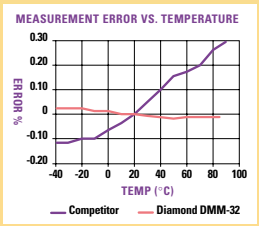
DIAMOND SYSTEMS

Catalog 1004

EMBEDDED COMPUTING DATA ACQUISITION EXPERTS



AUTOCALIBRATION TECHNOLOGY
provides 10x improvement in analog measurement accuracy!
See page 17

New this issue
EMERALD-MM-OPTO PC/104 ***See page 36***

- 4 RS-232/422/485 serial ports with opto-isolation
- 24 digital I/O lines
- -40 to +85°C operation

PANDORA PC/104 ENCLOSURE ***See page 44***

- Rugged aluminum construction
- Chromate EMF shield
- Quick, cable-free assembly
- PC/104, SpeedMOPS™, and Epic™

QUICK-START SOFTWARE DEVELOPMENT KITS
See pages 6-7

- VxWorks
- RTLinuxPro
- QNX
- Windows CE NET
- Linux

PC/104, EBX, AND CUSTOM FORM FACTOR EMBEDDED PCs AND I/O BOARDS

Featuring

- **RUGGEDNESS**
- **INTEGRATION**
- **ACCURACY**

Take advantage of our ruggedization/ customization program!
See page 2

Tough enough for use in space!

ATHENA

Rugged, compact, highly integrated embedded PC
See page 10

NEW!

- **VIA Eden 400-660MHz processor**
- **Low power fanless -40 to +85°C operation**
- **Memory soldered on board**
- **Integrated LCD/CRT, Audio, and Ethernet**
- **Integrated data acquisition**
- **Runs VxWorks, QNX, Linux, RTLinuxPro, DOS, Windows 2000/XP/XPe, and WindowsCE.Net**

(510) 456-7800
(800) 36PC104
Toll Free in USA

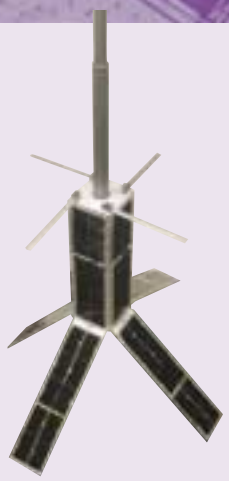
www.diamondsystems.com

THE DIAMOND SYSTEMS ADVANTAGE

Diamond Systems CPU boards in armored vehicle control systems

Diamond Systems I/O boards in medical equipment

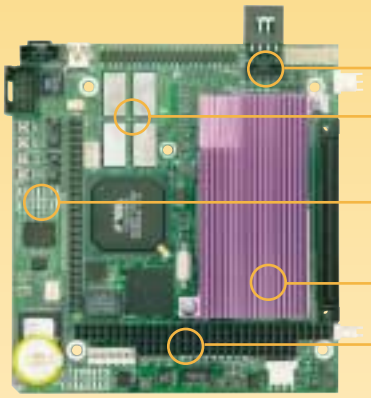
Diamond Systems I/O boards on the Space Shuttle



Diamond Systems CPU board on earthquake detector satellite

Proven success on these and other real-world applications:

Military combat vehicles
Space shuttle
Satellite
Medical Equipment
Commercial vehicles
Traffic control systems
Remote weather stations



The new ATHENA embedded CPU with 400-660MHz VIA Eden processor, on-board memory, video, LCD control, audio, Ethernet, and data acquisition, all on a single board measuring only 4.2" x 4.5". Customized version shown.

Customization

We know that no two applications are identical. That's why we offer advanced ruggedization and customization services to further enhance the reliability and usability of our products. We're pleased to provide these services even for small volume orders! Call us with your requirements and find out how our ruggedization/customization program can benefit you with these capabilities:

- Conformal coating using MIL-approved acrylic, urethane, and silicone materials
- Custom latching I/O connectors per your requirements
- Configuration jumpers replaced with soldered-on zero-Ohm resistors
- Customized BIOS settings
- MIL-spec shock/vibration testing and reports
- Full temperature range burn-in
- Complete manufacturing test reports for each board

Ruggedization

Diamond Systems understands the needs of real world embedded computing applications. That's why we offer rugged CPU and I/O boards built to withstand the challenges of harsh environments.

- Our products are tested and guaranteed to operate over -40 to +85°C.
- We solder memory directly to the board, to avoid vibration-induced failures common with plug-in memory modules, and to guarantee compatibility.
- We integrate more features onto a single board to improve reliability and reduce size and weight.
- We utilize the rugged PC/104 pin and socket expansion bus to provide a reliable way to customize the I/O features of your system.

Compatibility

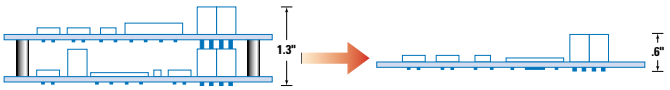
Diamond Systems' CPU and I/O boards are compatible with a wide range of operating systems, giving you the freedom to use the software platform of your choice. All I/O board driver software is provided free of charge.

Operating System	Athena CPU	Hercules CPU	Prometheus CPU	Data Acquisition I/O Boards
DOS	√	√	√	√
Linux	√	√	√	√
RTLinuxPro	√	√	√	√
QNX	√	√	√	√
Windows XP / XPe / 2000	√	√	√	√
Windows CE	√	√		√
VxWorks	√	√	√	√

DIAMOND SYSTEMS CORPORATION

WWW.DIAMONDSYSTEMS.COM 510-456-7800 TECHINFO@DIAMONDSYSTEMS.COM

Integration



2 in 1

Diamond Systems reduces the size of your embedded system with our 2-in-1 and 3-in-1 computer boards. These boards provide important benefits, including:

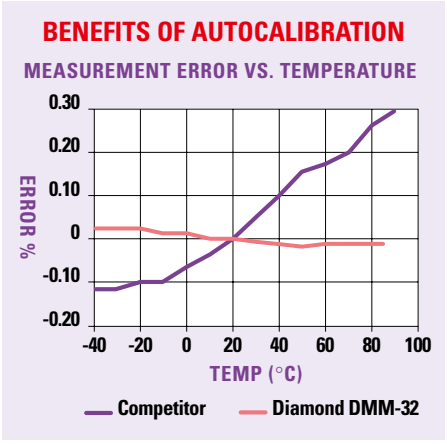
- Reduced system size and weight
- Reduced assembly and repair time
- Fewer system components and vendors

3 in 1

Look for the 2-in-1 and 3-in-1 logos throughout this catalog to identify boards with high-integration benefits.

Accuracy

Diamond Systems' autocalibration technology delivers maximum accuracy for your analog measurements regardless of time and temperature changes. Our unique multi-range calibration technique calibrates each A/D input range independently to maintain accuracy when switching between ranges.



The diagram here shows the actual performance of our autocalibrating A/D board vs. a competitor's manually-calibrated board. **Our board reduced temperature-based errors by a factor of 10!** Imagine what enhanced accuracy can mean for your application.

Expandability

Diamond Systems utilizes proven PC/104 technology to allow you to choose from hundreds of add-on I/O boards from us and dozens of other manufacturers around the world. The pin and socket bus connectors, together with stacking board design, provide a rugged and reliable expansion method.

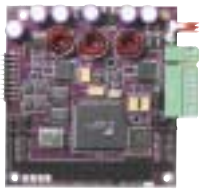
PC/104 ANALOG I/O MODULES

- 16-32 analog inputs
- 16-bit and 12-bit A/D resolution
- 2-16 analog outputs
- Autocalibration for maximum accuracy
- 40 to +85°C operation

PC/104 COMMUNICATIONS MODULES

- 4-8 serial ports on one board
- RS-232, RS-422, and RS-485 protocols
- Jumper and software configuration options
- Optoisolation option
- Ethernet, USB, and PCMCIA available
- 40 to +85°C operation

PC/104 POWER SUPPLIES



- 25-60 watts output power
- ±5V, ±12V outputs
- 6-30VDC input range
- Battery charger and UPS features
- 40 to +85°C operation

Flexibility

We offer embedded computing solutions in several form factors and performance levels to meet your needs. All boards may be customized to meet your exact needs, including latching I/O connectors, conformal coating, software modifications, and more.

PROMETHEUS

- PC/104 format 3.6" x 3.8"
- Low-power 486-100MHz processor, 5 watts
- Integrated memory, Ethernet, and data acquisition
- Operating temp -40 to +85°C

ATHENA

- Compact format 4.2" x 4.5"
- Low-power fanless VIA Eden P-3 400-660MHz
- Integrated memory, video, audio, Ethernet, and data acquisition
- Operating temp -40 to +85°C

HERCULES

- EBX format 8.0" x 5.75"
- Low-power fanless VIA Eden P-3 550-750MHz
- Memory soldered on board
- Integrated LCD, CRT, Ethernet and audio
- Integrated 5-28VDC input power supply
- Autocalibrating data acquisition on board
- Operating temp -40 to +85°C

WELCOME TO DIAMOND SYSTEMS

TABLE OF CONTENTS

MESSAGE FROM THE PRESIDENT

When I founded this company in 1989, I could not imagine that we would achieve the success we have today. The products in this catalog are used around the world in amazing applications, including satellites that measure changes in the Earth's magnetic field in order to predict earthquakes, military combat vehicles that can navigate and fight in darkness, and marine navigation equipment that detects underwater obstacles to steer a ship safely through a harbor.

Advanced Technology

Many of our products are leading edge: Our autocalibration technology yields measurements that are 10 times more accurate than our competition. Our CPU boards work reliably in the most extreme environments, and our 2-in-1 and 3-in-1 boards save significant space and weight.

Custom Design

Diamond Systems is not just a vendor of off-the-shelf products. Many of our highest-volume customers are buying custom boards that we designed specifically for them, using our large technology base. Our sales, engineering, and manufacturing processes are designed to enable efficient custom product development that meets your timeline and budget.

Sales Support

If you're located in the US, I encourage you to contact your local sales office, which can be found on our website. You'll find a staff of knowledgeable professionals with engineering backgrounds, who can help you design our products into your application.

If you're outside the US, I urge you to contact one of our 30 international distributors, who offer sales, design-in, and support services. Almost half of Diamond Systems' sales is to customers outside the US, and we owe our success in large part to our global network of dedicated professionals.

Technical Support

We stand behind our products. Our 2-year warranty protects your purchase decision. And we offer the best technical support to all our customers around the world. When you contact our technical support team, you'll be assisted by the actual engineers who designed the products. They know that our customers are the reason for our success, and they take pride in knowing that the results of their own work are helping you do yours.

PRODUCT SELECTION GUIDES

PRODUCT SELECTION GUIDES

ANALOG I/O MODULES

		ANALOG INPUTS								ANALOG OUTPUTS				MISC.	
PG	PRODUCT	# INPUTS	RES	BIP	UNI	GAIN	MAX	AUTOCAL	FIFO	# OUT	RES	BIP	UNI	# DIGITAL I/O	XT
10	Athena	16 SE, 8 D/I	16	4	2	Program	100KHz		48	4	12	2	2	24 I/O	Yes
12	Hercules	32 SE, 16DI	16	4	4	Program	250KHz	Yes	2048	4	12	2	2	40 I/O	Yes
14	Prometheus	16 SE, 8 D/I	16	4	2	Program	100KHz		48	4	12	2	2	24 I/O	Yes
18	DMM-48-AT	16 SE	16	2	2	Program	200KHz	Yes	2048	8	12	1	1	4 Opto, 8 relay	Yes
19	DMM-32-AT	32 SE, 16 DI	16	5	4	Program	200KHz	Yes	512	4	12	2	2	24 I/O	Yes
20	DMM-16-AT	16 SE, 8 DI	16	5	4	Program	100KHz	Yes	512	4	12	2	2	8 In, 8 Out	Yes
21	DMM-AT	16 SE, 8 DI	12	5	4	Program	100KHz	Yes	512	2	12	2	2	8 In, 8 Out	Yes
22	DMM	16 SE, 8 DI	12	6	6	Jumper	100KHz			2	12		2	8 In, 8 Out	
22	DMM-XT	16 SE, 8 DI	12	6	6	Jumper	100KHz			2	12		2	8 In, 8 Out	Yes
23	RMM-4-XT									4	12	4	4	24 I/O	Yes
23	RMM-8-XT									8	12	4	4	24 I/O	Yes
24	RMM-1612-XT									16	12	4	4	24 I/O	Yes
25	RMM-416-XT									4	16	2	1	24 I/O	Yes

LEGEND

SE Single-ended analog inputs
DI Differential analog inputs
I/O Programmable direction

HEADINGS

RES Resolution
BIP Bipolar ranges
UNI Unipolar ranges
MAX Max sample rate
AUTOCAL Autocalibration
XT -40 to +85°C

DIGITAL I/O AND COUNTER/TIMER I/O MODULES

		DIGITAL I/O					COUNTER/TIMERS			MISC.	
PG	PRODUCT	# I/O	BUF	PROG	OPTOS	RELAYS	# CTRS	RES	MAX	IRQ	XT
26	QMM-5	8 in, 8 out					5	16	7MHz	1	
26	QMM-5-XT	8 in, 8 out					5	16	20MHz	1	Yes
26	QMM-10	8 in, 8 out					10	16	7MHz	1	
26	QMM-10-XT	8 in, 8 out					10	16	20MHz	1	Yes
27	OMM-XT	48 I/O		Yes			3	16	10MHz	3	Yes
28	OMM-DIO-XT	48 I/O		Yes							Yes
29	GMM-48	48 I/O	Yes	Yes						2	
29	GMM-24	24 I/O	Yes	Yes						1	
30	PMM-XT					16					Yes
31	OPMM-XT				8	8					Yes*
32	IR104				20	20					

LEGEND

I/O Programmable direction

HEADINGS

BUF Buffered outputs
PROG Programmable direction
RES Resolution
MAX Max clock input rate
IRQ Interrupt outputs
XT -40 to +85°C operating temperature

SERIAL PORT AND ETHERNET MODULES

		SERIAL PORTS							MISC.	
PG	PRODUCT	10/100 ETHERNET	RS-232	RS-422	RS-485	MAX	PROT CFG	ADDR CFG	DIGITAL I/O	XT
33	MRC-224-XT	2							24 I/O	
34	EMM-XT		4	2	2	115.2K	Jumper	Jumper		Yes
34	EMM-4M-XT		4	4	4	115.2K	Jumper	Jumper		Yes
34	EMM-4232-XT		4			115.2K	Jumper	Jumper		Yes
35	EMM-8M-XT		8	8	8	460.8K	Jumper	Software	8 I/O	Yes
35	EMM-8232-XT		8			460.8K	Fixed	Software	8 I/O	Yes
36	EMM-OPTO-XT*		4	4	4	230.4K	Jumper	Jumper	24 I/O	Yes
37	EMM-DIO-XT		4			115.2K	Fixed	Jumper	48 I/O	Yes

HEADINGS

MAX Max baud rate
PROT CFG Protocol configuration
ADDR CFG Address configuration
XT -40 to +85°C operating temperature

*EMM-OPTO-XT has 4 individually opto-isolated serial ports

SOFTWARE DEVELOPMENT KITS

QUICK-START KITS FOR POPULAR EMBEDDED OPERATING SYSTEMS

Diamond Systems offers software development kits and driver support for popular embedded operating systems. Software development kits let you experience the operating system running on your CPU board in a quick-start fashion with minimal or no configuration effort. Many kits include development tools to enable immediate application development.

Software development kits are sold separately from CPU boards, so you can select exactly the right combination you need. A typical order includes the CPU of your choice, a CPU development kit or cable kit, and a software development kit. If you already have the CPU, you can just order the software development kit.

Note: Prometheus development kits include the CPU, while other development kits require a separate CPU purchase. All CPU development kits include a cable kit.

Flashdisk Modules

All our software development kits run on a solid state flashdisk module that mounts directly on the CPU board. The flashdisk provides rugged, low-power, light weight, solid-state mass storage and is a superior alternative to a hard drive for implementing an embedded system. Our software development kits are available either pre-loaded onto a flashdisk that is ready to install and run, or in soft copy form that you load onto your own flashdisk.

Availability

Availability of operating system software support is shown here. Any model of supported CPU may be used with any model of software development kit. Universal Driver programming library support for our I/O boards is always free and is included with every order. It may also be downloaded from www.diamondsystems.com.

PRODUCT	LINUX	RTLINUXPRO	WINDOWS CE.NET	VXWORKS	QNX
Athena	√	√	√	√	√
Hercules	√	√	√	√	√
Prometheus	√	√			√
Data Acquisition Boards	√	√	√	√	√

VxWorks

VXWorks support for Diamond Systems products consists of two components:

- A VxWorks board support package for the Athena and Hercules CPU boards is available to Wind River customers at **www.windriver.com.**
- Universal Driver for VxWorks software support for the data acquisition circuitry on our CPU boards and for our I/O boards is available free at **www.diamondsystems.com.**

The VxWorks development kits include a licensed, compiled run-time system utilizing the BSP and Universal Driver that demonstrates the operating system and the I/O circuitry running on the CPU.

WIND RIVER

KIT MODEL NO.	DK-VXW-32	DK-VXW-64	DK-VXW-128
Flashdisk	32MB	64MB	128MB
ACC-IDEEXT	√	√	√
CD or Download	CD	CD	CD

Windows CE.NET

- Pre-configured, licensed runtime environment
- Familiar Windows graphical user interface
- Windows programming API
- Lightweight, rugged, low-cost flashdisk storage
- Quick-start – just install flashdisk and boot
- Evaluation version of Windows CE development tools included on CD-ROM

The Windows CE.NET software development kit includes a licensed CE.NET runtime system with internet access and demo programs for our CPU board data acquisition circuitry. The CD includes the Windows CE development system evaluation version with eMbedded C++. This kit includes everything you need to begin development of a Windows CE.NET application for your CPU.

Microsoft® Windows® Embedded Partner

KIT MODEL NO.	DK-WCE-DL	DK-WCE-32	DK-WCE-64	DK-WCE-128
Flashdisk	Specify with order	32MB	64MB	128MB
CD or Download	Download	CD	CD	CD

SOFTWARE DEVELOPMENT KITS

QUICK-START KITS FOR POPULAR EMBEDDED OPERATING SYSTEMS

Linux

- Pre-configured Linux ready to boot and run
- Compact - 12MB file size, 3MB RAM
- Lightweight, rugged, low-cost flashdisk storage
- Quick start- just install flashdisk and boot
- Linux kernel version 2.6
- EXT3 journaling file system
- Development environment available on pre-configured hard disk

Diamond Systems' Flash Linux provides a quick-start compact Linux environment based on the Slackware 2.4 kernel. It is preconfigured for our embedded CPU boards and includes our Universal Driver for I/O programming. It is available both as a binary image that can be loaded onto a flashdisk module, or a pre-loaded flashdisk, that you can install on your CPU board and power on for immediate operation. Flash Linux utilizes the EXT3 journaling file system for enhanced file protection during power loss or improper shutdown, and the Lilo bootloader for a quick 15 second boot time.

The CD includes binary images of the flashdisk files that you may copy freely onto your own flashdisks.

The 20GB hard drive is pre-loaded with a full installation of Slackware Linux 9.1, including a full set of software development tools ready to run. This can be used to create an instant development system running on the target CPU, so you can develop application code and run it immediately on the same system.

KIT MODEL NO.	DK-LINUX-CD	DK-LINUX-FD32	DK-LINUX-FD128	DK-LINUX-HD20	DK-LINUX-COM	DK-LINUX-02
Flashdisk		32MB	128MB		32MB	
ACC-IDEEXT		√	√		√	
CD or Download	CD	CD	CD	CD	CD	
20GB Hard Drive				√	√	√
ACC-HDDMOUNT				√	√	√

RTLinuxPro

- Hard real-time design for maximum reliability
- Pre-configured, ready to boot and run
- Lightweight, rugged, low-cost flashdisk storage
- Quick start- just install flashdisk and boot
- Full developer seat available on pre-configured hard disk

RTLinuxPro from FSMLabs offers a hard real-time extension to Linux for true real-time capability. While other "real-time" extensions to Linux consist of simply reducing the maximum latency in order to minimize the variability of program execution time, RTLinuxPro consists of a hard real-time kernel that runs Linux as a single thread. This allows Linux to be completely pre-empted when a real-time application needs to run. In RTLinuxPro, your real-time applications can run with guaranteed latency, resulting in more reliable performance.

Diamond Systems offers an RTLinuxPro evaluation kit in free download form as well as a pre-loaded flashdisk. We also offer an RTLinuxPro developer license (model DK-RTL-DEV) with a fully installed development environment on a 20GB notebook hard drive. Simply connect the hard drive to your Diamond Systems CPU board and power up. Now you can develop your application code directly on the target hardware and run it instantly, without wasting time on file transfers or worrying about compatibility.

The RTLinuxPro software development kits include a licensed binary runtime system with built-in data acquisition and control demo programs showing the benefits of RTLinuxPro hard real-time performance.

KIT MODEL NO.	DK-RTL-DL	DK-RTL-32	DK-RTL-64	DK-RTL-128	DK-RTL-DEV
Flashdisk	Specify with order	32MB	64MB	128MB	
CD or Download	Download				
20GB Hard Drive					√
ACC-HDDMOUNT					√

QNX

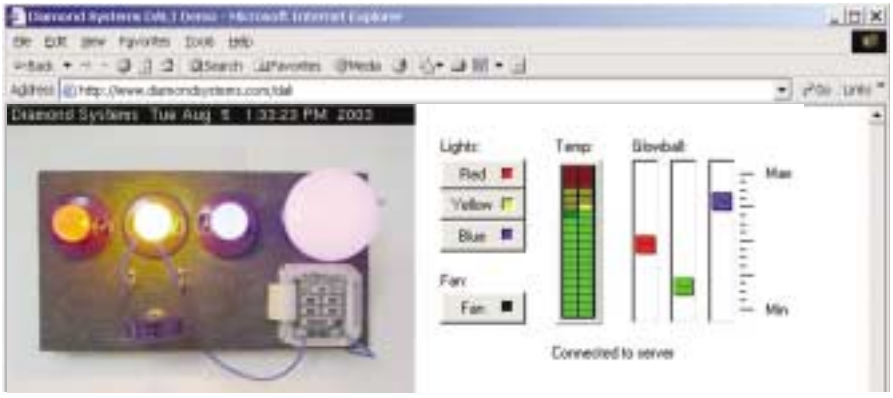
- Pre-configured, licensed runtime environment
- Lightweight, rugged, low-cost flashdisk storage
- Quick-start - just install flashdisk and boot
- Evaluation version of Momentics® development tools included on CD-ROM

The QNX development kits include a licensed QNX Neutrino run-time system with demo programs for the data acquisition circuitry on the CPU. The CD includes the Momentics Professional Edition evaluation version. This kit includes everything you need to begin development of a QNX application for your CPU.

KIT MODEL NO.	DK-QNX-DL	DK-QNX-32	DK-QNX-64	DK-QNX-128
Flashdisk		32MB	64MB	128MB
ACC-IDEEXT		√	√	√
CD or Download	Download	CD	CD	CD

DALI INTERNET-ENABLED REMOTE CONTROL SOFTWARE

CONTROL YOUR EMBEDDED SYSTEM IN REAL TIME OVER THE INTERNET



This demo shows our Prometheus CPU being controlled by a web page with an embedded ActiveX control element. The web page is served by DALI software running on the Prometheus. The demo system is located in our office. Try it now at: http://www.diamondsystems.com/dali/

- Control embedded hardware remotely over the Internet
- Real-time monitoring and control of analog and digital I/O
- Build graphical Human-Machine Interface applications easily
- Client-hosted and browser-based (web page) control methods
- Control multiple embedded systems from a single location
- Configurable alarm notification system
- Secure communication link using SSL encryption
- Utilizes widely-supported industry-standard SOAP protocol
- Transparent network – no need to write networking code
- Works with many 3rd party tools, including Microsoft Visual Studio .NET, Apache Axis, and IBM Web Services
- Demos and example code included for quick startup, including MFC and ActiveX
- Runs on Linux, Windows, and QNX operating systems

DALI is a software system that enables real-time remote data acquisition and control over a TCP/IP network. It provides the ability to collect data and to control a machine from anywhere as long as the machine is connected to a suitable network.

DALI is compatible with Linux, Windows NT/2000, and QNX 6. It is designed to run on a CPU embedded into the equipment to be controlled. Typical applications include remote monitoring and diagnostics; patient monitoring; security and access control; and building, factory, and home automation.

For flexibility, DALI provides multiple methods of user access to the system under control, including client-hosted applications and web pages served by the integrated web server to any suitable browser. Custom control panel screens may be easily designed using common software technologies, including MFC, ActiveX, Java, and PHP. A control panel may even provide access to multiple DALI systems simultaneously.

DALI Architecture

DALI consist of three main components:

- Server software which runs on the embedded system to be controlled.
- Client software which runs on a remote terminal either in standalone mode or in a web browser.
- A communications protocol that provides the link between the two.

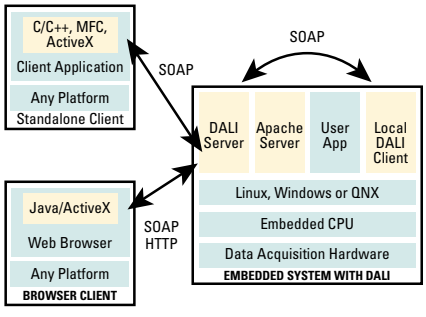
The DALI server is a multithreaded C++ program which gives many client programs concurrent access to one or more data acquisition boards on the embedded system. A built-in administrator system lets you define a security policy to require a login with a known username and password to access selected features.

The communications protocol is implemented using SOAP (Simple Object Access Protocol), a widely-used open standard for Internet software communication. DALI application developers can use the C/C++ or Java SOAP libraries provided by Diamond Systems, or any of the many SOAP toolkits available from 3rd party vendors, such as Microsoft's Visual Studio.NET, to access the A/D, D/A, and digital I/O features on the embedded system.

Software is included for developing graphical MFC or ActiveX control panel applications for Windows using Visual Studio. Only a basic knowledge of Windows GUI development is required. Many working example programs are included to assist in easy startup. A C/C++ library is also available for integrating DALI features into non-graphical applications.

The DALI Java toolkit is based on a 3rd party control graphics package. This toolkit provides a simple graphical way of creating a Java GUI using a drag-and-drop interface without writing any code at all.

DALI Access Methods



This diagram shows the conceptual architecture of DALI and three types of DALI clients. The DALI-enabled system contains a CPU with built-in data acquisition running Linux, QNX, or Windows. It communicates with the various clients using the SOAP protocol. The Apache server runs along with the DALI server to serve web pages and browser applications including Java applets and ActiveX controls.

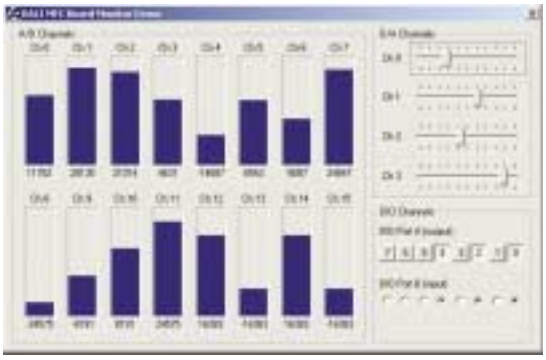
In the **Browser Client** example, a web page containing ActiveX controls or Java applets is downloaded over the Internet to provide a real-time GUI interface to the embedded system in a browser window. DALI includes working ActiveX controls, and the optional DALI Java Development Kit adds support for building Java applets which will run on any platform.

In the **Standalone Client** example, a control panel application is installed on a client PC and communicates with the DALI host via the Internet. The application can be written in C/C++, MFC, or Java.

In the **Local Client** example, a C/C++ program is running on the same embedded CPU running DALI. It interacts with the I/O through DALI using the SOAP protocol.

DALI INTERNET-ENABLED REMOTE CONTROL SOFTWARE

The DALI Web Administration system enables system configuration via the web, including security management.



A simple Microsoft MFC standalone application which monitors 16 A/D channels, 8 digital I/O lines, and 4 D/A channels on a DALI-enabled device across the Internet.

UNIVERSAL DRIVER SOFTWARE FOR I/O BOARD PROGRAMMING

Diamond Systems' Universal Driver software provides a powerful C language programming library for data acquisition and control. It contains a comprehensive set of functions that control the analog I/O, digital I/O, counter/timer, and interrupt features of the hardware. Universal Driver is provided free with all our I/O boards, as well as our Athena, Hercules, and Prometheus CPU boards with integrated data acquisition. It may also be downloaded from our website.

No other vendor offers you this level of software functionality for embedded systems data acquisition:

Cross Platform Compatibility

We support a wide variety of desktop and embedded operating systems, with virtually the same programming conventions for each one. This makes it easy for you to port your application code from one operating system to another and also enables us to maintain and upgrade the software more reliably.

