IN WIN DEVELOPMENT

Passive SAS/SATA Backplane User Manual

Supported Devices

Part Number	Description
3RAMVI005500 3RAMVI005600	RS104-02M PASSIVE BACKPLANE MODULE
3RAMVI006000 2RAKVI001000	RS110-02M PASSIVE BACKPLANE MODULE
3RAMVI006200 2RAKVI001200	RS208-02M PASSIVE BACKPLANE MODULE
3RAMVI006300 2RAKVI001300	RS212-02M PASSIVE BACKPLANE MODULE
3RAMVI006100 2RAKVI001100	SK34 PASSIVE BACKPLANE MODULE (IW-MS04/IW-MS08/IW-MS08-A/IW-PLV Tower/IW-PLG Tower)
3RAMVI005900	SK35 PASSIVE BACKPLANE MODULE (IW-R400-03N)

Draft Version: 0.2

History

Version	Changes	Date
0.1	First draft	2017/4/17
0.2	SGPIO setting behavior change	2017/5/9

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1 Overview

IN WIN backplanes (without Expander) are high performance economical 8 solution for users who has adequate SAS connection ports on motherboard or RAID/HBA card to accommodate the disks in the system.

The passive backplanes support state-of-the art SAS3 12Gbps HDD/SSD and also backward compatible with SAS 6Gbps, SATA 6Gps and SATA 3Gps HDD/SSD.

Basically, one single SFF-8643 miniSAS connector can support up to 4 disk bays. There are several miniSAS connectors and 29-pin high profile disk connectors on the backplanes depends on the product model.

The backplane is implemented with smart fan control feature to support wide variety of fan modules by auto-calibrating the installed fan modules at system boot. This feature provides an efficient way to control the thermal heat exhaustion by sensing the temperature in the enclosure. The fan module speeds up and down upon the temperature rises and falls in the enclosure.

Along with the smart fan control feature, a system alarming feature is also implemented to alert users in case Fan module failure and/or system overheat occurs by illuminating the LED indicator and sounding the buzzer at the same time. Users can then detect issue and take corresponding actions to resolve the issue according to the failure type. As soon the issue disappears the alarm stops.

2 Jumper Settings

System indicators and buttons are designed for chassis by connecting 2-wire cable from front panel (if existed) to the jumpers on the backplane to facilitate the alarm system accordingly.

The definitions of the Jumpers on the backplane are as below.

Jumper Name	Function	Details	Model
CN1	Setting Function 1 FAN FAIL LED + 2 FAN FAIL LED – 3 TEMP FAIL LED + 4 TEMP FAIL LED -	FAN FAIL LED illuminates when the fan module speed is going down below 75% of its expected RPM TEMP FAIL LED illuminates when enclosure temperature is going higher than the setting of TEMP ALERT of CN2	RS110 RS208 RS212
CN2	Setting Function 1-2 Short MAX FAN RPM=60% 3-4 Short MAX FAN RPM=80% 1-2 & 3-4 Short MAX FAN RPM=100% 5-6 Open TEMP ALERT 45C 5-6 Short TEMP ALERT 55C	RPM=60% limited the highest FAN RPM to 60% of full speed RPM=80% limited the highest FAN RPM to 80% of full speed RPM=100% allows fan module to its full speed TEMP ALERT 45C set alert triggered at 45 degree in Celsius.	RS110 RS208 RS212

