AP580E / AP580E-POE AcroPack

1Gb Ethernet (Power over Ethernet) Module

USER'S MANUAL

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1.0 GENERAL INFORMATION

1.1 Intended Audience

This users' manual was written for technically qualified personnel who will be working with I/O devices using the AcroPack module. It is not intended for a general, non-technical audience that is unfamiliar with industrial I/O devices and their application.

1.2 Preface

The information contained in this manual is subject to change without notice, and Acromag, Inc. (Acromag) does not guarantee its accuracy. Acromag makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Further, Acromag assumes no responsibility for any errors that may appear in this manual and makes no commitment to update, or keep current, the information contained in this manual. No part of this manual may be copied or reproduced in any form, without the prior written consent of Acromag,

1.2.1 Trademark, Trade Name and Copyright Information

1.2.2 Class A Product Warning

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may find it necessary to take adequate corrective measures.

1.2.3 Environmental Protection Statement

This product has been manufactured to satisfy environmental protection requirements where possible. Many components used (structural parts, circuit boards, connectors, etc.) are capable of being recycled. Final disposition of this product after its service life must be conducted in accordance with applicable country, state, or local laws or regulations.

1.3 AcroPack Information – All Models

The AcroPack IO module are based on the PCI Express Mini Card Electromechanical specification and are 70mm in length with an add 100 pin field I/O connector.

The AcroPack is 19.05mm longer than the full length mini PCIe card at 50.95mm. It has the same mPCIe board width of 30mm and uses the same mPCIe standard board hold down standoff and screw keep out areas.

The AP580 uses the Intel i210 Ethernet controller, high-density, single-width AcroPack module, with the capability to provide POE (Power over Ethernet) as a PSE (Power sourcing Device) end point. Is designed to meet IEEE 802.3af standard (10 Watt Limited) using a Linear Technology Single POE PSE controller.

1.3.1 Ordering Information

The AcroPack ordering options are given in the following table.

Model Number	*Description*	*Temp Range*
AP580E-LF [1]	*1Gb Ethernet*	*-40℃ to 70℃*
AP580E-POE-LF [1,2]	*1Gb Ethernet with POE*	*-40℃ to 70℃*

Note 1: The AP580 does not support the AcroPack Accessory AP-CC-01 (Conduction cool kit).

Note 2: 200LFM (minimum) Air flow is required above *50℃*

1.3.2 Key Features

- **POE PSE** – Designed to meet IEEE 802.3 af (10 Watts maximum)
- **Small Form Factor**
- **Intel I210 1Gb Ethernet Controller**
- **Single Port**
- **Audio Video bridging**
  - IEEE 1588/802.1AS precision time synchronization
  - IEEE 802.1Qav traffic shaper (with software extensions)
- Jumbo frames

- Interrupt moderation, VLAN support, IP checksum offload
- PCIe OBFF (Optimized Buffer Flush/Fill) for improved system power management
- Four transmit and four receive queues
- RSS and MSI-X to lower CPU utilization in multi-core systems
- Advanced cable diagnostics, auto MDI-X
- ECC – error correcting memory in packet buffers

1.3.3 Key Features PCIe Interface

- **PCIe Bus** – The AP module includes a PCI Express Generation 1 interface operating at a bus speed of 2.5 Gbps with one lane in each direction.
- **Compatibility** – PCI Express Base Specification v2.1 compliant PCI Express Endpoint.

1.4 Signal Interface Products

This AcroPack Module will mate directly to all Acromag AP carriers. Once connected, the module is accessed via a 50 pin or 68 pin panel connector.

The cables and termination panels are also available.

1.5 Software Support

The AcroPack series AP580 require support drivers specific to your operating system. Supported Operating Systems include: Windows and Linux.

These Device Drivers are typically native to the operations systems and require no additional special drivers to operate.

The AP580 uses the Intel i210 Ethernet controller PROset drivers.

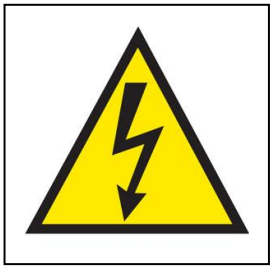
For more information go to:
https://downloadcenter.intel.com/product/64399/Intel-Ethernet-Controller-I210-Series.