Supported Operating Systems

- DOS
- Linux
- RTLinux
- QNX
- Window 98/NT/XPe/2000
- Windows CE.Net
- VxWorks

Supported Programming Languages

- C/C++
- Visual Basic
- Lab View

Multi-Board Operation

Universal Driver controls up to 16 boards simultaneously. You can use as many different boards as you want in one system, or even use multiple boards of the same type in one system.

Extensive Interrupt Handling Features

Universal Driver supports interrupt handling for faster A/D sampling on all boards that have this feature. You can run the standard built-in interrupt-processing functions, or add your own code that runs together with or instead of the built-in interrupt handlers for custom functionality. In addition, you can generate interrupts that directly trigger your own custom interrupt handlers to perform processing completely independent of any data acquisition operation.

Hard Real-Time Operation for Improved Performance

Users of RTLinuxPro will appreciate the hard real-time nature of Universal Driver performance for that operating system. Instead of simply running your data acquisition and control application as a Linux thread subject to variable latencies, Universal Driver for RTLinuxPro utilizes the real-time kernel environment to provide reliable operation with guaranteed latency and smooth performance.

Example Programs Save Time

We provide example programs for each board, each major function, and each operating system. This 3-dimensional example program library guarantees that you will be able to find a starting point that meets your needs and accelerates your application development. Project files are included so you can modify the code and recompile quickly without worrying about having the right settings.

Comprehensive, Easy-to-Use Documentation

Universal Driver documentation is now provided in HTML format. This new format enables rapid navigation to help you find the information you need in just a few mouse clicks. Updates can be added easily and quickly, so you always get the most up to date information. It's available online at our website and also included with each order.

Free, Knowledgeable Technical Support

Technical support for Universal Driver, as well as for our hardware products, is provided by the actual engineers who designed it. You don't have to put up with a help desk operator who simply relays messages back and forth. You get quick, friendly, knowledgeable answers to your questions by people who understand the technology in detail, so you can stay productive. We also offer an online FAQ database and discussion board to assist you in finding answers to common issues 24 hours a day.

ATHENA

400-660MHZ VIA EDEN PROCESSOR, ON-BOARD MEMORY AND DATA ACQUISITION

New size! 4.2" x 4.5"

CPU FEATURES

- VIA Eden 400-660MHz Processor
- Low-power fanless operation: 10 Watts @ 400MHz
- 128MB memory soldered on board
- 10/100Mbps Ethernet
- S3 Savage 4 Chipset with advanced 3D/2D video
- Flat panel, CRT, and LCD display support
- IDE port with UDMA-33 capability
- 4 RS-232 serial ports
- 4 USB 1.1 ports
- PS/2 keyboard/mouse ports
- Real-time clock
- Watchdog timer
- PC/104 ISA expansion bus
- -40 to +85°C operation

DATA ACQUISITION FEATURES

- 16 analog inputs, 16-bit A/D
- 100KHz max sampling rate
- Multi-channel scan sampling with interrupts and FIFO support
- Programmable input ranges
- 4 analog outputs, 12-bit D/A
- 24 programmable digital I/O
- 2 programmable counter/timers
- Supported by Universal Driver software

FEATURE	BENEFIT
Low-power VIA Eden processor	High computing power with reduced power consumption Reduced heat dissipation / no fan required (400MHz)
Integrated LCD, CRT, Ethernet, and system I/O	Small size Light weight
Integrated data acquisition	Single-board solution for increased reliability Guaranteed compatibility
-40/+85°C operation	Compatible with vehicle and outdoor applications
Ruggedization capability	Customizable for demanding applications Increased reliability

Operating System Compatibility

DOS
Linux
RTLinuxPro
QNX
Window 98/NT/XP/2000
Windows CE.Net
VxWorks

2 in 1 CPU + DATA ACQUISITION

The new Athena CPU from Diamond Systems combines the low-power Pentium-III class VIA Eden processor with on-board memory and data acquisition into a new compact form factor measuring only 4.2" x 4.5". The result is a small, low-heat-dissipation, and extremely rugged embedded CPU that fits in tight spaces and survives harsh environments. On-board 128MB RAM, LCD+CRT video, AC97 audio, 4 USB ports, 4 serial ports, a 16-bit low-noise data acquisition circuit, and extended temperature operation make Athena an all-in-one, complete embedded solution for demanding applications.

Athena can be customized for increased ruggedness. Options include latching connectors, hardwired configuration settings, rugged heat sink mounting, conformal coating, and BIOS modifications.

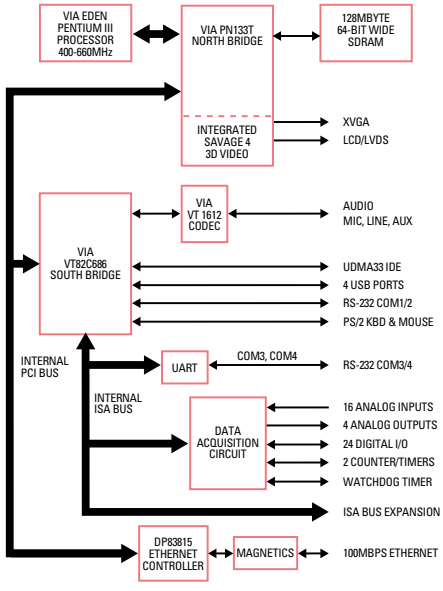
An enhanced set of I/O ports is provided to support any application's requirements, including 10/100Mbps Ethernet, UDMA-33 IDE, parallel port, PS/2 keyboard and mouse ports, and 4 USB 1.1 ports. The board also has 4 16450-compatible RS-232 serial ports. The watchdog timer provides protection from software crashes and is programmable for delays up to 2 seconds.

The built-in PC/104 expansion bus enables Athena to work with almost all the data acquisition and communications modules in this catalog, as well as hundreds of I/O boards from other vendors. The board can be provided with either stackthrough PC/104 connectors (standard) or non-stackthrough connectors for a slim baseboard application. The new compact 4.2" x 4.5" form factor, slightly larger than PC/104, enables Athena to include more features on a single board and still fit inside our Pandora enclosure system.

Cable Kit

The Athena cable kit includes all needed cables for Athena I/O features. All cables are also available individually. See page 47 for a compete list of cables.

ATHENA BLOCK DIAGRAM



CPU Enclosure

The Athena CPU can be mounted inside our Pandora enclosure with cable-free panel I/O board to form a rugged, compact, completely self-contained industrial computer system. See page 44 for information on Pandora enclosures.

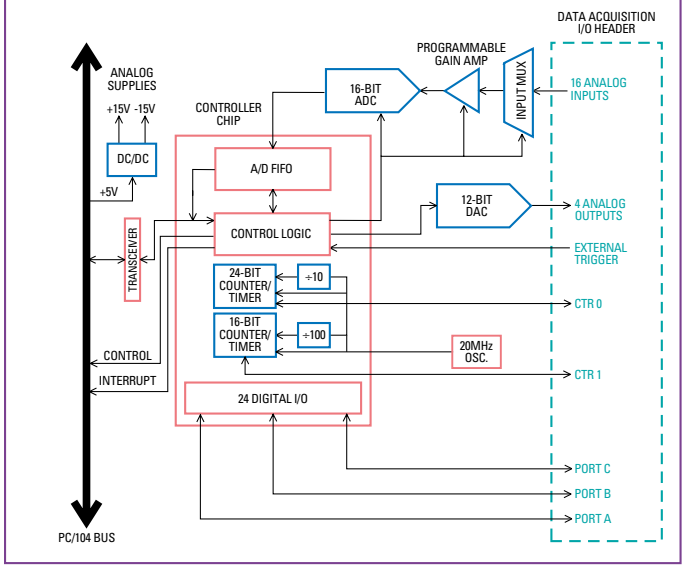
ATHENA

400-660MHZ VIA EDEN PROCESSOR, ON-BOARD MEMORY AND DATA ACQUISITION

Integrated Data Acquisition

The optional data acquisition circuit provides high-accuracy, stable 16-bit A/D performance with 100KHz sample rate, wide input voltage capability up to ±10V, and programmable input ranges. It includes 4 12-bit D/A channels, 24 programmable digital I/O lines, and two programmable counter/timers. A/D operation is enhanced by on-board FIFO with interrupt-based transfers, internal/external A/D triggering, and on-board A/D sample rate clock. Placement of the analog circuitry away from the high-speed digital logic ensures low-noise performance for critical applications. All data acquisition features are fully supported by our Universal Driver software for DOS, Linux, RTLinux, QNX, Windows 98/NT/2000/XP/CE, and VxWorks to simplify application development.

ATHENA DATA ACQUISITION BLOCK DIAGRAM



Solid State Storage

Athena is compatible with our solid state IDE flashdisk modules. These modules provide mass storage that is fully IDE compatible and requires no drivers to work with your operating system. They mount directly onto the board's IDE connector and are held in place with a mounting screw for extra ruggedness. See page 45 for flashdisk information.

Development Kit

A development kit is available with all the hardware you need to get started on your Athena embedded design project. The kit contains an AC power adapter, 128MB flashdisk module and programming adapter, cable kit, PC/104 mounting kit, and USB floppy drive. Kit items are also available individually.

SPECIFICATIONS

CPU AND SYSTEM		
Processor	VIA Eden, low-power Pentium-3 equivalent	
Speed	400MHz	660MHz
Power consumption	10 watts	12.5 watts
Cooling	Heat sink, no fan	Heat sink + fan
Display		
Chipset	VT8606 Savage4 3D and 2D acceleration, 4x AGP, and 128-bit engine	
Type	CRT and LCD	
Resolution	Up to 1280x1024x32 or 1920x1440x16	
Memory	8/16/32MB shared with system memory	
LCD interface	18-bit dual-channel LVDS, 1400x1050	
Memory	128MB soldered on board	
Mass storage		
IDE	44-pin connector, UDMA33 (33MB/sec), up to 2 drives	
Flashdisk	Solid state module, up to 512MB, mounts on board	
Real-time clock	On-board RTC with lithium backup battery	
Watchdog timer	0.15 - 2 sec user programmable	
Ethernet	National Semi DP83815, 10/100Mbps	
Serial ports	4x RS-232	
Ports 1/2	Up to 115.2kbps, 16-byte FIFO, 16C450 compatible	
Ports 3/4	Up to 460.8kbps, 128-byte FIFO, 16C2850 UART	
Parallel port	SPP, EPP, and ECP compatible; BIOS enable/disable	
USB ports	4, version 1.1	
PS/2	2 ports for keyboard & mouse	
DATA ACQUISITION		
Analog inputs	16 single-ended / 8 differential	
A/D resolution/speed	16 bits, 100KHz maximum	
Input ranges	±10V, ±5V, ±2.5V, ±1.25V / 0-10V, 0-5V, 0-2.5V, 0-1.25V	
Analog outputs	4, 12-bit resolution	
Output ranges	±10V, ±5V, 0-10V, 0-5V	
Digital I/O	24 lines, programmable direction	
Counter/timers	1 24-bit and 1 16-bit A/D sample rate control, counting/timing, programmable interrupts	
GENERAL		
Operating temp.	-40 to +85°C	
Power supply	+5VDC ±5% @ 2.0A (400MHz), 2.5A (660MHz)	
Dimensions	4.175"W x 4.475"H	
Weight	5.3oz / 150g	

ORDERING GUIDE

ATH400-128	Athena 400MHz 128MB with data acquistion
ATH400-128N	Athena 400MHz 128MB without data acquistion
ATH660-128	Athena 660MHz 128MB with data acquistion
ATH660-128N	Athena 660MHz 128MB without data acquistion
C-ATH-KIT	Athena cable kit
DK-ATH-01	Athena development kit
PS-5V-03	AC adapter for Athena

For flashdisks, cables and accessories, see pages 46-47.

EMBEDDED CPU

HERCULES™ EBX

PENTIUM III PERFORMANCE WITH ETHERNET, VIDEO, AUDIO, AND DATA ACQUISITION

CPU SECTION

- VIA Eden Pentium III class 550-750MHz processor
- 128-256MB SDRAM soldered on board
- VGA support up to 1920x1440
- Integrated S3 Savage 4 graphics with advanced 3D rendering capabilities
- LCD (LVDS) support up to 1600x1200
- AC97 audio with 2W per channel stereo amplifier
- TV out feature
- UDMA-100 IDE support
- 4 USB ports
- 4 RS-232/485 ports
- Dual IDE with ATA-100 support
- PS/2 keyboard and mouse
- Watchdog timer
- Low power fanless operation (<10W @ 550MHz)
- PC/104-plus ISA and PCI expansion
- -40 to +85°C operation

DATA ACQUISITION SECTION

- 32 channel 16-bit A/D
- 250KHz max sample rate
- Programmable input ranges
- Multi-channel scan sampling with interrupts and FIFO support
- 2K FIFO with programmable threshold
- 4 channel 12-bit D/A
- Multi-range autocalibration of A/D and D/A
- 40 digital I/O lines
- 16-bit and 24-bit counter/timers
- Field-upgradeable logic circuit

POWER SUPPLY SECTION

- 5-28VDC input range standard
- 20-48VDC input range optional
- 40 watts output power (10 watts used by CPU)
- Switched auxiliary power for IDE drives and accessories

FEATURE	BENEFIT
Low-power VIA Eden processor	High computing power with reduced power consumption Fanless operation (550MHz)
Memory soldered on board	Increased reliability and ruggedness Guaranteed compatibility
Integrated LCD, CRT, Ethernet, and system I/O	Complete PC on a single board
On-board DC/DC power supply	Suitable for vehicle applications Reduced size and weight
Integrated data acquisition circuit with autocalibration	Single-board solution for increased reliability Increased measurement accuracy
-40 to +85°C operation	Compatible with vehicle and outdoor applications
Ruggedization capability	Customizable for harsh environment applications

Operating System Compatibility

DOS

Linux

RTLinuxPro

QNX

Window 98/NT/XP/2000

Windows CE.Net

VxWorks

3 in 1 CPU + DC/DC POWER SUPPLY + DATA ACQUISITION

Hercules introduces a new level of integration in EBX format CPU boards. Combining processor, data acquisition, and power supply onto one board results in a thinner, lighter, more rugged, and easier to assemble embedded system. This 3-in-1 design addresses the needs of mobile and vehicle applications by offering the benefits of reduced size, weight, cost, and power consumption.

CPU Features

Hercules uses the VIA Eden processor chipset, featuring Pentium III class performance with dramatically reduced power consumption. The 550MHz board consumes only 10 watts and requires only a small heat sink to operate at temperatures up to 85°C.

System I/O includes a 10/100Mbps Ethernet port, 4 RS-232/485 ports, 4 USB ports, 2 IDE channels, and PS/2 keyboard/mouse.

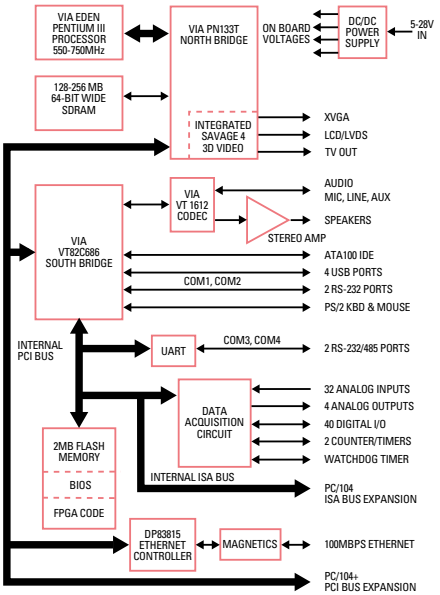
Hercules contains an integrated S3 Savage 4 video circuit. This advanced design provides hardware 2D and 3D acceleration, 32MB video buffer using shared system memory, 128-bit architecture, full internal AGP 4x performance, 3Dnow! and MMX instruction sets, and high-quality DVD video playback. The video circuit supports CRTs up to 1920x1440 and LVDS LCD panels up to 1600x1200 resolution. Simultaneous CRT and LCD display is supported.

Audio features include an integrated AC97 digital audio controller and codec. A built-in low-noise stereo speaker amplifier provides 2 watts per channel output power and hardware volume control. Audio I/O signals include mic in, CD in, line in/out, and speaker out.

Built-In DC/DC Power Supply

The built-in DC/DC power supply enables Hercules to be used in a wide range of applications without requiring a separate add-on power module. The on-board supply has 40 watts of output power, enough to power the CPU as well as peripherals and add-on boards. The standard input range of 5-28VDC means that Hercules is compatible with a standard off-the-shelf 5V supply as well as a vehicle, battery, or industrial power source. An optional 20-48VDC input range is also available. The on-board supply has ACPI compatibility for intelligent power management.

HERCULES EBX BLOCK DIAGRAM



Flashdisk Solid-State Storage

Install an IDE flashdisk module onto Hercules and Prometheus for lightweight, rugged mass storage. The flashdisk module works like a hard drive and provides high-speed nonvolatile solid-state storage in sizes of 32MB, 64MB, or 128 MB.

HERCULES™ EBX

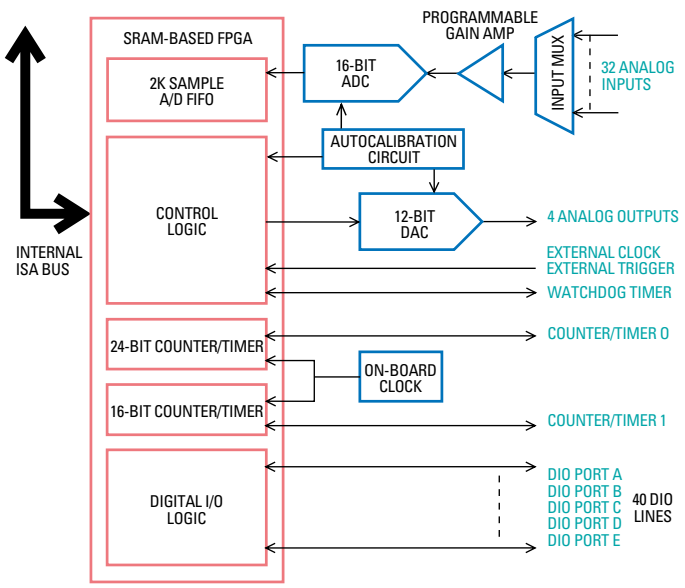
PENTIUM III PERFORMANCE WITH ETHERNET, VIDEO, AUDIO, AND DATA ACQUISITION

Built-In Data Acquisition

Hercules includes a top-of-the-line autocalibrating analog and digital I/O circuit, fully supported by our Universal Driver software for Linux, DOS, QNX, and Windows 95/98/NT/2000/XP. It has 32 analog inputs with 16-bit resolution and 250KHz sample rate, backed by a 2K-sample FIFO with programmable threshold. Programmable input ranges from a wide-range +/-10V down to 0-1.25V are provided. The analog circuitry also includes 4 D/A channels with 12-bit resolution and jumper-selected output ranges. Multi-range autocalibration of both A/D and D/A ensures maximum accuracy over time and temperature and enables reliable, maintenance-free performance over the life of the board.

On the digital side, Hercules provides 40 digital I/O lines with programmable direction, as well as two counter/timers for A/D sample rate control, pulse counting, frequency generation, or other applications. Its advanced control logic has the features and flexibility to fit almost any application, such as internal/external A/D clock source, scan and single-sample modes, and our exclusive programmable FIFO threshold that lets you tune the board's performance to your application.

HERCULES DATA ACQUISITION BLOCK DIAGRAM



Development Kit

A development kit is available with all the hardware you need to get started on your embedded design project. The kit contains a CPU board, flashdisk module, cable kit, software CD, AC power adapter, and USB floppy drive.

SPECIFICATIONS

CPU	
Processor	VIA Eden P-3, 550-750MHz
Display type	CRT and LDS LCD
Resolution	Up to 1280 x 1024 x 32 bits per pixel
Memory	8/16/32MB shared with system memory
LCD Interface	36-bit TFT / DSTN
SDRAM memory	128-256MB on board
Flash memory	2MB
System I/O	4 USB 1.1, PS/2 keyboard/mouse
Serial ports	2 fixed RS-232 or RS-485; / 2 configurable RS-232/485
Max data rate	460.8kbps all ports
IDE connections	1 44-pin connector for flashdisk; 1 40-pin dual-channel UDMA-100; Compact flash socket
Ethernet	10/100Mbps; NE2000 compatible
Serial console	Selectable COM1 / COM2
Floppy drive	USB legacy support
Parallel port	Not present
PC/104+ bus	+5V/+3.3V selectable
DATA ACQUISITION CIRCUITRY	
Analog inputs	32, 16-bit A/D resolution
Max sample rate	250KHz total
Input modes	Single-ended, differential
Input ranges	±10V, ±5V, ±2.5V, ±1.25V / 0-10V, 0-5V, 0-2.5V, 0-1.25V
Accuracy	< ±2LSB after autocalibration
Analog outputs	4, 12-bit D/A resolution
Settling time	7µS to ±.01%
Output current	±5mA max, 2kΩ min load
Digital I/O	40 lines, 5V logic compatible
Direction	Programmable in 8-bit ports
Output current	0: 12mA max; 1: -4mA max
Counter/timers	1 24-bit A/D sample rate control; 1 16-bit general purpose
POWER SUPPLY	
Input voltage	5-28VDC standard, 20-48VDC optional
Output power	40W total, 30W available
Power consumption	10W max
Output voltages	+5V, +3.3V (on PCI bus)
Switched outputs	+5V, +12V, +3.3V
GENERAL	
Dimensions	8.00" x 5.75" EBX format
Operating temp.	-40 to 85°C
Weight	10oz / 285g

ORDERING GUIDE

Contact factory for additional combinations of processor / memory / input voltage.

HRC550-5A128	550MHz CPU, 5-28V in, data acquisition, 128MB RAM
HRC550-5N128	550MHz CPU, 5-28V in, no data acquisition, 128MB RAM
HRC750-5A128	550MHz CPU, 5-28V in, data acquisition, 256MB RAM
HRC750-5N128	550MHz CPU, 5-28V in, no data acquisition, 256MB RAM
DK-HRC-01	HRC400-5A128 development kit
C-HRCEBX-KIT	Hercules cable kit
PS-12V-01	AC adapter for Hercules CPU

For flashdisks, cables and accessories, see pages 46-47.

PROMETHEUS

ZFX86 CPU, LOW POWER, BUILT-IN ETHERNET AND DATA ACQUISITION

- 2-in-1 design reduces cost, saves space
- ZFx86 processor - 486-DX2, 100MHz
- 32MB RAM
- On-board fash file system for DOS
- 10/100Mbps Ethernet
- 4 serial, 2 USB, 1 floppy port
- IDE and floppy ports
- Watchdog timer and real-time clock
- IrDA infrared port
- Solid-state IDE flashdisk compatibility
- Built-in data acquisition with:
  – 16-channel 16-bit A/D
  – 4-channel 12-bit D/A
  – 24 digital I/O
  – 2 counter/timers
- -40 to +85°C operation

Prometheus is compatible with our solid state flashdisk modules that provide IDE-compatible mass storage in a rugged format that bolts onto the board and requires no special drivers. See page 46 for more information.

ORDERING GUIDE

PR-Z32-EA-ST	Prometheus PC/104 CPU, With Ethernet & Data Acquisition
PR-Z32-E-ST	Prometheus PC/104 CPU, With Ethernet
PR-Z32-LC-ST	Prometheus PC/104 CPU, Low-Cost Model
PR-Z32-EA-DK	PR-Z32-EA-ST Development Kit
PR-Z32-E-DK	PR-Z32-E-ST Development Kit
C-PRZ-KIT	Prometheus Cable Kit

For flashdisks, cables and accessories, see pages 46-47.

FEATURE	BENEFIT
Low-power ZFx86 processor	Reduced heat dissipation / no fan required
Integrated Ethernet and system I/O	Small size, Light weight
Integrated data acquisition	Single-board solution for increased reliability Guaranteed compatibility
-40/+85°C operation	Compatible with vehicle and outdoor applications
Ruggedization capability	Customizable for demanding applications Increased reliability

Operating System Compatibility

DOS

Linux

QNX

Windows 98

The space-saving Prometheus combines a full-featured 486 CPU with an intelligent, professional-quality data acquisition circuit including analog I/O, digital I/O, and counter/timers, all on one board. Its low power consumption of 5 watts eliminates the need for a heat sink or fan and enables guaranteed operation over the range of -40 to +85°C. Prometheus has been successfully used in applications including satellites, military combat vehicles, and process control.

Built-in I/O includes a 10/100Mbps Ethernet port, 2 USB ports, 4 RS-232 ports with serial console capability, PS/2 keyboard/mouse, IDE port, parallel port, and floppy port. Prometheus also includes a real-time clock with backup battery and a programmable watchdog timer with both hardware and software retrigger capability.

For DOS applications, it includes a built-in flash file system that lets you store DOS operating system and application files right in the on-board flash memory without requiring any external storage. This saves time, reduces cost, and increases the ruggedness of your system.

The built-in data acquisition circuit is identical to the one used on our Athena CPU. It provides 16 analog inputs with 16-bit A/D resolution and a comprehensive set of features, including programmable input ranges, single-ended and differential inputs, and interrupt-based sampling with FIFO support. The circuit also provides 4 12-bit analog outputs with selectable output ranges, 24 digital I/O lines with programmable direction and enhanced output current, and 2 programmable counter/timers for sample rate control, event counting, and programmable interrupt generation.

Prometheus is available in three versions:

- **EA** Full-featured model, with 10/100Mbps Ethernet and data acquisition
- **E** Includes Ethernet, no data acquisition
- **LC** No Ethernet or data acquisition; 16MB RAM; Extra low power consumption of 2 watts

SPECIFICATIONS

CPU AND SYSTEM	
Processor	ZFMicro Devices ZFx86
Processor Clock	100 MHz
DRAM Memory	**EA, E:** 32 MB; **LC:** 16MB
Flash Memory	2 MB
System I/O	4 serial ports, 115 kbps max. 1 parallel port, 2 USB ports
Serial protocols	RS-232
Serial console	Selectable COM1 /COM2
Ethernet	–E and –EA models only 10/100BaseT 100Mbps max.
Desktop Ports	PS/2 Keyboard and Mouse
IDE expansion	Flash disk module – 32-512MB max 44-pin connector for external drives
Watchdog timer	Programmable, 0-5 sec
DATA ACQUISITION CIRCUITRY (MODEL –EA ONLY)	
Analog Inputs	16, 16-bit resolution (1/65536)
Max A/D rate	100 kHz
Input modes	Unipolar, bipolar, single-ended, differential
Input ranges	0-10V, 0-5V, 0-2.5V, 0-1.25V ±10V, ±5V, ±2.5V, ±1.25V
Accuracy	±3LSB
Analog outputs	4, 12-bit resolution (1/4096)
Settling time	13µS to .01%
Output ranges	0-5, ±5V
Output current	±1.25mA max per channel
Digital I/O	24 lines, TTL compatible
Direction	Programmable in groups of 8 bits
Output current	Logic 0: 12µA Logic 1: -8µA
Counter/timers	1 24-bit, 1 16-bit
Input clocks	10MHz, 1MHz, 100KHz, external
GENERAL	
Dimensions	3.550" x 3.775"
Operating temp.	-40°C to +85°C
Power requirements	**EA:** +5V/1A (5W typical) **E:** +5V/0.6A (3W typical) **LC:** +5V/0.4A (2W typical)
Weight	3.0oz / 85g

MORPHEUS

400-650MHZ ULTRA-LOW VOLTAGE CELERON PROCESSOR, MULTI-I/O, LOW COST

FEATURE	BENEFIT
Ultra-Low Voltage Intel Celeron processor	High computing power with reduced power consumption Reduced heat dissipation / no fan required (400MHz)
Integrated LCD, CRT, Ethernet, and system I/O	Small size / single-board solution Light weight Assured compatibility
Low cost	Makes increased computing power available to more applications

Operating System Compatibility

Linux

Windows 98/NT/2000/XP

DOS

- Intel ULV Celeron 400/650MHz Processor
- Low-power fanless operation: 10.5 Watts @ 400MHz
- Up to 512MB memory using DIMM
- 10/100Mbps Ethernet with wake-on-LAN
- S3 Savage 4 Chipset with advanced 3D/2D video
- Flat panel, CRT, and LCD display support
- IDE port with UDMA-33 capability
- 2 serial ports: 1 RS-232, 1 RS-232/422/485
- 2 USB 1.1 ports
- Parallel port and floppy drive port
- PS/2 keyboard/mouse ports
- Real-time clock
- Watchdog timer
- CompactFlash socket
- PC/104 ISA expansion bus

SPECIFICATIONS

Processor	Intel ULV Celeron, 400MHz or 650MHz	
Speed	400MHz	650MHz
Power consumption	10.5 watts	15 watts
Cooling	Heat sink, no fan	Heat sink + fan
Display		
Chipset	VT8606 Savage4 3D and 2D acceleration, 4x AGP, and 128-bit engine	
Type	CRT and LCD	
Resolution	Up to 1280 x 1024 x 32 bits per pixel	
Memory	8/16/32MB shared with system memory	
LCD interface	36-bit TFT/DSTN	
Memory	User-supplied 144-pin PC133 SODIMM, up to 512MB	
IDE	44-pin connector, UDMA33 (33MB/sec), up to 2 drives	
CompactFlash	Type I/II, up to 1GB	
Real-time clock	On-board RTC with lithium backup battery	
Watchdog timer	1-255 sec user programmable	
Ethernet	Realtek RTL8100 BL, 10/100Mbps	
Serial ports	1x RS-232, 1x RS-232/422/485 Up to 115.2kbps, 16-byte FIFO, 16C550 compatible	
Parallel port	SPP, EPP, and ECP compatible; BIOS enable/disable	
USB ports	2, version 1.1	
PS/2	2 ports for keyboard & mouse	
Floppy drive	1 port, up to 2 drives	
IrDA	SIR IrDA 1.1 compliant	
Dimensions	3.550" x 3.775"	
Operating temp.	0 to 60°C	
Power supply	+5VDC ±5% @ 2.1A (400MHz), 3.0A (650MHz)	
Weight	3.1oz / 110g	

Morpheus offers high computing power and high-density I/O in a compact, low power consumption, and low cost PC/104 module. It is a superior choice for low-cost / high-volume applications in stationary or interior environments with minimal temperature swings and limited space, such as medical equipment, process control, and instrumentation, or for outdoor applications in mild climates, such as ticketing and access control systems.

