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Product Specification
Industrial 2.5" SATA flash disk
(SATA Solid-State Disk)
-Hermes series-

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Revision History

Revision	Description	Date
1.0	<i>initial release</i>	<i>2008/12/11</i>
2.0	<i>System Performance updated</i>	<i>2009/01/21</i>
3.0	<i>Industrial grade 128GB part number added</i> <i>Page 14 – Warranty period corrected</i>	<i>2009/9/25</i>

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Preliminary Specification

1. Introduction

APRO Industrial rugged metal 2.5" SATA flash disk – Hermes series provide high capacity flash memory Solid State Drive (SSD) that electrically complies with Serial ATA 2.6 (SATA) standard. APRO Industrial rugged metal 2.5" SATA flash disk – Hermes series support SATA Gen-II (3.0 GB/s) with high performance. The main used flash memories are Samsung SLC-NAND type flash memory chips. The available disk capacities are 8GB, 16GB, 32GB, 64GB and 128GB for industrial grade and standard grade up to 128GB. The operating temperature grade is optional for commercial level 0°C ~ 70°C and wide temperature level -40°C ~ +85°C. The data transfer performance by sustained read is up to 152 MB/sec (Typ.), and sustained write is up to 121 MB/sec (Typ.).

The APRO Industrial rugged metal 2.5" SATA flash disk products provide a high level interface to the host computer. This interface allows a host computer to issue commands to the metal 2.5" SATA flash disk to read or write blocks of memory. Each sector is protected by a powerful 6 bits Error Correcting Code (ECC). APRO Industrial rugged metal 2.5" SATA flash disk Hermes series intelligent controller manages interface protocols, data storage and retrieval as well as ECC, defect handling and diagnostics, power management and clock control.

Figure 1 shows a block diagram of the used high tech Industrial rugged metal 2.5" SATA flash disk controller.

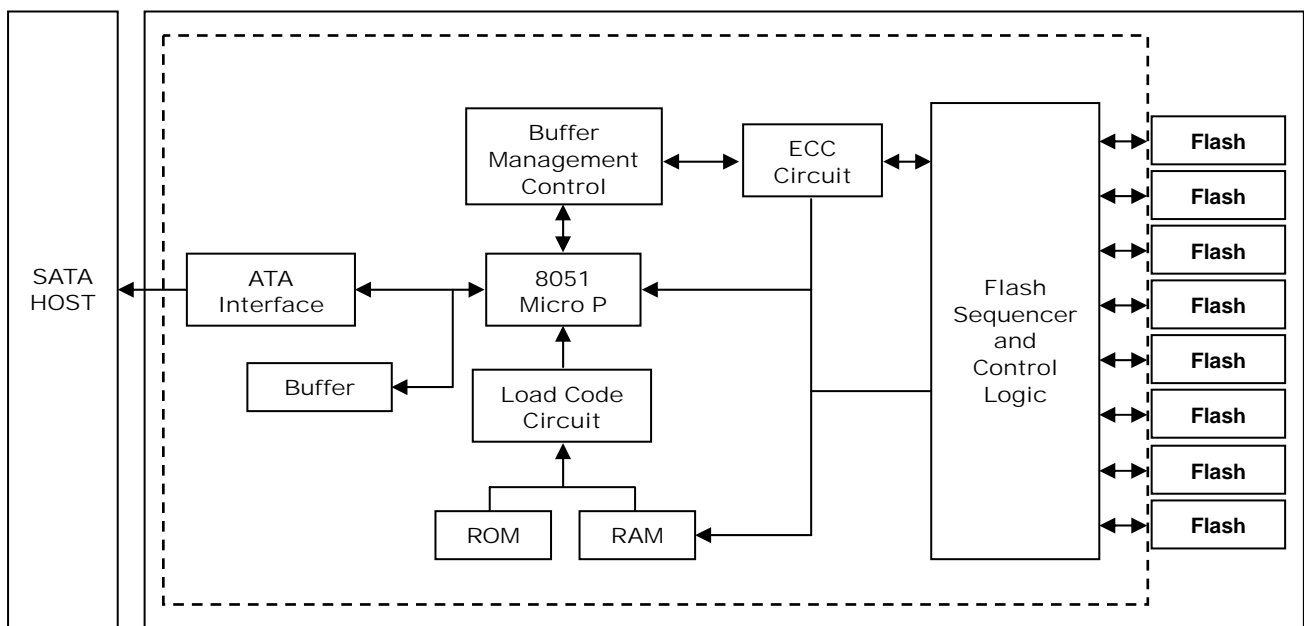


Figure 1: Industrial rugged metal 2.5" SATA flash disk Hermes series controller block diagram

