DAP a-Series Product Safety and Compliance Manual

Safety Guidelines and Declaration of Conformity for the DAP a-Series Family of Products

Version 1.01

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Part Number DAPSFTY101

Contents

1. Introduction....4
2. Products Covered....6
3. Specifications....8
4. Operating Environment....9
5. Electrical Grounding....10
6. Access and Maintenance....11
A. Appendix: Declarations of Conformity....12
Index....21

1. Introduction

This manual provides safety and maintenance information, applicable generally to data acquisition equipment, but directed specifically to the Microstar Laboratories *DAP a-Series* family of Data Acquisition Processor products. *DAP* is short for "Data Acquisition Processors," and is a trade name representing the family of products. The *a-Series* family of Data Acquisition Processor products is a set of similar and very closely related *DAP* products that will be defined more specifically in sections that follow. The *DAP a-Series* products have been tested and found to be in conformance with international standards, and declarations of conformity are included at the end of this manual. This manual covers only the *DAP a-Series* family. In all of the following sections of this manual, any reference to *DAP* boards or products products implicitly refers to the *DAP a-Series* family only.

Intended Use

The *DAP a-Series* family of Data Acquisition Processor products are boards operated as as plug-in components of a desktop, server, or workstation PC machine, through PCI interfaces of the host machine. This extends the capabilities of the host for capturing high-resolution measurements of signals, typically produced by sensor or digital logic devices. The captured signals are converted to a digitized form compatible with digital computer processing, and these results are then delivered to the PC host system directly through its PCI data bus. The microprocessor chip on a DAP board can provide additional processing to convert the signal data and deliver it in alternate forms, such as filtered signals with reduced levels of noise, or control output signals that respond to information extracted from input data.

Special restrictions on use of individual models are given in the hardware manual for each DAP product. The functionality of each of these board models is very similar, differing primarily in precision and delivery rates of digital data produced by the board, the number of channels of each type that can be configured, and the processing capacity of the microprocessor chips mounted on the DAP board.

DAP products are not intended for any application for which its performance is critical to human life and safety. DAP products cannot and do not guarantee the availability characteristics necessary for life-critical applications such as direct control of nuclear reactors, and they do not provide electrical isolation suitable for general medical applications.

Operating Environment

DAP devices, when properly mounted into their PC host machines, are mostly isolated by the PC host equipment. There are three potential points of interaction with the environment external to the PC host.

1. Low power analog and digital signals are routed through signal connectors exposed on the back panel of the host machine.

2. There is an incremental power consumption drawn by the PC host equipment to support the operation of the DAP board.

3. There are increased digital interactions with the computer signal lines on the PC host PCI data bus.

Operation of the DAP boards is inseparable from the operation of the host computer system. For the purposes of testing compliance with international safety and emissions standards, compliant cable equipment is connected or disconnected from the external connectors, according to testing requirements for performing each test. DAPserver devices, which were proven compliant by previous testing, were used as the host computer systems during testing. Generally speaking, the test criteria deem the DAP board to comply with international emissions standards if the combined operation of the DAP board and the PC host equipment is compliant.

Operating Instructions

After the DAP equipment is properly installed according to the installation guide provided with the board, it is powered up automatically when its host computer system is powered up. Once started, the equipment is operated through software commands, sent from an application on the PC host via the internal PCI interface bus. There is no direct interaction with the board during operation, except my means of software messages under control of host system software. The installation guide for PCI-based DAP boards provides instructions on signal connectors, board installation in the host, and software setup. The installation guide is available on the DAPtools software CD (or the equivalent downloaded file system image) provided with each DAP unit, or from the Microstar Laboratories Web site at http://www.mstarlabs.com.

2. Products Covered

All of the DAP a-Series products are variants of a basic DAP product, with small modifications to achieve different performance levels using devices with similar but slightly different performance ratings. There are also small modifications related to employing functionally similar but not completely interchangeable new components, to take advantage of reduced costs as technology has advanced.

