APRO Co., Ltd.

Industrial

PCMCIA ATA CARD

HERCULES-N Series

Product Specification

INDUSTRIAL

SLC PCMCIA ATA CARD

Version 01V0

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Revision History

Revision	Description	Date
1.0	Initial release	2014/3/10

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1. Introduction

APRO industrial PCMCIA ATA Card HERCULES-N Series designed to follow ATAPI-8 standard and fully compatible with PCMCIA card standard and PCMCIA V.2.1. The main used Flash memories are SLC-NAND type flash memory chips. The available Card capacities are 8GB, 16GB, 32GB and 64GB. The operating temperature grade is optional for commercial level 0°C ~ 70°C and wide temperature level -40°C ~ +85°C. The APRO industrial PCMCIA ATA Cards are designed electrically complies with the conventional IDE hard Card and support True IDE Mode. The data transfer modes supports PIO- 0~6 or MWDMA- 0~4 or UDMA- 0~7. The fastest reading speed is up to 117.4 MB/sec and writing speed is up to 83.8 MB/sec.

The APRO industrial PCMCIA ATA products provide a high level interface to the host computer. This interface allows a host computer to issue commands to the PCMCIA ATA Card to read or write blocks of memory. Each sector is protected by a powerful 72 bits per 1024 bytes block Error Correcting Code (ECC). APRO industrial PCMCIA ATA Card's HERCULES-N 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 PCMCIA ATA Card controller.

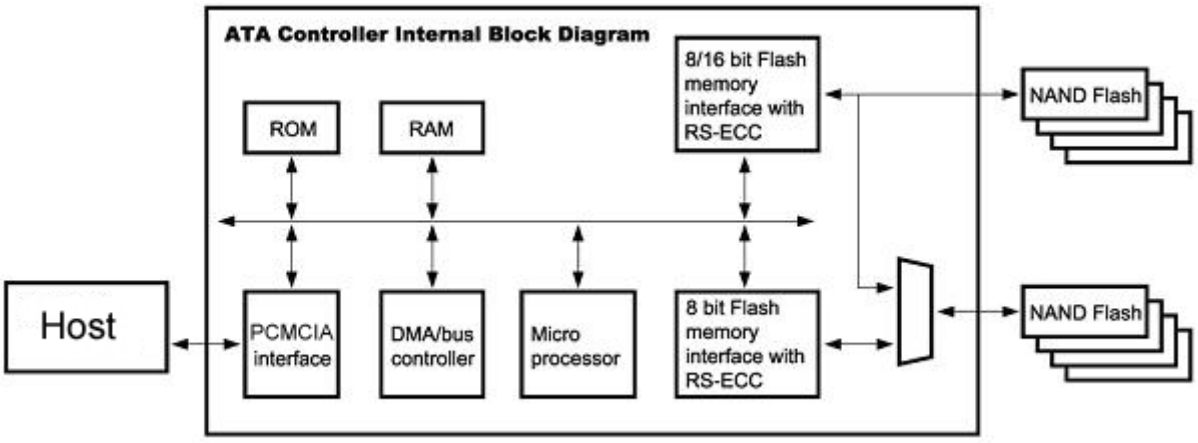

Figure 1: PCMCIA ATA Card HERCULES-N Series Controller Block Diagram

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1.1. *Scope*

This document describes the features and specifications and installation guide of APRO industrial PCMCIA ATA Card HERCULES-N Series. In the appendix, there provides order information, warranty policy, RMA/DOA procedure for the most convenient reference.

