Realtime Systems and Options Catalog

1988 January-March

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Realtime

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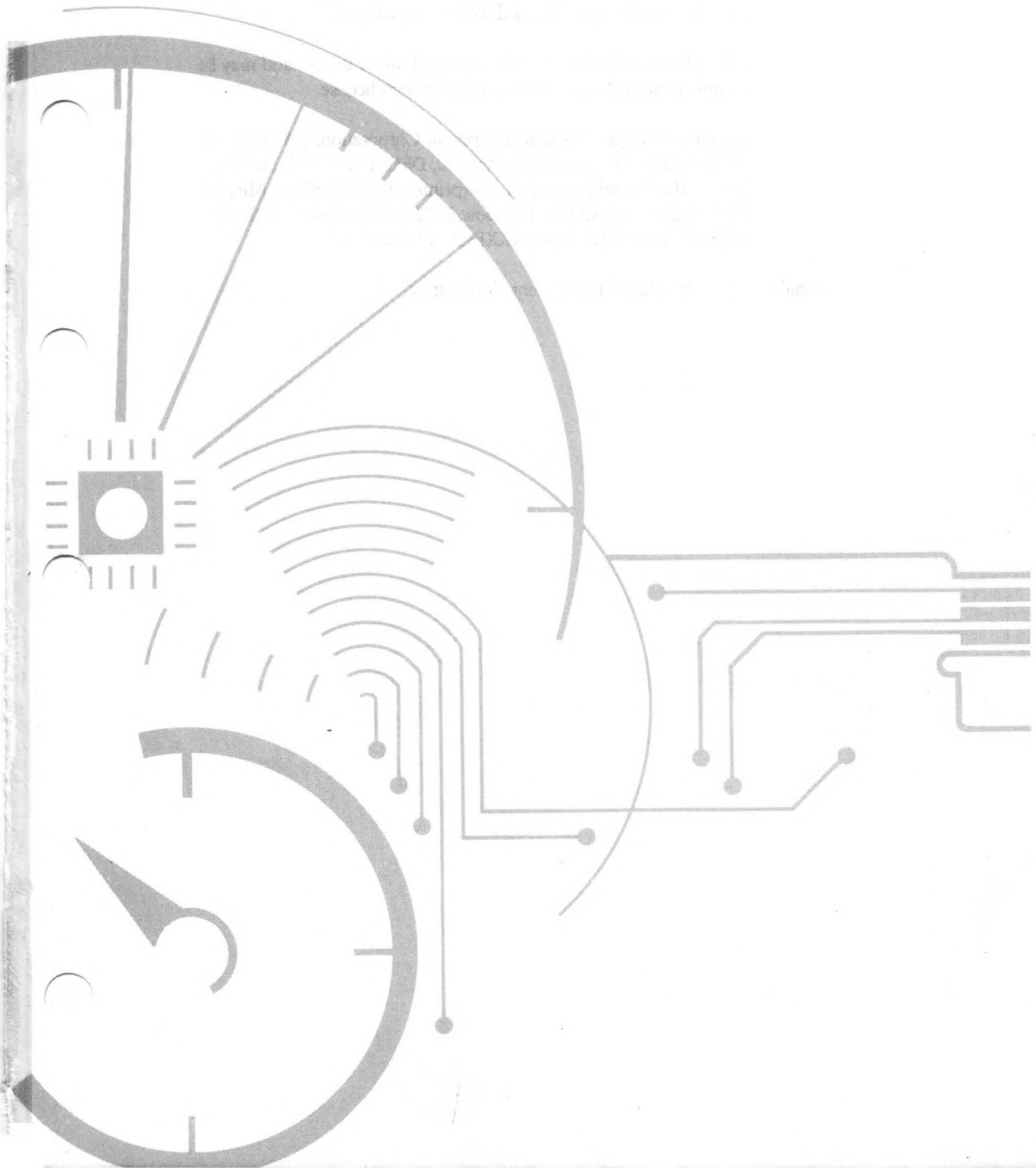

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Chapter Four: Services and Publications

Preface

The *Realtime Systems and Options Catalog* is published biannually as a reference document for use by Digital's customers, sales personnel, and headquarters personnel. It is intended to be a comprehensive collection of the most current descriptive, ordering, and configuring information available on products which Digital offers for use in realtime applications. The *Realtime Systems and Options Catalog* discusses only announced, actively marketed products and services that are available for ordering during a given biannual period.

Please fill out and mail the Reader Comment Card at the back of the book. Corporate Communications Group welcomes your comments and suggestions.

Introduction

Introduction

Since the introduction of the PDP-1 in 1960, Digital has been committed to providing realtime solutions for use in a wide array of applications. This tradition continues today in the form of VAX and PDP-11 systems, software, and networking tools which allow straightforward means of developing your realtime applications, networking them into an overall computing solution for your organization, and migrating them to higher performance/functionality equipment and options as your needs require.

Our realtime products are designed to both satisfy the demanding requirements of many factory, laboratory, and simulation activities (as examples), and to perform either as standalone computing solutions or as integral parts of corporate-wide, distributed networks. Figure 1 illustrates examples of how some of the products described in this document can work in conjunction with more general purpose computing elements to build an overall organizational solution.

The purpose of this catalog is to consolidate in one reference document those products which Digital offers that are suitable in, and in many cases designed specifically for, realtime applications. In some cases, information on these products can be found in other SOCs and documentation. Where reference to these other sources is useful, these other sources are listed in the section containing the specific product.

Realtime Characteristics and Requirements

A realtime computing application involves time-critical operations synchronized to external events or processes. The major characteristics of a realtime system may be stated as:

(1) Machine-to-machine interaction: Computers interacting with other computers, experiments, tests, tools, simulators, or other computers.