While the DAP products do not have a single physical entity that can be identified as a unique, common base product, the DAP 5000a model can be considered the most nearly prototypical, since it embodies all of the relevant electronic sections present on the other DAP models, and the circuit board designs of other models are obtainable by small adjustments to the design used in the DAP 5000a. In general terms, the functionality embodied in a DAP includes the following:

- a common mechanical assembly: circuit board, connectors, cabling
- an internally shielded, multilayer printed circuit board
- power regulation to remove noise from the DC power provided by the computer host
- electronic clock signal generation for internal timing
- signal processing components for input signal detection and digitization
- electronic control logic devices for coordinating high-speed signal conversion activities
- a general-purpose microprocessor for data management and transfer.

The models included in the DAP a-Series are the following:

- DAP5000a/526
- DAP5016a/527
- DAP5200a/626
- DAP5216a/627
- DAP4000a/112
- DAP4000a/212
- DAP 840
- DAP5400a/627
- DAP5380a/526

As a general principle, when functionality is reduced by lowering operating frequencies, omitting features, or using less expensive devices with lower performance ratings, changes such as these to derive one DAP model from another results in a product variant with fewer and lesser means for affecting its host PC environment, or for emitting interference signals beyond the PC environment. Consequently, if the more capable model passes all tests required for emissions compliance, the reduced functionality module is also compliant.

The following list summarizes the differences in capability among the DAP models, as compared to the prototypical DAP 5000a model.

- The DAP 5016a uses slightly different circuits in the low-power digitizer section to support a different numerical resolution and slightly reduced digitizing rates.

- The DAP 5200a and DAP 5216a are constructed using exactly the same circuit boards as their counterparts, the DAP 5000a and DAP 5016a. These boards all operate at the same internal timing rates and the same data rates on the digital host connections. The primary difference is a different pin-compatible main microprocessor chip on the DAP 5200a and DAP 5216a models, for supporting more advanced real-time algorithms.

- The DAP 4000a board was derived from the DAP 5000a by simplifying the microprocessor support circuits to use a simpler and much less powerful main processor, consequently much lower power draw. The overall architecture and layout of the board is the same. The circuit topologies are identical, and the signal processing section in particular is nearly identical to the DAP 5000a. The two variants of the DAP 4000a model use different grades of otherwise identical components.

- Though often not listed as part of the *DAP a-Series* boards, the DAP 840 board was derived from the DAP 4000a by further simplifying it to eliminate all functionality not required in a most-basic product. Though its electronic components are similar to or identical to corresponding components on the DAP 4000a, there are fewer of them, because there are fewer signal paths supported, hence operation is quieter with lower power demand.

- The DAP 5400a and DAP 5380a boards embody a very limited subset of the signal capture circuits of the DAP 5000a. All of the digital signal capture functions are eliminated. The reduced analog capture circuits are replicated 8 times so that 8 input signals can be processed simultaneously. There is no added clocking logic, since all of the analog sampling sections operate from a common clock line. The added circuits are very low power, with very limited means to power noise emissions. Connector and mounting configurations are identical to the DAP 5000a. The bus logic devices are the same as the DAP 5000a. The DAP 5400a and DAP 5380a models differ in the speed grade of the components and the instruction rates of their main microprocessor chips.

Specific information about hardware features available on each DAP model are provided in the user's manual for that product. Copies of these manuals are available on the Microstar Laboratories Web site at: http://www.mstarlabs.com.

3. Specifications

Technical specifications

Technical specifications are provided for each DAP product. These are available on the DAPtools software CD (or the equivalent downloaded file system image) provided with each DAP unit, or from the Microstar Laboratories Web site at http://www.mstarlabs.com/.

Electrical Specifications

Electrical specifications are included within the technical specifications documents. Most of these specifications are related to connections that, in operation, are inaccessible on the interior of the PC host, or inaccessible because of the shielded provided by attached cables. Except for the shielded signal connectors, there is no external access. Some general information related to safety is provided in this manual for completeness. For full information about electrical specifications, refer to the technical specifications sheet.