1.2. *System Features*

- Optional Rugged metal PCMCIA ATA casing to sustain the harshest environments
- Non-volatile memory and no moving parts
- NAND type SLC flash technology
- Card capacity from 8GB to 64GB
- ATA interface and support PC Card Memory mode, PC Card I/O mode and True IDE mode
- Data transfer supports PIO- 0~6, MWDMA- 0~4 or UDMA- 0~7
- The fastest reading speed is up to 117.4 MB/sec and writing speed is up to 83.8 MB/sec
- 72 bits per 1024 bytes block error correction (ECC) and retry capabilities
- Supports S.M.A.R.T. function (Self-Monitoring, Analysis and Reporting Technology)
- +5 V ±10% or +3.3 V ±5% operation
- Shock : 1,500 compliance to MIL-STD-810F
- Vibration : 15G compliance to MIL-STD-810F
- Working well in severe environment
- Supports Auto Stand-by mode and Auto Sleep mode
- Very high performance, very low power consumption
- Low weight, Noiseless

1.3. *PCMCIA Specification*

APRO Industrial PCMCIA ATA Flash Cards are fully electrically compatible with following PCMCIA specifications:

- *PCMCIA PC Card Standard, 7.0*
- PCMCIA V.2.1

PCMCIA (Personal Computer Memory Card International Association)
2635 North First Street Suite #218
San Jose, CA 95134 USA
Tel: (408) 433-2273
Fax: (408) 433-9558
http://www.pcmcia.org

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1.4. *ATA/ATAPI-8 Standard*

APRO industrial PCMCIA ATA Card HERCULES-N Series is compliant to ATA/ATAPI-8 and below version.

1.5. *Technology Independence*

With the proprietary method to manage variable kinds of flash in terms of global wear-leveling and 72 bits per 1024 bytes block ECC (Error Code Correction), it translate the ATA control, address and data bus signals into the management unit of NAND type flash devices and constitute the PCMCIA ATA Cards more ideal than the conventional hard Card drives.

1.6. *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.

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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 PCMCIA ATA Card HERCULES-N Series		Standard Grade	Industrial Grade
		SPAFCxxxG-MNCTC	WPAFCxxxG-MNITI
Temperature	Operating:	0ºC ~ +70ºC	-40ºC ~ +85ºC
	Non-operating:	-20ºC ~ +80ºC	-55ºC ~ +95ºC
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 PCMCIA ATA Card HERCULES-N Series		Standard Grade
		SPAFCxxxG-MNCTC
DC Input Voltage (VCC) 100mV max. ripple(p-p)		5V ± 10% / 3.3V ± 5%
+5V Current (Maximum average value)	Reading Mode :	210 (max.)
	Writing Mode :	210 (max.)
	Idle Mode :	6.6 (max.)

2.3. System Performance

Table 3: System Performances

Data Transfer Mode supporting		- PIO mode : 0, 1, 2, 3, 4, 5, 6 - DMA MW Mode: 0, 1, 2, 3, 4 - UDMA Mode: 0, 1, 2, 3, 4, 5, 6, 7			
Average Access Time		0.3 ms (estimated)			
Maximum Performance	Capacity	8GB	16GB	32GB	64GB
	Sequential Read (MB/s)	114.7	117.4	113.1	111.1
	Sequential Write(MB/s)	78.1	66.1	83.8	83.1

Note:

(1). All values quoted are typically at 25℃ and nominal supply voltage.

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(2). Testing of the PCMCIA ATA Card 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	Global Wear-leveling
Bad Blocks Management	Supportive
ECC Technology	72 bits per 1024 bytes
Endurance	Un-limited Read Cycles Endurance Management enables five years minimal useful life
Data Retention	10 years

2.5. *Physical Specifications*

Refer to Table 5 and see Figure 2 for APRO industrial PCMCIA ATA Card HERCULES-N Series physical specifications and dimensions.

Table 5: Physical Specifications of APRO PCMCIA ATA Cards

Length:	85.60±0.15mm(3.37±0.006 in)
Width:	54.00±0.10mm(2.13±0.004 in)
Thickness:	5.00±0.10mm(0.2±0.004 in)
Weight:	43.0g(1.52oz) typical

