IW-RS208-07 HYBRID_OCULINK Backplane USER MANUAL

P/N : 2RAKVI009900

Model：IW-RS208-07 HYBRID-OCULINK*4 Backplane MODULE

Version : V1.0

Revision History

Version	Changes	Date
V1.0	Official Release	2021/02/18

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Overview

The backplane is a high performance economical solution for users who has sufficient SAS host ports on MB or RAID/HBA to accommodate 8 disks in the system.

The hybrid backplane supports state-of-the-art SAS3 12Gbps HDD/SSD and also backward compatible with SAS 6Gbps, SATA 6Gps and SATA 3Gps HDD/SSD. The backplane supports NVMe SSD through OcuLink x4 connectors.

Basically, the 2 pcs of SFF-8643 miniSAS HD connectors can support up to 8 SAS/SATA disks. 4 of the disk slots are the so called Hybrid ports that can support U.2 NVMe SSD via OCulink x4 connectors. Please note that the hybrid ports can either support SAS/SATA or U.2 NVMe at a time.

One piece of 2*3-Pin 5V and one piece of 2*4-Pin 12V power receptacles support up to 5V(24A)/12V(32A) current to satisfy the power needs of fully loaded disk drives

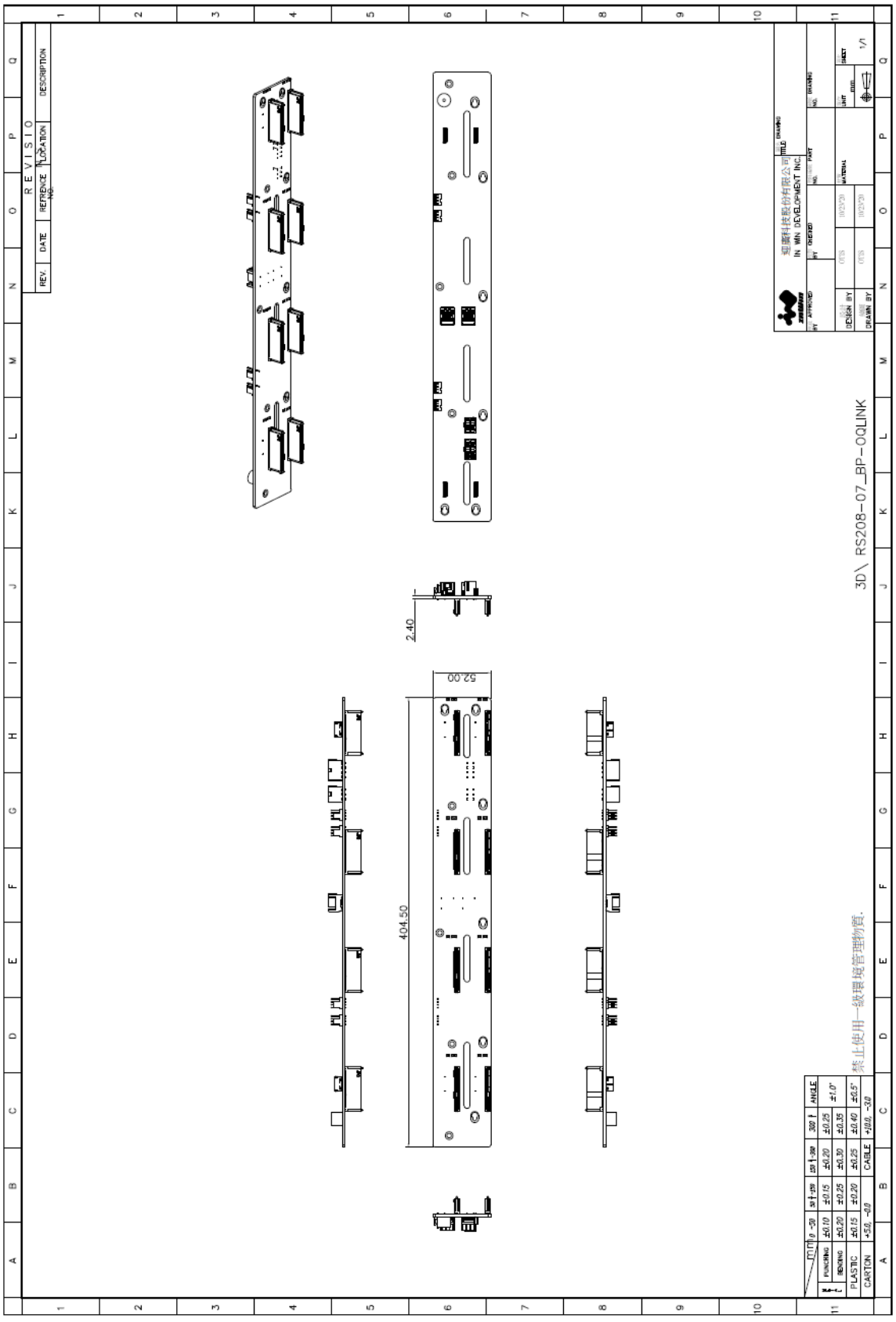
The backplane is implemented with smart fan control feature to support wide variety of fan modules by auto-calibrating the installed fan modules at system boot. This feature provides an efficient way to the thermal solution by sensing the temperature in the enclosure. The fan modules speed up and down 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 or resolved the alarm stops.