		TEMP ALERT 55C set alert triggered at 55 degree in Celsius. When the temp alert triggered, the TEMP FAIL LED of CN1 illuminates and buzzer sounds in 2 consecutive beeps, BB—BB—BB--.	
JM1	Setting Function 1-3 Short SGPIO_0 Enable 3-5 short SGPIO_0 Disable 2-4 Short SGPIO_1 Enable 4-6 Short SGPIO_1_Disable	To enable/disable SGPIO function. When SGPIO is enabled, the Green and RED LED for disk bay is controlled by MCU by sensing the SGPIO signals sent by RAID/HBA car. SGPIO_0 is for disk 0 ~ 3 SGPIO_1 is for disk 4 ~ 7	RS110 RS208 RS212 SK3-5
JM2	Fail_LED_0~3	Fail_LED_0~3 pins are for use when SGPIO is set to disabled for disk bay 0 ~ 3	RS110 RS208 RS212
JM3	Fail_LED_4~7	Fail_LED_4~7 pins are for use when SGPIO is set to disabled for disk bay 4 ~ 7	RS110 RS208 RS212
JM4	Fail_LED_8~11	Fail_LED_8~11 pins are for use when SGPIO is set to disabled for disk bay 8 ~ 11	RS110 RS212
JM5	Setting Function 2-4 Short SGPIO_2_Enable 4-6 Short SGPIO_2_Disable	SGPIO_2 is for disk 8 ~ 11	RS110 RS212
JM5	Setting Function 1-2 Short SGPIO_0_Enable 2-3 Short SGPIO_0_Disable	To enable/disable SGPIO function. When SGPIO is enabled, the GREEN and RED LED for disk bays are controlled by MCU by	SK3-4 SK3-5

		sensing the SGPIO signals sent by RAID/HBA card. SGPIO_0 is for disk 0 ~ 3 SGPIO_1 is for disk 4 ~ 7	
JS1	Setting Function 1 Fail_LED_1 2 Fail_LED_2 3 Fail_LED_3 4 Fail_LED_4	Fail_LED pins are for use for disk bay 1 ~ 4 fail LED when SGPIO is set to disabled	SK3-4
JS1, JS2	SGPIO Header	The SGPIO header for connecting to Motherboard or RAID/HBA card which equipped with SGPIO function.	SK3-5
JS3	Setting Function 1 Fail_LED_1 2 Fail_LED_2 3 Fail_LED_3 4 Fail_LED_4 5 Fail_LED_5	Fail_LED pins are for use for disk bay 1 ~ 5 fail LED when SGPIO is set to disabled	SK3-5

3 Connectors

3.1 29-pin SAS HDD connector

The Backplane has number of 29-pin disk connectors supporting SATA 3G, 6G, SAS 6G and 12G disk.

Different model has different type and different of 29-pin disk connector according to design and application.

Model	Number of 29-pin disk connector	Type	Supported Disk
RS104	4	Horizontal Type	SATA, SAS
RS110	10	Low Profile	SATA, SAS
RS208	8	High Profile	SATA, SAS
RS212	12	High Profile	SATA, SAS
SK3-4	4	High Profile	SATA, SAS
SK3-5	5	High Profile	SATA

3.2 SFF-8643 Mini-SAS connector:

Different model of backplane has different number of miniSAS connector. Most of backplanes are supporting 12G SAS connection while SK3-5 is supporting 6G SATA only.

Since these backplanes has no expander. All the miniSAS connectors or SATA connectors are directly wired to the 29-pin disk connectors.

Model	Number of miniSAS connector	Note
RS104	1	
RS110	3	
RS208	2	
RS212	3	
SK3-4	1	
SK3-5	5	SATA connector