(2) Predictability of response to external events: Implies time-criticality, not necessarily high performance.

(3) "Catastrophic" consequences if (2) is not satisfied: Loss of data, shutdown of manufacturing line, etc.

Performance in realtime applications can be further characterized by throughput (the number of operations performed per unit of time) and response time (the interval required for the system to respond to an external event). Optimizing throughput or response time can be quite complex, particularly when very high performance is required relative to system capabilities. Selecting a system of peripherals with adequate realtime features can drastically simplify application development. This book is designed to help you make these selections. Factors influencing realtime performance may be broken down further as follows.

System Bus Structure and Bandwidth

Most computers have a system bus servicing the CPU and main memory. In smaller computers this is typically the only bus and supports all I/O operations; more powerful systems provide separate I/O buses that can be configured to channel I/O operations rather than connecting external devices directly to the system bus.

The system bus determines maximum aggregate throughput for the computer and has a rated or estimated total bandwidth. If your application's throughput requirements exceed the system's bandwidth, then obviously you cannot perform the application. Even if the rated system bandwidth is in excess of your application requirements, *not* all of this bandwidth is available for I/O to realtime devices; part will be used to service system operations (e.g., context switching, paging) and non-realtime devices. You must therefore evaluate these loads on the system as well as realtime loads to determine if the system has adequate bandwidth. Even if the system is to be totally dedicated to realtime operations, only 50–75% of the rated bandwidth can be achieved in practice, unless you have specific knowledge or experience to the contrary.

Once you have selected a system with adequate bandwidth, use I/O buses when necessary to optimize data flows into or out of the system. In general, adding I/O buses to the system should be considered once the devices on the system bus generate I/O equal to approximately 50% of the rated aggregate bandwidth. This is accomplished by adding bus adaptors.

When do you need another I/O bus? Once the devices on the bus generate I/O equal to approximately 50% of the rated bandwidth, adding another bus adaptor is likely to increase overall performance or simplify the work required to reach a given level of performance.

On smaller systems, the same basic loading rules apply, but no I/O buses are typically available; you connect devices directly to the system bus. If your planned realtime operations approach 50% of the rated bandwidth of the system, consider purchasing a higher performance system. In the long run, it will probably be less expensive than trying to achieve the same level of performance in a smaller system through special programming or I/O options.

CPU Design and Speed

CPU design and speed are critical if your application involves program-controlled I/O or realtime processing. In program-controlled I/O the CPU moves every word of data into or out of memory; you can poll the device (i.e., check the status of a bit or bits) to determine when each word is ready to be moved into or out of memory or, if the processor design allows vectored interrupts, you can use them to let the processor know when each word is ready for input or output. The speed of the processor and its interrupt-handling logic determine (along with the software factors discussed below) how fast data can be moved in this fashion. If your application can use Direct Memory Access (DMA), then CPU speed is much less critical for I/O operations since the CPU typically is involved only during arbitration for the bus by the DMA device. During data transfers, the DMA controller actually moves blocks of data while the CPU is free to perform other tasks.

If your application requires processing of incoming data in realtime, then CPU performance is likely to be the factor constraining overall throughput. Simple processing operations (limit testing, summation, etc.) can be accomplished quickly. If you must perform a series of operations, then processing time is likely to be much longer than I/O time. A higher speed CPU, possibly coupled with a special purpose accelerator (floating point, array processor, etc.) may be required.

To determine processing throughput, you can either calculate the total time taken by a CPU to perform the specific operations, or you can run a benchmark and measure the elapsed time empirically. The former approach is practical only if your processing operation is very simple. For example, if you are polling a device to acquire data, you might limit your program to checking the status bit, moving the word, checking for a termination condition, incrementing a counter, and looping back to the status check. In such circumstances you can actually add the instruction execution times of the few instructions required to estimate the cycle time per word of I/O. For more complex programs or programs written in a high level language, benchmarks are usually necessary.

An additional consideration for applications for which MicroVAX products are well suited is the availability of CPUs using rtVAX microprocessor chip. These processors, which are available as boards as well as in system configurations, serve as VAXELN target engines only (see section on VAXELN in this book for further information), and are optimized for realtime performance. These may also represent a cost savings where a VMS processing environment is not required.

Operating System Characteristics

Operating system characteristics play a major role in determining realtime performance. By providing high level services such as multiple task scheduling, software priority levels, and I/O request management, the operating system can make inherently complex realtime tasks simple to program. These features and services involve operations that may not be necessary for your application (e.g., exception handling, error checking, allocation and verification of system resources). Because "overhead" services are not needed, you may want to bypass them in the interests of optimized performance.

The four aspects of operating system design that affect realtime programming most significantly are: task scheduling, I/O programming services, intertask communication and synchronization, and user controls for optimizing performance.

Task Scheduling

The number of users and tasks an operating system is required to handle concurrently plays a major role in determining the responsiveness and, in some cases, the throughput of the system. Single-user, single-task operating systems can be extremely small and simple and require very little overhead. Digital's RT-11 operating system is a premier example of a small, simple, and efficient operating system.

If your application involves multiple events or processes occurring in parallel, you will need a multitasking operating system to avoid complex systems programming. The operating system should allow you to set relative priorities among the tasks to determine when they will execute, rather than offering only the round-robin scheduling associated with multiuser timesharing systems. Without priority scheduling, your most time-critical tasks can fail to execute when they are needed. The system must also be able to respond to external events based on their priorities.

Multitasking operating systems inevitably impose more "overhead" on a single task, even if it is given the highest available priority. The system scheduler takes some resources to execute that could be available to the application if no scheduling were required. In general, program-controlled I/O operations always execute faster under a single-task operating system than a multitasking one. When multiple tasks are contending for the system, context-switching and related operations slow both throughput and response times in a multitasking system. Compensating for this overhead is the capability to efficiently handle many tasks and/or users concurrently.

