugins Attach to program	
Debugger Simulator Angel GDB Server IAR ROM-monitor J-Link/J-Trace TI Stellaris FTDI Macraigor PE micro RDI ST-LINK Thrid-Party Driver T urps you	□ Suppress download ▼ Use fash loader(s) □ Qvernike default board file \$TOOLKIT_DIR\$/configtlashloader\Nuvoton\NUC Edit	21

Figure 4-16 IAR EWARM Programming Settings

Step: 6: In the **Download** tab of the **Debugger** page, select the **Override default .board file** option if you want the firmware to be downloaded to APROM or LDROM, and then specify the *NUC100\_APROM.board* or *NUC100\_LDROM.board file* (NUC100 series is used in this case). If no file is founded, specify the following path "*\$TOOLKIT\_DIR\$\config\flashloader\ Nuvoton\*", as shown in Figure 4-17.

🔀 Open		×
🔾 🔍 📕 « config 🕨 flashloader	Nuvoton Si	earch Nuvoton 👂
Organize 👻 New folder		8≡ ▾ 🔟 📀
devices     flashloader     Actel     Actel     AnalogDevices     Armel     EnergyMicro     Freescale     Fujitsu     Holtek     Micronas     Nuvoton     NXP	Name M052_APROM.board M054_APROM.board M054_APROM.board M0516_APROM.board Mini51_APROM.board Nano100_APROM.board Nano100_APROM.board Nano100_APROM.board NUC100_LDROM.board NUC100_LDROM.board NUC100_LDROM.board	Date mo 2011/7/4 2011/7/4 2011/7/4 2011/7/4 2011/7/4 2011/7/4 2011/7/4 2011/7/4 2011/7/4 rd 2011/7/4 rd 2011/7/4 rd
File <u>n</u> ame: NUC1	0_APROM.board - Bo	ard Files (*.board)

Figure 4-17 Select.board File for IAR EWARM

#### **Driver Plugin File Settings:**

Step 7: In the **Third-Party Driver** page, specify the path of the IAR debugger driver plugin *"C:\Program Files\Nuvoton Tools\Nu-Link\_IAR\Nu-Link\_IAR.dll*", as shown in Figure 4-18.

stegory.		Factory Settings
eneral Options		<u>.</u>
C/C++ Compiler		
Output Converter	Third-Party Driver	
Custom Build		
Build Actions	IAR debugger driver plugin	
inker	CAPment Eiled Navetan Taala Nu Link I	DWN Link LOD dll
ebugger	C.4 logiant Pliesta avoidit Toolsaa a-Dilk_12	SKW@Ellk_IAK.01
Simulator		
Angel		
GDB Server		
IAR ROM-monitor		
J-Link/J-Trace		
TI Stellaris FTDI		
Macraigor		
PDI	Log communication	
ST-I INK	\$PROJ DIR\$\csnycomm log	
Third-Party Driver		

Figure 4-18 Set the Path of the IAR EWARM Debugger Driver Plugin

- Step 8: Click **OK** to save the settings and return to the IAR EWARM main window.
- Step 9: Invoke **Nu-Link** to open the *Nu-Link* form, select **SWD** as the Port, and specify the **Nu-Link**-**Pro I/O Voltage** in the **Target power control** section (3.3V in this case), as shown in Figure 4-19.

u-Link			
ICE version		Driver version	Build: 5320rc
Port	SWD 🔻	Max clock	(4MHz 🔻
arget device			
CPU family	Cortex-M0	Device ID	
Device type	NUC 100		
🔽 Enable flast	breakpoints		
arget power co	ontrol		
Power control i detected.	s used on Nu-Link-Pr	o, and is valid only if	target power is not
Nu-Link-Pro I	O Voltage		
(C) + OV	@ 2 EV	(a) 3 3V	5 0V

Figure 4-19 Specify the Port and Target I/O Voltage

#### 4.2.4 CooCox CoIDE

- Step 1: Install <u>CooCox CoIDE</u>, which does not require any driver installation.
- Step 2: Open CooCox CoIDE and open the project to be set. Please also refer to the <u>CoIDE Quick</u> <u>Start</u>.