The board utilizes the Intel Ultra-Low Voltage Celeron processor and is available in two speeds: 400MHz / fanless / 10.5 watts and 650MHz / fan / 15 watts. The companion VT8606 / VT686B chipset provides advanced video with 3D and 2D hardware acceleration and support for high-resolution LCD and CRT displays. In addition the Realtek RTL8100BL Ethernet controller provides 10/100Mbps network connectivity with wake-on-LAN capability supported in BIOS. Memory is provided via a user-supplied standard 144-pin PC133 SODIMM up to 512MB.

A full set of I/O ports is provided to support any application's requirements, including Ethernet, UDMA-33 IDE, CompactFlash, floppy, parallel, PS/2 keyboard and mouse, and 2 USB 1.1 ports. The board also has two 16450-compatible serial ports: One port is fixed RS-232, and the second is jumper-configurable for RS-232, RS-422, and RS-485 protocols. The watchdog timer provides protection from software crashes and is programmable for delays between 1 and 127 seconds.

The built-in PC/104 expansion bus enables the Morpheus to work with almost all the data acquisition and communications modules in this catalog, as well as hundreds of I/O boards from other vendors.

ORDERING GUIDE

MOR-400	Morpheus CPU, 400MHz / fanless, 0MB RAM
MOR-650	Morpheus CPU, 650MHz / fan, 0MB RAM
MEM-128-01	128MB RAM SODIMM
MEM-256-01	256MB RAM SODIMM
MEM-512-01	512MB RAM SODIMM
C-MOR-KIT	Morpheus cable kit
PS-5V-MOR	Universal AC adapter for Morpheus CPU

For flashdisks, cables and accessories, see pages 46-47.

Morpheus Cable Kit

1. Dual PS/2
2. Dual USB
3. VGA
4. Dual IDE
5. LPT
6., 7. 2x Serial
8. Dual Floppy
9. Ethernet

TMZ104

533MHZ TRANSMETA PROCESSOR, LOW COST, VERY LOW POWER

- Transmeta TM5500 CPU, 333-533MHz, fanless
- Extremely low power consumption: 1.5W
- 2 RS-232 ports up to 115.2kbaud
- 1 parallel, 1 USB 1.1 port
- PS/2 keyboard & mouse
- Floppy and IDE ports
- DIMM socket for up to 144MB RAM
- DiskOnChip socket for up to 1GB solid-state storage
- PC/104 ISA expansion bus

Development Kit

A development kit is available including a TMZ104 CPU board and accessories to get you started on your development project. Kit contents:

TMZ104 CPU board
128MB memory DIMM
C-TMZ2-KIT Cable set + panel I/O board
DEV104-EV Evaluation baseboard
48MB DiskOnChip with Linux pre-loaded
ISA Ethernet card (plugs into baseboard)
ISA VGA card (plugs into baseboard)
5.25" external floppy drive
Desktop PC power supply (AC input)
PC/104 extractor tool
Documentation

FEATURE	BENEFIT
Ultra-low power Transmeta Crusoe 5500 processor	Low heat dissipation; no heat sink required High performance at low cost
Memory and DiskOnChip sockets	Flexible memory size On-board solid state storage for ruggedness
Low cost	Makes increased computing power available to more applications
PC/104 expansion	Enables easy addition of hundreds of I/O boards for custom configuration

Operating System Compatibility

DOS

Linux

Windows 98/NT/2000 XP/XPe

The TMZ104 is the ideal choice for PC/104 computing applications requiring the highest possible processing power at the lowest possible power consumption, all at an attractive price. The Transmeta Crusoe TM5500 processor uses auto-switching between 333MHz and 533MHz and built-in advanced code morphing software to provide x86 compatibility up to Pentium MMX2, while boasting a miserly power consumption of only 1.5 watts (excluding memory). This enables the TMZ104 to operate without a heatsink or fan over its entire operating temperature range of -40 to +85ºC.

The TMZ104 includes popular standard I/O features such as RS-232 serial, parallel, PS/2 keyboard & mouse, USB, floppy, and IDE to enable you to create a complete PC-compatible embedded computer that is small in both size and cost. It features a DIMM memory socket so you can select the memory of your choice, from 16MB up to 272MB. A socket is also provided for M-Systems DiskOnChip 2000 and Millennium devices for reliable, solid-state mass storage up to 1GB.

Cables

Two cable sets are available for the TMZ104. C-TMZ1-KIT is a cables-only solution with serial, parallel, floppy, IDE, and utility cables. C-TMZ2-KIT includes floppy and IDE cables, along with a panel I/O board that provides industry-standard connectors for the other I/O features. The panel I/O board is especially suitable for mounting to an end cap on the CanTainer enclosure (see page 45), providing a quick, clean assembly method. The panel board also can be used for the direct mounting of a Royaltek REB2000/2100 or REB12R GPS receiver module that communicates with the TMZ104 via one of the serial ports.

SPECIFICATIONS	
Processor	Transmeta Crusoe TM5500
Speed	333-533MHz, auto-switching
Power consumption	1.5W w/o memory, 2.0W with memory
Cooling	No heatsink or fan required
Memory	User-supplied 144-pin SODIMM, up to 144MB
IDE	40-pin connector, UDMA100 (100MB/sec), up to 2 drives
Solid state storage	32-pin DIP socket for DiskOnChip 2000 or Millennium, up to 1GB
Real-time clock	On-board RTC with Lithium backup battery
Watchdog timer	Dual-mode: 46.4 sec and 2.9 sec with software reset
Serial ports	2x RS-232 Up to 115.2kbps, 16-byte FIFO, 16C550 compatible
Parallel port	SPP, EPP, and ECP compatible, bi-directional
USB ports	1, version 1.1
PS/2	2 ports for keyboard & mouse
Floppy drive	1 port, up to 2 drives
Dimensions	3.550" x 3.775"
Operating temp.	-40 to +85ºC
Power supply	+5VDC ±5% @ 300mA typical
Weight	2.5oz / 70g

ORDERING GUIDE

TMZ104	Transmeta Crusoe PC/104 CPU Module
DK-TMZ104-01	TMZ104 develop. kit, including TMZ104 CPU
C-TMZ1-KIT	TMZ104 cable kit, cables only
C-TMZ2-KIT	TMZ104 cable and panel I/O board kit
MEM-TMZ-16	16MB RAM DIMM for TMZ104
MEM-TMZ-48	48MB RAM DIMM for TMZ104
MEM-TMZ-144	144MB RAM DIMM for TMZ104

For flashdisks, cables and accessories, see pages 46-47.

Cable Kits

C-TMZ1-KIT
Dual IDE Cable
Dual floppy cable
Parallel port cable
Dual seriel port cable
Utility cable

C-TMZ2-KIT
Dual IDE Cable
Dual floppy cable
Panel I/O board with cables for mating to CPU board

tel: 510-456-7800 www.diamondsystems.com techinfo@diamondsystems.com

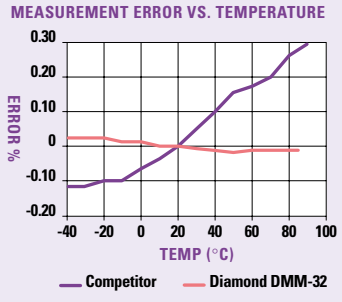
AUTOCALIBRATION & A/D TECHNOLOGY

Autocalibration

Autocalibration provides much better accuracy than manual calibration of an A/D board. It also reduces maintenance costs, because no user intervention is required. An autocalibrating A/D board contains built-in circuitry to support calibration. Usually the calibration procedure is managed by driver software. Autocalibration can be performed whenever desired and as often as desired. This way the board stays in calibration over its entire operating life with zero maintenance cost.

Multi-range autocalibration provides even better accuracy. Most autocalibrating A/D boards have multiple input ranges, yet they offer only a simple one-voltage one-input-range calibration. This can result in significant measurement errors. A typical programmable gain amplifier may exhibit errors as high as 0.2 percent between gain settings, or over 130 counts for a 16-bit A/D board!

BENEFITS OF AUTOCALIBRATION



To eliminate these errors, multi-range autocalibration provides separate calibration settings for each input range. This way, the board has the highest possible accuracy in all operating conditions: time, temperature, and input range. All Diamond Systems "AT" model A/D boards, and our Hercules CPU, feature multi-range autocalibration for maximum accuracy.

The diagram illustrates the difference between a competitor's manually-calibrated A/D board and a Diamond Systems DMM-32-AT autocalibrating board. Both boards are advertised as operating over the range of -40 to +85°C. Both boards were tested simultaneously under identical conditions. The DMM-32-AT exhibits a 10x reduction in measurement error over the competitor's board!

A/D Technology

An A/D board is much more than the number of inputs and the A/D resolution. Three important things that can have a major impact on an A/D board's performance and its ability to meet the needs of your application are described below.

1. A/D Trigger

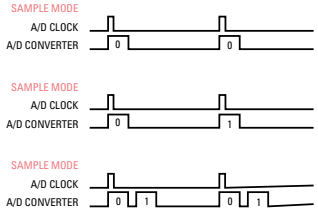
The trigger is the means of initiating an A/D conversion. All Diamond Systems A/D boards offer all three forms of triggering described below.

Software trigger – The application program executes a command to initiate the A/D conversion. This is used for "occasional" sampling, for example measuring a backup battery voltage once an hour.

External signal – An external signal is used to trigger the A/D. This allows synchronization to some external device or event, such as a rotary encoder.

Clock trigger – An on-board programmable timer initiates A/D conversions at precise intervals. This is required to obtain accurate timing for high speed sampling or waveform capture.

2. A/D Sampling Mode



Multiple sampling modes give you the ability to choose the timing that best fits your application needs. All Diamond Systems A/D boards offer all three modes illustrated here. For each mode the trigger can be any of the three types described above.

The upper diagram shows **single-channel** sampling. A single channel is sampled, either once or repeatedly with regular timing.

The middle diagram shows **multi-channel round robin** sampling. Multiple channels are being sampled in a rotating sequence. Only one channel is sampled on each A/D trigger.

The lower diagram shows **multi-channel scan** sampling. Multiple channels are sampled in quick succession (4-10µs apart) on each A/D trigger. Any sequential group of channels can be set up for scan mode. This is a more advanced architecture that simplifies data collection and provides better simultaneity in the sample timing.

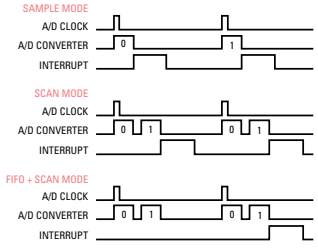
3. Data Transfer to Memory

A/D data must be transferred from the board into system memory, where it can be used by the application program. This step is critical, since it has a major impact on overall processor utilization.

Data transfer can occur in several ways. In **foreground** mode, the application software directly reads the data from the board. This is typical for low-rate occasional sampling, where sampling is done on demand by the application. In **background** mode, the data is transferred automatically without the application having to directly control it. This method is used for high-speed sampling. The most common method of background data transfer is with interrupts: The board generates an interrupt request, and the processor runs a software interrupt routine that reads the data out of the board The interrupt routine is provided by our Universal Driver programming library.

This illustration shows three different sampling methods with interrupts.

Upper diagram: **Single-channel sampling with interrupts.** Each A/D trigger generates one A/D sample on one channel and one interrupt.



This is the simplest method but involves the most software overhead. This method will only work up to about 1KHz in Linux or Windows due to the interrupt processing overhead required. (DOS will support interrupt rates up to about 20KHz.)

Middle diagram: **Multi-channel scan sampling with interrupts.** Each A/D trigger generates a sample on all channels in the scan range. At the end of the scan a single interrupt causes the entire scan to be transferred to memory. The interrupt rate is reduced by a factor equal to the scan size (in this case 2), resulting in improved performance.

Bottom diagram: **Multi-channel scan sampling with interrupts and FIFO support.** This method provides even better performance. The A/D samples are stored in a FIFO memory on the board. When a preset threshold is reached, the board generates an interrupt request, and the processor reads out the entire contents of the FIFO. The interrupt rate is reduced by the size of the FIFO threshold, resulting in a dramatic reduction in interrupt overhead. For example, a sample rate of 200KHz and a FIFO threshold of 200 results in an easily manageable interrupt rate of only 1KHz.

All Diamond Systems "AT" A/D boards, and all our CPU boards, support all the data transfer methods described here. The DMM board does not contain a FIFO, so it is limited to one A/D sample or scan per interrupt.

DIAMOND-MM-48-AT

16-BIT A/D, 16 CHANNELS, 200KHZ, AUTOCALIBRATION, RELAYS, OPTOCOUPLERS

AT AUTOCALIBRATION TECHNOLOGY

- 2-in-1 design reduces size, weight, and cost
- 16 analog inputs, 16-bit A/D
- 200KHz max sampling rate
- Multi-channel scan sampling with interrupts and FIFO support
- 2K A/D sample FIFO
- 8 analog outputs, 12-bit D/A
- Multi-range autocalibration of both A/D and D/A
- 8 SPDT relays
- 4 optocoupler inputs
- 4 programmable digital I/O lines
- 24-bit A/D sample rate counter/timer
- 16-bit auxiliary counter/timer
- -40 to +85°C operation
- FREE Universal Driver software included

ORDERING GUIDE

DMM-48-AT	16 16-bit A/D, 200KHz, bipolar, 8 12-bit D/A
DMM-48U-AT	16 16-bit A/D, 200KHz, unipolar, 8 12-bit D/A

For cables and accessories, see pages 46-47.

2 in 1

Diamond-MM-48-AT combines two I/O boards into one: An analog I/O board similar to our Diamond-MM-16-AT, and a relay / optocoupler board similar to our Opal-MM. This two-in-one design reduces the size and weight of your PC/104 system. Reducing the number of boards in your system also shortens assembly time and increases reliability.

The analog input circuit features 16 single-ended A/D input channels with 16-bit resolution and a jumper-selected input range of ±10V or ±5V. A 0-10V input range is also available as model DMM-48U-AT. The maximum A/D sampling rate of 200KHz is supported by a larger 2048-sample FIFO with selectable threshold of 256 or 1024 samples.

The board has 8 D/A channels with 12-bit resolution and a 0-4.095V output range. This range provides an intuitive conversion formula of 1mV per LSB to simplify programming and provide a natural set of actual output voltages.

Diamond-MM-48-AT features Diamond Systems' advanced autocalibration technology, which maintains maximum accuracy over temperature and time. A set of precision references on the board with known values are used to adjust the A/D and D/A circuits to within 2LSB (typically 1LSB or better) of their correct values. The entire procedure is controlled by our Universal Driver software. It takes approximately one second and can be run at any time, for example each time the system powers up or once a day.

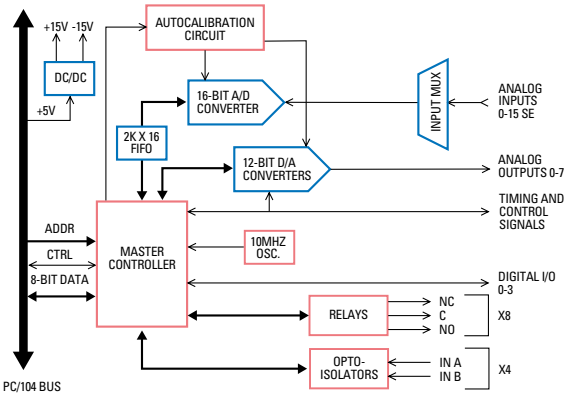
The board includes 8 relays with SPDT (form C) contacts and 1A/30VDC capacity. The 4 optocoupler inputs include programmable edge detection. When any selected edge event occurs, an interrupt will be generated and control will be passed to your own code. The board also has 4 TTL level digital I/O lines with individually programmable direction and edge detection. These lines can be configured to generate an interrupt when any change of state occurs.

A 24-bit timer provides programmable A/D sample rates from 200KHz down to .06Hz. A second 16-bit counter with programmable clock source and divisor can be used to drive external circuitry or count external events.

SPECIFICATIONS

ANALOG INPUTS	
No. of inputs	16 single-ended
A/D resolution	16 bits (1/65,536 of full scale)
Input ranges	±10V, ±5V standard; 0-10V optional
Input impedance	1013 Ω typ / ±20pA max bias current
Nonlinearity	±3LSB, no missing codes
Conversion rate	200,000 samples/sec max
Conversion trigger	software, timer, or external
A/D FIFO	2048 samples; Selectable threshold 256/1024
ANALOG OUTPUTS	
No / resolution	8, 12 bits (1/4096 of full scale)
Output range	0-4.095V (1mV/LSB)
Output current	2mA/channel / 2KΩ min load
Settling time	7µS max to ±2 LSB
Relative accuracy	±6 LSB
Nonlinearity	±1 LSB, monotonic
DIGITAL I/O	
No. / direction	4, individually programmable
Input voltage	Logic 0: 0.0-0.8V; Logic 1: 2.0-5.0V
Input current	±1µA max each line
Output voltage	**Logic 0:** 0.0-0.33V; **Logic 1:** 3.8-5.0V
Output current	±12mA max each line
Edge detection	Interrupt on any change
COUNTER/TIMERS	
A/D pacer clock	24-bit programmable timer
General purpose	16-bit down counter
RELAYS	
No. / type	8, SPDT (form C)
Capacity	1A / 30VDC / 0.3A / 125VAC
OPTOCOUPLERS	
No. / range	4, 3-28VDC
Edge detection	Each input individually configurable
GENERAL	
Power supply	+5VDC ±10%
Current	150mA + 30mA per activated relay
Operating temp.	-40 to +85°C
Weight	3.0oz / 85g

DIAMOND-MM-48-AT BLOCK DIAGRAM



I/O HEADER – RELAYS + OPTOS

OPTO 0 A	1	2	OPTO 0 B
OPTO 1 A	3	4	OPTO 1 B
OPTO 2 A	5	6	OPTO 2 B
OPTO 3 A	7	8	OPTO 3 B
(NOT USED)	9	10	(NOT USED)
RELAY 0 NO	11	12	RELAY 0 NC
RELAY 0 C	13	14	RELAY 1 NO
RELAY 1 NC	15	16	RELAY 1 C
RELAY 2 NO	17	18	RELAY 2 NC
RELAY 2 C	19	20	RELAY 3 NO
RELAY 3 NC	21	22	RELAY 3 C
RELAY 4 NO	23	24	RELAY 4 NC
RELAY 4 C	25	26	RELAY 5 NO
RELAY 5 NC	27	28	RELAY 5 C
RELAY 6 NO	29	30	RELAY 6 NC
RELAY 6 C	31	32	RELAY 7 NC
RELAY 7 NC	33	34	RELAY 7 C

I/O HEADER – ANALOG I/O

A/D 0	1	2	A/D 8
A/D 1	3	4	A/D 9
A/D 2	5	6	A/D 10
A/D 3	7	8	A/D 11
A/D 4	9	10	A/D 12
A/D 5	11	12	A/D 13
A/D 6	13	14	A/D 14
A/D 7	15	16	A/D 15
A/D GND	17	18	A/D GND
D/A 0	19	20	D/A 1
D/A 2	21	22	D/A 3
D/A 4	23	24	D/A 5
D/A 6	25	26	D/A 7
D/A GND	27	28	DIGITAL GND
EXTERNAL	29	30	GATE 0
CLK OUT 0	31	32	CLK 1
GATE 1	33	34	OUT 1
DIO 0	35	36	DIO 1
DIO 2	37	38	DIO 3
+5V	39	40	DIGITAL GND

DIAMOND-MM-32-AT

16-BIT A/D, 32 CHANNELS, 200KHZ, AUTOCALIBRATION

SPECIFICATIONS

ANALOG INPUTS	
Number. of inputs	32 single-ended, 16 differential, or 16 SE + 8 DI; user selectable
A/D resolution	16 bits (1/65,536 of full scale)
Bipolar ranges	±10V, ±5V, ±2.5V, ±1.25V, ±0.625V
Unipolar ranges	0-10V, 0-5V, 0-2.5V, 0-1.25V
Input bias current	100pA max
Nonlinearity	±3LSB, no missing codes
Conversion rate	200,000 samples/sec. max
Conversion trigger	software trigger, internal pacer clock, or external TTL signal
AD FIFO	512 samples, programmable thresholds
Calibration	Automatic; values stored in EEPROM
ANALOG OUTPUTS	
Number of outputs	4
D/A resolution	12 bits (1/4096 of full scale)
Output ranges	±5V, ±10V, 0-5V, 0-10V, programmable
Output current	±5mA max per channel
Settling time	6µS max to 0.01%
Relative accuracy	±1 LSB
Nonlinearity	±1 LSB, monotonic
Reset	All channels reset to 0V
Calibration	Automatic; values stored in EEPROM
DIGITAL I/O	
No. of I/O	24 programmable I/O
Input voltage	Logic 0: 0.0V min, 0.8V max Logic 1: 2.0V MIN, 5.0V max
Input current	±1µA max
Output voltage	Logic 0: 0.0V min, 0.33V max Logic 1: 2.4V min, 5.0V max
Output current	Logic 0: 64mA max per line Logic 1: -15mA max per line
COUNTER/TIMERS	
A/D Pacer clock	32-bits (2 82C54 counters cascaded)
Clock source	10MHz on-board clock or external signal
General purpose	16-bits (1 82C54 counter)
GENERAL	
Power supply	+5VDC ±10% @ 200mA typ
Operating temp.	-40 to +85°C
Weight	3.4oz / 96g

The Diamond-MM-32-AT is the undisputed world leader in PC/104 analog I/O. No other A/D board can match its combination of feature density, configuration flexibility, and advanced technology.

The 32 analog input channels reduce overall system size and cost for high channel count applications. A unique variable input configuration feature lets you configure the inputs for 32 single-ended, 16 differential, or a combination of 16 single-ended and 8 differential.

Nine analog input ranges, from a wide ±10V down to 0-1.25V, cover the greatest number of input requirements. A 512-sample FIFO with programmable threshold lets you reach maximum A/D speed without missing samples. With external triggering you can synchronize the A/D converter to external signals and events.

The four analog outputs can be configured in four different fixed output ranges as well as a programmable range anywhere from 1V to 10V with 1mV accuracy. Each output can drive up to 5mA.

The advanced autocalibration circuit calibrates both the analog inputs and outputs under software control. It provides individual precise adjustments for each analog input range to maximize accuracy across all configurations. Calibration takes just seconds and can be performed as often as desired.

The board contains an integrated 82C55-type digital I/O circuit with 3 8-bit ports. Each port features configurable direction. The digital I/O lines have user-configurable pull-up / pull-down resistors and latching / handshaking capability. Each output line can sink up to 64mA in logic 0 state or drive up to 15mA in logic 1 state.

A 32-bit counter/timer is provided for programming the A/D sample rate. A second 16-bit counter/ timer can be programmed to generate waveforms, count pulses and events, or generate interrupts at programmed rates. The counter clock source can be selected from the on-board 10MHz oscillator or an external signal.

AT AUTOCALIBRATION TECHNOLOGY

- 32 analog inputs, 16-bit A/D
- 200KHz maximum sampling rate
- Multi-channel scan sampling with interrupts and FIFO support
- Programmable input ranges
- Unipolar/bipolar and single-ended/ differential inputs
- 4 analog outputs, 12-bit D/A
- Multi-range autocalibration of A/D and D/A
- 24 digital I/O with latching capability and enhanced output current
- 512-sample FIFO with programmable threshold
- Counter/timers for A/D control and general use
- +5V power supply
- -40 to +85°C operation
- FREE Universal Driver software included

ORDERING GUIDE

DMM-32-AT 32 16-bit A/D, 200KHz, 4 12 bit D/A

For cables and accessories, see pages 46-47.

DIGITAL I/O HEADER

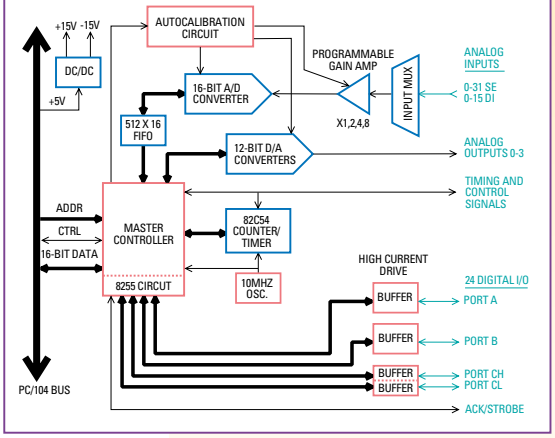
A7	1	2	A6
A5	3	4	A4
A3	5	6	A2
A1	7	8	A0
B7	9	10	B6
B5	11	12	B4
B3	13	14	B2
B1	15	16	B0
C7	17	18	C6
C5	19	20	C4
C3	21	22	C2
C1	23	24	C0
LATCH	25	26	ACK
NC	27	28	NC
NC	29	30	NC
NC	31	32	NC
+5V	33	34	DGND

NOTE:
The analog input range table shown on page 20 with the Diamond-MM-16-AT product also applies to Diamond-MM-32-AT.

ANALOG I/O HEADER

ANALOG GND	1	2	ANALOG GND
VIN 0/0+	3	4	VIN 16/0-
VIN 1/1+	5	6	VIN 17/1-
VIN 2/2+	7	8	VIN 18/2-
VIN 3/3+	9	10	VIN 19/3-
VIN 4/4+	11	12	VIN 20/4-
VIN 5/5+	13	14	VIN 21/5-
VIN 6/6+	15	16	VIN 22/6-
VIN 7/7+	17	18	VIN 23/7-
VIN 8/8+	19	20	VIN 24/8-
VIN 9/9+	21	22	VIN 25/9-
VIN 10/10+	23	24	VIN 26/10-
VIN 11/11+	25	26	VIN 27/11-
VIN 12/12+	27	28	VIN 28/12-
VIN 13/13+	29	30	VIN 29/13-
VIN 14/14+	31	32	VIN 30/14-
VIN 15/15+	33	34	VIN 31/15-
VOUT 3	35	36	VOUT 2
VOUT 1	37	38	VOUT 0
VREF OUT	39	40	AGND
CLOCK OUT	41	42	CTR 2 OUT/DOUT 2
S/H OUT/DOUT 1	43	44	CTR 0 OUT/DOUT 0
EXTCLK/DIN 3	45	46	EXGATE/DIN 2
GATE 0/DIN1	47	48	CLK 0/DIN 0
+5V	49	50	DGND

DIAMOND-MM-32 BLOCK DIAGRAM



DIAMOND-MM-16-AT

16-BIT A/D, 16 CHANNELS, AUTOCALIBRATION

AT AUTOCALIBRATION TECHNOLOGY

- 16 analog inputs, 16-bit A/D
- 100KHz maximum sampling rate
- Multi-channel scan sampling with interrupts and FIFO support
- Programmable input ranges (see table)
- Unipolar/bipolar and single-ended/ differential modes
- 512-sample A/D FIFO
- 4 analog outputs, 12-bit D/A
- Multi-range autocalibration of A/D and D/A
- 8 digital inputs
- 8 digital outputs
- Counter/timers for A/D control and general use
- Timer-controlled interrupt feature
- +5V power supply
- -40 to +85°C operation
- FREE Universal Driver software included

The Diamond-MM-16-AT features top performance and flexibility for a mid-range price. It has 16 single-ended / 8 differential analog inputs with both unipolar and bipolar input ranges and programmable gain. It has a maximum sampling rate of 100KHz, supported by a 512-sample FIFO with a 256-sample interrupt threshold. Both single-channel and multi-channel-scan sampling modes are supported, and the A/D can be triggered with a software command, the on-board programmable timer, or an external signal. These features give you maximum flexibility to configure the board to your application.