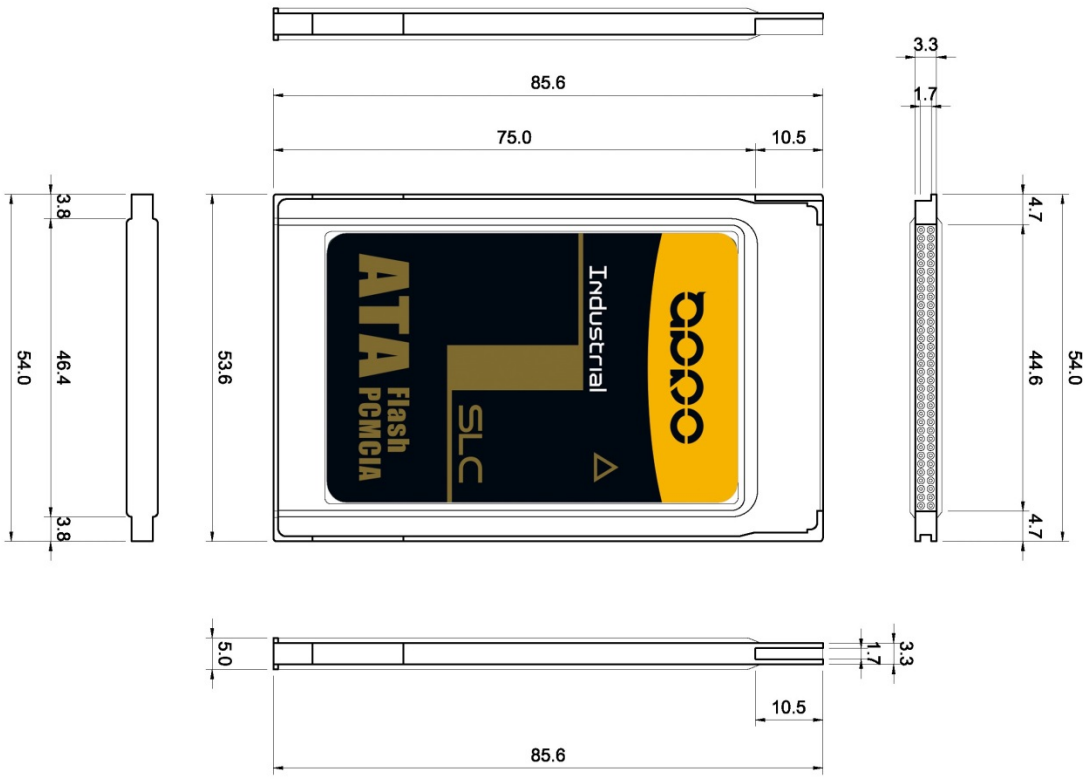

Figure 2: PCMCIA ATA Card Dimension

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2.6. *Device Parameter*

The table 6 shows the specific capacity for the various models and the default number of heads, sectors/track and cylinders.

Table 6: Device Parameter

Unformatted Capacity	Default Cylinder	Default Head	Default Sector	Default CHS Capacity
8GB	15,538	16	63	15,662,304
16GB	31,045	16	63	31,293,360
32GB	62,041	16	63	62,537,328
64GB	16,383	15	63	125,059,072

3. Interface Description

3.1. *APRO PCMCIA ATA Card interface*

The PCMCIA ATA Card uses a 68 pin connector. The connector in the host consists of two rows of 34 pins with 0.05 inch spacing (1.27mm). Female pins are used on the card side, male pins on the system end

3.2. *Pin Assignments*

Signals whose source is the host is designated as inputs while signals that the PCMCIA ATA Card sources are outputs. The pin assignments are listed in below table 7.

The signal/pin assignments are listed in below Table 7. Low active signals have a "-" prefix. Pin types are Input, Output or Input/Output.

Table 7: Pin Assignments and Pin Type

PC Card Memory Mode			PC Card I/O Mode			True IDE Mode		
Pin No.	**Signal Name**	**Pin Type**	**Pin No.**	**Signal Name**	**Pin Type**	**Pin No.**	**Signal Name**	**Pin Type**
1	GND	Ground	1	GND	Ground	1	GND	Ground
2	D3	I/O	2	D3	I/O	2	D3	I/O
3	D4	I/O	3	D4	I/O	3	D4	I/O
4	D5	I/O	4	D5	I/O	4	D5	I/O
5	D6	I/O	5	D6	I/O	5	D6	I/O
6	D7	I/O	6	D7	I/O	6	D7	I/O
7	CE1#	I	7	CE1#	I	7	CS0#	I
8	A10	I	8	A10	I	8	$A10^2$	I
9	OE#	I	9	OE#	I	9	OE#	I
10	NC	-	10	NC	-	10	NC	-
11	A9	I	11	A9	I	11	$A9^2$	I
12	A8	I	12	A8	I	12	$A8^2$	I
13	NC	-	13	NC	-	13	NC	-
14	NC	-	14	NC	-	14	NC	-