While priority-driven multitasking systems can handle both realtime device interactions and interactions with multiple human users concurrently under appropriate circumstances, the potential conflicts should be recognized and anticipated. If, periodically, there is a direct trade-off between time-critical device interactions and time-flexible user interactions, the human users must wait. This may cause disappointment or frustration, but the time-critical operation can be successfully completed. The only real alternative is to use separate systems for the two types of interaction, which tends to be more expensive and, in many situations, more cumbersome.

I/O Programming Services

The I/O programming services provided by an operating system determine how easily and efficiently I/O operations can be requested and executed. There is no single "right" approach, but several levels of programming and several modes of I/O operation that meet differing application needs.

The primary modes of I/O required in different circumstances are synchronous and asynchronous with respect to the calling task. In synchronous I/O, the program requests an I/O operation and then waits for that operation to complete before it continues. This is appropriate if the program requires the results of the operation to proceed. Otherwise it involves substantial inefficiencies since the I/O operation typically does not fully utilize system resources. In asynchronous I/O, the program requests an I/O operation and then continues to execute while the I/O operation is performed in parallel. This makes better use of the system resources by supporting more than one concurrent task. It also greatly facilitates vital operations such as realtime graphics or data processing by allowing the CPU to work on data as they are acquired rather than after the I/O operation is over. All Digital's realtime operating systems support both modes of I/O, even RT-11 in its Single Job Monitor, a single-task environment.

I/O programming level here refers to the degree of generality and simplicity involved in requesting an operation. The top level is generally a device-independent service providing access to system resources from high-level languages and data base managers. Such services are often file or record oriented rather than byte oriented. They use some standard formats to manage data. These services are easiest to use since they manage many aspects of data access and modification transparently, but they also incur the most overhead for users who do not need all the features they provide. All Digital operating systems have one or more file managers. The Record Management Service (RMS) package is also available for compatible I/O programming across the Professional Series, PDP-11s, and VAX systems.

At the next lower level is the I/O request manager that actually posts requests for I/O operations to device drivers and signals completion when the operation finishes. Higher level services, both file managers and other layered user interfaces such as subroutine libraries, typically make use of this request manager to perform their work as well. Several different services may be offered, depending on the modes of I/O supported. This level can include many pre-coded operations to simplify the user's job (e.g., error checking, exception handling, and verification of requested resources). Such operations prevent user mistakes from hanging or crashing the system. They also create latency periods after a request is issued from a user task until I/O actually starts, and thus can be viewed as imposing overhead on the I/O operation.

The Queue I/O Request system service handles this function under VMS, RSX-11, and P/OS on Digital systems. RT-11 has its own request manager. Using these services directly is a bit more difficult than working with RMS or a high-level subroutine calling interface, but it can be done from most high-level languages and does not involve detailed knowledge of the system or the I/O device.

The next level down is the actual device driver or handler itself. Many realtime devices are highly specialized and may not have device drivers available. Many users also prefer to write their own device drivers to optimize performance by omitting unessential operations that a general-purpose driver should have (sophisticated error handling routines and multiple termination condition checking are good examples). Specialized drivers can thus reduce overhead in the actual I/O operation itself, but still involve the I/O request service just described.

All of Digital's realtime operating systems allow users to write and install their own device drivers. All of the documentation sets include explicit instructions for designing and building such programs. This usually involves programming in assembly language (although not in VAXELN or MicroPower/Pascal), and thus requires user knowledge of the CPU instruction set as well as the I/O device's detailed design.

The lowest level of I/O programming service is direct access to the device itself. The user sets and clears bits in the device's CSRs and moves data into or out of memory as required by the device design. This level involves the minimum amount of operating system overhead because the user is controlling all aspects of the I/O operation and need not incur delays from unwanted activities. Depending on how the approach is implemented and what operating system is employed, some overhead can still be present so that you may have varying degrees of difficulty in accessing device registers and preventing unwanted operations.

Intertask Synchronization and Communication

Tasks that are executing concurrently must be able to communicate or synchronize with each other to provide maximum benefit. A processing or graphics task, for example, must be able to recognize when data is ready in an input buffer; a disk writing task must recognize when the processing task is complete and results are ready to be stored, and so on. There are four general methods of intertask communication: asynchronous system traps, event flags, message systems, and shared memory/disk areas.

Asynchronous system traps (ASTs) respond to an external event that generates an interrupt by halting the executing task and executing a user-written service routine. They provide high-speed response to external events.

Event flags can be used to signal asynchronous as well as synchronous events. Tasks can set event flags and can wait for flags to be set before they proceed. Some operating systems also allow tasks to recognize events involving a combination of flags such as logical ANDs or ORs. Event flags are handled with standard operating system services and have slower response times than ASTs.

Message systems can be managed by the operating system or the user. In VMS, for example, mailboxes provide a message service managed by the system. In RSX and RT-11, messages from one task to another are supported but must be managed to a greater extent by the user.

Shared memory or files allow tasks to receive information from a common database in memory or on disk. They can be read only as in RSX, or read/write as in VMS. Access typically requires synchronization using event flags, lock management, or other tools.

User Controls

Optimizing realtime performance on any computer system is ultimately a matter of user control over system resources. No operating system will meet all user needs completely; performance monitoring and system tuning are often essential.

All of Digital's realtime operating systems provide complete control over system resources. You can select high-level services that are useful in certain areas and eliminate services in other areas that impose overhead. For example, VMS does not have to be a virtual operating system; you can lock tasks into memory and eliminate paging altogether, or lock some tasks in memory while allowing others to swap. This gives you the benefits of virtual addressing while eliminating most of the potential overhead.