The board is available with 4 optional analog output channels. The D/A output range can be set to 0-5V, ±5V, or programmable range in 1mV steps. Outputs may be updated independently or simultaneously.

The advanced autocalibration circuit on Diamond-MM-16-AT calibrates both the analog inputs and outputs under software control. Calibration takes just seconds and can be performed as often as desired using our Universal Driver software shipped with the board.

The 16 digital I/O lines are configured as 8 inputs and 8 outputs. An 82C54 chip on board is provided for counting and timing operations. It gives you one 32-bit programmable timer to control the A/D sample rate and one 16-bit counter/timer for general purpose use, including event counting and square wave generation. This board offers the special feature of timer-controlled interrupts that enable you to run your own custom code at programmable intervals.

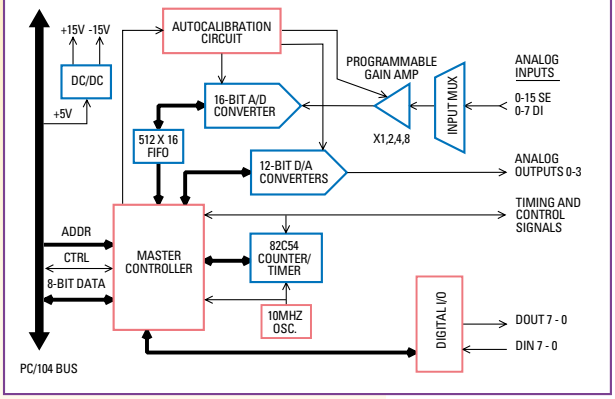
This board requires only a +5V power supply and operates over the temperature range of -40 to +85°C.

ORDERING GUIDE

DMM-16-AT	16 16-bit A/D, 100KHz, 4 12-bit D/A
DMM-16-NA-AT	16 16-bit A/D, 100KHz, no D/A

For cables and accessories, see pages 46-47.

DIAMOND-MM-16-AT BLOCK DIAGRAM



I/O HEADER

VIN 15/7-	1	2	VIN 7/7+
VIN 14/6-	3	4	VIN 6/6+
VIN 13/5-	5	6	VIN 5/5+
VIN 12/4-	7	8	VIN 4/4+
VIN 11/3-	9	10	VIN 3/3+
VIN 10/2-	11	12	VIN 2/2+
VIN 9/1-	13	14	VIN 1/1+
VIN 8/0-	15	16	VIN 0/0+
ANALOG GND	17	18	VREF OUT
ANALOG GND	19	20	VOUT 0
ANALOG GND	21	22	VOUT 1
ANALOG GND	23	24	+15V
-15V	25	26	VOUT 2
ANALOG GND	27	28	VOUT 3
CTR IN 0-	29	30	DIGITAL GND
CTR OUT 0	31	32	CTR OUT 2
DOUT 7	33	34	DOUT 6
DOUT 5	35	36	DOUT 4
DOUT 3	37	38	DOUT 2
DOUT 1	39	40	DOUT 0
DIN 7	41	42	DIN 6
DIN 5	43	44	DIN 4
DIN 3	45	46	DIN 2
DIN 1	47	48	DIN 0
+5	49	50	DIGITAL GND

SPECIFICATIONS

ANALOG INPUTS	
Number. of inputs	16 single-ended or 8 differential (user selectable)
A/D resolution	16 bits (1/65,536 of full scale)
Bipolar ranges	±10V, ±5V, ±2.5V, ±1.25V, ±0.625V
Unipolar ranges	0-10V, 0-5V, 0-2.5V, 0-1.25V
Input bias current	3nA max
Nonlinearity	±3LSB, no missing codes
Conversion rate	100,000 samples/sec. max
Conversion trigger	Software trigger, internal pacer clock, or external TTL signal
A/D FIFO	512 samples; 256 threshold
ANALOG OUTPUTS	
Number of outputs	4
D/A resolution	12 bits (1/4096 of full scale)
Output ranges	±5V, 0-5V, Programmable
Output current	±5mA max per channel
Settling time	6µS max to 0.01%
Relative accuracy	±1 LSB
Nonlinearity	±1 LSB, monotonic
Reset	All channels reset to mid-scale (0V for bipolar ranges)
DIGITAL I/O	
Number of inputs	8, 5V logic compatible
Input voltage	Logic 0: 0.0V min, 0.8V max Logic 1: 2.0V min, 5.0V max
Input current	±1mA max
Number of outputs	8, 5V logic compatible
Output voltage	Logic 0: 0.0V min, 0.33V max Logic 1: 3.8V min, 5.0V max
Output current	Logic 0: 64mA max per line Logic 1: -15mA max per line
COUNTER/TIMERS	
A/D Pacer clock	32-bits (2 82C54 counters cascaded)
Clock source	10MHz on-board clock or ext. signal
General purpose	16-bits (1 82C54 counter)
GENERAL	
Calibration	A/D and D/A circuits calibrated under software control
Power supply	+5VDC ±10% @ 350mA typ
Operating temp.	-40 to +85°C
Weight	3.3 oz / 93g

ANALOG INPUT RANGES

INPUT RANGE	RESOLUTION (1 LSB)
0 - 10V	0.153mV
0 - 5V	0.076mV
0 - 2.5V	0.038mV
0 - 1.25V	0.019mV
± 10V	0.305mV
± 5V	0.153mV
± 2.5V	0.076mV
± 1.25V	0.038mV
± 0.625V	0.019mV

DIAMOND-MM-AT

12-BIT A/D, 16 CHANNELS, 100KHZ, AUTOCALIBRATION

SPECIFICATIONS

ANALOG INPUTS	
Number of inputs	16 single-ended or 8 differential (user selectable)
A/D resolution	12 bits (1/4096 of full scale)
Bipolar ranges	±10V, ±5V, ±2.5V, ±1.25V, ±0.625V,
Unipolar ranges	0-10V, 0-5V, 0-2.5V, 0-1.25V
Input bias current	3nA max
Nonlinearity	±1LSB, no missing codes
Conversion rate	100,000 samples per second max
Conversion trigger	Software trigger, internal pacer clock, or external TTL signal
A/D FIFO	512 samples, 256 threshold
ANALOG OUTPUTS	
Number of outputs	2
D/A resolution	12 bits (1/4096 of full scale)
Output ranges	±5V, 0-5V, programmable
Output current	± 5mA max per channel
Settling time	4µS max to ±1/2 LSB
Relative accuracy	± 1 LSB
DIGITAL I/O	
Number of inputs	8, 5V logic compatible
Input voltage	Logic 0: 0.0V min, 0.8V max Logic 1: 2.0V min, 5.0V max
Input current	±1µA max
Number of outputs	8, 5V logic compatible
Output voltage	Logic 0: 0.0V min, 0.33V max Logic 1: 3.8V min, 5.0V max
Output current	Logic 0: 64mA max per line Logic 1: -15mA max per line
COUNTER/TIMERS	
A/D Pacer clock	32-bits (2 82C54 counters cascaded)
Clock source	10MHz on-board clock or external signal
General purpose	16-bits (1 82C54 counter)
GENERAL	
Calibration	A/D and D/A circuits calibrated under software control
Power supply	+5VDC ±10% @ 320mA typ
Operating temp.	-40 to + 85°C
Weight	3.3 oz / 93g

ANALOG INPUT RANGES

INPUT RANGE	RESOLUTION (1 LSB)
0 - 10V	2.44mV
0 - 5V	1.22mV
0 - 2.5V	0.061mV
0 - 1.25V	0.031mV
± 10V	4.88mV
± 5V	2.44mV
± 2.5V	1.22mV
± 1.25V	0.61mV
± 0.625V	0.31mV

For cost-sensitive applications where you still want state of the art performance, choose our Diamond-MM-AT 12-bit board This board has almost all the same features of the Diamond-MM-16-AT board at a 12-bit price. Identical connector pinout and software interface let you upgrade to 16-bit performance later.

Diamond-MM-AT has 16 single-ended / 8 differential analog inputs with 12-bit A/D resolution. A 512-sample FIFO with a 256-sample interrupt threshold enables reliable A/D sampling up to 100KHz in both single-channel and multi-channel-scan modes. Nine unipolar and bipolar input ranges let you work with a wide range of input signals.

The board also has 2 analog outputs with 12-bit D/A resolution. They can be set to 0-5V, ±5V, or programmable range in 1mV steps.

The advanced autocalibration circuitry on Diamond-MM-AT calibrates both the analog inputs and outputs under software control. Calibration takes just seconds and can be performed as often as desired using our Universal Driver software shipped with the board.

Diamond-MM-AT also has 8 digital inputs and 8 digital outputs on board. An 82C54 chip on board is provided for counting and timing operations. It provides one 32-bit programmable timer to control the A/D sample rate and one 16-bit counter/timer for general purpose use, including event counting and square wave generation.

This board requires only +5V power supply and operates over the extended temperature range of -40 to +85°C. All these features make Diamond-MM-AT the leader in mid-range PC/104 analog I/O boards.

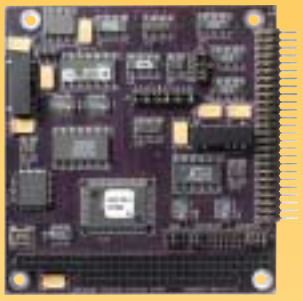
ORDERING GUIDE

DMM-AT 16 12-bit A/D, 100KHz, 2 12-bit D/A

For cables and accessories, see pages 46-47.

I / O HEADER

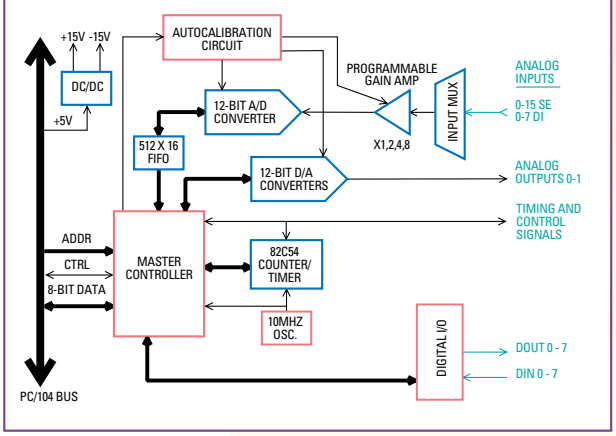
VIN 15/7-	1	2	VIN 7/7+
VIN 14/6-	3	4	VIN 6/6+
VIN 13/5-	5	6	VIN 5/5+
VIN 12/4-	7	8	VIN 4/4+
VIN 11/3-	9	10	VIN 3/3+
VIN 10/2-	11	12	VIN 2/2+
VIN 9/1-	13	14	VIN 1/1+
VIN 8/0-	15	16	VIN 0/0+
ANALOG GND	17	18	VREF OUT
ANALOG GND	19	20	VOUT 0
ANALOG GND	21	22	VOUT 1
ANALOG GND	23	24	+15V
-15V	25	26	VREF IN 0
ANALOG GND	27	28	VREF IN 1
CTR IN 0-	29	30	DIGITAL GND
CTR OUT 0	31	32	CTR OUT 2
DOUT 7	33	34	DOUT 6
DOUT 5	35	36	DOUT 4
DOUT 3	37	38	DOUT 2
DOUT 1	39	40	DOUT 0
DIN 7	41	42	DIN 6
DIN 5	43	44	DIN 4
DIN 3	45	46	DIN 2/Gate 0
DIN 1	47	48	DIN 0/Gate 1/2
+5	49	50	DIGITAL GND



AT AUTOCALIBRATION TECHNOLOGY

- 16 analog inputs, 12-bit A/D
- 100KHz maximum sampling rate
- Multi-channel scan sampling with interrupts and FIFO support
- Programmable input ranges (see table)
- Unipolar/bipolar and single-ended/ differential inputs
- 2 analog outputs, 12-bit D/A
- Multi-range autocalibration of A/D and D/A
- 8 digital inputs
- 8 digital outputs
- 512-sample FIFO
- Counter/timers for A/D control and general use
- +5V power supply
- -40 to +85°C operation
- FREE Universal Driver software included

DIAMOND-MM-AT BLOCK DIAGRAM



DIAMOND-MM

12-BIT A/D, 16 CHANNELS, 100KHZ

- 16 single-ended / 8 differential analog inputs
- 12-bit A/D resolution (1/4096)
- Up to 100,000 samples/sec with DMA
- No A/D FIFO
- 82C54 counter/timer on board for A/D sample rate control
- Interrupt and DMA operation
- 2 analog outputs, 12-bit D/A
- 8 digital inputs
- 8 digital outputs
- 0 to 70°C and -40 to +85°C versions available
- Best value for non-autocalibrating analog I/O
- FREE Universal Driver software included

Diamond-MM has all the primary features you expect in a high-performance analog I/O board, at a reduced price. The analog input circuit uses a 12-bit A/D converter and can be configured for single-ended or differential mode and unipolar or bipolar mode. It also offers 10 different input ranges, so it can work with a wide variety of input signals. The maximum A/D conversion rate is up to 20,000 per second using interrupts or up to 100,000 per second using DMA.

Two optional analog outputs provide 12-bit resolution over a 0-5V or user-adjustable range with 8mA drive current and 4µs settling time. The D/A can also be used as a digital attenuator for an analog signal fed into one of the reference inputs.

The board contains 8 digital inputs and 8 digital outputs. It also has an on-board 82C54 counter/timer chip to control the A/D sampling rate and provide general purpose counting functions.

Diamond-MM is available in four versions: With or without analog outputs, and in commercial (0-70°C) or industrial (-40 to +85°C) operating temperature range.

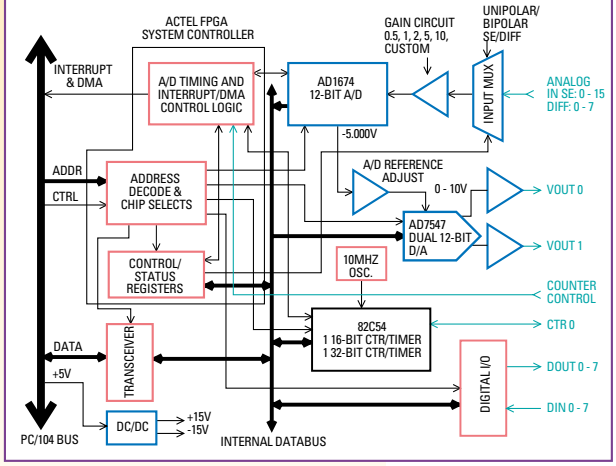
ANALOG INPUT RANGES

UNIPOLAR	**INPUT RANGE**	**RESOLUTION**
	0 - 10V	2.44mV
	0 - 5V	1.22mV
	0 - 2.5V	0.61mV
	0 1V	0.244mV
	0 - 0.5V	0.122mV
	Custom	(10K Ω / R) / 4096) V
BIPOLAR	**INPUT RANGE**	**RESOLUTION**
	± 10V	4.88mV
	± 5V	2.44mV
	± 2.5V	1.22mV
	± 1V	.488mV
	± 0.5	.244mV
	Custom	(10K Ω / R) / 2048) V

SPECIFICATIONS

ANALOG INPUTS	
Number of inputs	16 single-ended or 8 differential (user selectable)
A/D resolution	12 bits (1/4096 of full scale)
Bipolar ranges	±10V, ±5V, ±2.5V, ±1V, ±0.5V, Custom
Unipolar ranges	0-10V, 0-5V, 0-2.5V, 0-1V, 0-0.5V, Custom
Input bias current	50nA max
Protection	±35V on any analog input
Nonlinearity	±1LSB, no missing codes
Conversion rate	100,000 samples per second max
Conversion trigger	Software trigger, internal pacer clock, or external TTL signal
ANALOG OUTPUTS	
Number of outputs	2
D/A resolution	12 bits (1/4096 of full scale)
Output ranges	0-5V, adjustable, or external reference input
Output current	± 8mA max per channel
Settling time	4mS max to ±1/2 LSB
Relative accuracy	± 1 LSB
DIGITAL I/O	
Number of inputs	8, 5V logic compatible
Input voltage	Logic 0: 0.0V min, 0.85 max Logic 1: 2.0V min, 5.0V max
Input current	±1µA max
Number of outputs	8, 5V logic compatible
Output voltage	Logic 0: 0.0V min, 0.33 max Logic 1: 3.8V min, 5.0V max
Output current	±4mA max per line
COUNTER/TIMERS	
A/D Pacer clock	32-bits (2 82C54 counters cascaded)
Clock source	10MHz on-board clock or external signal
General purpose	16-bits (1 82C54 counter)
GENERAL	
Power supply	+ 5VDC ±10% @165mA typical
Operating temp.	0 to 70°C, standard models -40 to +85°C, XT models
Weight	3.3oz / 93g

DIAMOND-MM BLOCK DIAGRAM



I / O HEADER

VIN 15/7-	1	2	VIN 7/7+
VIN 14/6-	3	4	VIN 6/6+
VIN 13/5-	5	6	VIN 5/5+
VIN 12/4-	7	8	VIN 4/4+
VIN 11/3-	9	10	VIN 3/3+
VIN 10/2-	11	12	VIN 2/2+
VIN 9/1-	13	14	VIN 1/1+
VIN 8/0-	15	16	VIN 0/0+
ANALOG GND	17	18	VREF OUT
ANALOG GND	19	20	VOUT 0
ANALOG GND	21	22	VOUT 1
ANALOG GND	23	24	+15V
-15V	25	26	VREF IN 0
ANALOG GND	27	28	VREF IN 1
CTR IN 0-	29	30	DIGITAL GND
CTR OUT 0	31	32	CTR OUT 2
DOUT 7	33	34	DOUT 6
DOUT 5	35	36	DOUT 4
DOUT 3	37	38	DOUT 2
DOUT 1	39	40	DOUT 0
DIN 7	41	42	DIN 6
DIN 5	43	44	DIN 4
DIN 3	45	46	DIN 2/Gate 0
DIN 1	47	48	DIN 0/Gate 1/2
+5	49	50	DIGITAL GND

ORDERING GUIDE

DMM	0 to 70°C, 2 D/A channels
DMM-NA	0 to 70°C, no D/A
DMM-XT	-40 to 85°C, 2 D/A channels
DMM-NA-XT	-40 to 85°C, 2 no D/A

For cables and accessories, see pages 46-47.

RUBY-MM-4/8

12-BIT D/A, 4 OR 8 CHANNELS INCLUDES 24 DIGITAL I/O

SPECIFICATIONS	
ANALOG OUTPUTS	
Number of outputs	4 or 8, voltage output
Resolution	12 bits (1 part in 4096)
Fixed output ranges	±10V, ±5V, 0-10V, 0-5V
Adjustable ranges	Preset to 2.5V for ±2.5V, 0-2.5V ranges Adjustment range 0-2.5V
External reference	0V min, 10V max
Settling time	6ms max to ±.01%
Accuracy	±1LSB
Integral nonlinearity	±1LSB max
Differential nonlinearity	±1LSB max, guaranteed monotonic
Output current	±5mA max per channel
Minimum load	2K Ω
Update method	Simultaneous update
D/A reset voltage	0V for bipolar ranges, mid-scale for unipolar ranges
DIGITAL I/O	
Number of lines	24, CMOS / TTL compatible (82C55)
Input voltage	Logic 0: -0.5V min, 0.8V max Logic 1: 2.0V min, 5.5V max
Output voltage	Logic 0: 0.0V min, 0.4V max Logic 1: 3.0V min, Vcc - 0.4V max
Output current	±2.5mA max per line
Pull-up resistor	10KΩ on each I/O line
External trigger	Active high edge
GENERAL	
Power supply (Vcc)	+5VDC ±10%
Required current	RMM-4: 220mA typical, outputs open RMM-8: 290mA typical, outputs open
Operating temp.	-40 to +85°C
Size	3.55" x 3.775"
Data bus	8 bits
Weight	-4: 2.5oz / 71g -8: 2.7oz / 76g

Ruby-MM offers 4 or 8 full-featured analog outputs using quad 12-bit D/A converter chips. Each chip has its own user-configurable full-scale references, so each group of 4 channels can have its own output range (see table). The 2.5V range can be adjusted anywhere between 0V and 2.5V. Calibration circuitry is provided on board to ensure maximum accuracy of the analog outputs to ±1LSB. Analog output specifications include 6µs settling time and ±5mA max output current per channel.

The board contains an 82C55 chip to provide 3 8-bit digital I/O ports with programmable direction. Each digital I/O line has a 10KΩ pull-up resistor.

ANALOG OUTPUT RANGES	
OUTPUT RANGE	**RESOLUTION (1 LSB)**
0 - 10V	2.44mV
0 - 5V	1.22mV
0 - 2.5V	0.61mV
±10V	4.88mV
±5V	2.44mV
±2.5V	1.22mV

The output range can be configured independently for each group of 4 output channels.

- 12-bit D/A resolution (1/4096)
- 4 and 8 channel versions
- Unipolar and bipolar output ranges
- User-adjustable output range
- External reference input capability
- Simultaneous update of all channels
- 24 digital I/O lines (82C55)
- -40 to +85°C operating temperature
- FREE Universal Driver software included

ORDERING GUIDE

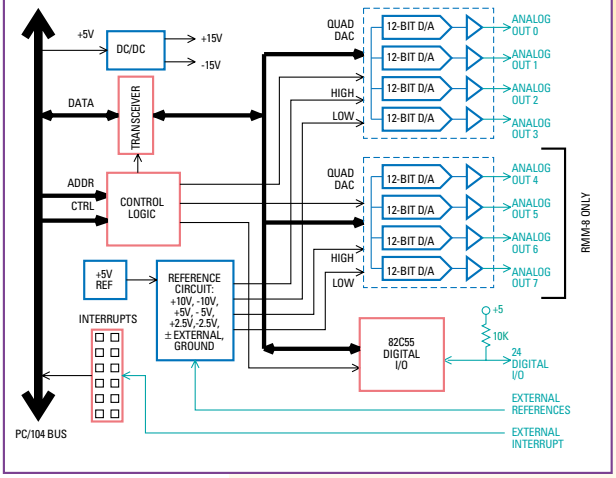
RMM-4-XT 4 12-bit D/A channels, 24 digital I/O
RMM-8-XT 8 12-bit D/A channels, 24 digital I/O

For cables and accessories, see pages 46-47.

I / O HEADER

ANALOG GND	1	2	VOUT 0
ANALOG GND	3	4	VOUT 1
ANALOG GND	5	6	VOUT 2
ANALOG GND	7	8	VOUT 3
ANALOG GND	9	10	VOUT 4
ANALOG GND	11	12	VOUT 5
ANALOG GND	13	14	VOUT 6
ANALOG GND	15	16	VOUT 7
EXTE REF A	17	18	EXT REF B
ANALOG GND	19	20	+15V
-15V	21	22	ANALOG GND
DIGITAL GND	23	24	EXT TRIGGER
DIGITAL I/O A7	25	26	A6 DIGITAL I/O
A5	27	28	A4
A3	29	30	A2
A1	31	32	A0
C7	33	34	C6
C5	35	36	C4
C3	37	38	C2
C1	39	40	C0
B7	41	42	B6
B5	43	44	B4
B3	45	46	B2
B1	47	48	B0
+5V	49	50	DIGITAL GND

RUBY-MM BLOCK DIAGRAM



RUBY-MM-1612

12-BIT D/A, 16 CHANNELS INCLUDES 24 DIGITAL I/O

- 12-bit D/A resolution (1/4096)
- 16 analog outputs
- Unipolar and bipolar output ranges
- User-adjustable output range
- External reference input capability
- Simultaneous update of all channels
- 24 digital I/O lines (82C55)
- -40 to +85°C operating temperature
- FREE Universal Driver software included

Ruby-MM offers 16 full-featured analog outputs using quad 12-bit D/A converter chips. Each chip has its own user-configurable full-scale references, so each group of 4 channels can have its own output range (see table). The 2.5V range can be adjusted anywhere between 0V and 2.5V. Calibration circuitry is provided on board to ensure maximum accuracy of the analog outputs to ±1LSB. Analog output specifications include 6µs settling time and ±5mA max output current per channel.

The board contains an 82C55 chip to provide 3 8-bit digital I/O ports with programmable direction. Each digital I/O line has a 10KΩ pull-up resistor.

ANALOG OUTPUT RANGES

OUTPUT RANGE	RESOLUTION (1 LSB)
0 - 10V	2.44mV
0 - 5V	1.22mV
0 - 2.5V	0.61mV
±10V	4.88mV
±5V	2.44mV
±2.5V	1.22mV

The output range can be configured independently for each group of 8 output channels.

I/O HEADER

AGND	1	2	VOUT 0
AGND	3	4	VOUT 1
AGND	5	6	VOUT 2
AGND	7	8	VOUT 3
AGND	9	10	VOUT 4
AGND	11	12	VOUT 5
AGND	13	14	VOUT 6
AGND	15	16	VOUT 7
VOUT 8	17	18	VOUT 9
VOUT 10	19	20	VOUT 11
VOUT 12	21	22	VOUT 13
VOUT 14	23	24	VOUT 15
DIO A7	25	26	DIO A6
DIO A5	27	28	DIO A4
DIO A3	29	30	DIO A2
DIO A1	31	32	DIO A0
DIO B7	33	34	DIO B6
DIO B5	35	36	DIO B4
DIO B3	37	38	DIO B2
DIO B1	39	40	DIO B0
DIO C7	41	42	DIO C6
DIO C5	43	44	DIO C4
DIO C3	45	46	DIO C2
DIO C1	47	48	DIO C0/EXT TRIG
+5V	49	50	DGND

SPECIFICATIONS

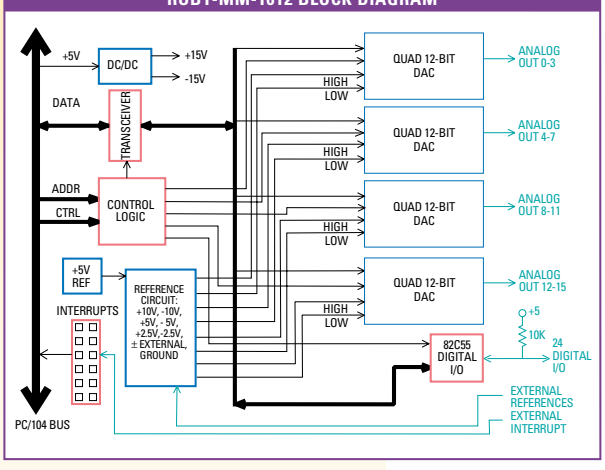
ANALOG OUTPUTS	
Number of outputs	16, voltage output
Resolution	12 bits (1 part in 4096)
Fixed output ranges	±10V, ±5V, 0-10V, 0-5V
Adjustable ranges	Preset to 2.5V for ±2.5V, 0-2.5V ranges Adjustment range 0-2.5V
External reference	0V min, 10V max
Settling time	6µs max to ±.01%
Accuracy	±1LSB
Integral nonlinearity	±1LSB max
Differential nonlinearity	±1LSB max, guaranteed monotonic
Output current	±5mA max per channel
Minimum load	2K Ω
Update method	Simultaneous update
D/A reset voltage	0V for bipolar ranges, mid-scale for unipolar ranges
DIGITAL I/O	
Number of lines	24, CMOS / TTL compatible (82C55)
Input voltage	Logic 0: -0.5V min, 0.8V max Logic 1: 2.0V min, 5.5V max
Output voltage	Logic 0: 0.0V min, 0.4V max Logic 1: 3.0V min, Vcc - 0.4V max
Output current	±2.5mA max per line
Pull-up resistor	10KΩ on each I/O line
External trigger	Active high edge
GENERAL	
Power supply (Vcc)	+5VDC ±10%
Required current	430mA typical, all outputs open
Operating temp.	-40 to +85°C
Size	3.55" x 3.775"
Data bus	8 bits
Weight	3.0oz / 85g

ORDERING GUIDE

RMM-1612-XT 16 12-bit D/A channels, 24 digital I/O

For cables and accessories, see pages 46-47.

RUBY-MM-1612 BLOCK DIAGRAM



RUBY-MM-416

16-BIT D/A, 16 CHANNELS INCLUDES 24 DIGITAL I/O

SPECIFICATIONS

ANALOG OUTPUTS	
Quantity / resolution	4 channels, 16 bits
Output ranges	0-10V, ±5V, ±10V
Settling time	10µs max to .003%
Linearity error	±2 LSB max
Differential nonlinearity	±2 LSB max
Monotonicity	15 bits minimum
Output current	±5mA max per channel
Minimum load	2K Ω
Reset	All DACs reset to mid-scale
DIGITAL I/O	
No. of lines	24, TTL/CMOS compatible
Input voltage	Logic 0: -0.5V min, 0.8V max Logic 1: 2.0V min, 5.5V max
Output voltage	Logic 0: 0.0V min, 0.4V max Logic 1: 3.0V min, 4.6V max
Output current	±2.5mA max per line
GENERAL	
Dimensions	3.55" x 3.775"
Operating temp.	-40 to +85°C
Power requirements	+5VDC ±10% @ 650mA typical
Weight	3.0oz / 85g

ORDERING GUIDE

RMM-416-XT 4 16-bit D/A channels, 24 digital I/O

For cables and accessories, see pages 46-47.