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15	WE#	I	15	WE#	I	15	WE#[3]	I
16	RDY/BSY#	O	16	IREQ#	O	16	INTRQ	O
17	VCC	Power	17	VCC	Power	17	VCC	Power
18	NC	-	18	NC	-	18	NC	-
19	NC	-	19	NC	-	19	NC	-
20	NC	-	20	NC	-	20	NC	-
21	NC	-	21	NC	-	21	NC	-
22	A7	I	22	A7	I	22	A7[2]	I
23	A6	I	23	A6	I	23	A6[2]	I
24	A5	I	24	A5	I	24	A5[2]	I
25	A4	I	25	A4	I	25	A4[2]	I
26	A3	I	26	A3	I	26	A3[2]	I
27	A2	I	27	A2	I	27	A2	I
28	A1	I	28	A1	I	28	A1	I
29	A0	I	29	A0	I	29	A0	I
PC Card Memory Mode			**PC Card I/O Mode**			**True IDE Mode**		
Pin No.	**Signal Name**	**Pin Type**	**Pin No.**	**Signal Name**	**Pin Type**	**Pin No.**	**Signal Name**	**Pin Type**
30	D0	I/O	30	D0	I/O	30	D0	I/O
31	D1	I/O	31	D1	I/O	31	D1	I/O
32	D2	I/O	32	D2	I/O	32	D2	I/O
33	WP	O	33	IOIS16#	O	33	IOCS16#	O
34	GND	Ground	34	GND	Ground	34	GND	Ground
35	GND	Ground	35	GND	Ground	35	GND	Ground
36	CD1#	O	36	CD1#	O	36	CD1#	O
37	D11[1]	I/O	37	D11[1]	I/O	37	D11[1]	I/O
38	D12[1]	I/O	38	D12[1]	I/O	38	D12[1]	I/O
39	D13[1]	I/O	39	D13[1]	I/O	39	D13[1]	I/O
40	D14[1]	I/O	40	D14[1]	I/O	40	D14[1]	I/O
41	D15[1]	I/O	41	D15[1]	I/O	41	D15[1]	I/O
42	CE2#[1]	I	42	CE2#[1]	I	42	CS1#[1]	I
43	VS1#	O	43	VS1#	O	43	VS1#	O
44	IORD#	I	44	IORD#	I	44	IORD	I
45	IOWR#	I	45	IOWR#	I	45	IOWR	I
46	NC	-	46	NC	-	46	NC	-
47	NC	-	47	NC	-	47	NC	-
48	NC	-	48	NC	-	48	NC	-
49	NC	-	49	NC	-	49	NC	-
50	NC	-	50	NC	-	50	NC	-
51	VCC	Power	51	VCC	Power	51	VCC	Power
52	NC	-	52	NC	-	52	VPP	-
53	NC	-	53	NC	-	53	NC	-
54	NC	-	54	NC	-	54	NC	-
55	NC	-	55	NC	-	55	NC	-
56	NC	-	56	NC	-	56	CSEL#	-
57	VS2#	O	57	VS2#	O	57	VS2#	O

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58	RESET	I	58	RESET	I	58	RESET#	I
59	WAIT#	O	59	WAIT#	O	59	IORDY	O
60	INPACK#	O	60	INPACK#	O	60	DREQ	O
61	REG#	I	61	REG#	I	61	DMACK	I
62	BVD2	I/O	62	SPKR#	I/O	62	DASP#	I/O
63	BVD1	I/O	63	STSCHG#	I/O	63	PDIAG#	I/O
64	D8[1]	I/O	64	D8[1]	I/O	64	D8[1]	I/O
65	D9[1]	I/O	65	D9[1]	I/O	65	D9[1]	I/O
66	D10[1]	I/O	66	D10[1]	I/O	66	D10[1]	I/O
67	CD2#	O	67	CD2#	O	67	CD2#	O
68	GND	Ground	68	GND	Ground	68	GND	Ground

Note:

1) These signals are required only for 16 bit accesses and not required when installed in 8 bit systems. Devices should allow for 3-state signals not to consume current.

