



Industrial

2.5" PATA SLC SSD

PHANES-B Series

Product Specification

INDUSTRIAL

APRO RUGGED METAL 2.5" PATA SLC SSD

Version 01V3

Document No. 100-xR2IF-PBTS

September 2016

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Revision History

Revision	Description	Date
1.0	Initial release	2014/8/6
1.1	Add Jumper Setting	2014/08/14
1.2	Add Power Protect Description	2014/12/12
1.3	Add Table 5: TBW (TeraBytes Written)	2016/09/06

CONTENTS

1.	INTRODUCTION	- 2 -
1.1.	SCOPE	- 3 -
1.2.	SYSTEM FEATURES	- 3 -
1.3.	FLASH MANAGEMENT TECHNOLOGY - STATIC WEAR LEVELING	- 3 -
1.4.	LOW VOLTAGE DETECTOR.....	- 3 -
1.5.	POWER-LOSS DATA PROTECTION.....	- 4 -
2.	PRODUCT SPECIFICATIONS	- 4 -
2.1.	SYSTEM ENVIRONMENTAL SPECIFICATIONS	- 4 -
2.2.	SYSTEM POWER REQUIREMENTS	- 4 -
2.3.	SYSTEM PERFORMANCE	- 5 -
2.4.	SYSTEM RELIABILITY.....	- 5 -
2.5.	PHYSICAL SPECIFICATIONS	- 6 -
2.5.1.	CONFORMAL COATING	- 7 -
3.	INTERFACE DESCRIPTION	- 7 -
3.1.	APRO RUGGED METAL 2.5" PATA SLC SSD INTERFACE	- 7 -
3.2.	PIN ASSIGNMENTS	- 8 -
3.2.1.	ELECTRICAL DESCRIPTION.....	- 9 -
	APPENDIX A: ORDERING INFORMATION	- 11 -
1.	PART NUMBER LIST	- 11 -
2.	PART NUMBER DECODER:	- 11 -
	APPENDIX B: LIMITED WARRANTY.....	12

1. Introduction

APRO Rugged Metal 2.5" PATA SLC SSD – PHANES-B Series provides high capacity flash memory Solid State Drive (SSD) that electrically complies with ATA/ATAPI 8 standard. APRO Rugged Metal 2.5" PATA SLC SSD – PHANES-B Series support UDMA-7 with high performance. The main used flash memories are SLC-NAND type flash memory chips. The available disk capacities are 8GB, 16GB, 32GB, 64GB, 128GB, and 256GB.

The operating temperature grade is optional for Standard grade 0°C ~ 70°C and wide temp grade supports -40°C ~ +85°C. The data transfer performance by sequential read is up to 88.4 MB/sec, and sequential write is up to 89.3 MB/sec.

APRO Rugged Metal 2.5" PATA SLC SSD products provide a high level interface to the host computer. This interface allows a host computer to issue commands to the Rugged Metal 2.5" PATA SLC SSD to read or write blocks of memory. Each sector is protected by a powerful 68 bits per 1024 bytes error correction (ECC). APRO Rugged Metal 2.5" PATA SLC SSD PHANES-B 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 Rugged Metal 2.5" PATA SLC SSD controller.