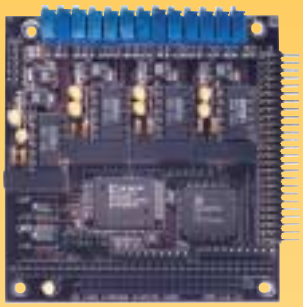
Ruby-MM-416 contains 4 channels of high-resolution analog output using 4 16-bit D/A converter chips. Each chip has its own user-configurable output range (see table). Calibration circuitry is provided on board to achieve accuracy of ±2LSB. Analog output specifications include 10µs settling time and ±5mA max output current per channel.

The board also contains an 82C55 chip to provide 3 8-bit digital I/O ports with programmable direction. Each digital I/O line has a 10KΩ pull-up resistor.

ANALOG OUTPUT RANGES

OUTPUT RANGE	RESOLUTION (1 LSB)
±5V	153µV
±10V	310µV
0 - 10V	153µV

The output range can be configured independently for each output channel.

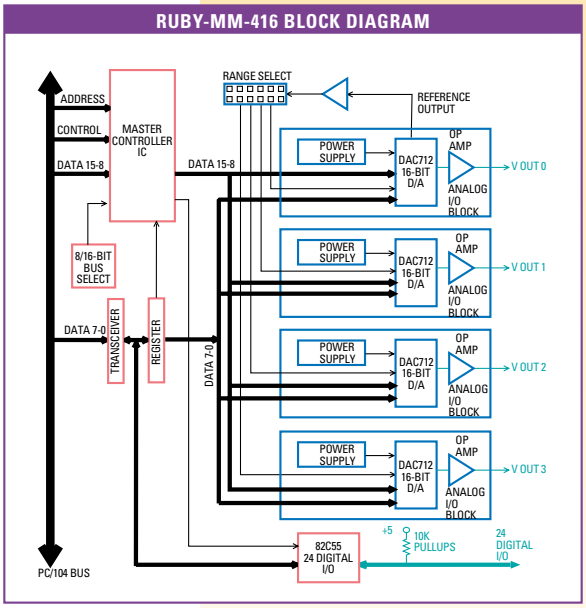


- 16-bit D/A converters (1/65536)
- 4 output channels
- Unipolar and bipolar output ranges
- Independent output range for each channel
- Simultaneous update of all channels
- External trigger capability
- 24 digital I/O lines (82C55)
- -40 to +85°C operating temperature
- FREE Universal Driver software included

I / O HEADER

ANALOG GND	1	2	VOUT 0
ANALOG GND	3	4	VOUT 1
ANALOG GND	5	6	VOUT 2
ANALOG GND	7	8	VOUT 3
N/C	9	10	N/C
N/C	11	12	N/C
N/C	13	14	N/C
N/C	15	16	N/C
N/C	17	18	N/C
ANALOG GND	19	20	+15V
-15V	21	22	ANALOG GND
DIGITAL GND	23	24	EXT TRIGGER
A7	25	26	A6
A5	27	28	A4
A3	29	30	A2
A1	31	32	A0
C7	33	34	C6
C5	35	36	C4
C3	37	38	C2
C1	39	40	C0
B7	41	42	B6
B5	43	44	B4
B3	45	46	B2
B1	47	48	B0
+5V	49	50	DIGITAL GND

RUBY-MM-416 BLOCK DIAGRAM



QUARTZ-MM

5 OR 10 COUNTER / TIMERS, 9513 CHIP, 16 DIGITAL I/O

- 5 or 10 16-bit counter/timers
- 9513 chip provides extensive counting, gating, and timing functions
- Frequency and period measurement
- PWM signal generation
- Maximum input frequency:
  7MHz (commercial temp.)
  20MHz (industrial temp.)
- Built-in programmable frequency generator
- 8 digital inputs, 8 digital outputs
- Timer-controlled interrupts
- 0 to 70°C and -40 to +85°C versions available
- FREE Universal Driver software included

Quartz-MM uses the 9513 counter/timer IC (originally from AMD) to provide versatile counting and timing capabilities. The 9513 chip has a high degree of functionality all under software control. It can perform frequency and period measurement, pulse-width modulation (PWM) and frequency-shift keying (FSK) signal generation, event counting, programmable pulse and one-shot generation, and more.

Each chip contains 5 counters and an internal frequency generator. One chip's frequency generator output is made available on the I/O header. The 5 counters can count in both binary and BCD modes, and they can be cascaded together (one counter's output is the next counter's input) to create wider counters.

The count direction, input source, input edge, gate function, and output signal are all programmable, providing maximum flexibility in counter configuration to suit all types of applications. Multiple counters can be latched simultaneously to avoid skew in the readings. All counter features are supported in our Universal Driver software.

The board provides a PC/104 bus interrupt input. By connecting a counter output to the interrupt input and using the Universal Driver "User Interrupt" feature, you can generate interrupts at a programmable rate for real-time control applications. Also included are 8 TTL digital inputs and 8 TTL digital outputs. All user I/O is contained on a single 50-pin header. Mating cable is C-50-18.

Quartz-MM is available with 5 or 10 counter/timers and in commerial or industrial temperature range. The 0-70°C rated boards use AMD AM9513APC chips with 7MHz maximum input frequency. The -40 to +85°C rated boards use Celeritous CTSC9513API-2 chips with 20MHz maximum input frequency. All models include an on-board 4MHz clock oscillator.

SPECIFICATIONS

COUNTER/TIMERS	
QMM-5	5, 16 bits wide
QMM-10	10, 16 bits wide
Max. input frequency	7MHz, 20MHz (XT)
On-board osc.	4MHz ±.01% (100 ppm)
Signal type	TTL
Input voltage	Low: -0.5V min, 0.8V max High: 2.2V min, 5V max
Input current	±10µA max
Output voltage	Logic 0: 0.0V min, 0.4V max @ 3.2mA max Logic 1: 2.4V min, 5.0V max @ -200µA max
DIGITAL I/O	
Compatibility	TTL
Input port	8 lines, 5V logic compatible
Input voltage	Logic 0: 0.0V min, 0.8V max
Input current	±1µA max
Output port	8 lines, 5V logic compatible
Output voltage	Logic 0: 0.0V min, 0.33V max Logic 1: 3.8V min, 5.0V max
Output current	±4mA max
GENERAL	
Operating temp.	0 to 70°C, standard models -40 to +85°C, XT models
Power supply	QMM-5: +5V ±10% @ 220mA typical QMM-10: +5V ±10% @ 290mA typical
Weight	QMM-10: 3.0oz / 85g QMM-5: 2.7oz /76g

ORDERING GUIDE

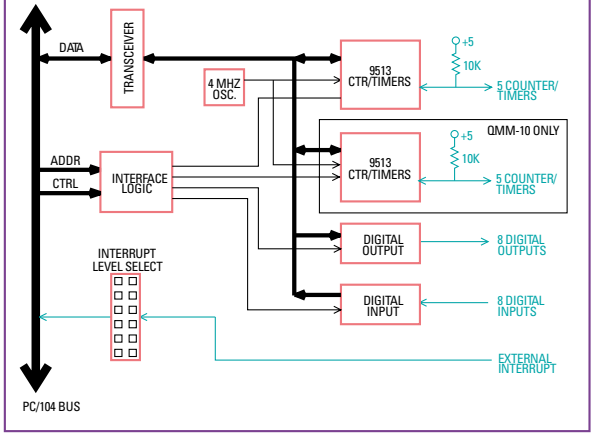
QMM-5	5 ctr/timers, 16 digital I/O, 0-70°C
QMM-5-XT	5 ctr/timers, 16 digital I/O, -40 to +85°C
QMM-10	10 ctr/timers, 16 digital I/O, 0-70°C
QMM-10-XT	10 ctr/timers, 16 digital I/O, -40 to +85°C

For cables and accessories, see pages 46-47.

I / O HEADER

	IN 1	1 2	IN 2
	GATE 1	3 4	GATE 2
	OUT 1	5 6	OUT 2
	IN 3	7 8	IN 4
	GATE 3	9 10	GATE 4
	OUT 3	11 12	OUT 4
	IN 5	13 14	OUT 5
	GATE 5	15 16	FOUT
QMM-10 ONLY	IN 6	17 18	IN 7
QMM-10 ONLY	GATE 6	19 20	GATE 7
QMM-10 ONLY	OUT 6	21 22	OUT 7
QMM-10 ONLY	IN 8	23 24	IN 9
QMM-10 ONLY	GATE 8	25 26	GATE 9
QMM-10 ONLY	OUT 8	27 28	OUT 9
QMM-10 ONLY	IN 10	29 30	OUT 10
QMM-10 ONLY	GATE 10	31 32	INTERRUPT
	DOUT 7	33 34	DIN 7
	DOUT 6	35 36	DIN 6
	DOUT 5	37 38	DIN 5
	DOUT 4	39 40	DIN 4
	DOUT 3	41 42	DIN 3
	DOUT 2	43 44	DIN 2
	DOUT 1	45 46	DIN 1
	DOUT 0	47 48	DIN 0
	+5	49 50	DIGITAL GND

QUARTZ-MM BLOCK DIAGRAM



ONYX-MM

3 COUNTER/TIMERS, 48 DIGITAL I/O, PROGRAMMABLE INTERRUPTS

SPECIFICATIONS

COUNTER/TIMERS	
Chip	82C54-2
Counter/timers	3, 16 bits wide
Maximum input freq.	10MHz
On-board osc.	4MHz ±.01%
Signal type	TTL
Input voltage,	Low: 0.5V min, 0.8V max High: 2.0V min, 5.5V max
Input current	-200µA max (low), 2mA max (high)
Output voltage	Low: 0.0V min, 0.4V max High: 3.0V min, Vcc -0.4V max
Output current	±2.5mA max, each line
Pullup resistors	10KΩ all input lines
DIGITAL I/O	
Chip	82C55A (qty. 2)
Number of I/O lines	48 (6 8-bit ports)
Direction	Programmable for each port
Output current	±2.5mA max, each line
Pullup resistors	10KΩ all input lines
INTERRUPTS	
Number of interrupts	3
Interrupt level	2 - 7
Interrupt sources	Counter/timer outputs, Interrupt input, or DIO line C0 (programmable)
GENERAL	
Power supply	+5V ±10% @ 120mA typical
Operating temp.	-40 to +85°C
PC/104 Bus	8 bits
Weight	2.8oz / 79g

Onyx-MM provides industry-standard I/O chips for counting, timing, and digital I/O operations as well as real-time control. The 82C54 IC has 3 16-bit counter/timers that can be used for counting, rate generator, one-shot generator, or square wave generator. In addition to the chip's internal counter configuration register, Onyx-MM contains a separate control register that is used to select the input source for each counter. You can select the on-board 4MHz clock, an external digital signal, or even another counter's output, so you can cascade counters together.

The 2 82C55 chips provide a total of 48 lines of digital I/O. Each chip has 3 8-bit ports with programmable direction. All ports power up in input mode, and all digital I/O lines have 10KΩ pull-up resistors.

The board also has 3 PC/104 bus interrupt lines controllable in software and supported by our Universal Driver software. You can select a counter output, a digital input signal, or an external trigger input as the interrupt source. With Onyx-MM you can generate interrupts at programmable rates or based on external events, and run custom code each time an interrupt occurs.

The 48 digital I/O lines are made available on two 50-pin headers, with 24 lines on each header in OPTO22-style pinout. The counter/timer signals are accessed on a separate 14-pin header. Mating cables are C-50-18 (2 per board) and C-14-18 (one per board).

See I/O connector pinout diagrams on next page.

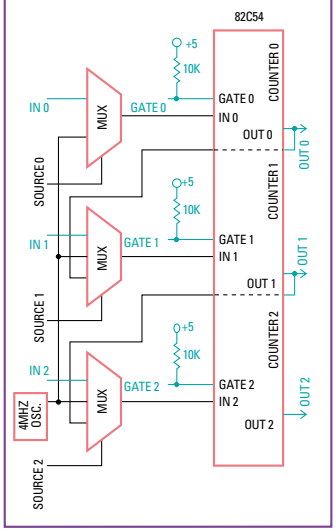
- 3 16-bit counter/timers using 82C54 chip
- Programmable counter sources – internal clock, external signal, or previous counter output
- 48 digital I/O using 2 82C55 chips
- Programmable port directions
- ±2.5mA output current on DIO lines
- DIO lines have 10KΩ pull-up resistors
- 3 PC/104 bus interrupts with programmable sources
- Timer-controlled interrupt capability
- -40 to +85°C operation
- FREE Universal Driver software included

ORDERING GUIDE

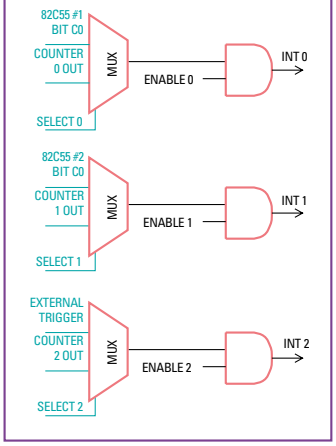
OMM-XT 48 digital I/O, 3 ctr/timers

For cables and accessories, see pages 46-47.

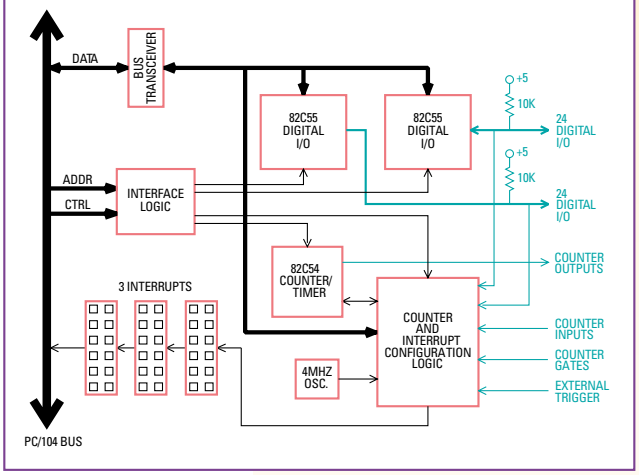
OMM COUNTER CONFIGURATION



OMM INTERRUPT CONFIGURATION



ONYX-MM BLOCK DIAGRAM



ONYX-MM-DIO

48 DIGITAL I/O, LOW COST

- 48 digital I/O lines using 2 82C55 chips
- Programmable port directions
- 10KΩ pull-up resistors on all lines
- ±2.5mA output current on each line
- Dual 50-pin I/O headers with 24 I/O lines each
- -40 to +85°C operation
- FREE Universal Driver software included

Onyx-MM-DIO provides low-cost, reliable digital I/O for your PC/104 embedded system. The board contains 2 82C55 chips with 24 lines each organized as 3 8-bit ports. Each port's direction can be set independently under software control. All I/O lines have 10KΩ pull-up resistors, and all ports power up in input mode.

The digital I/O lines are brought out on two 50-pin I/O headers, with 24 lines on each header. The I/O headers include +5V and ground for convenience. This board is also available with 3 counter/ timers and 3 programmable interrupts. See model Onyx-MM on page 27.

ORDERING GUIDE

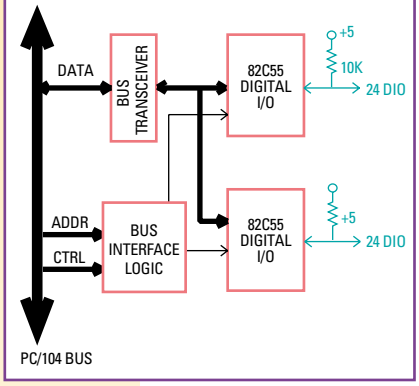
OMM-DIO-XT	48 digital I/O

For cables and accessories, see pages 46-47.

SPECIFICATIONS

DIGITAL I/O	
Chip	82C55A (qty. 2)
Number of I/O lines	48 (6 8-bit ports)
Direction	Programmable for each port
Input voltage	Low: -0.5V min, 0.8V max High: 2.0V min, 5.5V max
Output voltage	Low: 0.0V min, 0.4V max High: 3.0V min, Vcc -0.4V max
Output current	±2.5mA max, each line
Output drivers	None, direct interface
Pullup resistors	10KΩ all input lines
GENERAL	
Power supply	+5V ±10% @ 100mA typical, all outputs open
Temperature	-40° to +85°C
PC/104 Bus	8 bits
Weight	2.3oz / 65g

ONYX-MM-DIO BLOCK DIAGRAM



CTR/TIMER I/O HEADER

IN 0	1	2	IN 1
GATE 0	3	4	GATE 1
OUT 0	5	6	OUT 1
IN 2	7	8	EXTERNAL INTERRUPT
GATE 2	9	10	GROUND
OUT 2	11	12	GROUND
+5	13	14	GROUND

Both Onyx-MM and Onyx-MM-DIO contain two identical 50-pin I/O headers for the digital I/O as shown at right. The counter/timer header shown is on Onyx-MM only.

DIGITAL I/O HEADERS

PORT A	A7	1	2	GND
	A6	3	4	GND
	A5	5	6	GND
	A4	7	8	GND
	A3	9	10	GND
	A2	11	12	GND
	A1	13	14	GND
	A0	15	16	GND
PORT C	C7	17	18	GND
	C6	19	20	GND
	C5	21	22	GND
	C4	23	24	GND
	C3	25	26	GND
	C2	27	28	GND
	C1	29	30	GND
	C0	31	32	GND
PORT B	B7	33	34	GND
	B6	35	36	GND
	B5	37	38	GND
	B4	39	40	GND
	B3	41	42	GND
	B2	43	44	GND
	B1	45	46	GND
	B0	47	48	GND
	+5	49	50	GND

GARNET-MM

24 OR 48 LINES INPUT OUTPUT LINES, PROGRAMMABLE DIRECTION, BUFFERED OUTPUTS

SPECIFICATIONS	
DIGITAL I/O	
Chip	82C55 (qty. 2)
Number of I/O lines	24 or 48
Direction	Programmable in groups of 4 or 8
Input voltage	Logic 0: 0.0V min, 0.8V max Logic 1: 2.0V min, Vcc max
Output voltage	Logic 0: 0.0V min, 0.55V max Logic 1: 2.0V min, Vcc -0.3V max
Output current	Logic 0: 64mA max per line Logic 1: 15mA max per line
Output drivers	74F245/74F243
Pull-up resistors	None
GENERAL	
Power supply	+5V ±10% @ 160mA typical
Temperature	0° to 70°C
PC/104 Bus	8 bits
Weight	-24: 2.7oz / 76g -48: 3.0oz /85g

Garnet-MM provides 24 or 48 digital I/O lines using 1 or 2 82C55 chips. It has buffered outputs for extra drive current capability to drive loads such as LEDs, small mechanical relays, or solid-state relays. The output buffers are controlled by on-board logic that monitors the 82C55 configuration registers and sets the buffer directions automatically. This board does not provide pull-up resistors on the I/O lines.

The board includes 2 interrupt lines that may be used for digital I/O data transfer at low rates (up to 1-2 KB/sec).

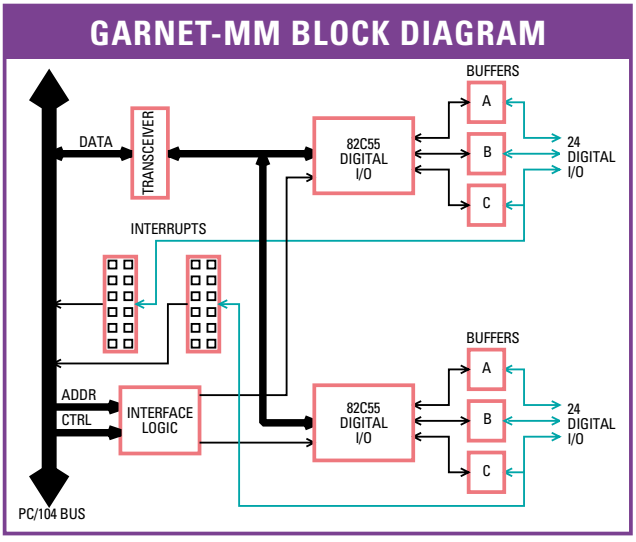
- 24 or 48 digital I/O lines using 1 or 2 82C55 chips
- Programmable port directions
- High-current outputs: -15/+64mA per line
- 2 PC interrupts
- Dual 50-pin I/O headers with 24 I/O lines each
- 0 to 70°C operation
- FREE Universal Driver software included

Garnet-MM has two identical digital I/O headers with 24 I/O lines on each.

I/O HEADERS

PORT A	A7	1	2	GND
	A6	3	4	GND
	A5	5	6	GND
	A4	7	8	GND
	A3	9	10	GND
	A2	11	12	GND
	A1	13	14	GND
	A0	15	16	GND
PORT C	C7	17	18	GND
	C6	19	20	GND
	C5	21	22	GND
	C4	23	24	GND
	C3	25	26	GND
	C2	27	28	GND
	C1	29	30	GND
	C0	31	32	GND
PORT B	B7	33	34	GND
	B6	35	36	GND
	B5	37	38	GND
	B4	39	40	GND
	B3	41	42	GND
	B2	43	44	GND
	B1	45	46	GND
	B0	47	48	GND
	+5	49	50	GND

GARNET-MM BLOCK DIAGRAM



ORDERING GUIDE

GMM-24	24 Digital I/O, high-drive outputs
GMM-48	48 Digital I/O, high-drive outputs

For cables and accessories, see pages 46-47.

PEARL-MM

16 RELAYS

Model PMM-P with pin headers

Model PMM-S with screw terminals

- 16 SPDT (form C) relays
- Extra-long life - 100,000,000 operations
- DC switching capacity 30V / 2A
- AC switching capacity 125VAC / 0.5A
- Max switched load 60W / 60VA
- Max switched voltage 220VDC / 250VAC
- Switching resistance 100 mΩ max
- 500VAC / DC isolation between board and signals
- Screw terminal and pin header I/O options
- -40 to +85°C operation
- FREE Universal Driver software included

ORDERING GUIDE

PMM-S	16 relays, screw terminals
PMM-P	16 relays, pin headers

For cables and accessories, see pages 46-47.

Pearl-MM is a PC/104 format industrial control module with 16 relays. The relays have SPDT (form C) configuration. Each relay has 3 contacts: Common, Normally Open, and Normally Closed. For safety and reliability, all relays are in their power-off state (Common connected to Normally Closed) at power-up or system reset. The relays can switch both AC and DC voltages. They feature long life (100,000,000 operations), quick actuation time (4ms max operate and release), and superior isolation (500V AC or DC).

Two user connection options are available:

- The -S version has miniature screw terminals on .1" centers, providing a means of direct connection to user wiring ranging from 16-28AWG.
- The -P version has standard pin headers to allow mating with a ribbon cable.

Relay Circuit

Pearl-MM has 16 relay outputs with SPDT (form C) design. Each relay has a common (C), normally open (NO), and normally closed (NC) contact. The relays are controlled with two 8-bit control registers and have have break-before-make operation to prevent shorting.

I/O Connectors

Pearl-MM is available with either pin headers or screw terminals for the relay connections. In the pin header drawing at left, note that each pair of pins is connected to the same signal. The screw-terminal pinout is equivalent to one column of the pin header, without the last unused row.

SPECIFICATIONS

RELAYS	
No. of Outputs	16
Relay type	SPDT (Form C)
Max voltage/current	DC: 30VDC / 2A60W (DC), 60VA (AC) AC: 125VAC / 0.5A resistive
Max operating voltage	220VDC, 250VAC
Min switching capacity	10mA @ 10mVDC
Contact resistance	100mΩ max
Relay lifetime	100,000,000 operations
Actuation time	4ms max operate or release
GENERAL	
I/O connections	Pin headers (-P) Screw terminals (-S)
Isolation (all I/O)	500VDC or AC, channel-to-channel and channel-to-board
Power supply	+5VDC ±10%
Operating temp.	-40 to +85°C
Weight	PMM-P: 3.4oz / 96g PMM-S: 3.6oz / 102g

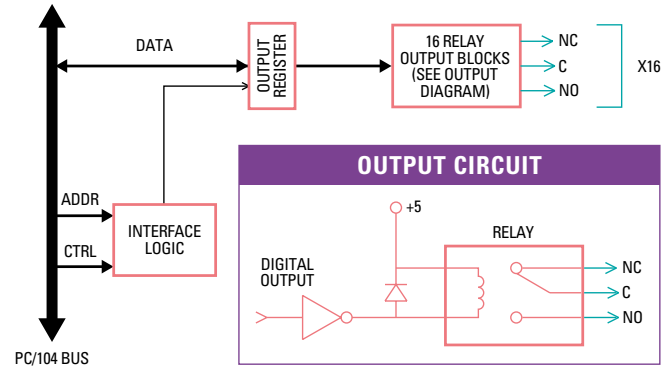
PIN HEADER

0 NO	1	2	0 NO
0 C	3	4	0 C
0 NC	5	6	0 NC
1 NO	7	8	1 NO
1 C	9	10	1 C
1 NC	11	12	1 NC
2 NO	13	14	2 NO
2 C	15	16	2 C
2 NC	17	18	2 NC
2 NO	19	20	3 NO
3 C	21	22	3 C
3 NC	23	24	3 NC
4 NO	25	26	4 NO
4 C	27	28	4 C
4 NC	29	30	4 NC
5 NO	31	32	5 NO
5 C	33	34	5 C
5 NC	35	36	5 NC
6 NO	37	38	6 NO
6 C	39	40	6 C
6 NC	41	42	6 NC
7 NO	43	44	7 NO
7 C	45	46	7C
7 NC	47	48	7 NC
NOT USED	49	50	NOT USED

SCREW TERMINALS

1	0 NO
2	0 C
3	0 NC
4	1 NO
5	1 C
6	1 NC
7	2 NO
8	2 C
9	2 NC
10	3 NO
11	3 C
12	3 NC
13	4 NO
14	4 C
15	4 NC
16	5 NO
17	5 C
18	5 NC
19	6 NO
20	6 C
21	6 NC
22	7 NO
23	7 C
24	7 NC

PEARL-MM BLOCK DIAGRAM



OPAL-MM

8 RELAYS, 8 OPTOISOLATED INPUTS

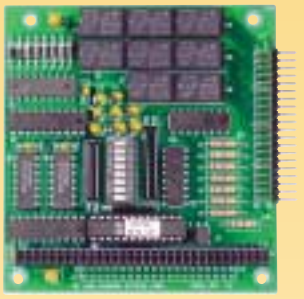
SPECIFICATIONS	
OPTOISOLATED INPUTS	
Inputs	8 nonpolarized optoisolators
Input voltage DC AC	3V min, 28V max, 3V p-p min, 28V p-p max, 40Hz or greater
Input switch time	100ms max
Input impedance	1.8KΩ min
AC input filter	Selectable on a per-channel basis
RELAY OUTPUTS	
Outputs	8
Relay type	SPDT (Form C)
Max power DC AC	30VDC / 1A 125VAC / 0.1A resistive, 125VAC / 0.2A inductive
Max switching cap.	30W (DC), 50VA (AC)
Max operating voltage	220VDC, 250VAC
Contact resistance	50mΩ max
Relay lifetime	1,000,000 operations
Actuation time	5ms max, operate or release
GENERAL	
I/O header	2 x 20 pin header; on .1" centers
Mating Cable	DSC #C-40-18
Isolation (all I/O) board to output	500VDC or AC, input to board or
Power supply	+5VDC ±10%
Current consumption	200mA typical, all relays off; Additional 40mA per activated relay
Operating temp.	-40 to +85°C
Weight	3.0oz / 85g

Opal-MM features 8 optoisolated digital inputs and 8 relays. The inputs accept signals ranging from 3-28V AC or DC. An on-board input filter circuit allows the sensing of AC inputs with frequencies of 40Hz or higher. This filter is individually selectable for each input channel.

The 8 relays are non-latching type SPDT (form C). Each relay has 3 contacts: Common (C), Normally Open (NO), and Normally Closed (NC). For safety and reliability, all relays retain their power-off state (C connected to NC) during power-up and return to it during system reset. The relays can switch both AC and DC voltages. Relay lifetime is 1,000,000 operations minimum at rated DC load. Quick actuation time (5ms operate or release), break-before-make operation, and bifurcated contacts ensure reliable operation even with low-level signals.

Signal Isolation

Opal-MM provides 500V DC or AC isolation between all I/O connections and the rest of the board. This specification does not apply between I/O channels, although all channels are isolated from each other as well. In many applications, the I/O points share a common power or ground line and require only isolation between the I/O lines as a group and the control circuitry.