Often such control will involve your decision to program the application or the system at a low level. This is a fundamental trade-off; the only way to eliminate overhead may be to do without a service. The ability to bypass services is not always provided, and many so-called realtime operating systems do not provide the services at the outset.

Digital's realtime operating systems give you a wide range of choices in the services available and also let you bypass those you don't need.

I/O Controller Speed and Features

Once you have selected a system with buses and CPU adequate for your needs, the specific features of that I/O controller will have the greatest impact on realtime performance. There are four key aspects of controller design that should be considered: DMA vs. program control, types of I/O supported, special functions, and buffer memory.

DMA vs. Program Control

I/O controllers with DMA capabilities can provide an order of magnitude increase in throughput over program controlled devices, as well as off-loading the CPU for other operations. Maximum data rates under program control usually range from one to 20 kHz depending on CPU speed, operating system, and application characteristics. With DMA, the same CPU and operating system can support data rates up to 500 kHz or more.

DMA operations can offer such performance enhancements only if the application involves transfers of relatively large blocks of data either into or out of the system. For applications that involve only one or two words per transfer or require mixed inputs and outputs of a few words per operation, DMA offers little or no advantage over program-controlled I/O. Moreover, the hardware to support DMA can be expensive and may not be required for your application.

Types of I/O Supported

The type of I/O operation supported by a peripheral can determine its maximum performance regardless of the system on which it is used. For example, very high resolution or wide dynamic range analog-to-digital conversion cannot be performed at the same speed as lower resolution conversion without paying a significant premium for such performance. The ADV11-DA can acquire analog signals as fast as 50 kHz with 12 bits of resolution. If your application requires an inherently lower speed form of I/O, then you can probably perform it with a lower cost system and I/O controller than a higher speed application.

Some I/O controllers support multiple types of devices concurrently. An example is the AXV11-C (analog inputs and outputs). You must be careful to investigate in such cases whether the controllers support all types of operations concurrently, and what impact concurrent operations will have on aggregate throughput. The throughput, when performing multiple types of I/O, is nearly always lower than when performing a single type of I/O because of software overhead.

The individual I/O ports of a controller or peripheral device will usually have speed or throughput specifications that reflect hardware limitations. These specifications do not reflect sofware constraints and may not be achieved easily, if at all. For example, specifications for the ADV11-C analog-to-digital converter indicate a maximum conversion rate of 25 kHz. Since it is a program-controlled device, achievable data rates without special assembly language programming are in the one to five kHz range. You cannot assume that the maximum hardware speeds are applicable unless the device specifications explicitly account for sofware factors.

Special Functions

Your application may require some combination of I/O and processing functions that are best performed by a specialized device with appropriate hardware including a microprocessor. Such applications can usually be performed by general purpose hardware and the system CPU, but at much lower speeds. For example, the DRE11 supports alternate buffering of input data to sustain high-speed digital inputs without losing data during software buffer management operations that would be required with the DR11-W.

Buffer Memory

Buffer memory in the I/O interface is a special function with very wide applicability to high performance realtime tasks. Such memory, usually in the form of First-In First-Out (FIFO) buffers, often makes the crucial difference in sustaining high-speed input operations. The FIFO is used temporarily to capture and store incoming data while the system bus or CPU is unavailable to service the operation. Without buffering, it is often impossible to sustain maximum data rates for more than short bursts.

How This Book Is Designed

This book is divided into several chapters, each chapter describing products or services of a particular type, as shown below:

Chapter 1: realtime CPU Products
Chapter 2: realtime Options
Chapter 3: realtime Software
Chapter 4: Services and Publications

An overall description of the contents and organization is provided at the beginning of each chapter.

Our goal is to simplify the selection process for our realtime products. It is our hope that you find the time you use it productive.

Chapter 1
Realtime
CPU Products

CPU Products

Chapter One: Realtime CPU Products/Introduction

Introduction

This chapter contains information on a variety of CPU products which are useful in Realtime applications. These products, which include both VAX and PDP-11 processors, span a wide performance range and choice of capabilities and options. Major sections are described below.

Systems CPUs

These are CPUs offered by Digital which are sold with a system box, backplane, and power supply, in configurations as outlined for the respective products. Many of these systems (the ones at the front of this section) are designed specifically for Realtime use, and include VAXELN target CPUs. The rest are described in less detail, and are examples of our general purpose systems which can also be used in Realtime situations (additional information can be obtained from the *VAX* and *PDP Systems and Options Catalogs*).

Board Level CPUs

These are processors sold as boards, to be configured into a Realtime solution by the customer either by using the product as a standalone processor or as part of a customer designed system. Also included are options which complement their functionality.

Chip Level CPUs

Included here are those CPUs sold by Digital as chips for integration into a customer's Realtime solution. Related options are also described.

VAX Computer Systems

Digital's VAX family of computer systems presents the broadest array of compatible systems available today. With 32-bit architecture and bus structures for high throughput, virtual memory operating systems, and 4 billion bytes of potential addressing space, VAX systems offer mainframe computing power in a multiuser, multiprogramming environment.

All VAX systems share the VAX architecture, a collection of attributes common to all family members, attributes that guarantee that all software runs without change on every VAX system. Each processor in the family uses slightly different implementation of the architecture to achieve a range of function and performance.

The VAX family includes two operating systems particularly well suited to realtime applications: **VMS** and **VAXELN**.

The **VMS** operating system provides a reliable, high performance environment, virtual memory management, event-driven priority scheduling, shared memory, file, and interprocess communication.

The **VAXELN** operating software offers a means to develop high performance software specifically for target systems. The kernel of the execute-only software that runs in a dedicated realtime environment, VAXELN runs on VAX/VMS computers.