DAP products are operated by PC host machines, which determine the externally observable power requirements.

Physical specifications

The DAP boards conform to size standards for PCI full-length boards, 10.5 cm wide including the PCI edge connector, and 30.0 cm long. Connectors mount flush on the panel strip at the end of the circuit board. That strip fits into a slot at one end and provides a mounting flange that can be locked into place by a screw on the other end, covering the opening in the back of the PC case. Once locked into place, the panel strip covers the rear panel slot, maintaining the integrity of the emissions shielding provided by the PC host back panel. The mounting hardware is no different than you would find on other kinds of PCI computer accessory boards, such as network adapters or video display drivers.

4. Operating Environment

There are typically no thermal hazards when computer host equipment is used as intended and with reasonable care. The air circulation fans provided by the PC equipment are usually sufficient for thermal control without any concern. However, the heat sinks on some of the DAP board models can sometimes stack too closely and interfere with air flow, which can lead to local overheating. More information about this is provided in the hardware manuals for each board model. Prolonged overheating of the boards due to inadequate circulation can lead to loss of performance, main processor shutdown failures, and possibly physical damage.

Cables are critical to successful DAP device operation. Avoid crimping or straining the cables, which could break conductors or breach the cable shields and increase noise susceptibility. Be particularly careful when mounting cable connectors to DAP board edge connectors, so that delicate pins are not broken or crimped to form a short circuit with neighboring pins. Avoid touching cable lines with fingers, which can deliver static discharges sometimes into the hundreds of volts, sufficient to seriously damage delicate input amplifier devices despite their low energy.

Always operate signals within the specified safe limits. Most signal devices will survive very short fault conditions, such as attempting to set a digital signal high while external equipment inadvertently connects that line to a firm ground. Sustained or repeated stresses of this sort are likely to result in damage, rendering the hardware channel inoperable.

It is essential to operate all attached equipment properly and safely, according to operating specifications. Particular caution is required when using high-power devices. For example, if you use the DAP board to measure a high-power device like an electric motor, and the connection to the motor's power supply ground is inadvertently broken, this could result in high motor currents seeking to reach ground through the delicate signal ground connections intended for measurements. The fault will clear almost instantaneously, but in general, computer equipment should not be expected to provide sufficient protection from serious power faults of this sort.

The processor chip on the DAP board can generate a significant amount of heat. Heat sinks could be hot to the touch after periods of normal operation, so it is best to let the boards cool first if you need to handle them. Be sure not to obstruct the fans, heat sinks, cooling plates and so forth that are provide for your host PC system. The maximum safe ambient temperature for DAP board operation, given in the technical specifications, will typically be around 50 degrees Centigrade. In general, ambient temperatures that are safe for humans are also safe for operating the PC host, and will be safe for operating the DAP boards as well, but sustained operation at relatively high ambient temperatures could accelerate degradation of materials in electronic components, thus impairing the product lifetime.

Take the normal and appropriate precautions to prevent liquids and other contaminants from getting into the equipment, as you would with any computing equipment.

5. Electrical Grounding

The ground connection from a DAP board to the power system ground is through the ground connections provided on the host system PCI bus connectors, internal to the host system enclosure. These bus connectors are strongly connected to the ground side of the PC system DC power supply, which in turn is strongly connected to the host equipment case and to the external earth ground provided by the PC host system power cord. Generally, this grounding strategy will provide a high degree of safety for desktop units, but for industrial equipment in a rack, beware that it can introduce unanticipated stray grounding effects between equipment. There is usually no danger from this, but there could be implications for how the affected equipment operates, and for conformance with EMC directives.

There can be exposure to equipment damage from connecting DAP systems to signal sources with a "floating ground." This kind of problem is less likely to be anticipated when inputs are configured for differential mode operation, since common mode rejection does not respond to the common mode "float" voltage, and problems might not be obvious. However, the combined common mode voltage and differential voltage needs to remain within the safe operating range specified for the input signals. For accurate measurements, the common mode plus differential voltages must remain within the measurable voltage range. Inputs can be damaged if any input voltage exceeds the maximum voltage range limits relative to the DAP ground, even for a short time.