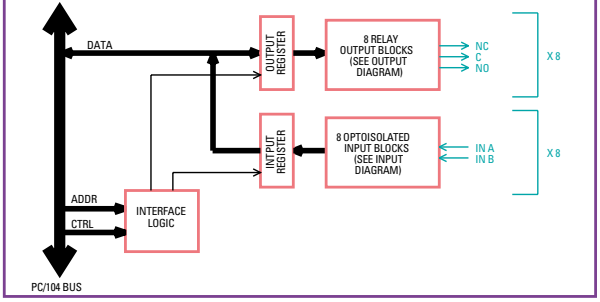
- 8 SPDT (form C) relays
- Long lifetime - 1,000,000 operations
- DC switching capacity 30VDC / 1A
- AC switching capacity 125VAC / 0.1A
- Switching resistance 50 mΩ max
- 8 non-polarized optoisolated inputs
- Input voltage: 3-28VDC or 3-28VAC p-p 40Hz or greater
- 40-pin header for all I/O
- -40 to +85°C operation
- FREE Universal Driver software included

ORDERING GUIDE

OPMM-XT 8 relays, 8 optocouplers

For cables and accessories, see pages 46-47.

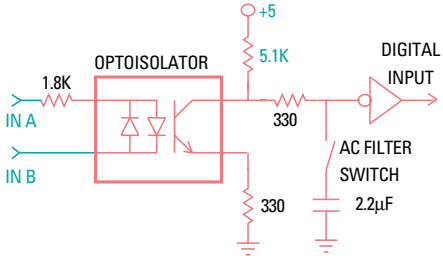
OPAL-MM BLOCK DIAGRAM



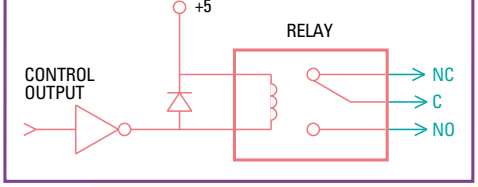
I / O HEADERS

OUT 7 C	1	2	OUT 6 C
OUT 7 NC	3	4	OUT 6 NC
OUT 7 NO	5	6	OUT 6 NO
OUT 5 C	7	8	OUT 4 C
OUT 5 NC	9	10	OUT 4 NC
OUT 5 NO	11	12	OUT 4 NO
OUT 3 C	13	14	OUT 2 C
OUT 3 NC	15	16	OUT 2 NC
OUT 3 NO	17	18	OUT 2 NO
OUT 1 C	19	20	OUT 0 C
OUT 1 NC	21	22	OUT 0 NC
OUT 1 NO	23	24	OUT 0 NO
IN 7 A	25	26	IN 7 B
IN 6 A	27	28	IN 6 B
IN 5 A	29	30	IN 5 B
IN 4 A	31	32	IN 4 B
IN 3 A	33	34	IN 3 B
IN 2 A	35	36	IN 2 B
IN 1 A	37	38	IN 1 B
IN 0 A	39	40	IN 0 B

OPAL-MM INPUT DIAGRAM



OPAL-MM OUTPUT DIAGRAM



(shown with control output = 0)

IR104

20 RELAYS, 20 OPTOISOLATED INPUTS

- 20 SPST (Form A) relays
- Long lifetime - 20,000,000 operations
- DC switching capacity 30VDC / 5A
- AC switching capacity 125VDC / 5A
- Maximum switched load 150W / 1250VA
- Maximum switched voltage 150VDC / 250VAC
- 20 non-polarized optoisolated digital inputs
- Input voltage: 3-24VDC, 3-24 p-p
- -20 to +70°C operation
- FREE Universal Driver software included

ORDERING GUIDE

IR104	20 relays, 20 optocouplers

For cables and accessories, see pages 46-47.

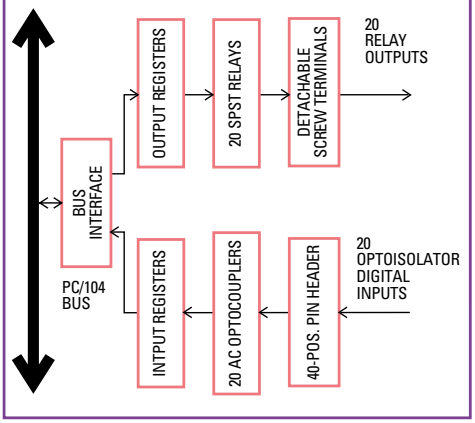
The IR104 provides our highest density of relays and optoisolated inputs on a PC/104 board. The 20 relays are SPST (form A) with two contacts. They are in the open state when deactivated / powered off. The relays feature a high 5 Amp DC current capacity, 6ms operate / 3ms release times and 30mΩ initial contact resistance. The board's control logic features a relay state readback capability for easier programming. The 20 relays are accessed via twin 20-position detachable screw terminal blocks, with 10 relays on each terminal block. The screw terminals accept wire sizes of 14-28AWG.

The 20 optoisolators accept both AC and DC inputs in the range 3-24V. They are accessed on a separate 40-pin header that mates with a standard ribbon cable.

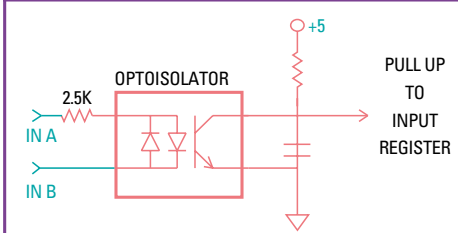
SPECIFICATIONS

Inputs	20 Optoisolated inputs
Input voltage	3-24V AC or DC
Input impedance	2.8KW
Outputs	20 SPST relays
Max voltage	150VDC, 250VAC
Max current	5A AC or DC (30VDC max)
Max power	150W, 1250VA
Contact resistance	30mW initially
UL rating	5A/30VDC or 250VAC 1/10HP 120VAC
Lifetime	20,000,000 cycles mechanical 100,000 cycles @ full power
Actuation time	6ms operate, 3ms release
I/O connectors	Inputs: 40-pin header Outputs: Dual 20-pos. detachable screw terminals
Power	5V @ 110mA typical (all relays off)
Operating Temp	-20 to +70°C
Size	3.550" x 3.775" 0.492" max component height
Weight	3.2oz / 90g

IR-104 BLOCK DIAGRAM



IR-104 INPUT DIAGRAM



OPTOISOLATOR INPUTS

IN 1 A	1	2	IN 1 B
IN 2 A	3	4	IN 2 B
IN 3 A	5	6	IN 3 B
IN 4 A	7	8	IN 4 B
IN 5 A	9	10	IN 5 B
IN 6 A	11	12	IN 6 B
IN 7 A	13	14	IN 7 B
IN 8 A	15	16	IN 8 B
IN 9 A	17	18	IN 9 B
IN 10 A	19	20	IN 10 B
IN 11 A	21	22	IN 11 B
IN 12 A	23	24	IN 12 B
IN 13 A	25	26	IN 13 B
IN 14 A	27	28	IN 14 B
IN 15 A	29	30	IN 15 B
IN 16 A	31	32	IN 16 B
IN 17 A	33	34	IN 17 B
IN 18 A	35	36	IN 18 B
IN 19 A	37	38	IN 19 B
IN 20 A	39	40	IN 20 B

RELAY OUTPUTS – LEFT SIDE

Top Edge of Board

RELAY 10 B	20
RELAY 10 A	19
RELAY 9 B	18
RELAY 9 A	17
RELAY 8 B	16
RELAY 8 A	15
RELAY 7 B	14
RELAY 7 A	13
RELAY 6 B	12
RELAY 6 A	11
RELAY 5 B	10
RELAY 5 A	9
RELAY 4 B	8
RELAY 4 A	7
RELAY 3 B	6
RELAY 3 A	5
RELAY 2 B	4
RELAY 2 A	3
RELAY 1 B	2
RELAY 1 A	1

PC/104 Connector End

RELAY OUTPUTS – RIGHT SIDE

Top Edge of Board

20	RELAY 20 B
19	RELAY 20 A
18	RELAY 19 B
17	RELAY 19 A
16	RELAY 18 B
15	RELAY 18 A
14	RELAY 17 B
13	RELAY 17 A
12	RELAY 16 B
11	RELAY 16 A
10	RELAY 15 B
9	RELAY 15 A
8	RELAY 14 B
7	RELAY 14 A
6	RELAY 13 B
5	RELAY 13 A
4	RELAY 12 B
3	RELAY 12 A
2	RELAY 11 B
1	RELAY 11 A

PC/104 Connector End

PC/104-PLUS DUAL ETHERNET + 24 DIGITAL I/O

SPECIFICATIONS

ETHERNET	
No. of Ethernet controllers	1 (MRC-100) or 2 (MRC-224)
Protocol	IEEE 802.3 10Base-T and 100Base-TX compatible
Maximum baud rate	100Mbps
DIGITAL I/O	
No. of I/O lines	24, using 82C55 chip
Direction	
Ports A and B	Each port programmable for all input or all output
Port C	Programmable in 4-bit groups for input or output
Input voltage	Low 0.5V min, 0.8V max High 2.0V min, 5.5V max
Output voltage	Low 0.0V min, 0.4V max High 3.0V min, Vcc - 0.4V max
Output current	±2.5mA max, each line
Pull-up resistors	10KΩ all lines, selectable with jumper
GENERAL	
I/O headers	
Ethernet	RJ-45 female sockets and 6-pin right-angle male headers
Digital I/O	26-pin (2x13) .025" square pin header
Mating cables	
Ethernet ports	RJ-45 sockets: Standard CAT5 cable Pin headers: Diamond Systems cable no. C-PRZ-02
Digital I/O	Diamond Systems cable no. C-26-18
Dimensions	3.55" x 3.775" (PC/104 standard)
Power supply	+5VDC ±10% @280mA / 1.4W
Operating temperature	-40 to +85°C
Weight	3.2 oz / 81g
PC/104 bus	Both PC/104 and PC/104+ stackthrough headers installed

2 in 1 ETHERNET + DIGITAL I/O

The Mercury PC/104 module integrates 2 PCI-based 10/100Mbps Ethernet ports with 24 user-configurable digital I/O lines on one board. This 2-in-1 combination of Ethernet and digital I/O can help lower the size and cost of your embedded system by eliminating one additional board from your PC/104 stack.

The Ethernet ports utilize the National Semiconductor DP83815 Mac + Phy PCI controller chip. Two I/O connectors are provided for each Ethernet port: a standard RJ-45 jack for convenience and a rugged friction-lock header for applications requiring vibration protection.

The 24 digital I/O lines are based on an 82C55 chip and feature programmable direction in 4- and 8-bit groups. Jumper-configurable options include the I/O address and 10K-Ohm pull-up resistors on the I/O lines.

Extended temperature capability (-40 to +85°C) enables the board to operate in environments with extreme temperature swings, such as vehicles or outdoor installations. In addition, the board may be custom-configured with 0-ohm resistors in place of jumper blocks for increased ruggedness in high-vibration applicaitons.

A low-cost model with one Ethernet port, no digital I/O, and PCI-104 bus configuration (PCI connector only) is available as special order.

- 2 PCI-based 10/100 Ethernet ports
- RJ-45 and pin header Ethernet connections
- Ethernet activity LEDs for each port
- 24 digital I/O lines on ISA bus
- Rugged design for harsh environment
- Operating temperature -40 to +85°C
- Fully PC/104-Plus compliant mechanical design
- Multiple assembly options: 1 or 2 Ethernet ports, with or without digital I/O

ORDERING GUIDE

MRC224-XT	Dual-Port PC/104-Plus Ethenret + 24 Digital I/O
MRC100-XT	Single-Port PCI-104 Ethernet, Low Cost (Special Order)

For cables and accessories, see pages 46-47.

I/O Headers

The Ethernet ports are equipped with two I/O header options: an RJ-45 jack and a friction-lock header. The friction-lock header is a locking 1x6 position right-angle header. The pinout is compatible with Diamond systems cable no. C-PRZ-02, which provides a panel-mountable RJ-45 jack at the other end. The RJ-45 connector is an industry-standard RJ-45 right-angle jack and may be used directly with standard CAT-5 Ethernet cabling.

The digital I/O lines are provided on a 26-pin (2x13) pin header.

I/O HEADER

1	COMMON
2	RX-
3	COMMON
4	RX+
5	TX-
6	TX+

Locking Ethernet

I/O HEADER

1	TX+
2	TX-
3	RX+
4	COMMON
5	COMMON
6	RX-
7	COMMON
8	COMMON

RJ-45 Ethernet

DIGITAL I/O HEADER

C7	1	2	C6
C5	3	4	C4
C3	5	6	C2
C1	7	8	C0
B7	9	10	B6
B5	11	12	B4
B3	13	14	B2
B1	15	16	B0
A7	17	18	A6
A5	19	20	A4
A3	21	22	A2
A1	23	24	A0
+5V	25	26	GROUND

Digital I/O

EMERALD-MM

4 PORTS, RS-232/422/485 PROTOCOLS

- Industry-standard design compatible with any popular operating system
- 4 asynchronous serial ports
- RS-232, RS-422, and RS-485 on one board
- RS-232 mode includes all 8 signals
- Jumper-selected protocols, addresses, and interrupts
- 16C554 UART with 16-byte FIFOs
- 115.2K max baud rate
- Built-in interrupt sharing
- Low-cost RS-232-only version available
- +5V-only supply
- -40 to +85°C operation

This top-selling serial port module has four independent PC-standard asynchronous serial ports based on the 16C554 quad UART chip.

The board is available in 3 models with different combinations of protocols (see ordering guide below). Each configurable port's protocol can be selected independently of any other port.

Protocol, address, and IRQ level are independently selected for each port. All configurations are made with jumpers for quick visual identification of the board's settings. Select from 8 I/O address combinations and 10 IRQ levels. All transceivers are already on the board, so no chips or modules need to be installed for configuration.

In RS-232 mode, each port has the full set of 8 signals plus ground. Termination resistors of 120Ω are provided for RS-422/485 protocols and are jumper-selectable. Interrupt sharing is supported with a built-in interrupt status register.

The board has 2 20-pin I/O headers, with 2 serial ports on each header. Use mating cable C-DB9M-2 (qty. 2). Emerald-MM requires only +5V supply and operates over the industrial temperature range of -40 to +85°C.

ORDERING GUIDE

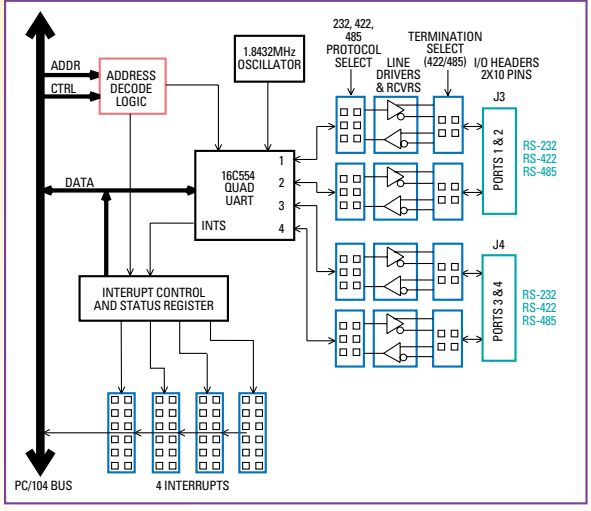
EMM-XT	Ports 1-2 configurable RS-232/422/485, Ports 3-4 fixed RS-232
EMM-4M-XT	Ports 1-4 configurable RS-232/422/485
EMM-4232-XT	Ports 1-4 fixed RS-232

For cables and accessories, see pages 46-47.

SPECIFICATIONS

SERIAL PORTS	
No. of serial ports	4
Protocol	RS-232, RS-422, RS-485 (jumper selected) depending on model
Maximum baud rate	115kbps
Communications	5, 6, 7, or 8 data bits; parameters Even, odd, or no parity
Short circuit protection	All outputs protected against continuous short circuit
RS-232 MODE:	
Input impedance	3KΩ minimum
Input voltage swing	± 30V maximum
Output voltage swing	± 5V min, ±7V typical
RS-422, RS-485 MODES:	
Differential	-0.2V min, +0.2V max input threshold
Input impedance	12KΩ minimum
Input current	+1.0mA max (VIN = 12V) -0.8mA max (VIN = -7V)
Differential output voltage	2.0V min (RL = 50Ω)
High/low states differential output voltage symmetry	0.2V maximum
GENERAL	
I/O headers	Dual 20-pin headers; Two ports per header
Dimensions	3.55" x 3.775"
Power supply	+5VDC ±10%
Current consumption	80mA typical, all outputs unloaded
Operating temp.	-40 to +85°C Extended
PC/104 bus	8 bit and 16-bit bus headers are installed
Weight	2.5oz / 71g

EMERALD-MM BLOCK DIAGRAM



INPUT/OUTPUT HEADERS (2 PER BOARD)

RS-232 Mode

DCD 1	1	2		DSR 1
RXD 1	3	4		RTS 1
TXD 1	5	6		CTS 1
DTR 1	7	8		RI 1
GND	9	10		N/C
DCD 2	11	12		DSR 2
RXD 2	13	14		RTS 2
TXD 2	15	16		CTS 2
DTR 2	17	18		RI 2
GND	19	20		N/C

RS-422 Mode

N/C	1	2		N/C
TXD+1	3	4		TXD-1
GND	5	6		RXD-1
RXD+1	7	8		N/C
GND	9	10		N/C
N/C	11	12		N/C
TXD+2	13	14		TXD-1
GND	15	16		RXD-2
RXD+2	17	18		N/C
GND	19	20		N/C

RS-485 Mode

N/C	1	2		N/C
TX/RX+1	3	4		TX/RX-1
GND	5	6		N/C
N/C	7	8		N/C
GND	9	10		N/C
N/C	11	12		N/C
TX/RX+2	13	14		TX/RX-2
GND	15	16		N/C
N/C	17	18		N/C
GND	19	20		N/C

Both ports in each example are shown with the same serial protocol for simplicity, however each port's protocol may be independently selected.

EMERALD-MM-8

8 PORTS, RS-232/422/485 PROTOCOLS, 8 DIGITAL I/O

SPECIFICATIONS

SERIAL PORTS	
No. of serial ports	8
Protocols	RS-232, RS-422, RS-485 (jumper selected)
Maximum baud rate	460.8kbps
Communications parameters	5, 6, 7, or 8 data bits; Even, odd, or no parity
Short circuit protection	Continuous, all outputs
RS-232 MODE:	
Input impedance	3KΩ minimum
Input voltage swing	± 30V maximum
Output voltage swing	± 5V min, ±7V typical
RS-422, RS-485 MODES:	
Differential threshold	-0.2V min, +0.2V max input
Input impedance	12KΩ minimum
Input current	+1.0µA max (VIN = 12V) -0.8µA max (VIN = -7V)
Differential output voltage	2.0V min (R_L = 50Ω)
High/low states differential output voltage symmetry	0.2V maximum
DIGITAL I/O	
No. / Direction	8, individually programmable
Input voltage	Logic 0: -0.3V min, 0.8V max Logic 1: 2.0V min, 5.3V max
Output voltage	Logic 0: 0.0V min, 0.4V max Logic 1: 3.7V min, 5.0V max
Output current	0: 6mA max; 1: -4mA max
GENERAL	
I/O headers	Dual 40-pin headers, 4 ports per
Dimensions	3.55" x 3.775"
Power supply	+5VDC ±10% @ 80mA typical
Operating temp.	-40 to +85°C Extended
Weight	2.6oz / 74g

Emerald-MM-8 has 8 serial ports using two 16C654 UART chips. The 64-byte FIFOs on these UARTS support a higher baud rate of 460.8kbps. The board also features programmable I/O addresses and interrupt levels for maximum flexibility. Configuration data is stored in an on-board EEPROM and is reloaded automatically on power-up.

Emerald-MM-8 is available in a multi-protocol RS-232/422/485 model (EMM-8M-XT) as well as a low-cost fixed RS-232 model (EMM-4232-XT). On EMM-8M-XT, each port's protocol may be selected independently with jumpers.

In RS-232 mode, each port has the full set of 8 signals plus ground. Termination resistors of 120Ω are provided for RS-422/485 protocols and are jumper-selectable.

Interrupt levels may be shared among any or all serial ports and are supported with an on-board status register. 8 digital I/O lines are also included, with independently programmable direction for each line.

The board has two 40-pin I/O headers, with 4 serial ports and 4 DIO lines on each header. Use mating cable C-DB9M-4 (qty. 2). Emerald-MM-8 requires only +5V supply and operates over the industrial temperature range of -40 to +85°C.

ORDERING GUIDE

EMM-8M-XT 8 ports configurable RS-232/422/485
EMM-8232-XT 8 ports fixed RS-232

For cables and accessories, see pages 46-47.

- Industry-standard design compatible with any popular operating system
- 8 asynchronous serial ports
- Dual 16C654 UARTs with 64-byte FIFOs
- 460.8K max baud rate
- RS-232, RS-422, and RS-485 on one board
- Low-cost RS-232-only version available
- Jumper-selected protocols, independent for each port
- Programmable addresses and interrupts
- 8 programmable digital I/O lines
- Built-in interrupt sharing
- +5V-only supply
- -40 to +85°C operation

INPUT/OUTPUT HEADERS (2 PER BOARD)

RS-232 Configuration

	DCD 1	1	2	DSR 1		
	RXD 1	3	4	RTS 1		
PORT 1	TXD 1	5	6	CTS 1		
	DTR 1	7	8	RI 1		
	GND	9	10	DIO A		
	DCD 2	11	12	DSR 2		
	RXD 2	13	14	RTS 2		
PORT 2	TXD 2	15	16	CTS 2		
	DTR 2	17	18	RI 2		
	GND	19	20	DIO B		
	DCD 3	21	22	DSR 3		
	RXD 3	23	24	RTS 3		
PORT 3	TXD 3	25	26	CTS 3		
	DTR 3	27	28	RI 3		
	GND	29	30	DIO C		
	DCD 4	31	32	DSR 4		
	RXD 4	33	34	RTS 4		
PORT 4	TXD 4	35	36	CTS 4		
	DTR 4	37	38	RI 4		
	GND	39	40	DIO D		

RS-422 Configuration

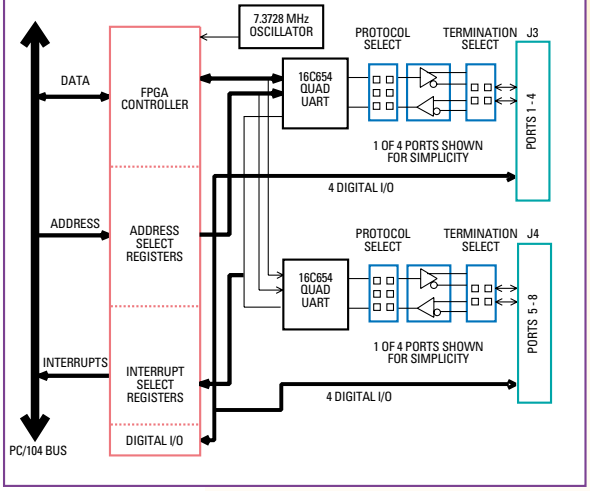
	NC	1	2	NC		
	TXD+1	3	4	TXD-1		
PORT 1	GND	5	6	GND		
	RXD+1	7	8	RXD-1		
	GND	9	10	DIO A		
	NC	11	12	NC		
	TXD+2	13	14	TXD-2		
PORT 2	GND	15	16	GND		
	RXD+2	17	18	RXD-2		
	GND	19	20	DIO B		
	NC	21	22	NC		
	TXD+3	23	24	TXD-3		
PORT 3	GND	25	26	GND		
	RXD+3	27	28	RXD-3		
	GND	29	30	DIO C		
	NC	31	32	NC		
	TXD+4	33	34	TXD-4		
PORT 4	GND	35	36	GND		
	RXD+4	37	38	RXD-4		
	GND	39	40	DIO D		

RS-485 Configuration

	NC	1	2	NC		
	TXD/RXD+1	3	4	TXD/RXD-1		
PORT 1	GND	5	6	NC		
	NC	7	8	NC		
	GND	9	10	DIO A		
	NC	11	12	NC		
	TXD/RXD+2	13	14	TXD/RXD-2		
PORT 2	GND	15	16	NC		
	NC	17	18	NC		
	GND	19	20	DIO B		
	NC	21	22	NC		
	TXD/RXD+3	23	24	TXD/RXD-3		
PORT 3	GND	25	26	NC		
	NC	27	28	NC		
	GND	29	30	DIO C		
	NC	31	32	NC		
	TXD/RXD+4	33	34	TXD/RXD-4		
PORT 4	GND	35	36	NC		
	NC	37	38	NC		
	GND	39	40	DIO D		

All ports shown in same protocol for simplicity. Each port may be independently configured.

EMERALD-MM-8 BLOCK DIAGRAM



EMERALD-MM-OPTO

OPTO-ISOLATED SERIAL PORTS + DIGITAL I/O

- 2 or 4 serial ports based on 16C2850 UART (1 or 2 UART chips)
- Opto-isolation for protection against spikes and ground differences
- RS-232, RS-422, and RS-485 protocols
- Auto-flow RS-485 control for compatibility and ease of use
- 460.8kbps max baud rate
- Line termination for reliable communications
- 128-byte FIFOs for reduced processor overhead
- 24 digital I/O lines using 82C55
- +5V only power supply
- Operating temperature -40 to +85°C

ORDERING GUIDE

EMM-OPT2-XT	2 opto-isolated RS-232/422/485 ports, 24 digital I/O
EMM-OPT4-XT	4 opto-isolated RS-232/422/485 ports, 24 digital I/O

For cables and accessories, see pages 46-47.

DIGITAL I/O HEADER

C7	1	2	C6
C5	3	4	C4
C3	5	6	C2
C1	7	8	C0
B7	9	10	B6
B5	11	12	B4
B3	13	14	B2
B1	15	16	B0
A7	17	18	A6
A5	19	20	A4
A3	21	22	A2
A1	23	24	A0
+5V	25	26	GND

The digital I/O is provided on a 26-pin pin header with the following pinout. Mating cable is C-26-18.

2 in 1 SERIAL PORTS + DIGITAL I/O

Emerald-MM-Opto provides 2 or 4 optically isolated serial ports with RS-232, RS-422, and RS-485 protocols, as well as 24 digital I/O lines, all on a single board. The optical isolation of 1000V DC or AC protects your embedded system from ground differentials or noise spikes on the serial ports that could damage non-isolated boards. Each port is isolated from the other ports as well as the system. An optional 3MΩ/ 220pF isolation bridge between port ground and system ground is available. Extended temperature capability (-40 to +85°C) enables the board to operate reliably in vehicles such as trains and buses.

In addition to ruggedness, Emerald-MM-Opto offers flexibility with the following advanced features:

- Independent protocol and IRQ configuration for each serial port.
- Eight different I/O address combinations with jumper selection
- 16C2850 UART chips with 128-byte FIFOs support high-speed data rates at up to 460kbps without overloading the system processor
- Auto-flow control enables easy RS-485 operation by automatically enabling and disabling the transmitter during data transmission, preventing bus conflicts and ensuring compatibility with standard serial port software.
- Multiple line termination options to support RS-422 or RS-485 networks, including 1KΩ pull-up / pull-down resistors and 150Ω end termination resistors.

The 24 digital I/O lines are based on an 82C55 chip and feature programmable direction in 4- and 8-bit groups. All I/O lines contain user-configurable 10KΩ pull-up resistors. This 2-in-1 combination of serial ports and digital I/O provides more functionality in less space.

Serial Port Connectors

Each serial port has its own 10-pin header. Mating cable C-DB9M-1 may be used for each port (qty 2 or 4 per board) to provide a standard male DB9 connector. In RS-232 mode, the pinout conforms to the PC standard for a 9-pin DTE (Data Terminal Equipment) serial port.

SPECIFICATIONS

SERIAL PORTS	
No. of serial ports	EMM-OPT2-XT: 2; EMM-OPT4-XT: 4
Protocol	RS-232, RS-422, RS-485; Jumper selected
Maximum baud rate	230.4kbps RS-232; 460.8kbps RS-422/RS485
Communications parameters	5, 6, 7, or 8 data bits; Even, odd, or no parity
Short circuit protection	All outputs protected against continuous short circuit
Isolation voltage	1000VDC or AC
Isolation coupling option	3MW in parallel with 220pF (consult factory for more details)
RS-232 MODE	
Input impedance	3KΩ min
Input voltage swing	±30V max
Output voltage swing	±5V min, ±7V typical
RS-422, RS-485 MODES	
Differential input threshold	-0.2V min, +0.2V max
Input impedance	12KW min
Input current	+1.0mA max (VIN = 12V) 0.8mA max (VIN = -7V)
Differential output voltage	2.0V min (RL = 50W)
High/low states differential output voltage symmetry	0.2V max
DIGITAL I/O	
No. of I/O lines	24, using 82C55 chip
Direction Ports A and B Port C	 Individually programmable for all input or all output Programmable in 4-bit groups for input or output
Input voltage	Low 0.5V min, 0.8V max High 2.0V min, 5.5V max
Output voltage	Low 0.0V min, 0.4V max High 3.0V min, Vcc - 0.4V max
Output current	±2.5mA max, each line
Pull-up resistors	10KΩ all lines, selectable with jumper
GENERAL	
Dimensions	3.55" x 3.775" (PC/104 standard)
Power supply	+5VDC ±10%
Current consumption	300mA / 1.5W typical, all outputs unloaded
Operating temp.	-40 to +85°C
Weight	3.0 oz / 85g

INPUT/OUTPUT HEADERS (2 OR 4 PER BOARD)

RS-232 Configuration

NC	1	2	NC
RXD	3	4	RTS
TXD	5	6	CTS
NC	7	8	NC
ISO GND	9	10	NC

RS-422 Configuration

RXD+	1	2	CTS-
RXD-	3	4	RTS+
TXD+	5	6	CTS+
TXD-	7	8	RTS-
ISO GND	9	10	NC

RS-485 Configuration

RXD+/RXD+	1	2	NC
TXD-/RXD-	3	4	NC
TXD+/RXD+	5	6	NC
TXD-/RXD-	7	8	NC
ISO GND	9	10	NC

In RS-485 mode, only one pair of signal wires is used, plus ground reference. Either pins 1 and 3 or pins 5 and 7 may be used.