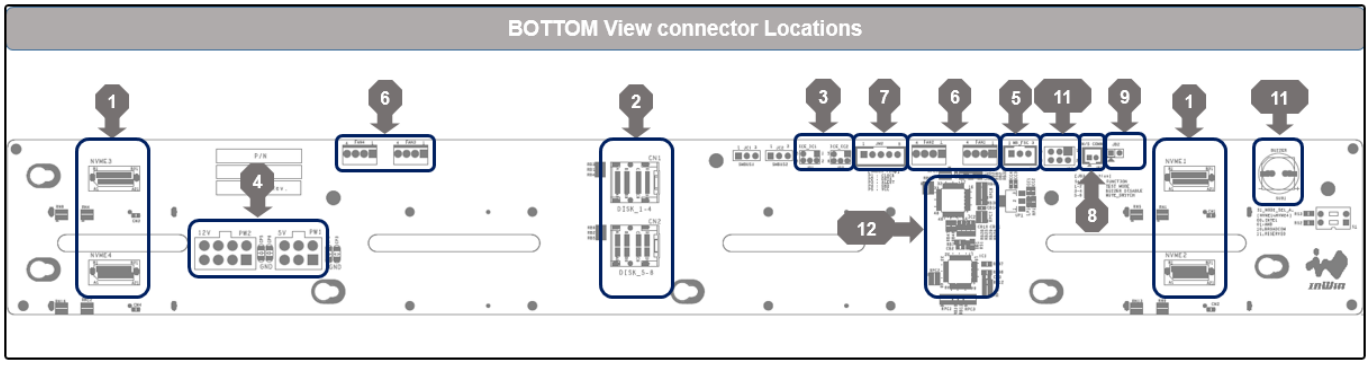
Physical Outlook

TOP VIEW	BOTTOM VIEW
	

Mechanical


REVISION
REV.
DATE
REFERENCE NO.
LOCATION
DESCRIPTION
2.40
52.00
404.50
3D\ RS208-07_BP-OQLINK
禁止使用一級環境管理物質.

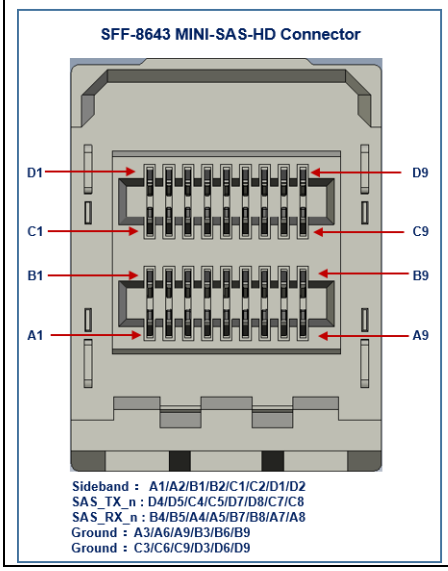
Connector Locations and LED Indicators



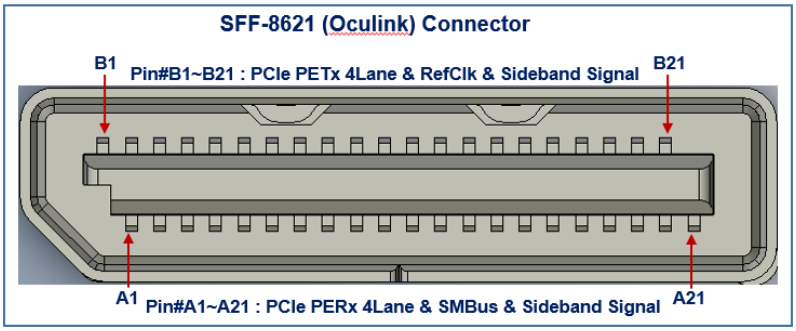
No	Description	No	Description
1	Host facing interface : NVME1~NVME4	7	SMBUS Connector : JM2
2	Host facing interface (SAS3) : CN1/CN2	8	M/S Communication Connector : JB1
3	Firmware Programming Header ： JD1/JD2	9	M/S BP Selection Header : JB2
4	Main Power Connector ： PW1/PW2	10	Multi-Function Header : JB3
5	M/B Fan Speed Control : JM1	11	Buzzer: SUB1
6	FAN Connector : FAN1~FAN4	12	M058 Micro-controller : IC1/IC2

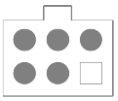
Connector Pin Definitions.