1.6 Introduction

The AP580E-LF provides a single port Ethernet connection which is capable of data rates 10, 100 0r 1000 Mbps (megabits per second). The AP580E-POE-LF is an optional model which adds POE (Power Over Ethernet) This makes the AP580E a power sourcing equipment device (PSE) that provides 52VDC up to 10Watts of power to Powered Devices (PD) such as a Video camera and VOIP phones or any other PD device

2.0 PREPARATION FOR USE

IMPORTANT PERSONAL AND PRODUCT SAFETY CONSIDERATIONS



It is very important for the user to consider the possible safety implications of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where personal injury or the loss of economic property or human life is possible. It is important that the user employ satisfactory overall system design. It is understood and agreed by the Buyer and Acromag that this is the Buyer's responsibility.

WARNING: This board utilizes static sensitive components and should only be handled at a static-safe workstation. This product is an electrostatic sensitive device and is packaged accordingly. Do not open or handle this product except at an electrostatic-free workstation. Additionally, do not ship or store this product near strong electrostatic, electromagnetic, magnetic, or radioactive fields unless the device is contained within its original manufacturer's packaging. Be aware that failure to comply with these guidelines will void the Acromag Limited Warranty.

2.1 Unpacking and Inspecting

Upon receipt of this product, inspect the shipping carton for evidence of mishandling during transit. If the shipping carton is badly damaged or water stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is absent when the carton is opened and the contents of the carton are damaged, keep the carton and packing material for the agent's inspection.

For repairs to a product damaged in shipment, refer to the Acromag Service Policy to obtain return instructions. It is suggested that salvageable shipping cartons and packing material be saved for future use in the event the product must be shipped.

This board is physically protected with packing material and electrically protected with an anti-static bag during shipment. However, it is recommended that the board be visually inspected for evidence of mishandling prior to applying power.