3.3 4-Pin power receptacle

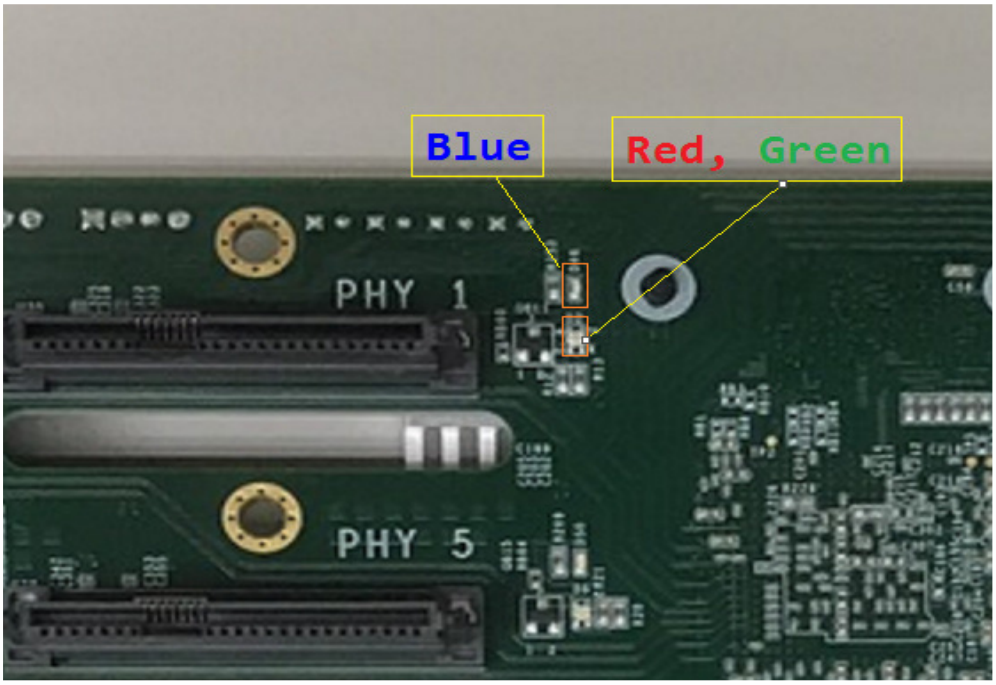
Different model of backplane has different number of 4-pin power connector according to the disk number the backplane supports.

Model	Number of 4-pin Power connector	Note
RS104	2	
RS110	4	
RS208	4	
RS212	6	
SK3-4	2	
SK3-5	2	

4 LED and Buzzer Behavior

4.1 Disk Bay LED

There are 3 color of LEDs for each bay to indicate HDD status by illuminating in different color and format.



Blue LED:
Power Indicator. Turned on whenever disk drive is properly installed.

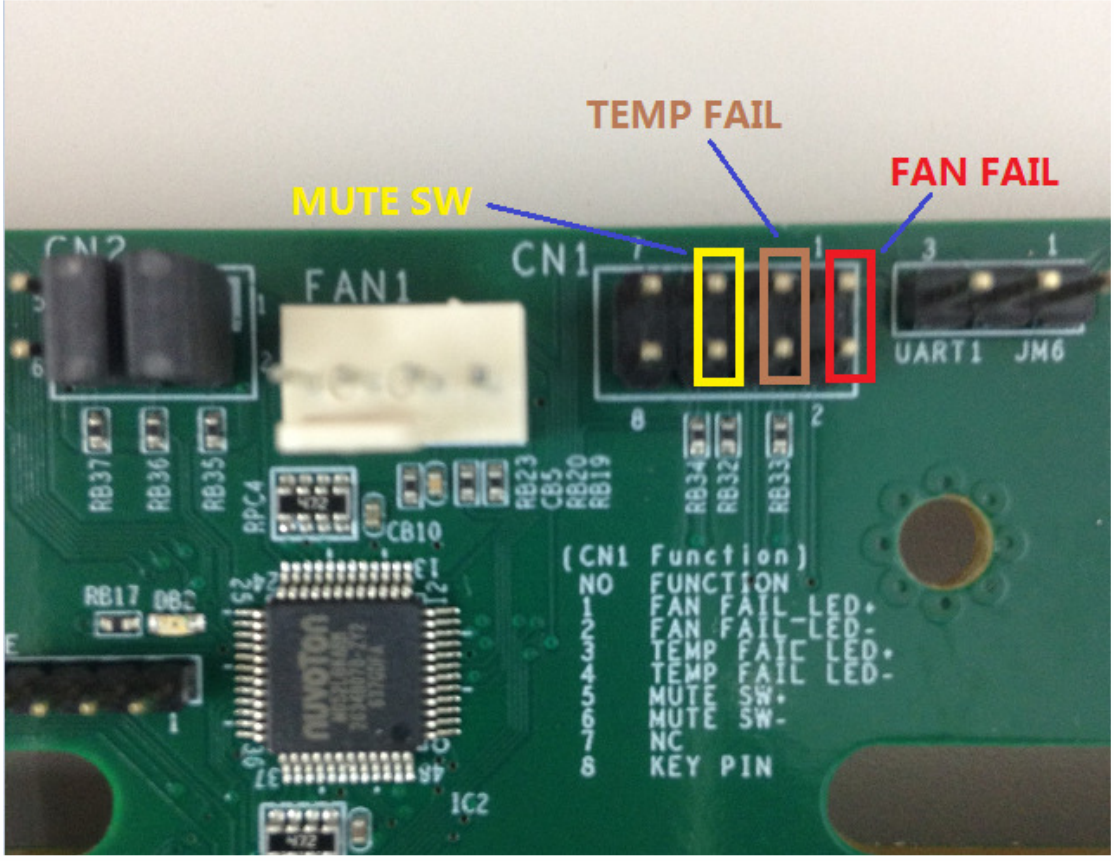
Green LED:
Activity indicator. Stay off when idle and blinking whenever disk drive is accessing.