As a VMS layered product running on the host development system, the VAXELN Toolkit gives software engineers access to development tools such as VMS compilers, symbolic debuggers, a downline loader, menu-driven system-building utilities, and transparent local area networking with Digital's DECnet support. The VAXELN Toolkit itself includes an optimized EPascal compiler, extensions of the C and optional ADA® runtime libraries, and FORTRAN runtime routines.

Realtime

On a dedicated realtime system, the low-overhead VAXELN environment optimizes the hardware and software for the highest performance and predictability. A VAXELN solution is memory-resident and can be configured to run with no disks. The rtVAX 1000 Realtime Computing Platform, a member of Digital's 32-bit VAX family of computer systems dedicated to realtime applications, uses the KA620 Realtime SBC and the extended Q-bus with VAXELN as the target operating environment.

Engineered to perform a wide range of realtime applications including Engineering, Laboratory, Manufacturing, Science, Communications, and Government, the rtVAX 1000 Realtime Computing Platform provides VAX software compatibility and can share resources with Digital's larger VAX systems in a networked environment.

rtVAX 1000

The rtVAX 1000 offers MicroVAX-II performance, Q-bus flexibility with the VAXELN operating environment, and is available in diskless and disk-based configurations. Application development on a VMS host using the VAXELN Toolkit is simple, highly efficient, and can be downline loaded over the network into the target system.

Packaged in the BA23, 8-slot, Q-22 system box, the rtVAX 1000 also comes in an office enclosure that fits under a table, into a corner, or on top of a desk. A rackmounting package and a 40-inch high cabinet are also packaging options.

Regardless of the package, each rtVAX 1000 Realtime Computing Platform has a rear I/O distribution panel that provides simple plug-in connectors for terminals, network interfaces, and many VAXELN-supported options.

Hardware

The rtVAX 1000 contains a single quad-height KA620 Single Board Computer, which includes the Realtime MicroVAX 32-bit central processor chip (with modified memory management). Also included are a floating point coprocessor chip, 1Mbyte of on-board memory, Q22-bus interface, Q22 map for DMA transfers, interval timer, boot and diagnostic facility, console serial line unit and time-of-year clock with optional battery backup support.

The rtVAX 1000 uses CD backplane interconnect and a 50-pin connector to communicate with up to two high-speed, tightly coupled memory expansion modules, each of which can contain 2, 4, or 8Mbytes of local memory.

rtVAX 1000 Realtime Computing Platform Standard Features

- KA620 Realtime Single Board Computer
- VAXELN operating environment
- Single precision (F), double precision (D), or (G) floating point datatypes on the floating point chip
- 8-slot (BA23) extended Q-bus backplane
- 8Kbyte I/O space
- Extended block mode transfer support
- 10 millisecond interval timer
- Console serial line
- 64Kbyte boot and diagnostic ROM
- VAX ASCII console and TTY emulation
- Microverify self-test diagnostics
- Mass storage control protocol
- Time-of-Year clock
- External baud rate selection
- Single 230 watt (BA23) or dual 230 watt (H9642) power supply
- I/O distribution panel with inserts for expansion

rtVAX 1000 Realtime Computing Platform Option Features

- 2-, 4-, or 8Mbyte parity MOS memory increments
- 20Mbyte half-height fixed disk subsystem
- 1.2Mbyte half-height single drive dual sided diskette subsystem
- Disk controller for both fixed and diskette drives
- Ethernet Q-bus interface
- Variety of VAXELN-supported realtime options

Software

VAXELN, a fully modular software system, lets programmers build dedicated, real-time applications on VMS development systems. The VAXELN Toolkit uses Pascal and C languages and is layered on the VMS operating system as a development tool. After development, VAXELN applications run stand-alone on rtVAX 1000 via the kernel executive and can be downline loaded from any VMS networked host.

Configuring Information

The I/O distribution panel on the BA23 package supports four 2-by-3 inch size B inserts, plus two 1-by-4 inch size A inserts. The I/O distribution panel on the H9642 cabinet supports eleven 2-by-3 inch size B inserts, plus six 1-by-4 inch size A inserts. By removing the post shown in the BA23 package, two size B inserts can be configured as three A size inserts. One size B insert is reserved for the CPU console terminal in both enclosures.

Available power and backplane slots are the limiting factors in configuring rtVAX 1000. As with other Q-bus systems, memory cards should immediately follow the CPU, followed by option cards in descending priority.

Note: When adding power loads, substract power for disk drive configurations from the total.

System CPUs/rtVAX 1000

If your configuration includes a networked interface module, place it in the slot following the last memory module. A VAXELN rtVAX 1000 target supports a maximum of one DEQNA module.

All rtVAX 1000 configurations require a minimum of 2Mbytes of memory and a VAXELN runtime license. The System Building Block menus currently reflect this requirement.

Specifications

Enclosure	Pedestal	Rackmount	Cabinet
Height	64.2 cm (25.3 in)	13.3 cm (5.2 in)	106.8 cm (41.7 in)
Width	25.4 cm (10 in)	48.3 cm (19 in)	64.6 cm (25.4 in)
Depth	72.6 cm (28.6 in)	64.3 cm (25.3 in)	91.4 cm (36.0 in)
Power Consumption	345W	345W	1400W

Receptacle required: NEMA 1.5-30R (120 Vac/60 Hz)

Configuration Rules

See configuration rules for MicroVAX II BA23.

Configuration Template

See configuration template for MicroVAX II BA23.

rtVAX 1000 Base Target Platform

Note: Selection from Steps 1 through 6 is mandatory for a functioning system.

Step 1 Hardware Systems
(Choose one. -A2 Model Recommended for U.S.)

-A2 Base Hardware System in Pedestal/Table Enclosure

Check	Quantity	Part Number	Description
☐	1	620QY-A2	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, asynchronous console serial line, BCC08-10 serial line cable, BA23-A in a pedestal/table enclosure and US 120V power cord. Does not include diagnostics, license, or user documentation.