1.1. Scope

This document describes the features and specifications and installation guide of APRO's Industrial rugged metal 2.5" SATA flash disks – Hermes series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. System Features

- SLC-NAND type flash technology
- Standard 2.5" SATA flash disk form-factor
- SATA 7-pin (data) + 15-pin (power connector) host Interface
- Extremely rugged metal casing to endure harsh environments
- SATA 1.0a and SATA 2.6 specification compliance
- SMART (Self-Monitoring, Analysis and Reporting Technology) function supported.
- Non-volatile memory and no moving parts
- Standard grade capacity from 8GB up to 128GB
- Industrial grade capacity from 8GB up to 128GB
- Performance up to 152 MB/sec
- Automatic 6 bits error correction (ECC) and retry capabilities
- +5 V $\pm 10\%$ operation
- MTBF > 3,000,000 hours.
- Shock : 1,500G, compliance to MIL-STD-810F
- Vibration : 5G, compliance to MIL-STD-810F
- Critical environment is working well
- Very high performance, very low power consumption
- Low weight, Noiseless

1.3. Flash Management Technology - Static Wear Leveling

In order to gain the best management for flash memory, APRO Industrial 2.5" SATA flash disk Hermes series supports **Static Wear Leveling technology** to manage the Flash system. The life of flash memory is limited; the management is to increase the life of the flash product.

A static wear-leveling algorithm evenly distributes data over an entire Flash cell array and searches for the least used physical blocks. The identified low cycled sectors are used to write the data to those locations. If blocks are empty, the write occurs normally. If blocks contain static data, it moves that data to a more heavily used location before it moves the newly written data. The static wear leveling maximizes effective endurance Flash array compared to no wear leveling or dynamic wear leveling.

2. Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

2.1. System Environmental Specifications

Table 1: Environmental Specification

APRO Industrial rugged metal 2.5" SATA flash disk Hermes series		Commercial Grade	Industrial Grade
		SR2SFDxxxG-JACSC Series	WR2SFDxxxG-JAISI Series
Temperature	Operating:	-10°C ~ +70°C	-40°C ~ +85°C
	Non-operating:	-20°C ~ +80°C	-50°C ~ +95°C
Humidity	Operating & Non-operating:	10% ~ 95% non-condensing	
Vibration	Operating & Non-operating:	15G, compliance to MIL-STD-810F	
Shock	Operating & Non-operating:	1,500G, compliance to MIL-STD-810F	

2.2. System Power Requirements

Table 2: Power Requirement

APRO Industrial rugged metal 2.5" SATA flash disk Hermes series		Standard Grade	Industrial Grade
		SR2SFxxxG-JACSC Series	WR2SFxxxG-JAISI Series
DC Input Voltage (VCC) 100mV max. ripple(p-p)		5V±10%	
+5V Current (Maximum average value)	Reading Mode :	200mA (max.)	
	Writing Mode :	360mA (max.)	
	Stand By Mode :	120mA (max.)	