RED LED:
Fail and Locate indicator. Turned on when disk failure occurs. Blinking when locate HDD, RAID rebuild and RAID consistent check.

Basically, The LEDs behave following the SGPIO signal from side band bus when corresponding SGPIO setting is set to enable. When SGPIO is set to disable, the LEDs behave according to the disk access pin and the fail signal from host directly.

4.2 System Alarm LED

There is a FAN FAIL LED and a TEMP FAIL LED designed on the Backplane to indicate Fan Fail and Over-Temperature separately.



Fan Fail:
When the Fan RPM is lower than 75% of the expected speed the Fan Fail indicator goes ON. And it would go off when the issue is resolved or disappeared.

Overheat:
When the system temperature at the backplane area is going beyond 45 ℃ or 55 ℃ (according to TEMP ALARM setting) the Temp Fail LED would be turned ON. And would be turned off when temperature is going under 44 ℃ or 54 ℃.

Note:

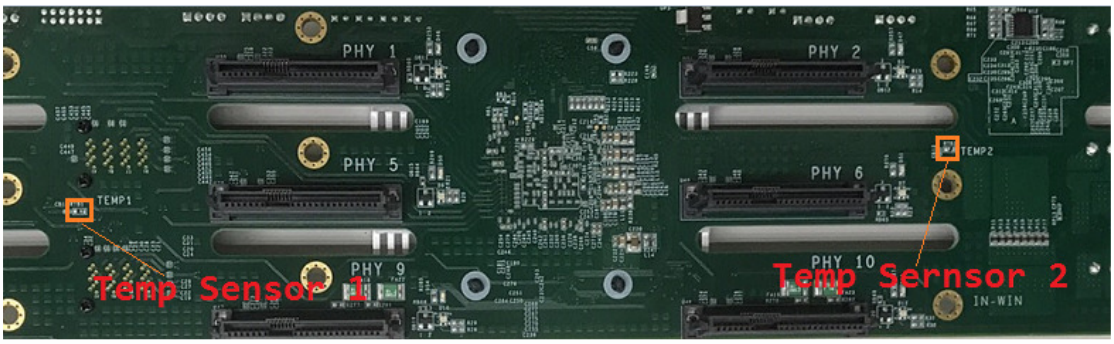
- When the system alarm is triggered, the Buzzer beeps along with it

and stops beeping when alarm is disappeared.