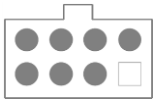
CN1/CN2

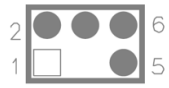


NVME1~NVME4



PW1	Power 2*3-Pin Connector	
	PIN #	Definition
	1~3	+5V
	4~6	Ground

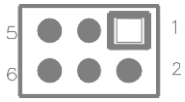
PW2	Power 2*4-Pin Connector	
	PIN #	Definition
	1~4	+12V
	5~8	Ground

JD1~JD2	Firmware Programming Connector			
	PIN #	Definition	PIN No#	Definition
	2	ICE_CLK	1	VCC
	4	ICE_DATA	3	#Key
	6	ICE_RST	5	Ground

JM1	M/B FSC 3-Pin Connector	
	PIN #	Definition
	1	MB_PWM
	2	BP_TACH
	3	Groubd

JM2	SMBUS Connector	
	PIN #	Definition
	1	Clock
	2	Data
	3	Alert
	4	Ground
	5	Vcc

FAN1~FAN4	FAN 4-Pin Connector	
	PIN #	Definition
	1	Ground
	2	+12V
	4	Tachometer
	5	PWM Output

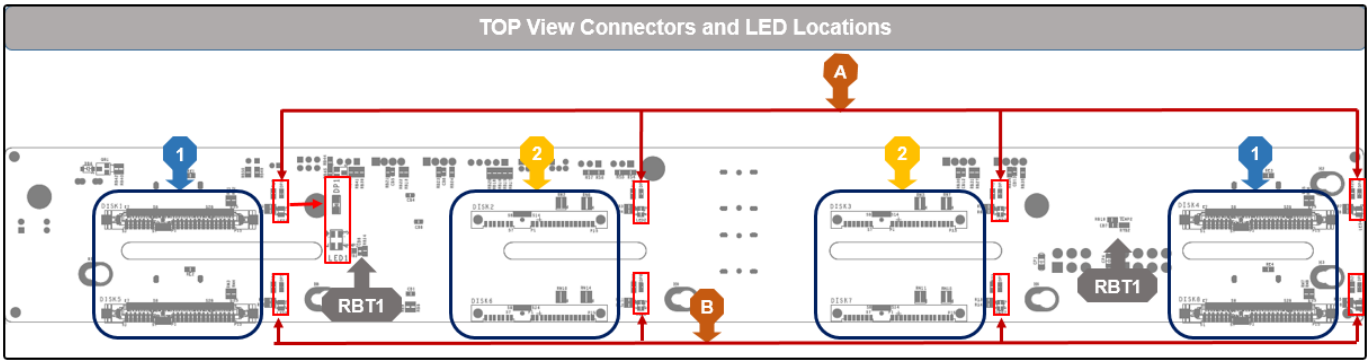
JB3	Multi-Function Header			
	PIN #	Definition	PIN No#	Definition
	1	TEST_P+	2	TEST_P-
	3	BUZ_EN+	4	BUZ_EN-
	5	MUTE_SW+	6	MUTE_SW-