#### **Debugger Settings:**

Step 3: In the **Debugger** tab of the *Debug Configurations* form (through invoking **Debug** → **Debug Configurations)**, select "**Nu-Link**" as the Adapter, select "**SWD**" as the Port, and click **Apply** to save the settings, as shown in Figure 4-20.

zreate, manage, and run configurations	
rpe filter text  Cortex-M Application  Start Kit.configuration  Launch Group  Kutunk  Startup  Run to main  Advance  Reset Mode SYSRESETREQ  Targetinfo  Host Name: localhost	Port SWD   Max Clock(Hz) 1M
Filter matched 3 of 3 items	m Apply Reyert

Figure 4-20 Specify the Debugger Options for CooCox CoIDE

#### Programmer Settings:

Step 4: In the **Download** tab of the *Debug Configurations* form (through invoking **Debug**  $\rightarrow$  **Debug Configurations**), select the **Auto Download Before Debugging** or **Verify After Download** option to proceed with a specific programming, and set the Programming Algorithm path as "C:\CooCox\CoIDE\flash\NUC1xx\_128.elf", as shown in Figure 4-21.

reate, manage, and run co	vifigurations 👘
	· · · · · · · · · · · · · · · · · · ·
ype filter text	to Debugger 🕱 DownLoad
Cortex-M Application	Download
Start_Kit.configuration	V Auto Download Before Debugging
Launch Group	Verify
	Verify After Download
	Erase
	💿 Erase Full Chip 🛛 🕘 Erase Effected 👘 Do not Erase
	Programming Algorithm
	file Path
	C\CooCox\CoIDE\flash\NUC1xx 128.elf
	Add Remove default
ilter matched 3 of 3 items	Apply Revert
inter matched 5 of 5 items	
	Close

Step: 5: To ensure the firmware will be downloaded to APROM or LDROM, select NUC1xx\_128.elf or NUC1xx\_LDROM.elf file (NUC100 series is used in this case) as shown in Figure 4-22; "32, 64, or 128" in the file name means the capacity of APROM. If no specific file is founded, specify the following path "C:\CooCox\CoIDE\flash\".

Organize 🔻 New folder		
<ul> <li>Windows7 (C:)</li> <li>SRecycle.Bin</li> <li>boot</li> <li>Cadence</li> <li>CooCox</li> <li>CoIDE</li> <li>bin</li> <li>CoIDEHelpFileDir</li> <li>config</li> <li>configuration</li> <li>data</li> <li>flash</li> <li>source</li> <li>jre</li> </ul>	Name           M051_8.elf           M051_16.elf           M051_32.elf           M051_10ROM.elf           Mini51_4.elf           Mini51_4.elf           Mini51_64.elf           Mini51_64.elf           Mini51_64.elf           Mini51_16.elf           NUC1xx_32.elf           NUC1xx_128.elf           NUC1xx_L0ROM.elf	Date modified 2010/12/16 17:2 2010/12/16 17:2 2010/12/16 18:0 2010/12/16 18:0 2010/12/16 18:0 2011/11/14 09:2 2011/11/14 09:2 2011/11/14 09:2 2011/11/14 09:2 2011/11/14 09:2 2011/10/20 16:0 2011/10/20 15:5 2011/10/20 16:0
File name: NUC1x	<128.elf	

Figure 4-22 Set the Programming Algorithm File for CooCox CoIDE

Step 6: At last, click **Apply** to save the settings, as shown in Figure 4-21.

### 5 + Appendix

### 5.1 Nu-Link Adapter Operating Current

When power is supplied via an USB during online programming, the operating current of Nu-Link Adapter is shown in the table below.

Type Parameter		Nu-Lir	ık-Pro	Nu-Link	Nu-Li	nk-Me	
SWD I/O Mode Settings	5.0V	3.3V	2.5V	1.8V	-	5.0V	3.3V
USB Input Voltage (V)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
USB Input Current (mA)	101	92	88	84	110	74	60
SWD I/O Voltage (V)	5.06	3.34	2.54	1.83	4.77	4.79	3.37

Table 5-1 Nu-Link Adapte	er Operating Current	(Online Programming)
Table J-T Nu-Link Auaple	operating ourient	(Online Frogramming)

When power is supplied from a target board (SWD VCC pin) during offline programming, the operating current of Nu-Link Adapter is shown in the table below.

Type           Parameter		Nu-Lir	ık-Pro			Nu-Link	
Power Supplied from a Target Board	5.0V	3.3V	2.5V	1.8V	5.0V	3.3V	2.5V
Power Supplied via an USB	Off	Off	Off	Off	Off	Off	Off
SWD VCC Input Voltage (V)	5.00	3.30	2.50	1.80	5.00	3.30	2.50
SWD VCC Input Current (mA)	64	86	117	171	100	77	62

Table E O Nu Link	A damtar Omaratina	Current (Off	
1 able 5-2 INU-LINK /	adabler Oberalind	Current (C)II	iine Proorammino)
	auptor oporating		mio i rogiammig/

### 6 Revision History

Revision	Description	Date	
V1.00	Preliminary version.	2012/07/16	
V1.01	1. Update section 3.1.3 Direct Register Control Interface & 3.1.4 Semihost.	2014/10/28	
	2. Revise section 4.2.1 ICP Tool step number error.		

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