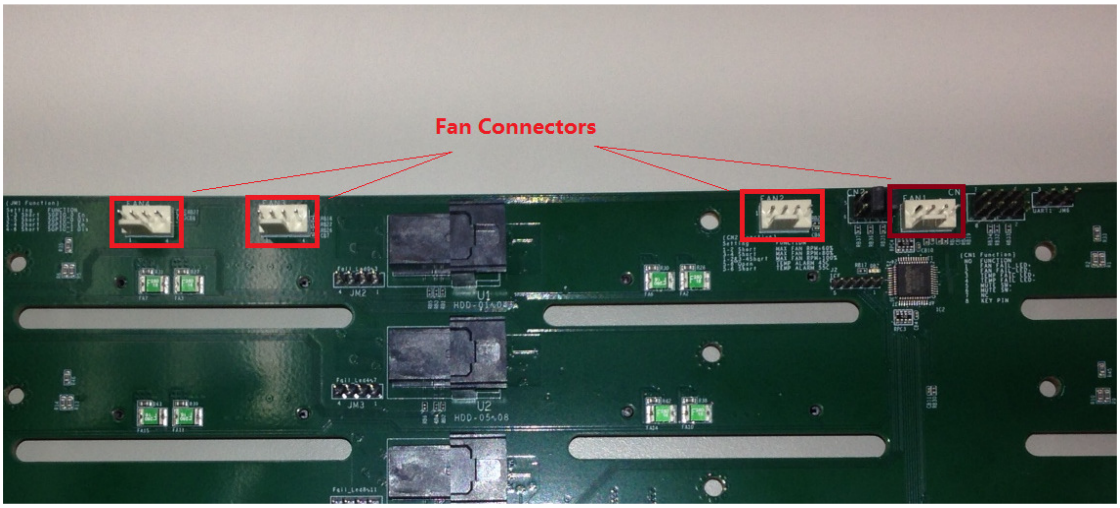
- 1 short beep(B—B—B) stands for Fan Fails
- 2 short beeps(BB—BB—BB) stand for Over-Temperature
- Press Mute Button to disable buzzer beeping and will be retriggered when either failure occurs again.

5. Smart Fan Control

IN WIN's Backplane is implemented Smart Fan Control feature by automatically detecting the existences of the Fan Modules and intelligently control the Fan RPM per the system temperature being detected by 1 or 2 thermal sensors on the backplane.



Thanks to Smart Fan Control feature the Fan connectors on backplane support wide variety of PWM driven Fan modules being used in the enclosure.



How it works?

1. Fan module auto-calibration would launch in every system boot. The profile would then be recorded and used until next reboot.
2. Backplane starts fan calibration and calculates the corresponding PWM duty cycle for each level. There are totally 8 speed levels to be calculated and used until next system boot.
3. The 8 levels of fan speed are mapped to the temperature readings detected by thermistor spreading from 25 to 45 ℃ in 3.75 degree C step.
4. In normal operation, when the system temperature changes to next level, the fan module would change speed accordingly. And, the Fan failure alarm would be triggered when the RPM of the Fan module is dropped lower than 75% of its expected speed.
5. The fan module calibration and control profile are as below.