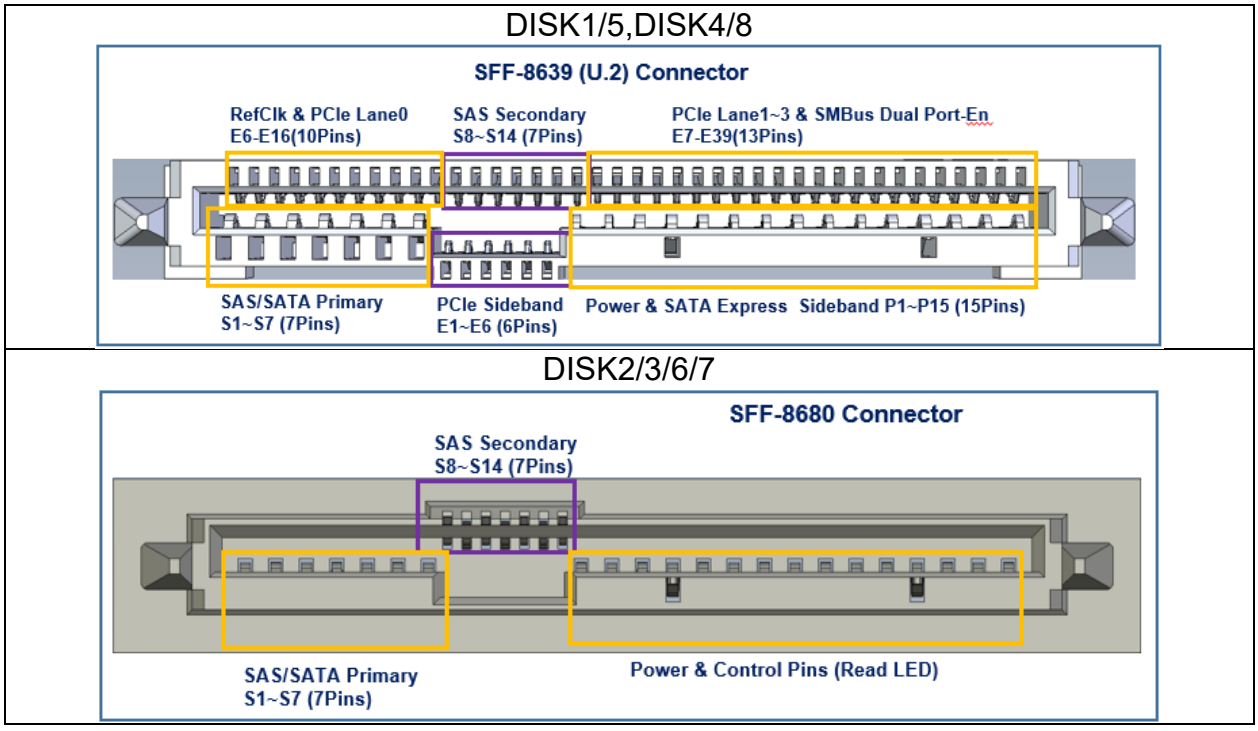
JB3 Function Description:
Pin#1-Pin#2 Short for Test Mode.
Pin#3-Pin#4 Short for Buzzer Disable.
Pin#5-Pin#6 for External Mute Switch.

JB1	SYNC 2-Pin Connector	
	PIN #	Definition
	1	LINK_CLK
	2	LINK_DAT

JB2	M/S Selection Header		JB2 Function Description:
2 ● ■ 1	PIN #	Definition	Pin#1-Pin#2 OPEN for Master BP. Pin#1-Pin#2 Short for Slave BP.
	1	M/S_SEL1	
	2	M/S_SEL2	

Connector/ LED Indicators.





No	Location	Description
1	DISK1/5	NVMe SSD or SATA/SAS Disk #1/#2
2	DISK4/8	NVMe SSD or SATA/SAS Disk #3/#4
3	DISK2/3~DISK6/7	SATA/SAS Disk #2/#3#6/#7

No	Location	Description	Location	Description
A	DP1~DP4	DISK1~DISK4 Power LED	LED1~4	DISK1~DISK4 Activity/Failure LED
B	DP5~DP8	DISK5~DISK8 Power LED	LED5~8	DISK5~DISK8 Activity/Failure LED