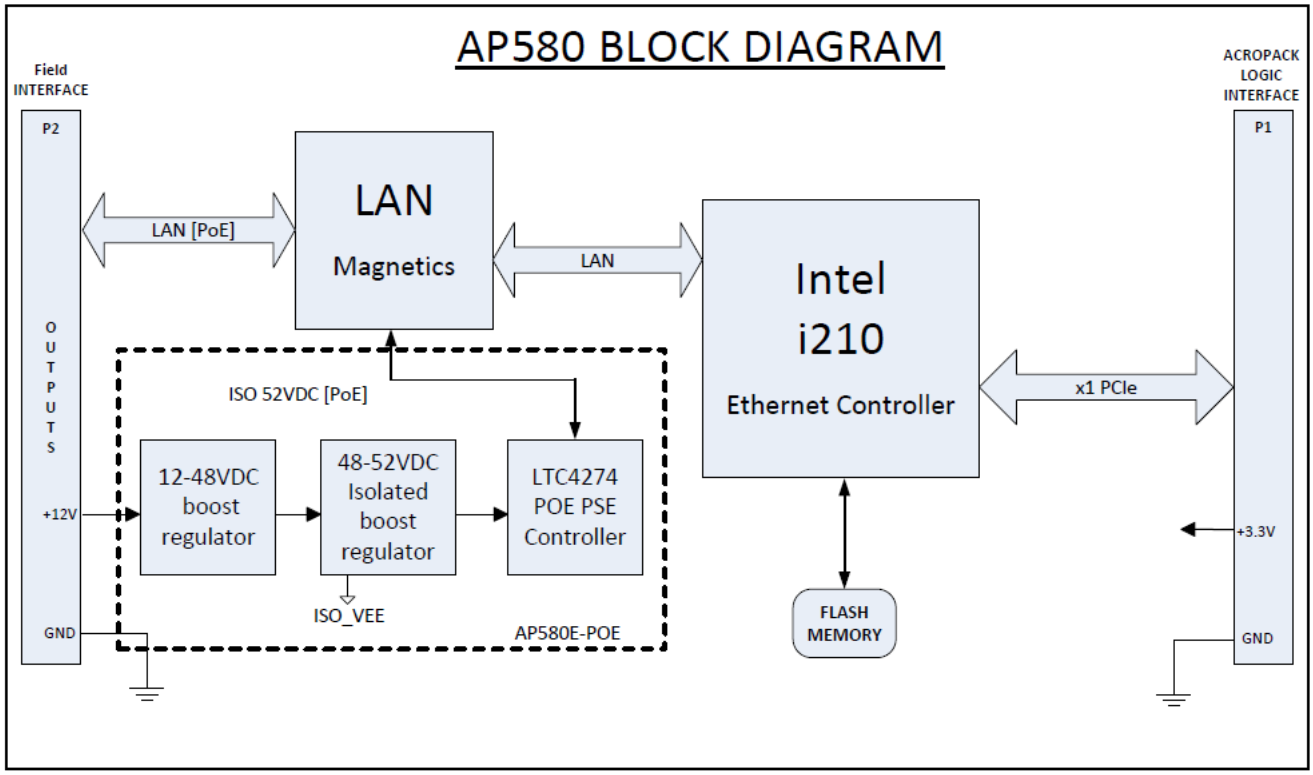
2.2 Installation Considerations

IMPORTANT: Adequate air circulation must be provided to prevent a temperature rise above the maximum operating temperature.

Refer to the specifications section for loading and power requirements. Be sure that the system power supplies are able to accommodate the power requirements of the system boards, plus the installed Acromag board, within the voltage tolerances specified.

In an air cooled assembly, 200 LFM of air circulation is recommended. If operating in an ambient temperature of > 50°C, 200 LFM of Air circulation is required to prevent a temperature rise above the maximum operating temperature and to prolong the life of the electronics. If the installation is in an industrial environment and the board is exposed to environmental air, careful consideration should be given to air-filtering.

2.3 Functional Block diagram



2.4 Field I/O Connector

A field I/O interface connector provides a mating interface between the AP modules and the carrier board. The 100 pin ST5-50-1.50-L-D-P-TR Samtec connector is used on the AcroPack card as board to board interconnect. This connector will mate with the 100 pin SS5-50-3.00-L-D-K-TR Samtec connector on the carrier. The stack height is 4.5mm.

Threaded metric M2.5 screws and spacers are supplied with the module to provide additional stability for harsh environments.

Pin assignments are unique to each AP model. Table 2.1 lists signal pin assignments for the module field I/O connector. Every other pin of the 100 pin connector is left unconnected in order to meet the minimum distance required for 60 Volt isolation.

Table 2.1 Field I/O Connector Pin Assignments

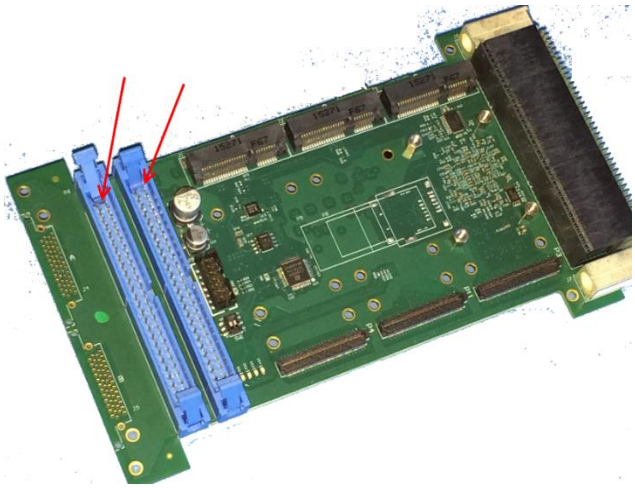
68 Pin Champ Carrier Connector	50 Pin Champ Carrier Connector [2]	*Ribbon Carrier Connector [1]*	*Module P2 Pin Number*	*Field Signal Name*
1	1	1	2	MDI0+ /RJ45 Pin 1 (POE DC+)
35	26	2	1	MDI0- /RJ45 Pin 2 (POE DC+)
			4	Reserved/isolation
			3	Reserved/isolation
2	2	3	6	MDI1+ /RJ45 Pin 3 (POE DC-)
36	27	4	5	MDI1- /RJ45 Pin 6 (POE DC-)
			8	Reserved/isolation
			7	Reserved/isolation
3	3	5	10	MDI2+ /RJ45 Pin 4
37	28	6	9	MDI2- /RJ45 Pin 5
			12	Reserved/isolation
			11	Reserved/isolation
4	4	7	14	MDI3+ /RJ45 Pin 7
38	29	8	13	MDI3- /RJ45 Pin 8
			16	Reserved/isolation
			15	Reserved/isolation
5	5	9	18	
39	30	10	17	
			20	Reserved/isolation
			19	Reserved/isolation
6	6	11	22	