EMERALD-MM-DIO

4 PORTS, RS-232, 48 DIGITAL I/O WITH EDGE DETECTION

SPECIFICATIONS

SERIAL PORTS	
No. of serial ports	4, RS-232
Maximum baud rate	115kbps
Communications parameters	5, 6, 7, or 8 data bits; Even, odd, or no parity
Short circuit protection	All outputs protected against continuous short circuit
Input impedance	3KΩ min
Input voltage swing	±30V max
Output voltage swing	±5V min, ±7V typical
DIGITAL I/O	
No. of lines	48, 5V logic compatible
Direction	Programmable bit by bit
Output current	0: 8mA max; 1: -0.3mA max
GENERAL	
I/O headers Serial ports Digital I/O	 Dual 20-pin headers Dual 50-pin headers
Dimensions	3.55" x 3.775"
Power supply	+5VDC ±5%
Current consumption	100mA typical, all outputs open
-40 to +85°C	Operating temp.
PC/104 bus	8 bit and 16-bit bus headers are installed (16-bit header used for interrupt levels only)
Weight	3.2oz. / 91g

ORDERING GUIDE

EMM-DIO-XT 4 RS-232 ports, 48 digital I/O

For cables and accessories, see pages 46-47.

DIGITAL I/O HEADERS

PORT 2 BIT 7	1	2	GND
PORT 2 BIT 6	3	4	GND
PORT 2 BIT 5	5	6	GND
PORT 2 BIT 4	7	8	GND
PORT 2 BIT 3	9	10	GND
PORT 2 BIT 2	11	12	GND
PORT 2 BIT 1	13	14	GND
PORT 2 BIT 0	15	16	GND
PORT 1 BIT 7	17	18	GND
PORT 1 BIT 6	19	20	GND
PORT 1 BIT 5	21	22	GND
PORT 1 BIT 4	23	24	GND
PORT 1 BIT 3	25	26	GND
PORT 1 BIT 2	27	28	GND
PORT 1 BIT 1	29	30	GND
PORT 1 BIT 0	31	32	GND
PORT 0 BIT 7	33	34	GND
PORT 0 BIT 6	35	36	GND
PORT 0 BIT 5	37	38	GND
PORT 0 BIT 4	39	40	GND
PORT 0 BIT 3	41	42	GND
PORT 0 BIT 2	43	44	GND
PORT 0 BIT 1	45	46	GND
PORT 0 BIT 0	47	48	GND
+5V	49	50	GND

SERIAL HEADERS

DCD 1	1	2	DSR 1
RXD 1	3	4	RTS 1
TXD 1	5	6	CTS 1
DTR 1	7	8	RI 1
GND	9	10	N/C
DCD 2	11	12	DSR 2
RXD 2	13	14	RTS 2
TXD 2	15	16	CTS 2
DTR 2	17	18	RI 2
GND	19	20	N/C

Emerald-MM-DIO contains two headers for serial ports and two headers for digital I/O with the pinouts shown here.

2 in 1 SERIAL PORTS + DIGITAL I/O

The two-in-one concept of Emerald-MM-DIO saves critical space for users with limited stack height in their enclosures. The 4 RS-232 ports feature a full set of 8 signals and are based on the 16C554 UART for compatibility with almost all embedded operating systems. Eight address combinations and eleven interrupt levels are provided for configuration flexibility.

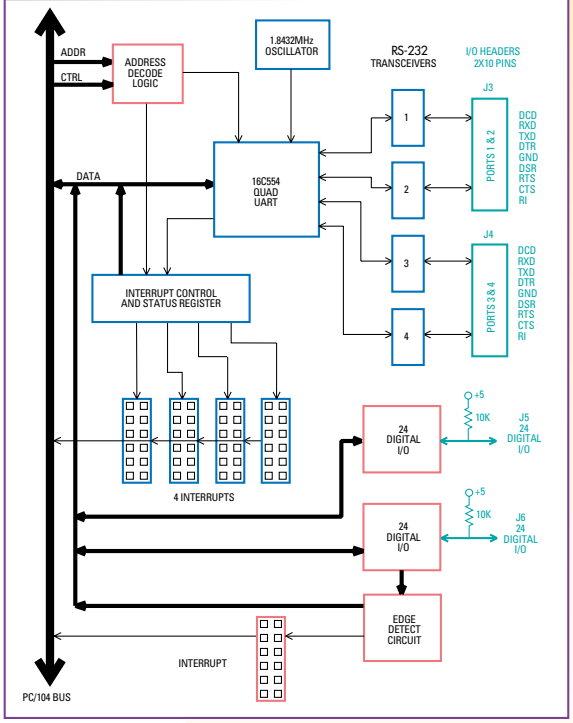
The 48 digital I/O lines are organized into 6 8-bit ports. Output current is 0.3mA in high state and 8mA in low state. Emerald-MM-DIO uses inverting logic on the DIO lines. Port direction is programmable bit by bit: When a 0 is written to any bit, its output is tri-stated and pulled high by a 10KΩ resistor, indicating a logic 1 and enabling it to also be used as an input. When a 1 is written to a bit, its output is driven low indicating a logic 0. Input data is also inverted, so readback of output ports matches the written data.

Emerald-MM-DIO features edge detection capability on 24 DIO lines. You can enable or disable edge detection and select high or low edge on each bit independently. When any specified edge occurs, an interrupt will be generated. Edge detection is fully supported by our Universal Driver software, letting you run your own custom code whenever a change of state occurs. This powerful feature can be used for security and safety applications, pattern matching, and more.

Mating cables are C-DB9M-2 (qty. 2) for the serial ports and C-50-18 (qty. 2) for the digital I/O.

- Two boards in one saves space
- Industry-standard design compatible with any popular operating system
- 4 RS-232 ports
- 16C554 UART with 16-byte FIFOs
- 115.2K max baud rate
- Jumper-selected address and interrupts
- Built-in interrupt sharing
- 48 digital I/O lines
- Edge detection on DIO with interrupt on change of state
- +5V power supply
- -40 to +85°C operation
- FREE Universal Driver software included

EMERALD-MM-DIO BLOCK DIAGRAM



PYXIS-MM

GPS RECEIVER AND MODEM CARRIER BOARD

- PC/104 carrier board for GPS receiver and landline modem module
- Compatible with:
  - Trimble Lassen SKII 8-ch. GPS receiver module
  - MultiTech SocketModem family of embedded modem modules
- Built-in TTL serial-to-PC/104 bus interface
- Built-in land-line telephone interface circuit
- -40 to +85°C operation

MODEM FEATURES

- 2400 baud to 56K baud data rates
- Worldwide approvals
- Bluetooth v1.2 available

GPS FEATURES

- TSIP, TAIP, and NMEA protocols
- Differential measurement capability
- Compatible with popular mapping software
- Backup battery connection to maintain GPS almanac

Model PXMM-GPS-XT with GPS receiver installed.

Pyxis-MM enables you to install a Trimble Navigation GPS receiver module and the SocketModem family of embeddable modem modules from MultiTech Systems onto a PC/104 system. Use it to provide location identification and communications features for vehicle-based embedded systems such as vehicle tracking, navigation, or precision farming. Or use it to communicate via land-line telephone connection to remote equipment such as weather stations or oil & gas wells.

You can install a GPS receiver module alone, any one SocketModem module alone, or a GPS receiver plus a modem module. Pyxis-MM includes all the necessary I/O circuitry to interface the selected modules onto the PC/104 bus, including serial ports, power supplies, and land-line telephone interface. A backup power connector is provided to maintain GPS almanac and minimize time to first fix. The board runs on +5V and operates over -40 to +85°C.

Model PXMM-XT is the carrier board alone. Add your own GPS and/or SocketModem modules.

Model PXMM-GPS-XT is the carrier board with Lassen SKII GPS receiver installed. A SocketModem can be added to the board.

Trimble Navigation Lassen SKII GPS Module

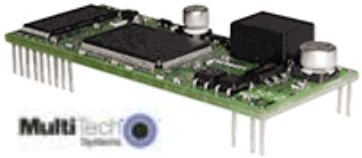
This is the same GPS receiver used in BMW's navigation system. It provides 8 channels of reception and features a quick 2 second reacquisition time. It communicates with the host CPU over either 1 or 2 RS-232 ports built onto the Pyxis-MM carrier board. The dual-channel interface enables differential GPS measurements with the input of a differential receiver signal.

The Lassen SKII supports industry-standard TSIP, TAIP, and NMEA protocols and is compatible with popular mapping and navigation software. Protocol and baud rate are user-programmable. Operating power is less than 0.5 watt, and operating temperature is -40 to +85°C. Applet software is provided for programming the module and viewing real-time GPS data. See **www.trimble.com** for more information.

ORDERING GUIDE

PXMM-GPS-XT	Pyxis-MM carrier board with GPS receiver installed
PXMM-XT	Pyxis-MM basic carrier board

For cables and accessories, see pages 46-47.



MultiTech SocketModem Modules

The SocketModems are a family of miniature modem modules, all with identical footprints, that provide landline modem and Bluetooth communications. Their universal socket interface lets you select the model just right for each application without any changes to hardware or software design. Each modem is a complete solution with built-in DAA (data access interface), controller, and memory. They are available in multiple versions to fit almost any application:

- Modems feature V.22bis (2400 baud) up to v.92 (56Kbaud) data rates
- Bluetooth wireless communications with 100 meter range
- Worldwide approvals
- 0 to +70°C and -40 to +85°C temperature ranges

All SocketModems use the standard AT command set. They include non-volatile RAM to store user settings and phone numbers, and low power consumption of 1.3W (typical). The modem installs onto the carrier board and locks in place with a snap-fit standoff. It utilizes a standard RS-232 circuit and RJ-11 telephone jack with telephone line interface built onto the Pyxis-MM carrier board.

Some MultiTech SocketModems modules compatible with Pyxis-MM are listed below (see **www.multitech.com** for complete details and ordering information):

MT5634SMI-92	V92 (56K) data/fax modem, commercial temp range, global approvals
MT5634SMI-ITP-92	V92 (56K) data/fax modem, industrial temp range, global approvals
MT5600SMI-34	V.34 (33.6K) data/fax modem, global approvals
MT5600SMI-32	V.32bis (14.4K) data/fax modem, global approvals
MT2456SMI-22	V.22bis (2400) data modem, global approvals
MTS2BTSMI	Bluetooth V1.2 interface with 100 meter range

CRYSTAL-MM-HP

SOUNDBLASTER AUDIO WITH BUILT-IN STEREO AMPLIFIER

SPECIFICATIONS	
Mono microphone input 100KW max	10mV to 125mV p-p 30KW min,
Stereo CD input	0V to 4V p-p 30KW min, 100KW max
Stereo line input	0V to 4V p-p 30KW min, 100KW max
Stereo line output	0V to 3.5V p-p 30KW typical
PC speaker input	TTL input from CPU
STEREO SPEAKER OUTPUT	
CMM-HP-5	0.5W per channel into 8Ω
CMM-HP-12	1.5W per channel into 8Ω
CMM-HP-EX	Up to 5W per channel into 8Ω (depends on input voltage)
POWER OPTIONS	
CMM-HP-12	+5VDC and +12VDC from PC/104 bus
CMM-HP-5	+5VDC from PC/104 bus
CMM-HP-EX	+5VDC from PC/104 bus 6-28VDC from external source
GENERAL	
Dimensions	3.550" x 3.775"
PC/104 Bus	16-bit configuration
Operating temp.	-20 to +70°C operating

MAIN I/O HEADER

SPEAKER L	1	2	AGND
SPEAKER R	3	4	AGND
CD L	5	6	CD R
MIC IN	7	8	AGND
LINE IN L	9	10	AUX L
LINE IN R	11	12	AUX R
LINE OUT L	13	14	AGND
LINE OUT R	15	16	AGND
DGND	17	18	MUTE
VOLUME UP	19	20	VOLUME DOWN

SPEAKERS

LEFT OUT	1	2	LEFT IN
AGND	3	4	RIGHT OUT
RIGHT IN	5	6	AGND
SPEAKER L	7	8	AGND
SPEAKER R	9	10	AGND

PC SPEAKER

PC SPKR OUT	1
MONO OUT	2
MONO IN	3
AGND	4
PS SPKR IN	5
DGND	6

3.5 MM JACK NO. 1*

SPKR OUT L/LINE OUT L	TIP
SPKR OUT R/LINE OUT R	RING
AGND	SHIELD

3.5 MM JACK NO. 2*

LINE IN L / MIC IN	TIP
LINE IN R / NC	RING
AGND	SHIELD

**The signal assignments on these jacks are jumper configured.*

The Crystal-MM-HP audio module offers full-duplex performance, plug and play capability, and multiple output power options. It is fully compatible with the SoundBlaster Pro™ and Windows Sound System™ standards.

Full-duplex capability enables the board to perform simultaneous recording and playback on separate channels. Sample rates of up to 44.1KHz are supported for both record and playback. An extensive selection of audio inputs and outputs on multiple I/O connectors make Crystal-MM-HP easily adaptable to any application's configuration. Both pin headers and stereo mini-jacks are provided to enable easy connections to custom wiring as well as industry-standard connectors.

Crystal-MM-HP includes a 6-channel mixer with stereo inputs for line, CD, auxiliary, and MIDI, and mono input for microphone. Outputs include speaker, line, and MIDI. An optional mono I/O channel can be provided with a semicustom configuration.

Plug and play configuration provides 4 DMA and 6 interrupt selections for increased flexibility and ease of installation. Additional features include a PC-compatible dual game port and connections for hardware volume and mute controls, so that volume can be controlled both in software and through front-panel controls. Software drivers for Windows 3.1, Windows 95, and Windows NT are included.

Crystal-MM-HP is available in several input/output power configurations. The standard +12-powered board provides 1.5W per channel into 8 ohms. A low-power +5V-supply version provides 0.5W per channel for +5V-only systems. A high-power version can output up to 5W per channel with external 24VDC input.

I/O Connections

Crystal-MM-HP includes multiple I/O connectors to handle the wide range of audio signals. Many signals are present on more than one header for increased flexibility in I/O connections. The two stereo mini-jacks are configurable with jumpers for input and output source. The speaker outputs are available on a mini-jack, a dedicated pin header with external volume control input, and a combination I/O main header. Only one speaker connection should be used at a time.

ORDERING GUIDE

CMM-HP-5	5V in, 0.5Wx2 output
CMM-HP-12	12V in, 1.5Wx2 output
CMM-HP-EX	12-28V in, 5Wx2 output

For cables and accessories, see pages 46-47.

CMM-HP-5

CMM-HP-12

CMM-HP-EX

- 16-bit stereo audio recording and playback
- SoundBlaster Pro and Windows Sound System compatibility
- 3 models to choose from
  - 5V in, 2x1/2W output
  - 12V in, 2x1.5W output
  - 28Vin, 2 x 5W output
- Stereo line in, CD in
- Mono mic in, PC speaker in
- Stereo line out, speaker out
- Hardware and software volume controls
- ESS Technology drivers included
- -20 to +70° operation

JUPITER-MM

50 WATTS, DUAL OR QUAD OUTPUTS, RUGGED DESIGN

- 50 watts output power
- Dual output version: +5V, +12V
- Quad output version: ±5V, ±12V
- 7-30VDC input range
- Shutdown control
- Current limiting and short-circuit protection
- ±3% load regulation
- Rugged SMT design
- Slim heat sink conforms to PC/104 mechanical limits
- -40 to +85°C operation

ORDERING GUIDE

JMM-512	50 Watts, +5V, +12V outputs
JMM-512-V512	50 Watts, ±5V, ±12V outputs

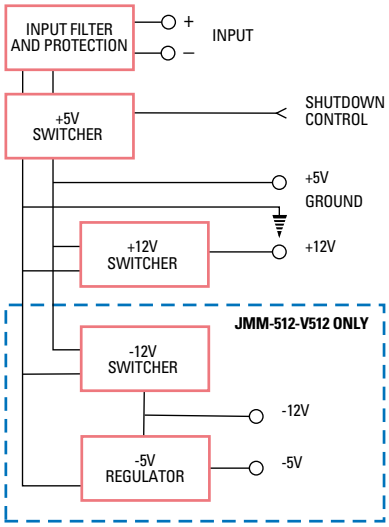
For cables and accessories, see pages 46-47.

Jupiter-MM provides competitively-priced, stable DC power for mobile PC/104 systems. The small magnetics and SMT components combined with slim heat sink design create a fully PC/104-compliant module that can be stacked above or below other boards. The dual-output JMM-512 has +5V and +12V outputs, while the quad-output JMM-512-V512 adds -5V and -12V outputs.

The input is protected against transients, and the outputs have built-in protection against short circuits. Power circuits are cascaded, allowing all power to be utilized on the +5V output (10A) or shared across multiple outputs. A shutdown control input is provided to enable remote shutdown of the supply.

Power I/O connections are through convenient detachable screw terminals. All output voltages are also routed to their respective PC/104 bus pins. Power output LEDs provide a convenient indication of power supply operation.

JUPITER-MM BLOCK DIAGRAM



The cascade configuration of the power conversion circuitry enables the full output power (5 or 10 Amps) to be supplied to the +5V line if needed. The +12 and -12 outputs derive from the +5 output, and the -5 line derives from the -12. The total power available on any output is the difference between that output's maximum rating and any power consumed by outputs further down the chain.

SPECIFICATIONS

INPUT	
Input voltage	7-30VDC
Transient protection	1500W transient voltage suppressor
Transient cutoff	31V nominal
OUTPUT	
Output voltage/current	See configuration table
Output protection	Current limit / short circuit protection
Output ripple	<50mV RMS (+5V output, 50% load)
Load regulation	±3%
Efficiency	80% to 92%, varies with load and input voltage
MECHANICAL/ENVIRONMENTAL	
Size	3.55" x 3.775"
PC/104 bus	J1 (64 pins) and J2 (40 pins) stackthrough connectors installed
Operating temperature	-40 to +85°C
Weight	5.0oz / 142g

OUTPUT POWER

JUPITER-MM-512	
+5V	10A
+12V	2A
JUPITER-MM-512-V512	
+5V	10A
+12V	2A
-5V	0.15A
-12V	0.8A

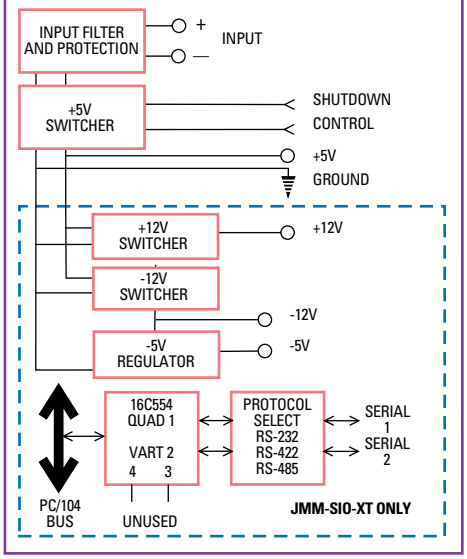
PC/104 BUS POWER PINS

Ground	A32, B1, B31, B32, C0, D0, D18, D19
+5V	B3, B29, D16
+12V	B9
-12V	B7
-5V	B5

JUPITER-MM-SIO & JUPITER-MM-LP

50 WATTS, QUAD OUTPUTS, 2 SERIAL PORTS

JUPITER-SIO-XT DIAGRAM



SPECIFICATIONS

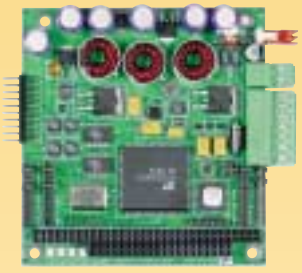
INPUT / OUTPUT POWER	
Input voltage	7-30VDC
Input transient protection	1500W transient (a two line feature) protection voltage suppressor
Transient cutoff	31V nominal
Output JMM-SIO	+5V @ 10A, +12V @ 2A, -5V @ 100mA, 12V @ 0.5A
JMM-LP	+5V @ 5A
Output protection	Current limit / short circuit protection
Output ripple	<50mV RMS (+5V output, 50% load)
Load regulation	±3%
Efficiency	80% to 92%, varies with load and input voltage
DUAL SERIAL PORTS (JMM-SIO-XT ONLY)	
Protocols	RS-232, RS-422, RS-485
Maximum baud rate	115kbps
RS-232 MODE:	
Input impedance	3KΩ min
Input voltage	± 30V max
Output voltage	± 5V min
RS-422, RS-485 MODES:	
Input threshold	±0.2V
Input impedance	12KΩ min
Output threshold	2.0V min
MECHANICAL/ENVIRONMENTAL	
Size	3.55" x 3.775"
PC/104 bus	J1 (64 pins) and J2 (40 pins) stackthrough connectors installed
Operating temp.	-40 to +85°C
Weight	JMM-SIO: 4.0oz / 113g JMM-LP: 2.5oz / 71g

2 in 1 POWER SUPPLY + SERIAL PORTS

Jupiter-MM-SIO provides the most compact, lightest weight DC/DC power source for mobile PC/104 applications. The advanced high-frequency (200KHz) design enables smaller magnetics and components, yielding a fully PC/104-compliant design that can be stacked above or below other boards. Jupiter-MM-SIO also features higher efficiency of up to 92%, eliminating the need for heat sink and reducing the weight of the board. The input is protected against transients, and the outputs have built-in protection against short circuits. Power circuits are cascaded, allowing all power to be utilized on the +5V output (10A) or shared across multiple outputs.

The board includes two full-featured serial ports for added value and further reduction in total system size. RS-232/422/485 protocols, I/O addresses, and IRQ levels are all jumper-selected. Select from 8 I/O address combinations and 10 IRQ levels. In RS-232 mode, each port has the full set of 8 signals plus ground. Termination resistors of 120Ω are provided for RS-422/485 protocols. Interrupt sharing is supported with a built-in interrupt status register.

The board has a 20-pin I/O header for the two serial ports that mates with our cable C-DB9M-2. Power I/O connections are through convenient detachable screw terminals. All output voltages are also routed to their respective PC/104 bus pins. Power output LEDs provide a convenient indication of power supply operation.



JUPITER-MM-SIO

- 50 watts output power
- ±5V, ±12V outputs
- 7-30VDC input range
- Shutdown control
- Current limiting and short-circuit output protection
- Rugged, lightweight design
- Lightweight – no heat sink required
- Integrated dual RS-232/422/485 serial ports
- -40 to +85°C operation

PC/104 BUS POWER PINS

Ground	A32, B1, B31, B32, C0, D0, D18, D19
+5V	B3, B29, D16
+12V	B9
-12V	B7
-5V	B5

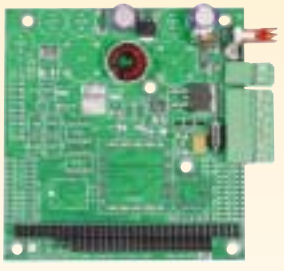
25 WATTS, +5VDC OUTPUT, LOW COST

For low cost, light weight, and reliable performance, select Jupiter-MM-LP. This depopulated version of our higher-power JMM-SIO-XT board provides the lightest weight PC/104 DC/DC power supply available anywhere. The 5 Amps of output current is enough to power an entire Pandora enclosure full of electronics, including our Prometheus CPU, two add-on boards, and a notebook hard disk drive. Power I/O is through convenient detachable screw terminals, and output power is also routed to the PC/104 bus. Shutdown control input and power status LED are included.

ORDERING GUIDE

JMM-SIO-XT	50 watts, ±5V, ±12V, 2 RS-232/422/485 ports
JMM-LP-XT	25 watts, +5V output

For cables and accessories, see pages 46-47.



JUPITER-MM-LP

- 25 watts output power: +5VDC @ 5A
- 7-30VDC input range
- Low-cost, lightweight unit
- -40 to +85°C operation

DC/DC POWER SUPPLIES

PC/104 DC/DC POWER SUPPLIES

FEATURES

- Designed for vehicle applications
- Multi-output DC power for PC/104 systems
- Wide-range input voltages
- Battery charger capability
- Power management feature
- Output power on PC/104 bus
- Auxiliary power out on screw terminals
- -40 to +85°C operation

HESC-104

- 60 watts output power
- ±5V, ±12V outputs
- Built-in smart charger and power management
- PC/104 bus power output
- Feature programming via PC/104 bus

HESC-SER

- 60 watts output power
- ±5V, ±12V outputs
- Built-in smart charger and power management
- Output power on screw terminals
- Feature programming via serial port

HE104-DX

- 60 watts output power
- ±5V, ±12V outputs
- PC/104 bus power output

HE104+DX

- 60 watts output power
- +3.3V, +5V, ±12V outputs
- PC/104 and PC/104-Plus bus power output

HE-HP

- 100 watts output power
- +5V, +12V outputs
- Output power on screw terminals

HE104

- 50 watts output power
- +5V, +12V outputs standard
- -5V, -12V outputs optional
- AC termination option

V104

- 25 watts output power
- +5V, +12V outputs standard
- -5V, -12V outputs optional
- AC termination option
- Low cost

These power supplies accept a DC input voltage from a vehicle power system, battery, or other power source and provide clean output power for PC/104 systems. Input power is provided on a detachable screw terminal block. Output power is provided directly on the PC/104 bus connectors and/or on a separate screw terminal block. LEDs provide indications of output power status, and load dump protection prevents potential damage to the embedded system.

The HESC104 and HESC-SER models provide four output voltages: ±5VDC and ±12VDC. They include built-in power management and smart battery charging features. They can be programmed to turn on and off at user-defined intervals, for example to take measurements or report data. This feature dramatically lowers total power consumption because the system is only powered on when needed. The battery chargers on these units can work with NiCd, NiMH, and sealed lead acid (SLA) batteries (see page 43). Software is provided to define battery charging curves as well as control shutdown timing. Configuration settings are stored in an on-board EEPROM.

The HE104-DX provides 60 watts of power on both the PC/104 bus and screw terminals. The HE014+DX adds 3.3V output on the PC/104+ PCI connector for PC104-Plus and PCI-104 CPUs.

The HE-HP provides 100 watts of output power for systems with heavy load requirements. Power input and output are accessed via screw terminals.

The HE104 offers +5V and +12V outputs, while the low-cost V104 provides single +5V or dual +5V/+12V output. These economically priced supplies are available with additional output voltages according to your application needs. See ordering guide on page 43 for model numbers.

SPECIFICATIONS

Model	HESC-104	HESC-SER	HE104-DX	HE104+DX	HE-HP	HE104	V104
POWER							
Input voltage	6-40VDC	6-40VDC	6-40VDC	6-40VDC	6-40VDC	6-40VDC	8-30VDC
Max output power	60W	60W	60W	60W	100W	50W	25W
Max +3.3V output				10A			
Max +5V output	12A	12A	12A	12A	20A	10A	5A
Max +12V output	2.5A	2.5A	2.5A	2.5A	2.5A	2A	1A (opt)
Max -5V output	0.4A	0.4A	0.4A			0.4A (opt)	0.4A (opt)
Max -12V output	0.5A	0.5A	0.5A	0.5A		0.5A (opt)	0.16A (opt)
Max efficiency	95%	95%	95%	95%	95%	95%	85%
Soft start	10ms on +5V output	10ms on +5V output					
MECHANICAL							
Size	3.550" x 3.775"	3.550" x 3.775"	3.550" x 3.775"	3.550" x 3.775"	3.550" x 3.775"	3.550" x 3.775"	3.550" x 3.775"
Weight	6.6oz / 186g	7.3oz / 207g	6.1oz / 173g	6.1oz / 173g	6.1oz / 173g	6.3oz / 178g	5.0oz / 142g
Operating temp.	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C	0 to 70°C
PC/104 connector	√		√	√		√	√
PC/104-*Plus* connector				√			
BATTERY CHARGER							
Max charge current	4.0A	4.0A					
Charge voltage	9.5-19.5V	10-35V					
Charger control	PC/104 bus	Serial port					

POWER SUPPLY ACCESSORIES

BACKUP BATTERIES AND AC TERMINATION

POWER SUPPLY ORDERING GUIDE

HESC-104	60W DC/DC PS, smart charger, power management, PC/104 bus
HESC-SER	60W DC/DC PS, smart charger, power management, serial interface
HE104-DX	60W DC/DC power supply, quad outputs, PC/104
HE104+DX	60W DC/DC power supply, quad outputs, PC/104-Plus
HE-HP	100W DC/DC power supply, discrete wire I/O
HE512	HE104 base unit with +5V/+12V outputs
VE5	V104 base unit with +5V output
VE512	V104 base unit with +5V/+12V outputs

For V104 and HE104 only, select additional options by adding these suffixes to the model number.