Hardware Specification

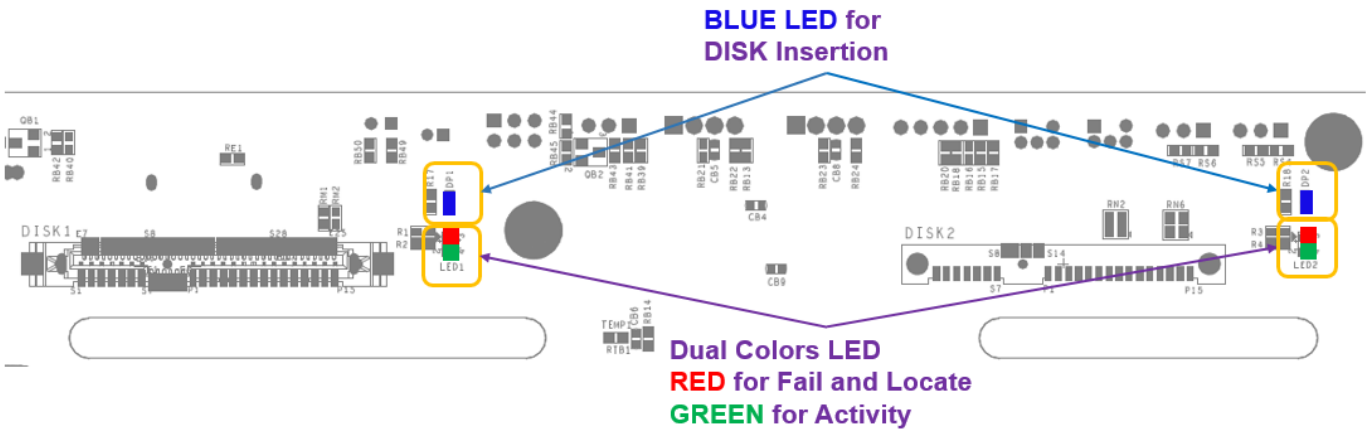
HOST Interface ： MiniSAS HD/ OCulink

Hard Disk (SSD) Interface ： SATA/SAS3/ NVMe

- Indicator ：
  - Power LED (DP1~DP8) : Blue –(When HDD is resent)
  - Dual color(Green/Red) LED LED1~LED8 for Hard Disk Drive Status (Activity/Fail/Locate)
  - Activity LED: Green (When HDD is Access)
  - Fail/Locate LED : Red (When HDD Fail or Locate)
- Environment Control :
  - PWM FAN Connector (FAN1~FAN4) for Cooling system.
  - Temperature Sensor (RTB1/RBT2) Monitor HDD bay inside temperature.
  - Buzzer (SUB1) for Over-temperature and FAN fail alerting.
- High Speed Connector
  - SFF-8643 MiniSAS HD Connector *2 (CN1/CN2)
    - One MiniSAS HD connector can support up to 4 SAS3 disk bays. All the miniSAS HD connectors are directly wired to the 29-pin disk connectors.
      - CN1 directly wired to DISK1~DISK4.
      - CN2 directly wired to DISK5~DISK8.
  - SFF-8680 SAS29PIN Connector *8 (DISK1~DISK8) for SATA/SAS3 Disk.
  - SFF-8621 OCULINK 42PIN Connector *4 (NVME1~NVME4)
  - SFF-8639 U.2 68Pin Connector *4 (DISK1,5 / DISK4,8) for SATA/SAS3 Disk or NVMe SSD.
  - SFF-8680 SAS29Pin Connector *4 (DISK2,3 / DISK6,7) for SATA/SAS3 Disk.
- Power Connector/Signal Control Header：
  - P4.2mm Disk Drive Power Connector*2 (PW1[5V]/PW2[12V]).
  - JB1 M/S Link Connector for Synchronous signal connection between two backplane.
  - JB2 Header for Backplane Master/Slave Selection.
  - JB3 Header for Test_Mode/Buzzer Alarm Enable/Disable selection and Mute_SW.
  - JD1/JD2 Header for Programming MCU Firmware.
  - JM1 connector for Fan speed control connected between Motherboard and backplane.
  - JM2 SMBUS Connector for external SMBUS control function.

LED Behavior

Disk Bay LED



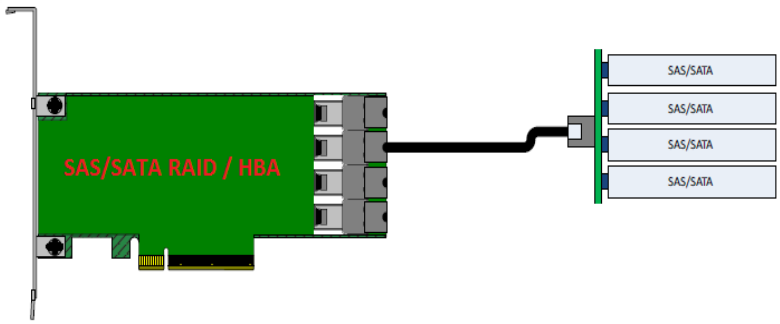
Blue LED:
Disk Insertion Indicator –
Turned on whenever disk drive is properly installed.

Green LED:
Activity indicator –
Stay off when idle and blinking (~8 Hz) whenever disk drive is being accessed.

RED LED:
Fail and Locate indicator –
Turned steady on when disk failure occurs. Blinking (1 Hz) when locating Disk, RAID rebuild and RAID consistent check.

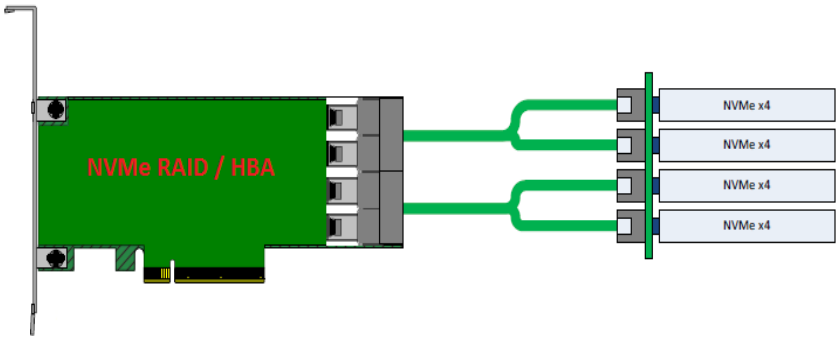
There are 2 parts of LED Management on the backplane. One is for SAS and another is for NVMe. Please note that the disk slots can only accommodate SAS/SATA or NVMe disk at a time since they share the same disk connector.