2) The signal should be grounded by the host.

3) The signal should be tied to VCC by the host.

4) The mode is optional for CF+ Cards, but required for PCMCIA ATA Cards.

5) The -CSEL signal is ignored by the card in PC Card modes. However, because it is not pulled up on the card in these modes, it should not be left floating by the host in PC Card modes. In these modes, the pin should be connected by the host to PC Card A25 or grounded by the host.

6) If DMA operations are not used, the signal should be held high or tied to VCC by the host. For proper operation in older hosts: while DMA operations are not active, the card shall ignore this signal, including a floating condition

7) Signal usage in True IDE Mode except when Ultra DMA mode protocol is active.

8) Signal usage in True IDE Mode when Ultra DMA mode protocol DMA Write is active.

9) Signal usage in True IDE Mode when Ultra DMA mode protocol DMA Read is active.

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Appendix A: Ordering Information

1. Part Number List

◆ **APRO PCMCIA ATA Card – HERCULES-N Series (Plastic frame)**

Product Picture	*Grade*	*Standard grade (0ºC ~ 70ºC)*	*Industrial Grade (-40ºC ~ +85ºC)*
	8GB	SPAFC008G-MNCTC-UF(/C)	WPAFC008G-MNITI-UF(/C)
	16GB	SPAFC016G-MNCTC-UF(/C)	WPAFC016G-MNITI-UF(/C)
	32GB	SPAFC032G-MNCTC-UF(/C)	WPAFC032G-MNITI-UF(/C)
	64GB	SPAFC064G-MNCTC-UF(/C)	WPAFC064G-MNITI-UF(/C)

◆ **APRO PCMCIA ATA Card – HERCULES-N Series (Rugged Metal frame)**

Product Picture	*Grade*	*Standard grade (0ºC ~ 70ºC)*	*Industrial Grade (-40ºC ~ +85ºC)*
	8GB	SRAFC008G-MNCTC-UF(/C)	WRAFC008G-MNITI-UF(/C)
	16GB	SRAFC016G-MNCTC-UF(/C)	WRAFC016G-MNITI-UF(/C)
	32GB	SRAFC032G-MNCTC-UF(/C)	WRAFC032G-MNITI-UF(/C)
	64GB	SRAFC064G-MNCTC-UF(/C)	WRAFC064G-MNITI-UF(/C)

2. Part Number Decoder:

X1 X2 X3 X4 X5 X6 X7 X8 X9 – X11 X12 X13 X14 X15 – Z1 Z2 – C

X1 : **Grade**
S: Standard Grade – operating temp. 0º C ~ 70 º C
W: Wide Temp Grade- operating temp. -40º C ~ +85 º C

X2 : **The material of case**
P : Plastic frame
R : Rugged Metal frame

X3 X4 X5 : **Product category**
AFC : PCMCIA ATA Flash Card

X6 X7 X8 X9 : **Capacity**
008G: 8GB **064G:** 64GB
016G: 16GB
032G: 32GB

X11 : **Controller**
M : SMI (HERCULES-N 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

Z1 Z2
PF : PIO-6 mode / fixed disk type
PR : PIO-6 mode / removable disk type
UF : Defaulted as UDMA-7 mode / fixed disk type
UR : UDMA-7 mode / removable disk type
AA : PIO/UDMA & fixed/removable disk type auto-detected

C : **Reserved for specific requirement**
C : Conformal-coating

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Appendix B: Limited Warranty

APRO warrants your PCMCIA ATA Card 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:

- **SxAFCxxxG-MNCTC-UF(/C)** **3 years**

- **WxAFCxxxG-MNITI-UF(/C)** **5 years**

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

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