-V5	-5VDC output
-V12	-12VDC output
-V512	Both -5V and -12V outputs
-T	AC termination
Example:	HE512-V512-T = HE104 with +5/+12/-5/-12 outputs and AC termination

These rechargeable battery packs are provided in PC/104 form factor so they can be easily mounted inside a PC/104 enclosure or assembled together with a PC/104 computer. All models are compatible with the HESC-104 and HESC-SER DC/DC power supplies, which provide smart charging capability. The BAT104 and HESC products used together form a reliable uninterruptible power supply (UPS) for PC/104 embedded systems.

AC Termination

Vehicles exhibit high levels of electrical noise, EMI, power supply spikes, and other noise sources that can affect signal integrity on the CPU bus. The AC Termination feature can be installed on the HE104 and V104 power supplies to protect the PC/104 bus from errors induced by these types of noise. It consists of a series of termination networks soldered onto the bottom side of the power supply.

A small add-on module is also available to provide AC termination protection for systems not using the HE104 or V104. See page 46.

BAT104-NiCd, 4.2Ah

BAT104-NiMH, 14.7Ah

BATTERY SPECIFICATIONS AND MODEL NUMBERS

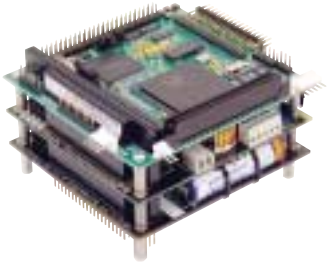
MODEL	BAT104-NICD	BAT104-NIMH	BAT104-SLA25	BAT104-SLA45
Technology	Nickel-Cadmium	Nickel Metal Hydride	Sealed Lead Acid	Sealed Lead Acid
Configuration	7 x AA	7 x AA	5 x D	5 x DD
Max output voltage	8.4V	8.4V	10V	10V
Capacity	4.2Ah	14.7Ah	12.5Ah	22.5Ah
Length x width	3.55" x 3.775"	3.55" x 3.775"	3.55" x 3.775"	3.55" x 3.775"
Height	0.59"	0.59"	2.80"	4.15"
Weight	7.8oz / 221g	7.8oz / 221g	40.8oz / 1155g	52.1oz / 1474g
Temperature range	-20 to +60°C	-10 to +65°C discharge, 0 to 45°C charge	-65 to +65°C	-65 to +65°C

BAT104-SLA25, 12.5Ah

BAT104-SLA45, 22.5Ah

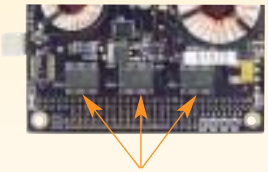
This PC/104 system with UPS…

- PR-Z32-EA-ST Prometheus CPU with data acquisition
- HESC-104 power supply with battery charger
- BAT104-NiMh backup battery



…fits into this compact Pandora enclosure!

- Dimensions 5.5" x 5.75" x 3.0"
- Quick, rugged assembly
- Only 2 small cables required! (power input to HESC-104, battery to HESC-104)
- -40 to +85 operation



AC Termination installed on HE104 power supply

PANDORA

- Smooth exterior with multiple mounting options
- Easy, rugged assembly
- Cable-free configuration with Prometheus CPU
- Available in lengths from 1.7" to 10"
- Now available in black and purple
- Wall-mount panel available

ORDERING GUIDE

Select length <L> and color <C> in part numbers below:

<L>:	170	1.7" / 43mm
	300	3.0" / 76mm
	500	50" / 127mm
	700	7.0" / 178mm
	1000	10.0" / 254mm
<C>:	(blank)	Purple
	K	Black
PB-<L>-<C>		Pandora enclosure
PB-Z32-<L>-E		Pandora enclosure for Prometheus, models PR-Z32-E-ST and PR-Z32-LC-ST (purple only)
PB-Z32-<L>-EA-<C>		Pandora enclosure for Prometheus PR-Z32-EA-ST and Athena
PNL-Z32-E		Panel I/O board for PR-Z32-E-ST and PR-Z32-LC-ST
PNL-Z32-EA		Panel I/O board for PR-Z32-EA-ST
PBEC-00-<C>		Blank end cap
PBEC-01-<C>		End cap with PC/104 top/front-mount holes
PBEC-02-<C>		End cap with PC/104 bottom/rear-mount holes
PBEC-03		Wall mount end cap
PBEC-04		End cap for PNL-Z32-E panel I/O board (purple only)
PBEC-05-<C>		End cap for PNL-Z32-EA panel I/O board
PBEC-06-K		End cap for PBMT-07 mounting plate (black only)
PBMT-07		Internal mounting plate for 7" enclosure

For cables and accessories, see pages 46-47.

Pandora provides a fast, light, rugged, and flexible enclosure solution for PC/104 systems. In the Pandora concept, one end cap comprises a base plate on which you construct your PC/104 stack and attach cables. Once your board and cable assembly is complete, you simply insert the system into the enclosure body and bolt it in place. Then attach your cables to the second end cap and bolt it into place. Pandora also includes plenty of space all around your boards for cable runs. This results in a solid, reliable, easy-to-use enclosure system and also enables quick disassembly if needed.

Pandora's design features smooth outer walls, integrated pre-tapped mounting screw holes, counter-sunk panel mounting holes, and flush-mount hardware to provide a clean, finished unit with simplified assembly effort and maximum interior space.

Pandora is available in two standard colors, black and purple. It comes in multiple sizes, from a slim 1.7" that houses one or two boards, up to a roomy 10" length that accommodates multiple boards plus a hard drive or other equipment.

1.7" / 43mm *3" / 76mm* *5" / 127mm* *7" / 178mm* *10" / 254mm*

Standard end caps are available, either blank or with pre-drilled PC/104 mounting holes. A convenient wall mount plate is also available with corner mounting tabs so you can mount the system to a wall or bulkhead. Custom end caps can be made as well using the template available on our website.

Each standard Pandora case comes with two blank end caps, one end cap with PC/104 mounting holes for bottom-up assembly (3 end caps total), and stainless steel mounting screws.

PBEC-00 blank end cap *PBEC-02 bottom/rear end cap* *PBEC-03 wall mount plate*

Pandora for Prometheus CPU

Pandora provides an especially rugged and convenient packaging solution for our Prometheus PC/104 CPU. The CPU mounts directly to a Panel I/O board that provides industry-standard connectors for all I/O features. This panel board then mounts directly to a specially-designed front plate. The resulting assembly requires no cables and can fit in our smallest enclosure, measuring only 1.7" thick. Two panel boards and matching end caps are available to match the two versions of Prometheus with and without the data acquisition circuit and connector.

This configuration will also work with other PC/104 CPUs, such as Athena, that provide connector compatibility with Prometheus.

Pandora for EPIC™

A base plate is available for mounting EPIC CPU boards inside a 7" Pandora enclosure. This base plate may also be used for PC/104 stacks mounted in a non-axial configuration. The base plate slides into interior grooves in the enclosure body and bolts to the two end caps for rigidity.

Hard Drive Mounting Board

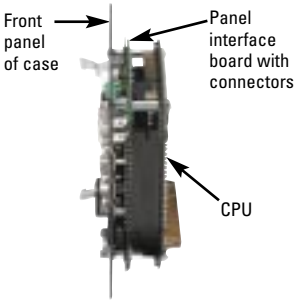
Install a notebook hard drive inside the Pandora easily with our ACC-HDDMOUNT accessory board. This board mounts a 2.5 notebook hard drive right on the bottom of the PC/104 stack in the air gap created by the PC/104 bus connector pins, without requiring any additional case length.

Panel I/O Board

Our unique Panel I/O Board system provides industry-standard I/O connectors for the I/O on our Athena and Prometheus CPUs, including CRT, Ethernet, USB, Serial, Parallel, PS/2, and data acquisition. Status LEDs and PC speaker are also included.

Two power input options are provided: a circular jack can be used with an AC wall adapter, and for rugged applications the multi-input DB-9 connector provides power input and ATX power control.

Panel I/O board for Athena and Prometheus CPUs



Assembly of Prometheus CPU

CAN-TAINER / VERSA-TAINER

The Can-Tainer and Versa-Tainer are rugged PC/104 enclosure systems constructed of .125" aluminum and designed for hostile and mobile environments. They feature a dual system of shock and vibration isolation: The PC/104 modules are mounted axially in the enclosure with four internal rubber corner rails to absorb high-frequency vibrations, while the entire enclosure is mounted on the host platform with a thick rubber pad which absorbs low-frequency G-forces. The rubber pad is optional and may be removed for hard mounting.

The Can-Tainer cross section measures 6.00" wide by 5.45" high (not including mounting pad) and is designed to mount PC/104 boards axially along the length of the enclosure body. The Versa-Tainer is a wider version that measures 7.1" wide by 5.7" high. The extra width accommodates EBX boards in addition to PC/104 boards, and it also provides additional room for cable runs along the sides. Both enclosures are available in multiple lengths. To calculate the height of your PC/104 stack, refer to the table on page 44. To compute the length of the enclosure you need, add 1-2 inches additional length for each end where cabling will be brought out to I/O connectors.

To mount boards or items such as hard drives that are larger than 3.550" x 3.775", use the optional CTn-VD00 mounting plates (n = 6, 8, 10, or 12). These install vertically into rails that run the length of both enclosures. For smaller items, an optional PC/104-size aluminum plate, CT-AL00, enables you to mount accessories directly onto the PC/104 stack. To mount an EBX format CPU, such as Hercules (see page 12), inside the Versa-Tainer, use the VT-EBX board, which mounts horizontally on the lower two corner guides. Additional PC/104 boards may then be installed on top of the EBX CPU.

An optional fan (CT-FAN) may be used to provide forced air cooling. To provide air flow through the enclosure, drill intake holes at the point where the fan is mounted and exhaust holes at one additional location (usually at one end cap). For a sealed environment with only conduction cooling, the fan may be mounted offset from the enclosure wall with spacers.

Each Can-Tainer and Versa-Tainer comes as a kit with end caps and mounting accessories. Additional blank and pre-designed end caps are available, or you may design your own cutouts using the blank end cap.

Kit Contents

Each Can-Tainer comes as a kit with the following accessories:

1 enclosure of selected length
1 solid end cap
1 end cap with 4 DB9 and 2 DB-25 cutouts, or 2nd solid end cap
2 endcap gaskets
16 endcap screws
4 internal rubber corner rails
8 internal rubber corner stops
1 tube adhesive for mounting corner stops
1 rubber anti-shock external mounting pad

Each Versa-Tainer comes as a kit with the following accessories:

1 enclosure of desired length
2 solid end caps
16 endcap screws
4 corner guides
8 rubber corner stops
1 tube CA glue
1 anti-shock external mounting pad

Additional end caps for both enclosures are available separately.

PC/104 STACK HEIGHT

# BOARDS	1ST BOARD IS NON-STACKTHROUGH		1ST BOARD IS STACKTHROUGH	
	inch	mm	inch	mm
1	0.60	15.2	0.92	23.4
2	1.26	32.1	1.58	40.2
3	1.92	48.9	2.24	57.0
4	2.59	65.7	2.91	73.8
5	3.25	82.5	3.57	90.6
6	3.91	99.3	4.23	107.4
7	4.57	116.1	4.89	124.3
8	5.23	132.9	5.55	141.1

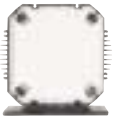
To compute the length of the Pandora, Can-Tainer, or Versa-Tainer enclosure you need, determine the height of your board stack from the table above, then add 1-2 inches more for each end where cables will be brought out to an end cap.


CT-EC00 blank end cap


CT-EC01 end cap


CT-FAN miniature, 12VDC fan


Versa-tainer cross section


Can-tainer cross section


CT-AL00 PC/104 size mounting plate


CT-6VD00 vertical mounting plate

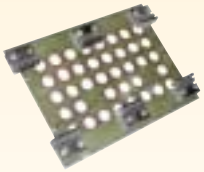
- Heavy duty .125" aluminum construction
- Shock and vibration protection system
- Available in lengths from 4" to 12"
- PC/104 and EBX mounting capability
- Multiple pre-formed end caps available

ORDERING GUIDE

Select length <L> in part numbers below:

<L>	4	4" / 102mm
	5	5" / 127mm
	6	6" / 152mm
	8	8" / 203mm
	10	10" / 254mm
	12	12" / 305mm
CT-<L>		Can-Tainer enclosure; specify length
VT-<L>		Versa-Tainer enclosure; specify length
VT-EBX		EBX mounting plate for Versa-Tainer 8" or longer
CT-FAN		12VDC fan; mounting hardware not included
VT-EC00		Versa-Tainer blank end cap
VT-EC02		Versa-Tainer end cap, 4x DB9 and 2x DB25
CT-EC00		Can-Tainer blank end cap
CT-EC01		Can-Tainer end cap, 4x DB9 and 2x DB25
CT-nVD00		Vertical mounting plate; n = 6, 8, 10, or 12
CT-AL00		PC/104 size aluminum mounting plate

For cables and accessories, see pages 46-47.


VT-EBX bottom view


Hercules CPU mounted on VT-EBX in Versa-Tainer

IDE Flashdisk Solid-State Storage

Install an IDE flashdisk module onto any of our CPU boards for rugged, lightweight, solid-state mass storage. The flashdisk module works just like an IDE drive and requires no drivers. It provides high-speed nonvolatile mass storage in capacities of 32MB up to 256MB. The flashdisk mounts on the IDE connector and is held in place with a spacer and screws (included). It includes a master/slave jumper and operates over -40/+85°C.


IDE Flashdisk

IDE Programming Board

Our ACC-IDEEXT accessory board lets you connect a flashdisk and an IDE drive (hard disk or CD-ROM), or two IDE drives, to your Diamond Systems CPU. You can also use it to load files from your desktop computer onto a flashdisk module. The ACC-IDEEXT board includes 40-pin and 44-pin mating connectors for compatibility with almost any computer and IDE device.


ACC-IDEEXT

Hercules Data Acquisition Demo Board

The ACC-HRCDAQ provides a convenient way to test the data acquisition circuitry on our Hercules CPU, to assist in software development or system checkout. (It is not compatible with Athena or Prometheus CPUs.) The board provides an assortment of analog signals that drive the analog inputs of the board in both single-ended and differential mode. The Hercules analog outputs are also routed back to analog input channels for measurement.


ACC-HRCDAQ

Digital I/O signals on port A are looped back to port B, and C high is connected to C low. Pin headers provide access to most analog I/O signals, along with counter/timer and PWM signals, so you can monitor these signals with an oscilloscope or voltmeter.

ACC-HRCDAQ is the size of a PC/104 board and can mount directly on top of Hercules or sit off to the side. It does not use the PC/104 bus connectors. Mating 40-pin and 50-pin ribbon cables are included. Note: This board is included in the DK-HRC-01 Hercules development kit.

PC/104 Spacers

These spacers are 0.6" long x 3/16" diameter x #4-40 thread, with one end male and one end female. Clear aluminum material. Spacers mate end to end to build a PC/104 board stack. Available in bulk form or in a mounting kit with 4 ea. spacers, screws, and nuts.


PC/104 Spacers

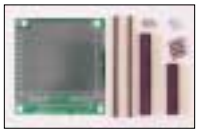
AC Bus Termination

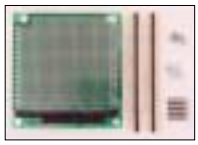
This accessory board mounts on the PC/104 stack and provides AC line termination to protect the bus signals from noise sources that can disrupt reliable operation. The built-in stackthrough bus connectors enable mounting on either the top or bottom of the stack.


AC-104-16

PC/104 Prototype Board

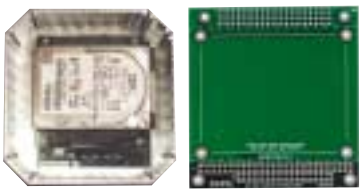
The Proto-104 board provides a blank PC/104 board with a 0.1" x 0.1" grid of holes for the installation of custom circuitry or components. It includes PC/104 mounting holes in the corners, so it can be mounted on the PC/104 stack. All PC/104 bus connector signals can be tapped with accessory holes for use by your circuitry. The board provides grids of +5V and ground on the top and bottom sides. Mounting hardware and I/O connectors are included. Available in kit form with PC/104 headers loose (PROTO-104-K) or with PC/104 connectors already installed for extra convenience (PROTO-104-A). Mounting hardware and pin headers are included.


PROTO-104-K


PROTO-104-A

PC/104 Hard Drive Mounting Board

ACC-HDDMOUNT provides a convenient way to mount a 2.5" notebook hard drive directly onto a PC/104 stack in either the top or bottom position. Holes on the board enable the PC/104 connectors to pass through unaffected, so the board can be installed at the bottom of the stack closer to the lower board. Mounting spacers and screws for both the hard drive and the board are included, along with a 44-pin ribbon cable.


ACC-HCCMOUNT

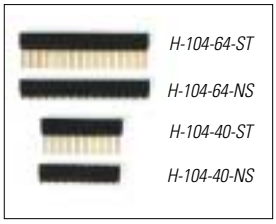
PC/104 Screw Terminal Board

This compact PC/104-size screw terminal board mounts directly on the PC/104 stack to maintain a neat, integrated assembly. A 50-pin header allows cable connection to most of our I/O boards. Unneeded pins can be cut away for use with smaller size cables. Each connector pin has its own elevator-style angled screw terminal that accepts wire sizes from 12-28AWG. Multiple boards can be stacked together without interference.


STB-104

PC/104 Headers

These PC/104 headers are available in both stack-through (long gold-plated pins) and non-stackthrough (standard PC-mount pins) versions, in both 64-pin (J1) and 40-pin (J2) sizes. Stackthrough parts require manual soldering. All parts have gold plating on all contact areas.



AC Adapters

The AC adapter provides a convenient way to power your embedded CPU during development or demos. it contains the proper connector for direct connection to the CPU board. Each order ships with the correct power cord for the country of destination.


AC Adaptor

CPU Cable Kits

A cable kit providing access to all I/O features is available for each CPU. It is strongly recommended for first time buyers in order to facilitate quick project startup. These cables convert the pin headers on the CPU board to industry-standard connectors, such as RJ-45 for Ethernet, Mini-DIN for PS/2, and DB-9 for serial ports, so you can make quick connections to your peripherals. Each CPU development kit also includes a cable kit. All cables are also available individually.

Athena Cable Kit

Hercules Cable Kit

Prometheus Cable Kit

ACCESSORIES ORDERING GUIDE

FD-xx-XT	Flashdisk, -40 to +85°C; select xx = 32, 64, 128, or 256 for MB capacity
ACC-IDEEXT	IDE flashdisk programming board with cables
ACC-HRCDAQ	Hercules data acquisition demo board with cables
SPC104	PC/104 spacer, English, single piece
MTG104	PC/104 mounting hardware kit
AC-104-16	AC termination board for PC/104 bus
PROTO-104-A	PC/104 prototype board, loose PC/104 headers
PROTO-104-K	PC/104 prototype board, assembled PC/104 headers
ACC-HDDMOUNT	IDE drive mounting board kit
STB-104	Screw terminal board, 50 positions
H-104-64-ST	PC/104 header, 64-pin stackthrough J1
H-104-64-NS	PC/104 header, 64-pin non-stack-through J1
H-104-40-ST	PC/104 header, 40-pin stackthrough J2
H-104-40-NS	PC/104 header, 40-pin non-stack-through J2
PS-5V-02	5VDC 4A adapter, Prometheus
PS-5V-03	5VDC 5A adapter, Athena
PS-12V-01	12VDC 4A adapter, Hercules

ATHENA CABLE KIT

QTY	PART NO.	DESCRIPTION
	C-ATH-KIT	Athena cable kit, includes 1 each of the following:
1	698032	USB cable, ports 2 & 3
2	698012	USB cable, ports 0 & 1
3	698009	Power input cable
4	698006	Power output cable
5	698011	External battery cable
6	C-PRZ-02	Ethernet cable, pin header to RJ-45
7	C-PRZ-01	Breakout cable: serial, parallel, PS/2, utility
8	698030	VGA cable, pin header to DB15
9	698031	Audio cable, pin header to 4x stereo jack
10	C-50-18	Data acquisition, 50 conductor .1" ribbon cable
11	698004	IDE 44-conductor 2mm ribbon cable

HERCULES CABLE KIT

QTY	PART NO.	DESCRIPTION
	C-HRC-KIT	Hercules cable kit, includes 1 each of the following except as noted:
1	C-PRZ-02	Ethernet cable, pin header to RJ-45
2	698022	Dual-port PS/2 cable
3	698025	Audio cable, pin header to 4x stereo jack
4	698017	TV output cable
5	698018	Speaker output cable
6	698024	VGA cable, pin header to DB15
7	C-20-18	20-conductor ribbon cable
8	C-40-18	Analog I/O, 40 conductor .1" ribbon cable
9	C-50-18	Digital I/O, 50 conductor .1" ribbon cable
10	C-DB9M-4	Serial port cable, pin header to 4x DB9
11	698026	UDMA IDE 40-conductor ribbon cable
12	698004	IDE 44-conductor 2mm ribbon cable
13	698015	Power input cable for 5-28VDC models
14	698016	Power input cable for 20-48VDC models
15	698011	External battery cable
16	698006	Output power cable
17	698012	Dual-port USB cable, qty 2 included
18	861002	Utility assembly: LEDs, reset/power switches

PROMETHEUS CABLE KIT

QTY	PART NO.	DESCRIPTION
	C-PRZ-KIT	Prometheus cable kit, includes 1 each of the following:
1	698012	Dual port USB cable
2	C-PRZ-01	Breakout cable: serial, parallel, PS/2, utility
3	C-50-18	Data acquisition, 50 conductor .1" ribbon cable
4	698008	Floppy drive cable
5	698004	IDE 44-conductor 2mm ribbon cable
6	C-PRZ-02	Ethernet cable, pin header to RJ-45
7	698005	Auxiliary serial port cable
8	698006	Auxiliary power output cable
9	698009	Power input cable for Prometheus

WHAT CABLES DO I NEED?

Use the list below to select the cables for each PC/104 I/O board in this catalog. Boards not listed use discrete wiring.

DIAMOND-MM-48-AT
1 C-40-18
1 C-34-18

DIAMOND-MM-32-AT
1 C-50-18
1 C-34-18

DIAMOND-MM-16-AT
1 C-50-18

DIAMOND-MM-AT
1 C-50-18

DIAMOND-MM
1 C-50-18

EMERALD-MM
2 C-DB9M-2

EMERALD-MM-8
2 C-DB9M-4

EMERALD-MM-DIO
2 C-DB9M-2
2 C-50-18

EMERALD-MM-OPTO
1 C-26-18
4 C-DB9M-1

RUBY-MM-4, -8
1 C-50-18

RUBY-MM-1612
1 C-50-18

RUBY-MM-416
1 C-50-18

GARNET-MM-24
1 C-50-18

GARNET-MM-48
2 C-50-18

IR104
1 C-40-18
Uses discrete wiring for relays

JUPITER-MM-SIO
1 C-DB9M-2
Uses discrete wiring for power

MERCURY
2 C-PRZ-02 or standard CAT-5
1 C-26-18

ONYX-MM-DIO
2 C-50-18

ONYX-MM
1 C-50-18
1 C-14-18

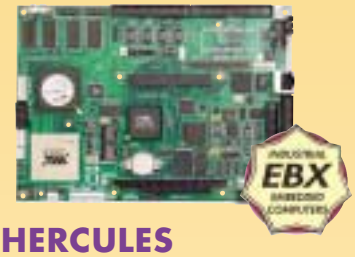
OPAL-MM
1 C-40-18

PEARL-MM-S
Uses discrete wiring

PEARL-MM-P
1 C-50-18

QUARTZ-MM
1 C-50-18

DIAMOND SYSTEMS EMBEDDED CPUS



HERCULES

EBX FORMAT EMBEDDED CPU

- 550-750MHz VIA Eden Processor
- PC/104-Plus expansion
- Integrated DC/DC power supply for vehicle applications
- Integrated autocalibrating data acquisition for measurement and control
- 4x RS-232, 4x USB 1.1, 1x 10/100 Ethernet
- Integrated LCD/CRD and AC97 audio
- -40 to +85°C operation
- Runs VxWorks, QNX, Linux, Windows XP/CE

ATHENA

PC/104-EXPANDABLE CPU

- 400-660MHz VIA Eden Processor
- PC/104 expansion
- Integrated data acquisition
- 4x RS-232, 4x USB 1.1, 1x 10/100 Ethernet
- Integrated LCD/CRD and AC97 audio
- -40 to +85°C operation
- Runs VxWorks, QNX, Linux, Windows XP/CE

PROMETHEUS

PC/104 CPU

- 100MHz ZFx86 Processor
- PC/104 expansion
- Integrated data acquisition
- 4x RS-232, 2x USB 1.1, 1x 10/100 Ethernet
- -40 to +85°C operation
- Runs VxWorks, QNX, Linux, DOS

ABOUT PC/104

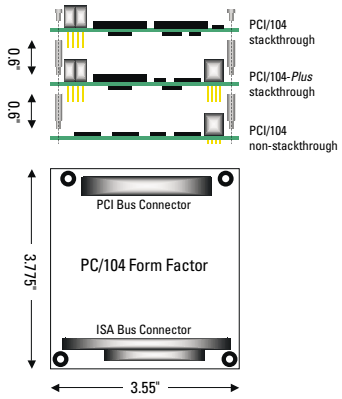
PC/104 is an embedded systems specification that defines a miniature form factor for PC-compatible embedded computers. The use of PC technology means that board designers can take advantage of the large supply of high-performance processors and chips, while embedded system developers can take advantage of the huge base of operating systems and software development tools.

FEATURES	BENEFITS
Industry-standard PC technology	Wide selection of processors and chipsets Wide selection of operating systems and development tools
Compact size – 3.55" x 3.75" (90 x 96mm)	Reduced size and weight to enable use in a wider range of applications
Rugged mechanical design – pin and socket connectors, no backplane	Can survive harsh environments including military and vehicle applications
Open standard – 100 vendors worldwide	Large selection of compatible hardware to enable easy design of custom-tailored system

Each PC/104 board measures 3.55" x 3.775", and boards are stacked with 0.6" clearance between them. The ISA and PCI buses are implemented with "stackthrough" connectors, containing sockets on the top side and pins on the bottom side. A "non-stackthrough" board eliminates the bottom side pins for further reduction in size. This stacking bus connector system eliminates the need for a backplane and dramatically increases the ruggedness of the assembly. The result is a compact, lightweight, rugged, and reliable embedded system that can fit in tight spaces. With approximately 100 vendors worldwide offering PC/104 CPU and I/O boards, PC/104 has become an important embedded standard for military/aerospace, industrial, process control, transportation, medical, and scientific applications.

Three different standards are currently in existence. PC/104 boards have only the ISA bus connector, PCI-104 boards have only the PCI connector, and PC/104-Plus boards have both the ISA bus and PCI-bus connectors. In addition to these PC-104 form factor (PC/104-compliant) boards, many embedded CPU vendors offer PC/104-expandable boards which may be larger in size but offer PC/104 bus expansion connectors. Examples are EBX, Epic, and Biscuit. These CPUs add to the popularity of PC/104 and provide a convenient means of customizing and expanding the base CPU board.

The diagrams here show the mechanical format of a PC/104 board and illustrate how boards fit together into a stack. This stack can be mounted on a baseplate inside an enclosure, with cables bringing out the I/O from the board edges to the enclosure end panels.

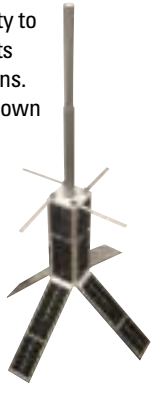


Tough Enough for Use in Space!

Diamond Systems' PC/104 boards have been successfully used in a variety of space applications, demonstrating their ability to survive the most extreme environments and satisfy the most critical applications.

The QuakeSat miniature satellite shown here used our Prometheus CPU to do research on earthquake detection theories from a 600-mile orbit.

Our Diamond-MM A/D boards have been used on several space shuttle flights, including STS-95 with John Glenn.



Visit our website www.diamondsystems.com for full details on all our products!

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