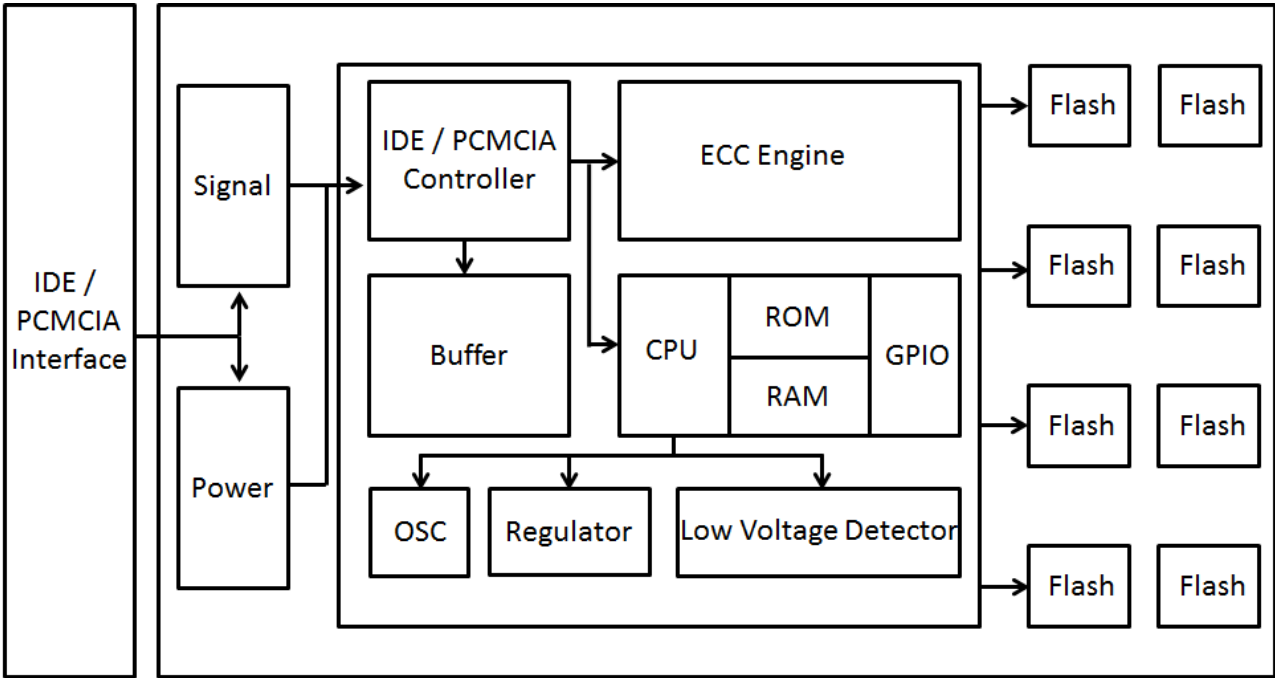


Figure 1: APRO Rugged Metal 2.5" PATA SLC SSD PHANES-B Series controller block diagram

1.1. Scope

This document describes features, specifications and installation guide of APRO's Rugged Metal 2.5" PATA SLC SSDs – PHANES-B 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" Flash Disk form-factor (7.2mm height)
- Standard 44-Pin PATA (IDE) male connector
- Extremely Rugged Metal casing to endure harsh environments
- PIO 0~4, MWDMA 0~2, UDMA 0~7 supported
- Non-volatile memory and no moving parts
- SLC Flash SSD standard grade capacity from 8GB up to 256GB
- Sequential read performance up to 88.4 MB/sec
- Sequential write performance up to 89.3 MB/sec
- Automatic 68 bits per 1024 bytes error correction (ECC) and retry capabilities
- +3.3V \pm 10% / +5V \pm 10% operation
- Shock : 0.5ms, 1500 G, 3 axes
- Vibration : 20 Hz to 2K Hz, 20G, 3 axes
- Built-in Low Voltage Detector
- Very high performance, very low power consumption
- Low weight, Noiseless
- Standard grade supports operating temperature 0°C to +70°C, and Industrial Grade, -40°C to +85°C

1.3. Flash Management Technology - Static and Dynamic Wear-leveling

NAND Flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling technique is applied to extend the lifespan of NAND Flash by evenly distributing write and erase cycles across the media.

APRO 2.5" PATA SLC SSD PHANES-B Series provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND Flash is greatly improved.

1.4. Low Voltage Detector

APRO industrial 2.5" PATA SSD – PHANES-B Series has built-in Low Voltage Detector, it becomes active when detecting voltage threshold near 50% of the power it should receive from host. In this scenario, storage will take precedence for the data that host has already completed its command to write into flash at the same time whenever low voltage is detected.

1.5. Power-Loss Data Protection

APRO industrial 2.5" PATA SSD – PHANES-B Series utilizes host and device-initiated power fail protection mechanisms to guarantee data integrity. When encountering sudden power interruption, device will check the last programmed page for any uncorrectable error, if errors were found, all data written prior of the error will be moved to a new block while old block will be erased and corrected during the next power on.