-A3 Base Hardware System in Pedestal/Table Enclosure

Check	Quantity	Part Number	Description
☐	1	620QY-A3	Same as 620QY-A2 except 240V and no power cord (see Step 2 to order separately).

-A2 Base Hardware Rackmount System

Check	Quantity	Part Number	Description
☑	1	620QY-A2	Same as 620QY-A2 except BA23-A in a rackmount enclosure.

-A3 Base Hardware Rackmount System

Check	Quantity	Part Number	Description
☐	1	620QZ-A3	Same as 620QY-A2 except BA23-A in a rackmount enclosure, 240V and no power cord (see Step 2 to order separately).

Step 2 Power Cords
Models (Choose One. Mandatory for -A3 Models Only.)

Check	Quantity	Part Number	Description
☐	1	BN02A-2E	UK/Ireland 240V @5A
☐	1	BN03A-2E	Central Europe* 220V @6A
☐	1	BN04A-2E	Switzerland 220V @6A
☐	1	BN05A-2E	Australia/New Zealand 240/230V @6A
☐	1	BN06A-2E	Denmark 240V @6A
☐	1	BN07A-2E	Italy 220V @6A
☐	1	BN18K-1K	Japan 200V @6A
☐	1	BN18L-2E	Israel 230V @6A
☑	1	BN18J-1K	U.S. 208-240V @6A

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Documentation

Hardware Documentation (Mandatory on order.)

Check	Quantity	Part Number	Description
☑	1	ZNARA-GZ	English-language HW documentation

Step 4 Licenses

VAXELN Runtime License (Mandatory on order.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory

Modules (One additional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☑	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Step 6 Mass Storage Devices

(Choose only one combination.)

Mass Storage Combination With Diskette Drive

Check	Quantity	Part Number	Description
☐	1	RX33A-AA	1.2 MB diskette drive
☐	1	RQDX3-AA	RD/RX controller

Mass Storage Combination With Fixed Disk Drive

Check	Quantity	Part Number	Description
☑	1	RD53A-AA	71 MB fixed disk drive
☐	1	RX50A-AA	800 KB diskette drive
☑	1	RQDX3-AA	RD/RX controller

Note: Selection from Step 7 is optional for a functioning system.

Step 7 Networking

DEQNA-M Networking Option (Choose a maximum of one DEQNA.)

Check	Quantity	Part Number	Description
☐	1	DEQNA-M	Ethernet communications controller
☐	1	CK-DEQNA-KB	Cabinet kit

DESTA-AA Networking Option

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet-to-Thin Ethernet transceiver cable adapter
☐	1	BNE3D-05	Ethernet transceiver cable
☐	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H400	Ethernet transceiver
☐	—	BNE3D-20	Ethernet transceiver cable

rtVAX 1000 Networked Pedestal Target Platform

Note: Selection from Steps 1 through 5 is mandatory for a functional and maintainable system. The DH-620Q1-AA/A3 VAXELN Ethernet Target Platform is suitable only for use as a client node in a Local Area VAX network. The system does not include a load device (either a floppy disk or tape); instead, the Ethernet plus the VAX/VMS Host serves this purpose for loading the target VAXELN application. The DH-620Q1-AA/A3 is not operational stand-alone without a floppy disk.

Step 1 Packaged Hardware and Software

(Choose one. -AA Model Recommended for U.S.)

Note: Base Hardware System includes 1 serial line for a console terminal and a BCC08-10 serial-line cable.

-AA Hardware and Software Package in Pedestal/Tabletop Enclosure

Check	Quantity	Part Number	Description
☐	1	DH-620Q1-AA	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, DEQNA, BA23-A in a pedestal/tabletop enclosure, U.S. 120V power cord, end English-language hardware documentation, User Diagnostics, and a VAXELN Runtime License, 120V.

-A3 Hardware and Software Package in Pedestal/Tabletop Enclosure

Check	Quantity	Part Number	Description
☐	1	DH-620Q1-A3	Same as DH-620Q1 except 240V, no power cord, documentation, or licenses (see Steps 2 through 5 to order separately).

Step 2 Power Cords

Models (Choose One. Mandatory for -A3 Models Only.)

Check	Quantity	Part Number	Description
☐	1	BN02A-2E	UK/Ireland 240V @5A
☐	1	BN03A-2E	Central Europe* 220V @6A
☐	1	BN04A-2E	Switzerland 220V @6A
☐	1	BN05A-2E	Australia/New Zealand 240/230V @6A
☐	1	BN06A-2E	Denmark 240V @6A
☐	1	BN07A-2E	Italy 220V @6A
☐	1	BN18K-1K	Japan 200V @6A
☐	1	BN18L-2E	Israel 230V @6A
☐	1	BN18J-1K	U.S. 208-240V @6A

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Hardware Kits

Hardware Documentation (Mandatory for -A3 Models only.)

Check	Quantity	Part Number	Description
☐	1	ZNARA-GZ	English-language HW documentation (mandatory for -A3 models)
☐	1	ZNA02-C	Diagnostics/Networked English-Language HW documentation

*VAX Host media selection -AA/A3 models (CS=TK50, CM=1600 bpi, CH=RL 02)

Step 4 Licenses

VAXELN Runtime License (Mandatory for -A3 orders.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory

Modules (One additional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☐	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Note: Selection from Step 6 or 7 is optional for a functioning system.