Fan Speed Measurement

R_{diff} = Maximum RPM – Minimum RPM

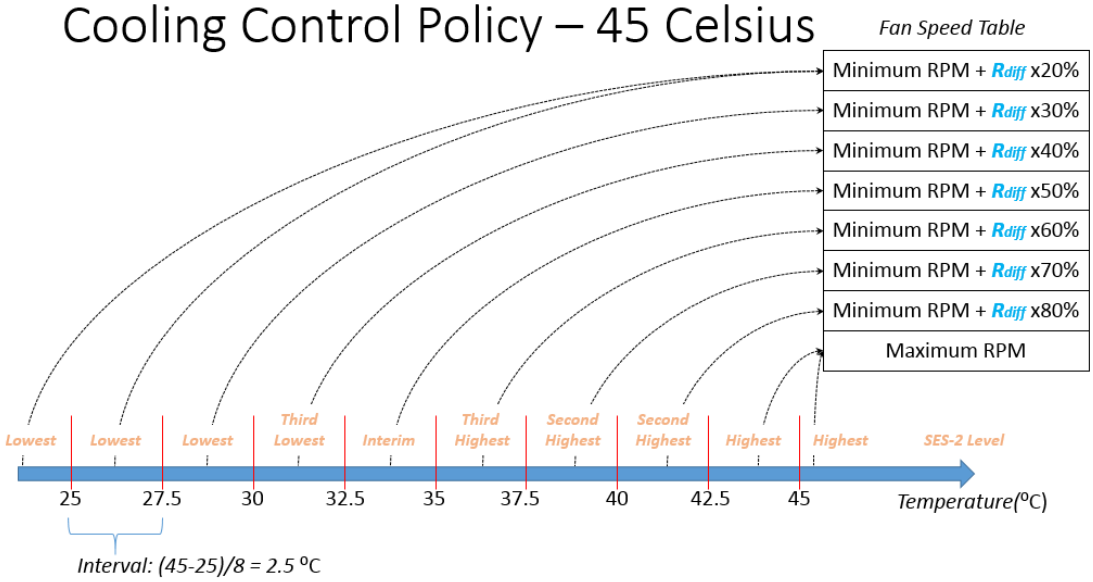
PWM Duty: 10
PWM Duty: 20
PWM Duty: 30
PWM Duty: 40
PWM Duty: 50
PWM Duty: 60
PWM Duty: 70
PWM Duty: 80
PWM Duty: 100

Minimum RPM
RPM1
RPM2
RPM3
RPM4
RPM5
RPM6
RPM7
Maximum RPM

Fan Speed Table
Minimum RPM + R_{diff} x20%
Minimum RPM + R_{diff} x30%
Minimum RPM + R_{diff} x40%
Minimum RPM + R_{diff} x50%
Minimum RPM + R_{diff} x60%
Minimum RPM + R_{diff} x70%
Minimum RPM + R_{diff} x80%
Maximum RPM

PWM Level Table
PWM Duty0
PWM Duty1
PWM Duty2
PWM Duty3
PWM Duty4
PWM Duty5
PWM Duty6
PWM 100