68 Pin Champ Carrier Connector	50 Pin Champ Carrier Connector [2]	*Ribbon Carrier Connector [1]*	*Module P2 Pin Number*	*Field Signal Name*
40	31	12	21	
			24	Reserved/isolation
			23	Reserved/isolation
7	7	13	26	
41	32	14	25	
			28	Reserved/isolation
			27	Reserved/isolation
8	8	15	30	
42	33	16	29	
			32	Reserved/isolation
			31	Reserved/isolation
9	9	17	34	
43	34	18	33	
			36	Reserved/isolation
			35	Reserved/isolation
10	10	19	38	
44	35	20	37	
			40	Reserved/isolation
			39	Reserved/isolation
11	11	21	42	
45	36	22	41	
			44	Reserved/isolation
			43	Reserved/isolation
12	12	23	46	POE INPUT 12VDC+
46	37	24	45	POE INPUT 12VDC+
			48	Reserved/isolation
			47	Reserved/isolation
13	13	25	50	POE INPUT 12VDC+
47	38	26	49	POE INPUT 12VDC+
			52	Reserved/isolation
			51	Reserved/isolation
14	14	27	54	POE INPUT 12VDC+
48	39	28	53	POE INPUT 12VDC+
			56	Reserved/isolation
			55	Reserved/isolation
15	15	29	58	POE INPUT 12VDC+

68 Pin Champ Carrier Connector	50 Pin Champ Carrier Connector [2]	*Ribbon Carrier Connector [1]*	*Module P2 Pin Number*	*Field Signal Name*
49	40	30	57	POE INPUT 12VDC+
			60	Reserved/isolation
			59	Reserved/isolation
16	16	31	62	POE INPUT 12VDC+
50	41	32	61	POE INPUT 12VDC+
			64	Reserved/isolation
			63	Reserved/isolation
17	17	33	66	LAN LINK 100 LED
51	42	34	65	
			68	Reserved/isolation
			67	Reserved/isolation
18	18	35	70	LAN LINK 1000 LED
52	43	36	69	
			72	Reserved/isolation
			71	Reserved/isolation
19	19	37	74	LAN Activity LED
53	44	38	73	
			76	Reserved/isolation
			75	Reserved/isolation
20	20	39	78	
54	45	40	77	
			80	Reserved/isolation
			79	Reserved/isolation
21	21	41	82	OUTPUT 3.3VDC
55	46	42	81	GND
			84	Reserved/isolation
			83	GND
22	22	43	86	GND
56	47	44	85	GND
			88	Reserved/isolation
			87	GND
23	23	45	90	GND
57	48	46	89	GND
			92	GND
			91	GND
24	24	47	94	GND

68 Pin Champ Carrier Connector	50 Pin Champ Carrier Connector [2]	*Ribbon Carrier Connector [1]*	*Module P2 Pin Number*	*Field Signal Name*
58	49	48	93	GND
			96	GND
			95	GND
25	25	49	98	GND
59	50	50	97	GND
			100	GND
			99	GND

Note 1: VPX4500-CC-LF is an example of a carrier that uses the ribbon cable connector. See image of carrier.



Note 2: APCe7020E-LF is an example of a carrier that uses the Champ connector. See image of carrier.

2.8 Logic Interface Connector

The AP module logic edge connector interfaces to the mating connector on the carrier board. The pin assignments of this connector are standard for all AP modules according to the PCI Express MINI Card Electromechanical Specification, REV 1.2 (with exceptions shown in Table 2.2 and noted below).

Power supplies +5, +12, and -12 Volt have been assigned to pins that are reserved in the mini-PCIe specification. The Present signal is grounded on the AP module

Table 2.2 Logic Interface connector Pin Assignments

Pin #	Name	Pin #	Name
51	(+5V)[1,2]	52	+3.3V[3]
49	(+12V)[1,2]	50	GND
47	(-12V)[1,2]	48	(+1.5V)[1]
45	Present[4]	46	(LED_WPAN#)[1]
43	GND	44	(LED_WLAN#)[1]
41	+3.3V[3]	42	(LED_WWAN#)[1]
39	+3.3V[3]	40	GND
37	GND	38	(USB_D+)[1]
35	GND	36	(USB_D-)[1]
33	PETp0	34	GND
31	PETn0	32	(SMB_DATA)[1]
29	GND	30	(SMB_CLK)
27	GND	28	(+1.5V)[1]
25	PERp0	26	GND
23	PERn0	24	+3.3V[3]
21	GND	22	PERST#
19	TDI	20	(W_DISABLE#)[1]
17	TDO	18	GND
15	GND	16	(UIM_VPP)[1]
13	RECLK+	14	(UIM_RESET)[1]
11	REFCLK-	12	(UIM_CLK)[1]
9	GND	10	(UIM_DATA)[1]
7	CLKREQ#	8	(UIM_PWR)[1]
5	(TCK)[1]	6	(+1.5V)[1]
3	(TMS)[1]	4	GND
1	WAKE#[4]	2	+3.3V[3]