Step 6 Mass Storage Devices

Mass Storage Combination With Fixed Disk and Diskette Drives

Check	Quantity	Part Number	Description
☐	1	RD31A-AA	20 MB fixed disk drive
☐	1	RX33A-AA	1.2 MB diskette drive
☐	1	RQDX3-AA	RD/RX controller

Step 7 Networking

(Required for all Thin Ethernet implementations.) DESTA-AA Networking Option

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet to Thin Ethernet tranceiver cable adapter
☐	1	BNE3D-05	Ethernet transceiver cable
☐	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H4000	Ethernet transceiver
☐	—	BNE3D-20	Ethernet transceiver cable

rtVAX 1000 Networked Rackmount Target Platform

Note: Selection from Steps 1 through 5 is mandatory for a functional and maintainable system. The DH-620Q2-AA/A3 VAXELN Ethernet Target Platform is suitable only for use as a client node in a Local Area VAX network. The system does not include a load device (either a floppy disk or tape); instead, the Ethernet plus the VAX/VMS Host serves this purpose for loading the target VAXELN application. The DH-620Q2-AA/A3 is not operational stand-alone without a floppy disk.

Step 1 Packaged Hardware and Software

(Choose one, -AA Model Recommended for U.S.)

Note: Base Hardware System includes 1 serial line for a console terminal and a BCC08-10 serial-line cable.

-AA Hardware and Software Rackmount Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q2-AA	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, DEQNA, BA23-A in a rackmount enclosure, U.S. 120V power cord, end English-language hardware documentation, User Diagnostics, and a VAXELN Runtime License, 120V.

-A3 Hardware and Software Rackmount Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q2-A3	Same as DH-620Q2 except 240V, no power cord, documentation, or licenses (see Steps 2 through 5 to order separately).

Step 2 Power Cords

Models (Choose One. Mandatory for -A3 Models Only.)

Check	Quantity	Part Number	Description
☐	1	BN02A-2E	UK/Ireland 240V @5A
☐	1	BN03A-2E	Central Europe* 220V @6A
☐	1	BN04A-2E	Switzerland 220V @6A
☐	1	BN05A-2E	Australia/New Zealand 240/230V @6A
☐	1	BN06A-2E	Denmark 240V @6A
☐	1	BN07A-2E	Italy 220V @6A
☐	1	BN18K-1K	Japan 200V @6A
☐	1	BN18L-2E	Israel 230V @6A
☐	1	BN18J-1K	U.S. 208-240V @6A

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Hardware Kits
(Mandatory for -A3 Models only.)
Hardware Documentation

Check	Quantity	Part Number	Description
☐	1	ZNARA-GZ	English-language HW documentation (mandatory for -A3 models)
☐	1	ZNA02-C	Diagnostics/Networked English-Language HW documentation

*VAX Host media selection -AA/A3 models (CS=TK50, CM=1600 bpi, CH=RL 02)

Step 4 Licenses
VAXELN Runtime License
(Mandatory for -A3 orders.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory
Modules (One additional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☐	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Note: Selection from Step 6 or 7 is optional for a functioning system.

Step 6 Mass Storage Devices
Fixed Disk Drive and Diskette Drive Combination

Check	Quantity	Part Number	Description
☐	1	RD31A-AA	20 MB fixed disk drive
☐	1	RX33A-AA	1.2 MB diskette drive
☐	1	RQDX3-AA	RD/RX controller

Step 7 Networking
(Required for all Thin Ethernet implementations.)
DESTA-AA Networking Option

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet to Thin Ethernet tranceiver cable adapter
☐	1	BNE3D-05	Ethernet transceiver cable
☐	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H4000	Ethernet transceiver
☐	—	BNE3D-20	Ethernet transceiver cable

rtVAX 1000 Single-User 20 MB Pedestal Target Platform

Note: Selection from Steps 1 through 5 is mandatory for a functioning system.

Step 1 Packaged Hardware and Software

(Choose one, -CA Model Recommended for U.S.)

Note: Base Hardware System includes 1 serial line for a console terminal and a BCC08-10 serial-line cable.

-CA Hardware and Software Package in Pedestal/Tabletop Enclosure

Check	Quantity	Part Number	Description
☐	1	DH-620Q1-CA	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, RD31 20 MB disk drive, RX33 1.2 MB diskette drive, BA23-A in a pedestal/tabletop enclosure, U.S. 120V power cord, English-language hardware documentation, User Diagnostics, and a VAXELN Runtime License, 120V.

-C3 Hardware and Software Package in Pedestal/Tabletop Enclosure

Check	Quantity	Part Number	Description
☐	1	DH-620Q1-C3	Same as DH-620Q1-CA except 240V, no power cord, documentation, or licenses (see Steps 2 through 4 to order separately).

Step 2 Power Cords

Models (Mandatory for -C3 Models.)

Check	Quantity	Part Number	Description
☐	1	BN02A-2E	UK/Ireland 240V @5A
☐	1	BN03A-2E	Central Europe* 220V @6A
☐	1	BN04A-2E	Switzerland 220V @6A
☐	1	BN05A-2E	Australia/New Zealand 240/230V @6A
☐	1	BN06A-2E	Denmark 240V @6A
☐	1	BN07A-2E	Italy 220V @6A
☐	1	BN18K-1K	Japan 200V @6A
☐	1	BN18L-2E	Israel 230V @6A
☐	1	BN18J-1K	U.S. 208-240V @6A

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Hardware Kits

(Mandatory for -C3 Models only.)

Hardware Documentation

Check	Quantity	Part Number	Description
☐	1	ZNARA-C3	English-language HW documentation with diagnostics on RX50 media

Step 4 Licenses

VAXELN Runtime License (Mandatory for -C3 models.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory

Modules (One additional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☐	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Note: Selection from Step 6 is optional for a functioning system.

Step 6 Networking

(Required for all Thin Ethernet implementations.)