Cooling Control Policy – 45 Celsius

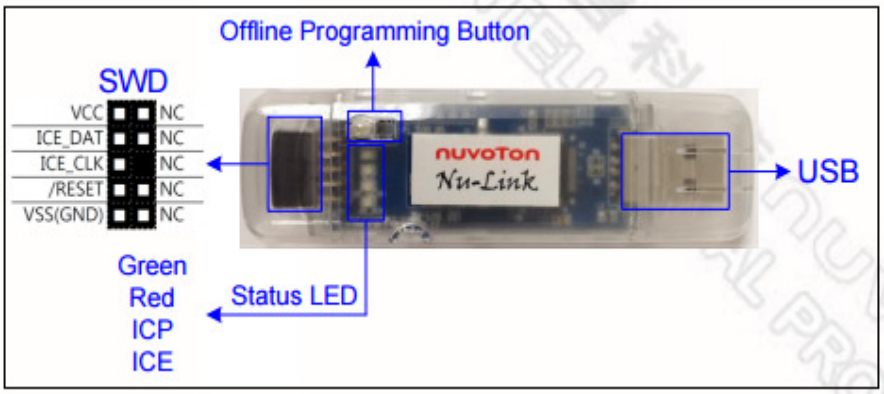


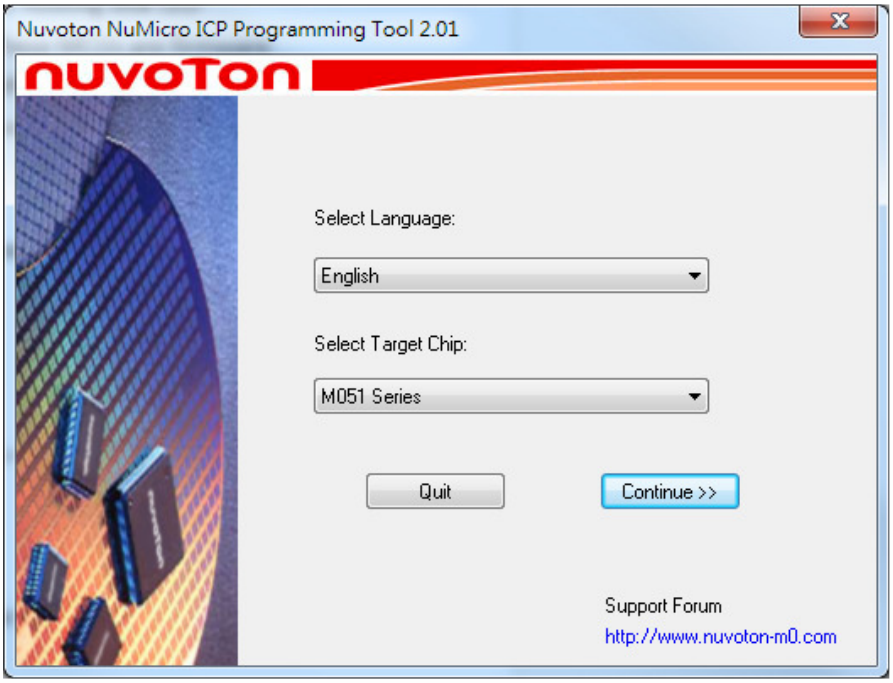
6. Firmware Upgrade

The passive backplanes are planted Nuvoton M052 series MCUs for hosting disk LED indication, Fan speed control and system fail alarm. These MCUs are preprogrammed in manufacturing. In most cases, the MCUs are not required to reprogram unless there is issue needed to fix.

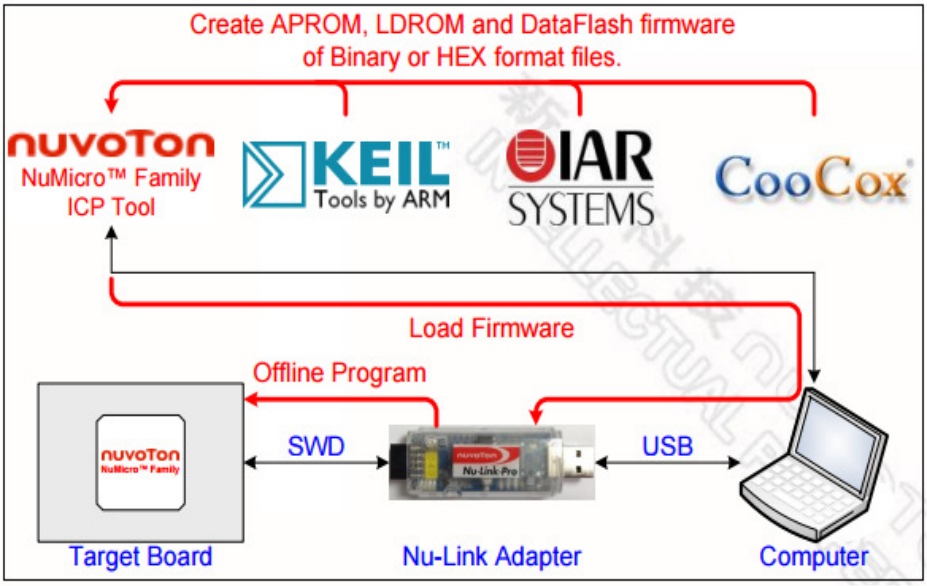
How to upgrade firmware?