There are ground-reference pins on analog connectors, intended for equalizing small voltage differences that might exist between sensors and signal inputs. There are also ground-return pins on digital input and output connectors. If any of these are connected to a power current source because of improper equipment wiring, this would almost guarantee damage to the DAP board.

Be particularly careful when wiring signals. It is best to have all systems turned off and unplugged from power sources when wiring. It is easy to accidentally short-circuit signal lines to pins or to the strongly grounded case, damaging the signal inputs, the sensors, or both. Signals lines that you think are not powered could pack a damaging level of static charge, so anti-static precautions are strongly advised.

6. Access and Maintenance

There are no user-maintainable components on DAP boards.

Over long periods of time, it is possible that a DAP unit will start to exhibit small offset and gain errors. Follow your organization's policies, and use good technical judgment, about how often to check the calibration of your equipment. Some organizations prefer to make calibration adjustments themselves – check the manual for your board to decide whether you want to try this, and follow the instructions. Other organizations prefer to have Microstar Laboratories perform the same kind of calibration process that is applied to new boards in production – contact Microstar Laboratories for assistance in making these arrangements.

In cases where it is necessary to ship boards to Microstar Laboratories for repairs or calibration, shut down the PC host and remove its power cord, remove the mounting screw from the cover strip that holds the board in place in the host system's back panel, and pull the board carefully out of the PCI slot. DAP boards are highly sensitive to electrostatic damage, so be sure to take proper precautions for static control, and if possible, handle the DAP board only at a grounded static-controlled workstation. Keep the DAP board wrapped with conductive plastic material while they are out of the enclosure.

A. Appendix: Declarations of Conformity

DAP products are intended to be used in an industrial or controlled laboratory environment. They are not intended to be used in residential or commercial environments.

Installations must provide 3-wire AC power with an earth ground to the computer system hosting the DAP products, as discussed in Chapter 5 of this document, in order to meet the IEC61326 EMC requirements as set forth in the applicable EMC directives.

NOTE: DAP products are used in combination with separate host computer equipment provided by the system user or system integrator. Testing of the *DAP a-Series* family was done using Microstar Laboratories DAPserver devices as the PC hosts. It is the responsibility of the system user or system integrator to ensure that any system using a DAP product is compliant to all relevant standards.

NOTE: This equipment was found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules (USA), and to ICES-003 (Canada). Cet appareil numérique de la classe A est conforme à la norme NMB-003 (du Canada). The class A limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used with the right computer equipment, in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area can cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5000a**

Year CE mark first applied: **2006**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5016a**

Year CE mark first applied: **2006**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5200a**

Year CE mark first applied: **1999**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5216a**

Year CE mark first applied: **2000**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5400a**

Year CE mark first applied: **2000**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 840**

Year CE mark first applied: **1999**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 4000a**

Year CE mark first applied: **1999**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

DECLARATION OF CONFORMITY

(According to ISO/IEC GUIDE 22 and EN 45014)

Manufacturer: Microstar Laboratories, Inc.
2265 116th Avenue N.E.
Bellevue WA 98004 USA

DECLARES THAT THE PRODUCTS

Product Name: **DAP a-Series**

Model Number: **DAP 5380a**

Year CE mark first applied: **2006**

CONFORM TO THE FOLLOWING EUROPEAN DIRECTIVES

EMC Directive: 2004 / 108 / EC

Test Protocols: EMC: ***61326-1:2013 class A***

Signatory: Ian Lewis, Compliance Officer
Microstar Laboratories, Inc.

Index

Calibration....11
Copyrights and Trademarks....1
DAP a-Series products....6
Declarations of Conformity....12
Grounding....10
Hardware features....7
Installation guide....5
Intended Use....4
Operating Environment....4
Operating Instructions....5
Specifications....8
Thermal hazards....9
User's manual....7