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 Rugged Metal 2.5" PATA SLC SSD		Standard Grade	Industrial Grade
PHANES-B Series		SR2IFxxxG-PBCTC-U	WR2IFxxxG-PBITI-U
Temperature	Operating:	0°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:	20 Hz to 2K Hz, 20G, 3 axes	
Shock	Operating & Non-operating:	0.5ms, 1500 G, 3 axes	

2.2. System Power Requirements

Table 2: Power Requirement

APRO Rugged Metal 2.5" PATA SLC SSD		Standard Grade
PHANES-B Series		SR2IFxxxG-PBCTC-U
DC Input Voltage (VCC) 100mV max. ripple(p-p)		+3.3V ± 10% / +5V ± 10%
+3.3V Current (Maximum average value)	Reading Mode :	149 mA (max.)
	Writing Mode :	155 mA (max.)
	Idle Mode :	5.1 mA (max.)

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		PIO 0~4, MWDMA 0~2, UDMA 0~7 supported					
Average Access Time		0.1 ms (estimated)					
Maximum Performance	Capacity	8GB	16GB	32GB	64GB	128GB	256GB
	Sequential Read (MB/s)	61.6	61.1	82.0	88.4	86.8	87.3
	Sequential Write(MB/s)	38.0	51.0	80.6	89.3	79.6	90.6

Note:

- (1). All values quoted are typically at 25 °C and nominal supply voltage.
- (2). Testing of the Rugged Metal 2.5" PATA SLC SSD 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

Wear-leveling Algorithms	Static and Dynamic Wear-leveling
Bad Blocks Management	Supported
ECC Technology	68 bits per 1024 bytes
Endurance	Un-limited Read Cycles Endurance Management enables five years minimal useful life
Data Retention	10 years

Note:

- (1). Samples were built using Toshiba SLC NAND flash.
- (2). TBW may differ according to flash configuration and platform.
- (3). The endurance of SSD could be estimated based on user behavior, NAND endurance cycles, and write amplification factor. It is not guaranteed by flash vendor.

Table 5: TBW (TeraBytes Written)

TBW (Tera Bytes Written)		
Capacity	TBW(TB)	DWPD & Lifespan
4GB	91	DWPD=5.91 DWPD (Drive Written Per Day) Lifespan = 5 Years
8GB	111	
16GB	183	
32GB	352	
64GB	694	
128GB	1,378	
256GB	2,697	

2.5. Physical Specifications

Refer to Table 5 and see Figure 3 for Rugged Metal 2.5" PATA SLC SSD PHANES-B Series physical specifications and dimensions.

Table 6: Physical Specification

Length:	100.10 mm / 3.94 in
Width:	69.80 mm / 2.75 in
Thickness:	7.20 mm / 0.28 in
Weight:	115.00 g / 4.06 oz