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		Serial ATA Gen-II (3.0Gb/s = 380MB/s)				
Average Access Time		0.2 ms (estimated)				
Maximum Performance	Capacity	8GB	16GB	32GB	64GB	128GB
	Sequential Read (MB/s)	146.5MB/s	149.6MB/s	150.7MB/s	152.2MB/s	150.5MB/s
	Sequential Write(MB/s)	110.8MB/s	112.3MB/s	119.8MB/s	121.2MB/s	118.8MB/s
The number of Flash IC		4pcs	8pcs	16pcs	16pcs	16pcs

Note:

- (1). All values quoted are typically at 25°C and nominal supply voltage.
- (2). Testing of the Industrial rugged metal 2.5" SATA flash disk maximum performance was performed under the following platform:
 - Computer with AMD 3.0GHz processor
 - Windows XP Professional operating system

2.4. System Reliability

Table 4: System Reliability

MTBF	>3,000,000 hours
Data Reliability	<1 non-recoverable error in 10^{14} bits read <1 erroneous correction in 10^{20} bits read
Wear-leveling Algorithms	Static Wear Leveling
Bad Blocks Management	Supportive
ECC Technology	6 bits Error Connection Code
Endurance	<ul style="list-style-type: none"> ● Unlimited Read Cycles ● Greater than 2,000,000 cycles Logically contributed by Wear-leveling and advanced bad sector management
Data Retention	10 years

2.5. Physical Specifications

Refer to Table 5 and see Figure 3 for Industrial rugged metal 2.5" SATA flash disk Hermes series physical specifications and dimensions.

Table 5: Physical Specifications of Industrial rugged metal 2.5" SATA flash disk-Hermes series

Length:	99.70 mm / 4.0 in
Width:	69.90 mm / 2.79 in
Thickness:	9.40 mm / 0.38 in
Weight:	105.00 g / 4.0 oz

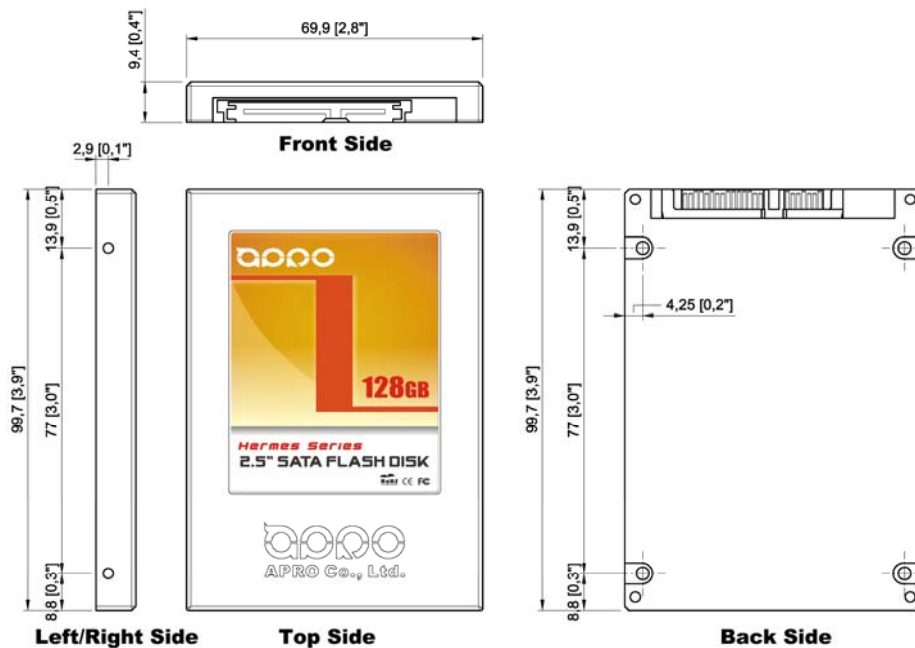


Figure 2: Rugged Metal 2.5" SATA flash disk Dimension

2.6. Capacity Specifications

APRO Industrial rugged metal 2.5" SATA flash disks are built-in mainly Samsung SLC -NAND Type Flash memory chips. The Table 6 shows the equivalent part number of applied Samsung Flash memory chips for each card.