Note 1: Signals are not applicable for the AP580 implementation. Pins are "no connects" on the module.

Note 2: +5V, +12V, and -12V power supplies have been assigned to pins that are reserved in the mini-PCIe specification.

Note 3: All +3.3Vaux power pins are changed to +3.3V power.

Note 4: The signal is tied to circuit GND on the AP module.

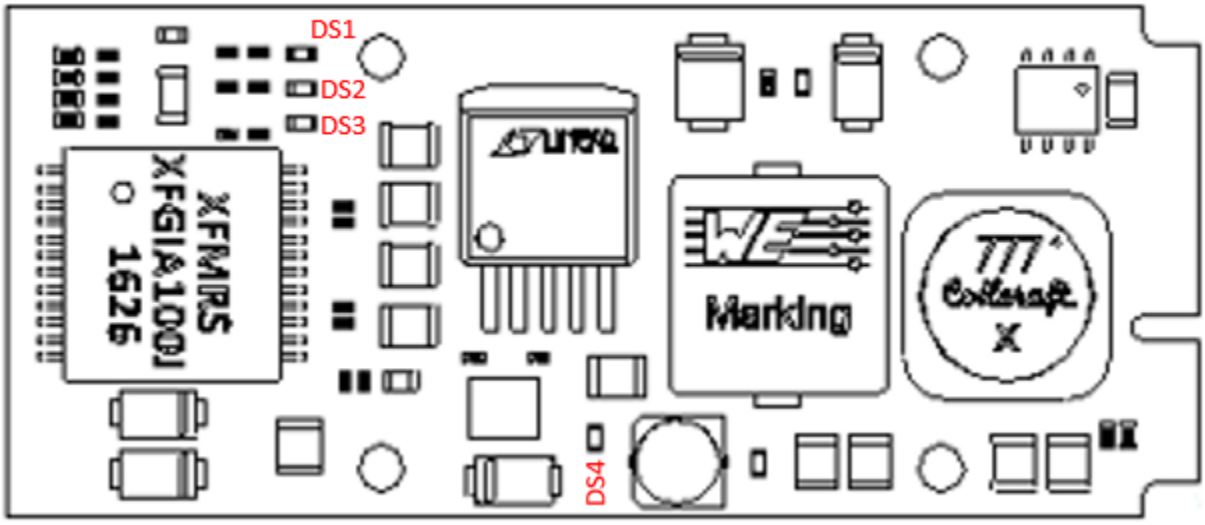
2.9 LEDs

DS1 (Yellow) Network Link Speed 100 Mbps

DS2 (Green) Network Link Speed 1000 Mbps

DS3 (Green) Network Activity

DS4 (Yellow) POE Power Ready (POE version only)



AP580E-POE version shown, some of the components in this image will not be present on the AE580 (non-POE version)

3.0 SERVICE AND REPAIR

3.1 Service and Repair Assistance

Surface-Mounted Technology (SMT) boards like the AcroPack family of carrier boards are generally difficult to repair. The board can be easily damaged unless special SMT repair and service tools are used. For these and other reasons, it is strongly recommended that a non-functioning board be returned to Acromag for repair. Acromag has automated diagnostic and test equipment that thoroughly checks the performance of suspect boards. Furthermore, when any repair is made, the board is retested before return shipment to the customer.

Please refer to Acromag's Service Policy Bulletin or contact Acromag for complete details on how to obtain parts, or return parts for repair.

3.2 Preliminary Service Procedure

CAUTION: POWER MUST BE TURNED OFF BEFORE SERVICING BOARDS

Before beginning repair, be sure that all of the procedures in the "Preparation for Use" section have been followed. Also, refer to the documentation of your carrier board to verify that it is correctly configured. Replacement of the board with one that is known to work correctly is a good technique for isolating a faulty part.