1. Require Nuvoton ARM Cortex-M0 programming tool. Nu-Me or Nu-Link and install Nuvoton ICP Programming tool software.

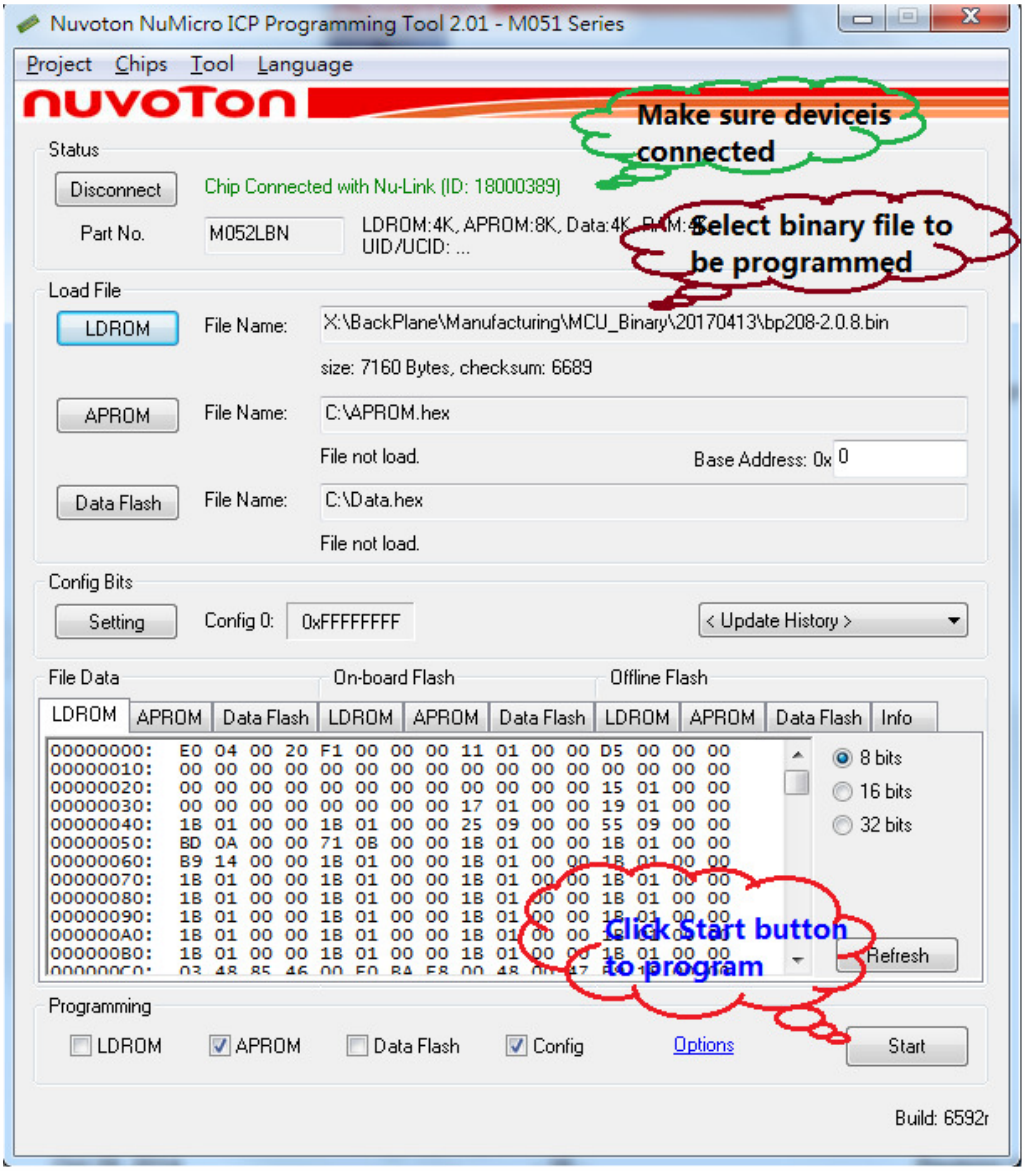




2. Connect Nu-Link USB end to a host and the SWD end to Backplane ICE connector for each MCU.



3. Make sure device is connected and select the binary file being programmed and then click on Start button to program firmware.



4. Please refer to http://www.nuvoton.com/resource-files/NuLink_Adapter_User_Manual_EN_V1.01.pdf for more details.