Table 6: Card Configuration vs. Samsung NAND SLC part number

Card capacity	Samsung SLC flash memory part number * Q'TY	
8GB	Commercial Grade:	K9WAG08U1M-PCB0(16Gb) or equivalent * 4
	Industrial Grade:	K9WAG08U1M-PIB0(16Gb) or equivalent * 4
16GB	Commercial Grade:	K9WBG08U1M-PCB0(32Gb) or equivalent * 4
	Industrial Grade:	K9WBG08U1M-PIB0(32Gb) or equivalent * 4
32GB	Commercial Grade:	K9WBG08U1M-PCB0(32Gb) or equivalent * 8
	Industrial Grade:	K9WBG08U1M-PIB0(32Gb) or equivalent * 8
64GB	Commercial Grade:	K9WBG08U1M-PCB0(32Gb) or equivalent * 16
	Industrial Grade:	K9WBG08U1M-PIB0(32Gb) or equivalent * 16
128GB	Commercial Grade:	K9NCG08U5M-PCB0(64Gb) or equivalent * 16
	Industrial Grade:	K9NCG08U5M-PIB0(64Gb) or equivalent * 16

The table 7 shows the specific capacity for the various models and the default number of heads, sectors/track and cylinders.

Table 7: Device Parameters

Unformatted Capacity	Default Cylinder	Default Head	Default Sector	LBA
8GB	14,645	16	63	14,761,984
16GB	16,383	16	63	29,523,968
32GB	16,383	16	63	59,047,936
64GB	16,383	16	63	118,095,872
128GB	16,383	16	63	23,6791,744

3. Interface Description

3.1. Industrial metal 2.5" SATA flash disk interface

APRO Industrial rugged metal 2.5" SATA flash disk comes with 7 pins + 15 pins Serial ATA connector.

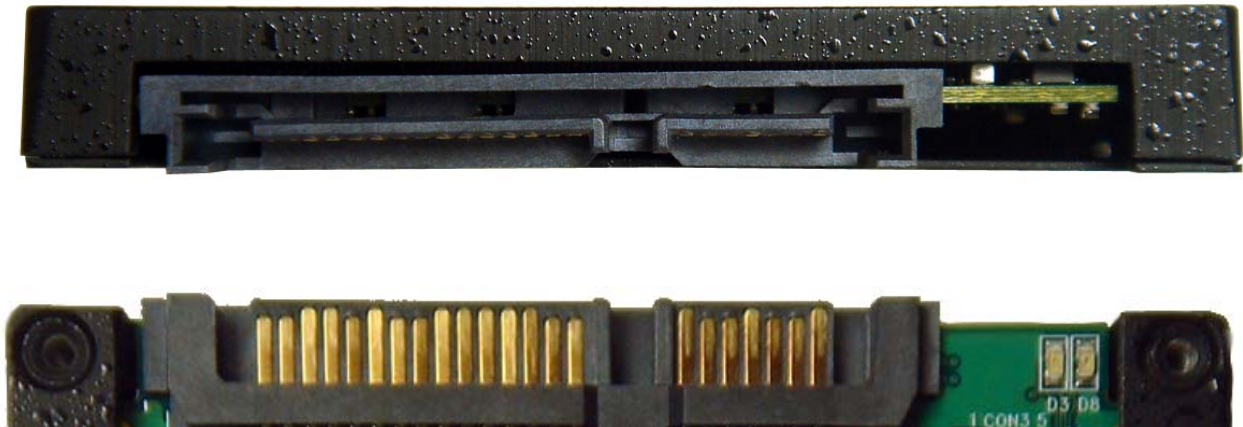


Figure 3 :The front view of 2.5" SATA flash disk

3.2. Pin Assignments

There are total of 7 pins in the signal segment and 15 pins in the power segment. The pin assignments are listed in below table 8.

Table 8 - Pin Assignments

Name	Type	Description
S1	GND	
S2	A+	Differential Signal Pair A
S3	A-	
S4	GND	
S5	B-	Differential Signal Pair B
S6	B+	
S7	GND	
Key and Spacing separate signal and power segments		
P1	V33	3.3V Power
P2	V33	3.3V Power
P3	V33	3.3V Power, Pre-charge
P4	GND	
P5	GND	
P6	GND	
P7	V5	5V Power, Pre-Charge
P8	V5	5V Power
P9	V5	5V Power
P10	GND	
P11	DAS/DSS	Device Activity Signal / Disable Staggered Spin up
P12	GND	
P13	V12	12V Power, Pre-charge
P14	V12	12V Power
P15	V12	12V Power