3.3 Where to Get Help

For assistance from Acromag's website go to the "Support" tab and submit/search the Acromag forum or fill out the contact us form. You can get additional documentation from your products webpage by using the search feature. If you'd like to speak with an application engineer please call 248-295-0310 or email solutions@acromag.com.

4.0 SPECIFICATIONS

4.1 Physical

Height: 10.8 mm (0.4921 in)

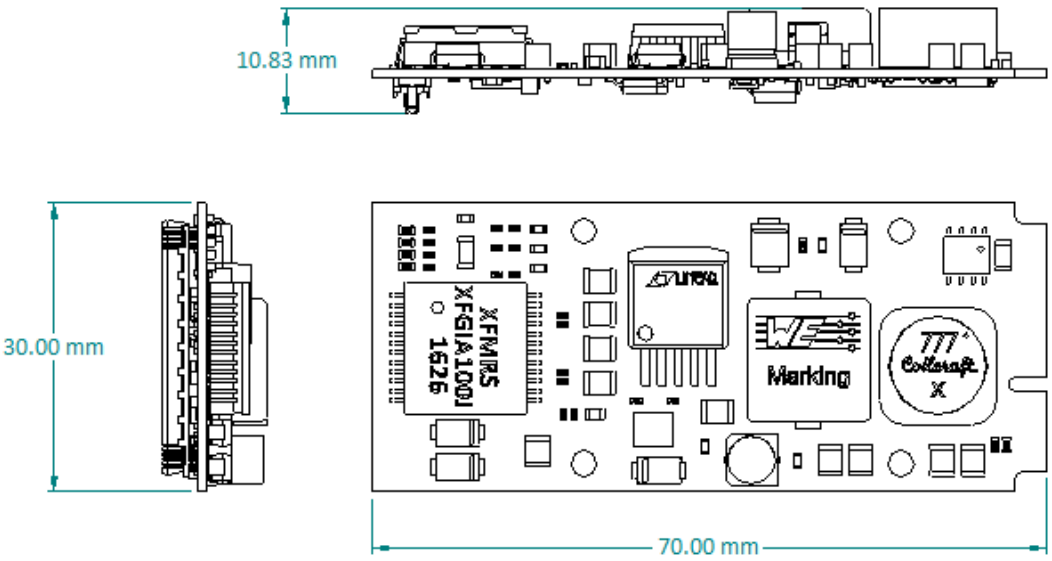
Height defines Carrier to Module Maximum component height

Board Thickness 1.0 mm (0.03937 in)

- AcroPack L x W: 70 mm x 30.00 mm (2.76 in x 1.18 in)

Unit Weight (does not include shipping material):

- AcroPack 0.016 lbs. (0.0074 kg)



4.2 Power Requirements

Summarized below are the expected current draws for each of the specified power supply voltages.

Power Supply Voltage	Current Draw
• +3.3 VDC +/- 5%[1]	115 mA (max)
• 1.5 VDC	Not Used
• 5.0 VDC	Not Used
• +12 VDC	Not Used
• -12 VDC	Not Used

Note 1: *Typical current draw is using an AP580 with* APCe*7020E-LF*

4.2.1 POE Power Requirements

+12VDC @1.5A (minimum)

4.2.2 POE Power Output (to PD device)

52VDC @ .193A (Max) 10 watts

DC isolation is limited to 100VDC, this limitation is due to the signal paths of the PCB.

4.3 Environmental Considerations

Summarized below are the operating temperature range, airflow and other environmental requirements and applicable standards for the AcroPack module.

4.3.1 Operating Temperature

Model Number	***Description***	***Temp Range***
AP580E-LF [1]	*1Gb Ethernet*	*-40*℃ *to 70*℃
AP580E-POE-LF [1,2]	*1Gb Ethernet with POE*	*-40*℃ *to 70*℃

Note 1: The AP580 does not support the AcroPack Accessory AP-CC-01 (Conduction cool kit).

Note 2: 200LFM (minimum) Air flow is required above *50*℃

4.3.2 Other Environmental Requirements

4.3.2.1 Relative Humidity

The range of acceptable relative humidity is 5% to 95% non-condensing.

4.3.2.2 Isolation

POE Output voltage, 100VDC

4.3.3 Vibration and Shock Standards

The AcroPack is designed to comply with the following Vibration and Shock standards.