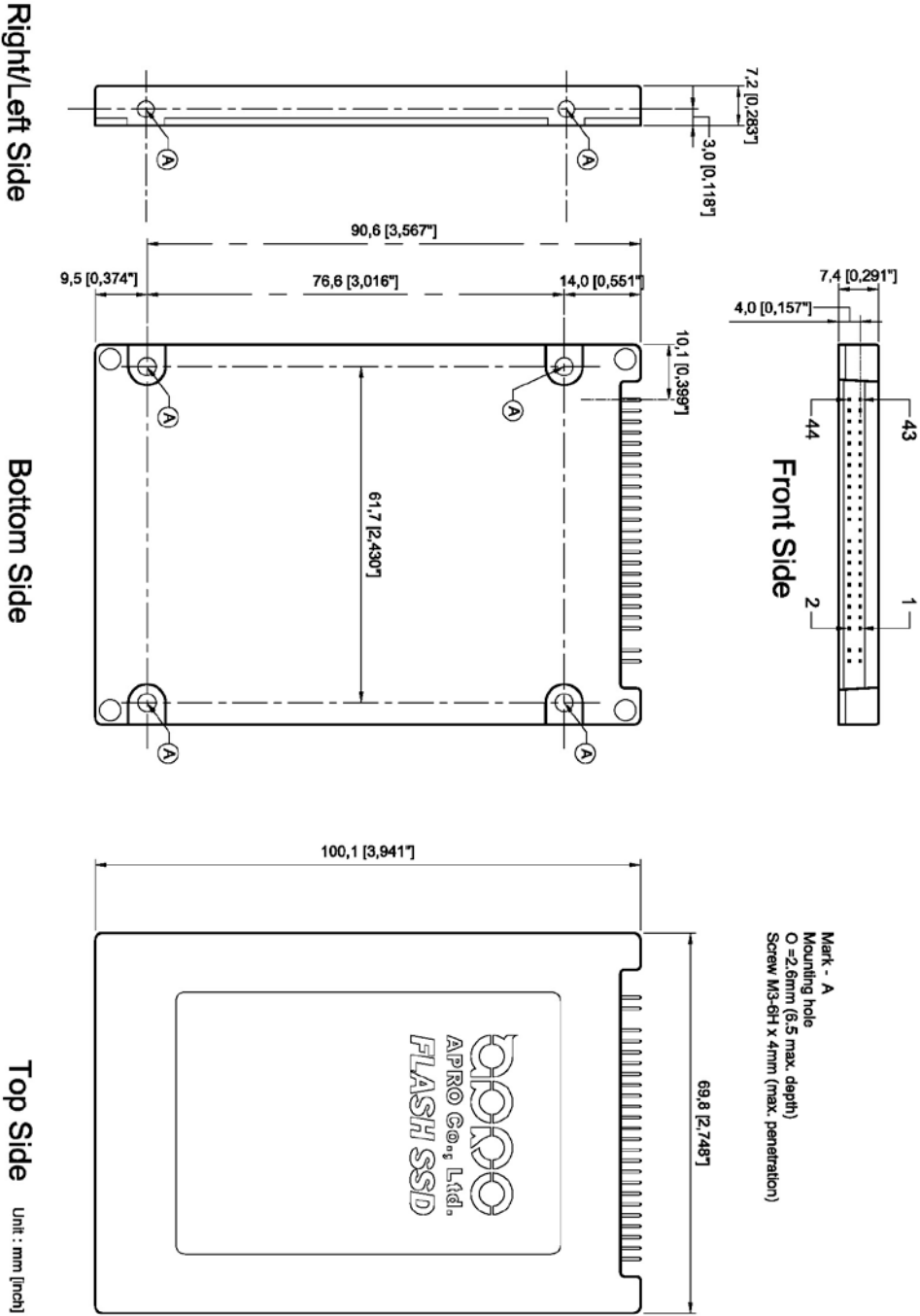


Figure 2: APRO Rugged Metal 2.5" PATA SLC SSD Dimension

2.5.1. Conformal coating

Conformal coating is a protective, dielectric coating designed to conform to the surface of an assembled printed circuit board. Commonly used conformal coatings include silicone, acrylic, urethane and epoxy. APRO applies only silicone on APRO storages products upon requested especially by customers. The type of silicone coating features good thermal shock resistance due to flexibility. It is also easy to apply and repair.

Conformal coating offers protection of circuitry from moisture, fungus, dust and corrosion caused by extreme environments. It also prevents damage from those Flash storages handling during construction, installation and use, and reduces mechanical stress on components and protects from thermal shock. The greatest advantage of conformal coating is to allow greater component density due to increased dielectric strength between conductors.

APRO uses MIL-I-46058C silicon conformal coating

3. Interface Description

3.1. APRO Rugged Metal 2.5" PATA SLC SSD interface

Pin 1 ~ pin 44 are for IDE interface. Pin A ~ pin D is for Master/Slave selection via physical jumpers.