Note:

- 1. All pins are in a signal row with a 1.27 mm (0.050" pitch).**
- 2. The commands on the mating sequence in forward table apply to the case of backplane blind mate connector only. In this case, the mating sequences are:**
 - (1) The pre-charge power pins and other ground pins.**
 - (2) The signal pins and the rest of the power pins.**

4. Electrical Specification

4.1. Device Electrical Characteristics

Table 9 - Absolute Maximum Ratings

Parameter	Symbol	Condition	Min	Max	Unit
Analog power supply	AV _{DDH}		-0.5	6	V
Digital I/O power supply	DV _{DD}		-0.5	6	V
Digital I/O input voltage	V _{I(D)}		-0.4	DV _{DD} +0.4	V
Storage temperature	T _{STORAGE}		-55	140	°C

Table 10 - Recommended Power Supply Operation Conditions

Parameter	Symbol	Condition	Min	Typical	Max	Unit
DC Power Supply	V _{DD}		-0.3		+5.5	V
Input voltage	V _{IN}		-0.3		+5.5	V
Output voltage	V _{OUT}		-0.3		+3.8	
Operating Temperature	T _A	Standard	0		+70	°C
		Industrial	-40		+85	°C
Storage Temperature	T _{ST}	Standard	-20		+80	°C
		Industrial	-55		+95	°C

5. Functional Description

5.1. ATA Commands

The commands supported ATA/ATAPI-6 commands, certain obsolesced commands are also supported. The supported commands are listed in Table 16.

Table 14 - ATA Commands Supported

Command	Code	Support	Ext
Check Power Mode	E5H	Yes	Yes
Download Microcode	92H	Yes	Yes
Flush Cache	E7H	Yes	Yes
Identify Device	ECH	Yes	Yes
Idle	E3H	Yes	Yes
Idle immediate	E1H	Yes	Yes
Initialize Device Parameters	91H	Yes	Yes
Read Multiple	C4H	Yes	Yes
Read Sector(s)	20H	Yes	Yes
Read Verify Sector	40H	Yes	Yes
Read DMA	C8H	Yes	Yes

Recalibrate	10H	Yes	Yes
Set Features	EFH	Yes	Yes
Set Multiple Mode	C6H	Yes	Yes
Set Sleep Mode	E6H	Yes	Yes
SMART	B0H	Yes	Yes
Standby	E2H	Yes	Yes
Standby Immediate	E0H	Yes	Yes
Security Set Password	F1H	Yes	Yes
Security Unlock	F2H	Yes	Yes
Security Erase Prepare	F3H	Yes	Yes
Security Erase Unit	F4H	Yes	Yes
Security Freeze Lock	F5H	Yes	Yes
Security Disable Password	F6H	Yes	Yes
Write Multiple	C5H	Yes	Yes
Write Sector	30H	Yes	Yes
Write DMA	CAH	Yes	Yes

6. Ordering Information

6.1 Part Number List

◆ Industrial metal 2.5" SATA flash disk – Hermes series

Grade	Standard grade (-10°C ~ 70°C)	Industrial Grade (-40°C ~ 85°C)
8GB	SR2SFD008G-JACSC	WR2SFD008G-JAISI
16GB	SR2SFD016G-JACSC	WR2SFD016G-JAISI
32GB	SR2SFD032G-JACSC	WR2SFD032G-JAISI
64GB	SR2SFD064G-JACSC	WR2SFD064G-JAISI
128GB	SR2SFD128G-JACSC	WR2SFD128G-JAISI

6.2 Part Number Decoder

X1 X2 X3 X4 X5 X6 X7 X8 X9 – X11 X12 X13 X14 X15 / C

X1 : Grade

S : Standard Grade – operating temp. 0° C ~ 70 ° C

W : Industrial Grade – operating temp. -40° C ~ 85 ° C

X2 : The material of case

R : 2.5" Rugged metal Casing

X3 X4 X5 : Product category

2SF : 2.5" SATA Flash Disk

X6 X7 X8 X9 : Capacity

008G: 8GB 064G: 64GB

016G: 16GB 128G: 128GB

032G: 32GB

X11 : Controller

J : JMicron (Hermes Series)

X12 : Controller version

A,B,C,.....