Vibration, Operating: MIL-STD-810G, Method 514.6
Procedure I (General Vibration)
Category 20 (Ground vehicles/ground mobile)
8-500Hz, Sinusoidal 5Grms X, Y and Z axis. 1hr per axis (15 minute sweep up / 15 minute sweep down test duration)
Shock, Operating: MIL-STD-810G, Method 516.6
Procedure I (functional Shock)
50g, 11ms half-sine 3 positive/negative per axis (Total of 18 drops)

4.3.4 EMC Directives

The AcroPack is designed to comply with EMC Directive 2004/108/EC.

- **Immunity per EN 61000-6-2:**
  Electrostatic Discharge Immunity (ESD), per IEC 61000-4-2.
  Radiated Field Immunity (RFI), per IEC 61000-4-3.
  Electrical Fast Transient Immunity (EFT), per IEC 61000-4-4.
  Surge Immunity, per IEC 61000-4-5.
  Conducted RF Immunity (CRFI), per IEC 61000-4-6.
- **Emissions per EN 61000-6-4:**
  Enclosure Port, per CISPR 16.
  Low Voltage AC Mains Port, per CISPR 16.
  Note: This is a Class A product

4.4 Reliability Prediction

AP580E-LF

MTBF (Mean Time Between Failure): MTBF in hours using MIL-HDBK-217F, FN2. *Per MIL-HDBK-217, Ground Benign, Controlled, G_BG_C*

Temperature	MTBF (Hours)	MTBF (Years)	Failure Rate (FIT[1])
25°C	4,820,810	550.3	207.4
40°C	3,351,094	382.5	298.4

[1] FIT is Failures in 10^9 hours.

AP580E-POE-LF

MTBF (Mean Time Between Failure): MTBF in hours using MIL-HDBK-217F, FN2. Per MIL-HDBK-217, Ground Benign, Controlled, GBGC

Temperature	MTBF (Hours)	MTBF (Years)	Failure Rate (FIT[1])
25°C	2,656,974	303.3	376.4
40°C	1,738,619	198.5	575.2

[1] FIT is Failures in 10^9 hours.

4.5 PCIe Bus Specifications

Compatibility	Conforms to PCI Express Base Specification, Revision 2.1
Line Speed	Gen1 (2.5Gbps) Available through system connector
Lane Operation	1-Lane
4K Memory Space Required	One Base Address Register (BAR)

Appendix

Certificate of Volatility

Acromag Model AP580-LF AP580E-POE-LF	Manufacturer: Acromag, Inc. 30765 Wixom Rd Wixom, MI 48393			
Volatile Memory				
Does this product contain Volatile memory (i.e. Memory of whose contents are lost when power is removed) □ Yes ■ No				
Type (SRAM, SDRAM, etc.) Configurable Logic Blocks	Size:	User Modifiable □ Yes □ No	Function:	Process to Sanitize:
Type (SRAM, SDRAM, etc.)	Size:	User Modifiable □ Yes □ No	Function:	Process to Sanitize:
Non-Volatile Memory				
Does this product contain Non-Volatile memory (i.e. Memory of whose contents is retained when power is removed) ■ Yes □ No				
Type(EEPROM, Flash, etc.)	Size: 8 Meg x 1bit	User Modifiable ■ Yes □ No	Function: Data storage for Ethernet controller	Process to Sanitize: Write all zeros to device
Type(EEPROM, Flash, etc.)	Size:	User Modifiable □ Yes □ No	Function:	Process to Sanitize:

Acromag Representative				
Name: Russ Nieves	Title: Director of Sales and Marketing	Email: solutions@acromag.com	Office Phone: 248-295-0310	Office Fax: 248-624-9234

Revision History

The revision history for this document is summarized in the table below.

Release Date (DD MMM YYYY)	Version	EGR/DOC	Description of Revision
12 JUL 2017	A	PDG/ARP	Initial Release.
23 OCT 2017	B	CAB/ARP	Section "1.5 Software Support" updated to include link to download driver.
30 NOV 2017	C	PDG/ARP	In the Certificate of Volatility, updated the Non-Volatile Memory size from 4 Meg x 1bit to 8 Meg x 1bit.
16 APR 2016	D	PDG/ARP	Updated Section 3.3 Where to Get Help.
07 DEC 2020	E	ENZ/AMM	Updated MTBF Numbers.