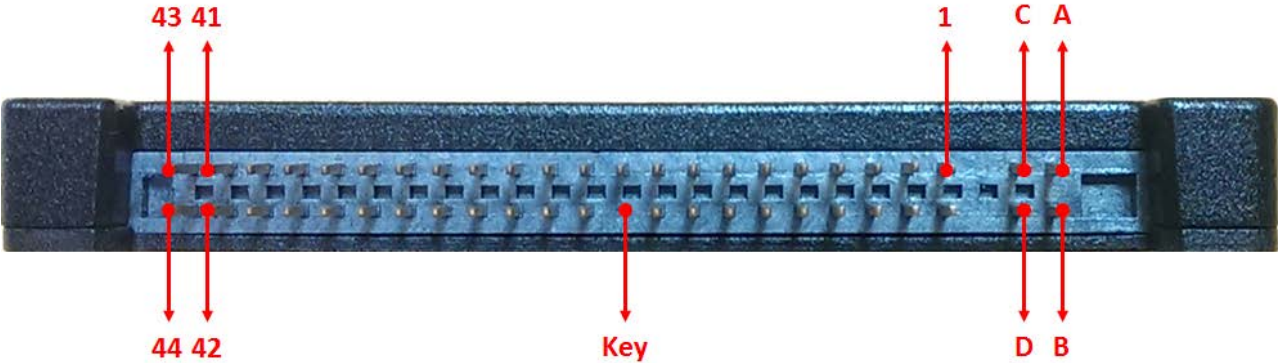
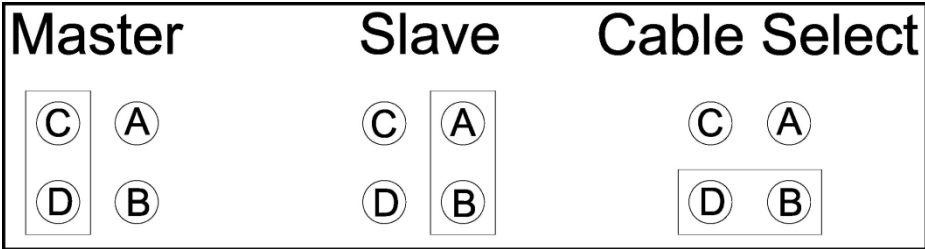


Figure 3 : The connectors of 2.5" PATA SLC SSD

3.2. Pin Assignments

Signals whose source is the host is designated as inputs while signals that APRO 2.5" PATA SLC Solid State Disk PHANES-B Series sources are outputs. The pin assignments are listed in below table 7.

Table 7 - Pin Assignments

Pin	Name	Descriptions	Pin	Name	Descriptions
01	-RESET	Drive Reset	02	GND	Ground
03	DD7	Drive data bus bit 7	04	DD8	Drive data bus bit 8
05	DD6	Drive data bus bit 6	06	DD9	Drive data bus bit 9
07	DD5	Drive data bus bit 5	08	DD10	Drive data bus bit 10
09	DD4	Drive data bus bit 4	10	DD11	Drive data bus bit 11
11	DD3	Drive data bus bit 3	12	DD12	Drive data bus bit 12
13	DD2	Drive data bus bit 2	14	DD13	Drive data bus bit 13
15	DD1	Drive data bus bit 1	16	DD14	Drive data bus bit 14
17	DD0	Drive data bus bit 0	18	DD15	Drive data bus bit 15
19	GND	Ground	20	KEY	No pin
21	DMARQ	DMA request	22	GND	Ground
23	-DIOW:STOP	Drive I/O Write	24	GND	Ground
25	DIOR-	Drive I/O Read	26	GND	Ground
27	IORDY	I/O channel ready	28	CSEL	Cable select
29	-DMACK	DMA acknowledge	30	GND	Ground
31	INTRQ	Drive interrupt	32	IOIS16	Drive 16 bit I/O
33	DA1	Drive address bus bit 1	34	-PDIAG:-CBLID	Passed diagnostics
35	DA0	Drive address bus bit 0	36	DA2	Drive address bus bit 2
37	-CS0	Chip select 0	38	CS1	Chip select 1
39	-DASP	Drive active slave present	40	GND	Ground
41	VCC	+5V supply	42	VCC	+5V supply
43	GND	Ground	44	NC	Reserved for future definition

3.2.1. Electrical Description

APRO 2.5" PATA SLC Solid State Disk PHANES-B Series is optimized for operation with hosts. Table 9: describes the signals of 44-pin interface.