For SAS application, The LEDs behave by following SGPIO signal coming through sideband bus inside the SFF-8643 cables. Please refer to Section 2 for SGPIO settings. When SGPIO Jumper setting is enabled the LEDs behave according to the SGPIO signals. When SGPIO is disabled, the RED LEDs (for Locate and Fail) do not behave while the GREEN LEDs (for Activity) behave according to the signal from P11 (READY LED) of the disk connectors.



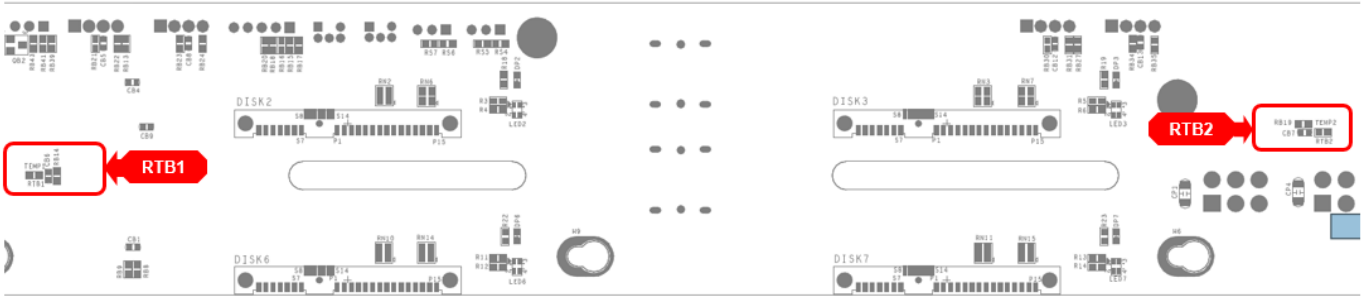
For NVMe application, The LEDs behave according to the VPP over I2C signals from NVMe host controllers through sideband bus of Oculink or SlimSAS cables. Whenever the NVMe host controller support VPP over I2C, the RED LEDs behave Locate, Fail and Rebuild signals following VPP signals on the I2C bus. The Green LEDs (for Activity) behave according to the signal from P11 (Activity) of the disk connectors.

Examples of NVMe connections to Broadcom RAID/HBA controller. Each pair of VPP over I2C signal supports 2 pieces of NVMe disks LED management. The I2C bus is leaded to odd-number NVMe connector (Oculink or SlimSAS) to manage its corresponding and the following NVMe disks. For example, NVMe1 and NVMe2 LED management signal is form NVMe1 connector's sideband I2C bus, NVMe3 and NVMe4 LED management signal is from NVMe3 connector's sideband I2C bus and …etc.

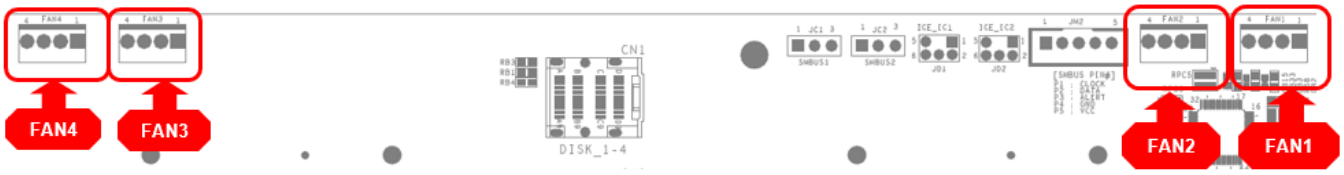


Smart Fan Control

InWin'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 two thermal sensors (RTB1/RTB2) on the backplane.



Thanks to Smart Fan Control feature the Fan connectors (FAN1/FAN2/FAN3/FAN4) on backplane support wide variety of PWM driven Fan modules being used in the enclosure.



How it works?

1. Fan module auto-calibration triggered in every system boot. The thermal 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 sensed 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 thermal profile are as below.
6. When an external PWM source joins, the output PWM duty is determined by comparing the internal calculated PWM and external PWM and then select whichever is higher as the output PWM to the fan modules.