X13 : Controller Grade

C : Commercial grade

I : Industrial grade

X14 : Flash IC

S : Samsung SLC-NAND Flash IC

X15 : Flash IC grade / Type

C : Commercial grade

I : Industrial grade

C : Reserved for specific requirement

C : Conformal-coating

Appendix A. Limited Warranty

APRO warrants your Industrial rugged metal 2.5" SATA flash disk against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair. The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered. In no event shall APRO be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM APRO.

Product shall be returned to APRO with shipping prepaid. If the product fails to conform based on customers' purchasing orders, APRO will reimburse customers for the transportation charges incurred.

Remark:

The warranty does not cover product damage due to improper operation or force of nature such as fire or flood.

1.3. Service charge for out of warranty period

Out of warranty repair charges are dependent on component cost and labor time. APRO will issue an estimate after diagnosing the problem.

1.4. End of Life service

APRO cannot guarantee repair of any products beyond one year of End-of-Life due to limited availability of replacement components. If repair components are not available, APRO will suggest equivalent products for purchase and offer special pricing.

1.5. Shipping Charges

The customer is responsible for packaging the product such that no additional damage occurs during normal shipping and handling. Any freight-collect shipments without notice in advance will be refused.

For warranty repairs, the customer is responsible for the cost of shipping the product back to APRO. APRO will pay for shipping back to the customer.

For DOA warranty replacements, APRO will pay shipping charges for return and replacement. APRO reserves the right to use the most economical shipping method available.

2. Procedure

The definition of defective products fall into three categories as described below:

- DOA (Defect on Arrival): Defect occurs within 30 days of purchase.
- RMA in warranty period
- RMA out of the warranty period

The above terms are determined by the purchase date on the invoice up to the time to product is returned to APRO.

APRO's repair service procedure is as follows:

2.1. Request an RMA Number from APRO:

- (1) Fill out an "RMA Request Form" and send it by fax to +886-2-2929 0307 or e-mail to rma@APRO-tw.com
- (2) APRO's RMA engineer will check that the "RMA Request Form" has been completed with precise information. Then the customer will receive a RMA number.

If you need a replacement rather than wait for the returned defective product to be repaired, this requirement must be noted in your "RMA Request Form".

2.2. Package and Delivery to APRO

- (1) Returned products have to be packed properly to avoid damage during the transportation.
- (2) DOA products: DOA products qualify for complete replacement and have to be returned with all accessories included in the original purchase.
- (3) Please indicate your unique RMA number on the top outside of the package.
- (4) To speed up the RMA/DOA procedure, please notify us by e-mail (rma@APRO-tw.com) with information that includes the shipping date, the name of carrier and the tracking number of the package.

2.3. Product Check On Arrival

- (1) APRO's RMA engineer will check your product within 8 hours since arrival.
- (2) If the product arrives undamaged and conforms to the conditions described on the "RMA Request Form", it will be for repairing.
- (3) If the product is damaged or there is some inconsistency with the "RMA Request Form" description, APRO will contact and confirm the status with the customer before proceeding.

2.4. Repair

- (1) The RMA engineer will repair the defect as described by the customer. The products will also be tested to ensure it is in proper working order.
- (2) If no additional problems are detected, APRO will notify the customer.
- (3) If the customer does not reply us within 48 hours, and no failure occurs during testing, the product will be processed as NTF. (No testing failure).

2.5. Charge

The customer will be charged for repairs under below conditions:

- (1) RMA is out of the warranty period
- (2) RMA or DOA terms apply, but it is determined by APRO's RMA engineer that the defect was caused by abuse, misuse or unauthorized repair.

2.6. Package and Delivery to the customer

- (1) We will properly pack the repaired product along with a RMA report.
- (2) The RMA number and quantity will be clearly marked on the package.
- (3) The customer will receive an e-mail notification of the product RMA number and shipping advice.