Table 8: Signal Description

Pin No.	Signal Name	Type	Description
37, 38	CS(1:0)- (Chip Select)	I	These signals are used to select the Command Block or Control Block registers. When DMACK- is asserted, CS0- and CS1- shall be negated and transfers shall be 16 bits wide.
33, 35, 36	DA(2:0) (Device Address)	I	This is the 3-bit binary coded address for host to access a register or data port in this controller.
39	DASP- (Device active, device 1 present)	I/O	During the reset protocol, DASP- shall be asserted by Device 1 to indicate that the device is present.
3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	DD(15:00) (Device Data)	I/O	Bi-directional data bus. DD(7:0) are used for 8-bit register transfers.
25	DIOR-: HDMARDY-: HSTROBE (I/O Read: Ultra DMA Ready: Ultra DMA Data Strobe)	O	DIOR- is the strobe signal used by the host to read device registers of the Data port.
			When Ultra DMA mode DMA Read is active, HDMARDY- should be asserted by the host to indicate that the host is ready to receive Ultra DMA data-in bursts.
			HSTROBE receives the data-out strobe signal from the host for an UDMA burst.
23	DIOW-: STOP (I/O Write: Stop Ultra DMA Burst)	I	This pin is the strobe signal used by the host to write device registers or the Data port.
29	DMACK- (DMA acknowledge)	I	This signal is used by the host in response to DMARQ to initiate DMA transfers.
21	DMARQ (DMA Request)	O	For DMA data transfers, this controller will assert DMARQ when the controller is ready to transfer data to or from the host.
31	INTRQ (Interrupt)	O	When this device is selected, this signal is the active high Interrupt Request to the host.
27	IORDY:DDMARDY: DSTROBE (I/O channel ready: Ultra DMA ready: Ultra DMA data strobe)	O	The controller will assert this signal to indicate that the device is ready to receive Ultra DMA data-out bursts.
			When Ultra DMA mode DMA Read is active, this signal is the data-in strobe generated by the controller.


Product Specification

34	PDIAG--:CBLID-- (Passed diagnostics: Cable assembly type identifier)	I/O	PDIAG-- will be asserted by Device 1 to indicate to Device 0 that Device 1 has completed diagnostics.
1	RESET-- (Hardware RESET)	I	This is the hardware RESET pin from the host.
28	CSEL (Cable select)	I	This pin is used to configure this device as Device 0 or Device 1. When this pin is grounded, this device is configured as Device 0; When the pin is High, this device is configured as Device 1.

Appendix A: Ordering Information

1. Part Number List

◆ APRO Rugged Metal 2.5" PATA SLC SSD – PHANES-B Series

Product Picture	Grade	Standard grade (0°C ~ 70°C)	Industrial Grade (-40°C ~ +85°C)
	8GB	SR2IF008G-PBCTC-U(/C)	WR2IF008G-PBITI-U(/C)
	16GB	SR2IF016G-PBCTC-U(/C)	WR2IF016G-PBITI-U(/C)
	32GB	SR2IF032G-PBCTC-U(/C)	WR2IF032G-PBITI-U(/C)
	64GB	SR2IF064G-PBCTC-U(/C)	WR2IF064G-PBITI-U(/C)
	128GB	SR2IF128G-PBCTC-U(/C)	WR2IF128G-PBITI-U(/C)
	256GB	SR2IF256G-PBCTC-U(/C)	WR2IF256G-PBITI-U(/C)

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: Wide Temp Grade- operating temp. -40° C ~ +85 ° C

X2 : The material of case

R : 2.5" Rugged Metal Casing

X3 X4 X5 : Product category

2IF : 2.5" PATA SSD

X6 X7 X8 X9 : Capacity

008G:	8GB	064G:	64GB
016G:	16GB	128G:	128GB
032G:	32GB	256G:	256GB

X11 : Controller

P : PHANES Series

X12 : Controller version

A, B, C.....

X13 : Controller Grade

C : Commercial grade

I : Industrial grade

X14 : Flash IC

T : Toshiba SLC-NAND Flash IC

X15 : Flash IC grade / Type

C : Commercial grade

I : Industrial grade

X16 : Data Transfer Rate

U: Defaulted as UDMA mode / Fixed disk type

C : Reserved for specific requirement

C : Conformal-coating

Appendix B: Limited Warranty

APRO warrants your Rugged Metal 2.5" PATA SLC SSD 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.

WARRANTY PERIOD:

- SLC STD. Grade 3 years / Within 60K Erasing Counts
- SLC IND. Grade 5 years / Within 60K Erasing Counts

The warranty period is able to extend. Please contact APRO and/or Your APRO distributors for more information.