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

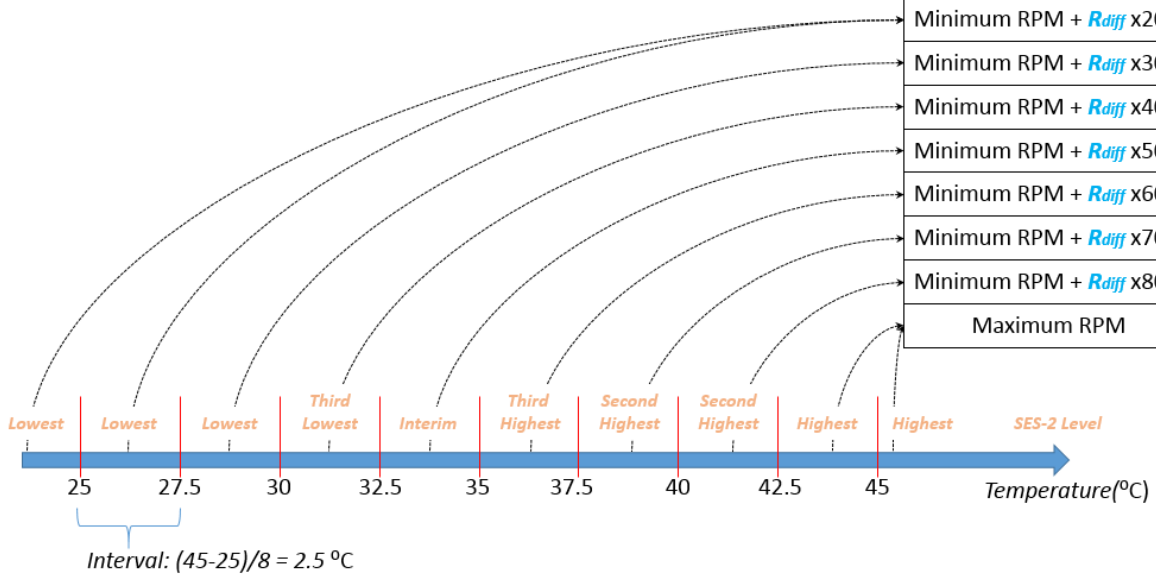
PWM Level Table

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

Cooling Control Policy – 45 Celsius

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

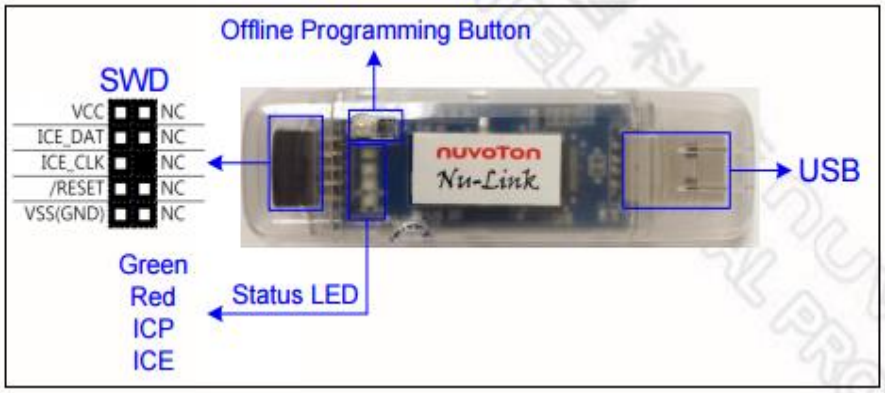


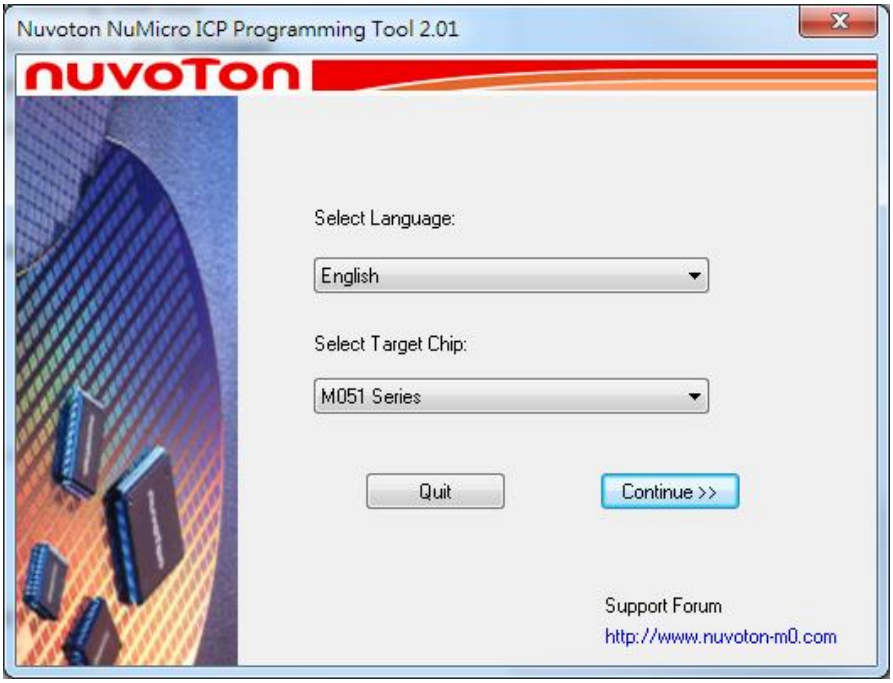
Firmware Upgrade

The passive backplanes are planted Nuvoton M058 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.

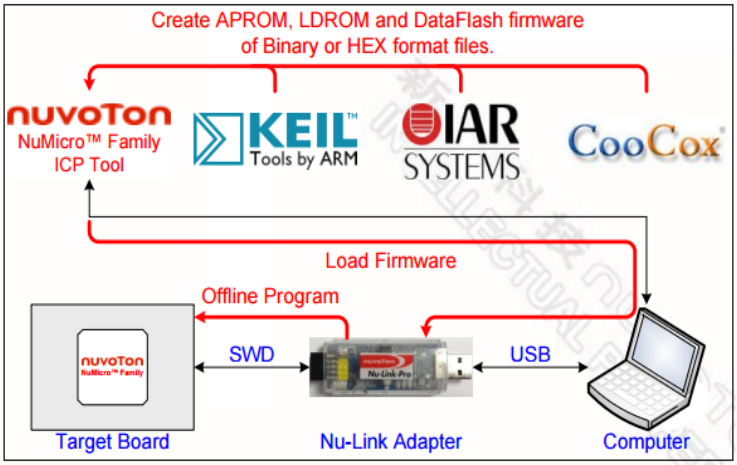
How to upgrade firmware?

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

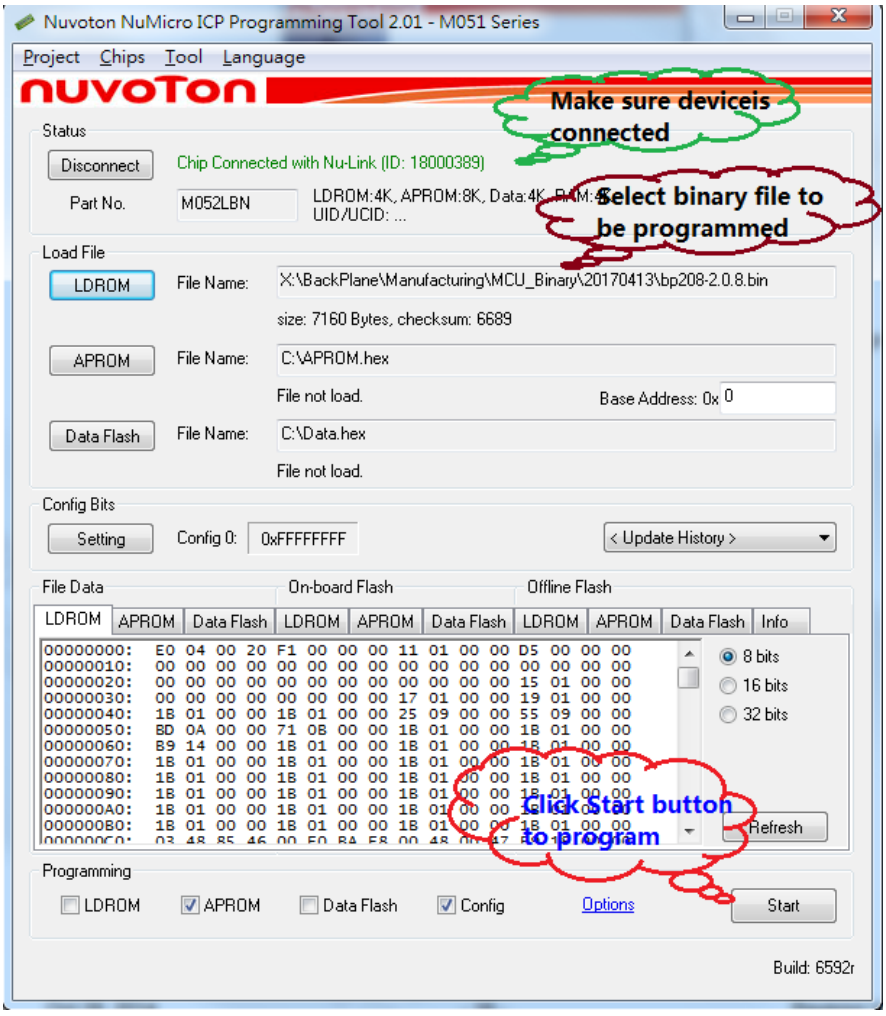




2. Connect Nu-Link USB end to a host and the SWD end to Backplane ICE connector for each MCU.



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.