DEQNA-M Networking Option (Maximum of one DEQNA)

Check	Quantity	Part Number	Description
☐	1	DEQNA-M	Ethernet communications controller
	1	CK-DEQNA-KB	Cabinet kit

DESTA-AA Networking Option (Required for all Thin Ethernet implementations.)

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet-to-Thin Ethernet tranceiver cable adapter
☐	1	BNE3D-05	Ethernet transceiver cable
☐	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H4000	Ethernet transceiver
☐	1	BNE3D-20	Ethernet transceiver cable

rtVAX 1000 Single-User 20 MB Rackmount Target Platform

Note: Selection from Steps 1 through 5 is mandatory for a functioning system.

Step 1 Packaged Hardware and Software

(Choose one. -CA Model Recommended for U.S.)

Note: Base Hardware System includes 1 serial line for a console terminal and a BCC08-10 serial-line cable.

-CA Hardware and Software Rackmount Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q2-CA	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, RD31 20 MB disk drive, RX33 1.2 MB diskette drive, BA23-A in a rackmounted enclosure, U.S. 120V power cord, English-language hardware documentation, User Diagnostics, and a VAXELN Runtime License, 120V.

-C3 Hardware and Software Rackmount Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q2-C3	Same as DH-620Q2-CA except 240V, no power cord, documentation, or licenses (see Steps 2 through 4 to order separately).

Step 2 Power Cords

Models (Mandatory for -C3 Models.)

Check	Quantity	Part Number	Description
☐	1	BN02A-2E	UK/Ireland 240V @5A
☐	1	BN03A-2E	Central Europe* 220V @6A
☐	1	BN04A-2E	Switzerland 220V @6A
☐	1	BN05A-2E	Australia/New Zealand 240/230V @6A
☐	1	BN06A-2E	Denmark 240V @6A
☐	1	BN07A-2E	Italy 220V @6A
☐	1	BN18K-1K	Japan 200V @6A
☐	1	BN18L-2E	Israel 230V @6A
☐	1	BN18J-1K	U.S. 208-240V @6A

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Hardware Kits

(Mandatory for -C3 Models.)

Hardware Documentation

Check	Quantity	Part Number	Description
☐	1	ZNARA-C3	English-language HW documentation with diagnostics on RX50 media

Step 4 Licenses

VAXELN Run License (Mandatory for -C3 models.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory

Modules (One addtional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☐	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Note: Selection from Step 6 is optional for a functioning system.

Step 6 Networking

DEQNA-M Networking Option (Maximum of one DEQNA)

Check	Quantity	Part Number	Description
☐	1	DEQNA-M	Ethernet communications controller
☐	1	CK-DEQNA-KB	Cabinet kit

DESTA-AA Networking Option (Required for all Thin Ethernet implementations.)

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet-to-Thin Ethernet tranceiver cable adapter
—	1	BNE3D-05	Ethernet transceiver cable
—	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H4000	Ethernet transceiver
☐	1	BNE3D-20	Ethernet transceiver cable

rtVAX 1000 Single-User 20 MB Cabinet Target Platform

Note: Selection from Steps 1 through 5 is mandatory for a functioning system.

Step 1 Packaged Hardware and Software

(Choose one. -AA Model Recommended for U.S.)

Note: Base Hardware System includes 1 serial line for a console terminal and a BCC08-10 serial-line cable.

-AA Hardware and Software Cabinet Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q5-AA	Includes rtVAX 1000 CPU with FPU, 1 MB onboard memory, RD31 20 MB disk drive, RX33 1.2 MB diskette drive, RQDX3 disk controller, BA23-A in an H9642 cabinet, U.S. 120V power cord, English-language hardware documentation, User Diagnostics, and a VAXELN Runtime License, 120V.

-A3 Hardware and Software Cabinet Package

Check	Quantity	Part Number	Description
☐	1	DH-620Q5-A3	Same as DH-620Q5-AA except 240V, no power cord, documentation, or licenses (see Steps 2 through 4 to order separately).

Step 2 Power Cords

Models (Mandatory for -A3 Models.)

Check	Quantity	Part Number	Description
☐	1	BN18B-4E	UK/Ireland 240V @13A
☐	1	BN18C-4E	Central Europe* 220V @16A
☐	1	BN18D-4E	Australia/New Zealand 240/230V @15A
☐	1	BN18E-4E	Italy 220V @16A
☐	1	BN18F-4E	Israel 230V @16A
☐	1	BN18H-4E	India 200V @15A
☐	1	BN18T-4E	Japan 200V @12A
☐	1	BN18P-4E	Denmark 240V @16A
☐	1	BN18Y-4E	U.S. 208V @12A (50 Hz only)

*Central European countries include Austria, Belgium, France, Germany, Finland, Netherlands, Norway, Portugal, Spain, and Sweden.

Step 3 Hardware Kits

(Mandatory for -A3 Models.)

Hardware Documentation

Check	Quantity	Part Number	Description
☐	1	ZNARA-C3	English-language HW documentation with diagnostics on RX50 media

Step 4 Licenses

VAXELN Runtime License (Mandatory for -A3 models.)

Check	Quantity	Part Number	Description
☐	1	QZ376-DZ	VAXELN Runtime license

Step 5 Memory

Modules (One additional memory module required; two maximum. Minimum memory required for a maintainable and functional system is 2 MB, including 1 MB on the CPU module.)

Check	Quantity	Part Number	Description
☐	1	MS630-BA	2 MB MOS memory
☐	1	MS630-BB	4 MB MOS memory
☐	1	MS630-CA	8 MB MOS memory

Note: Selection from Step 6 is optional for a functioning system.

Step 6 Networking

DEQNA-M Networking Option (Maximum of one DEQNA)

Check	Quantity	Part Number	Description
☐	1	DEQNA-M	Ethernet communications controller
☐	1	CK-DEQNA-KB	Cabinet kit

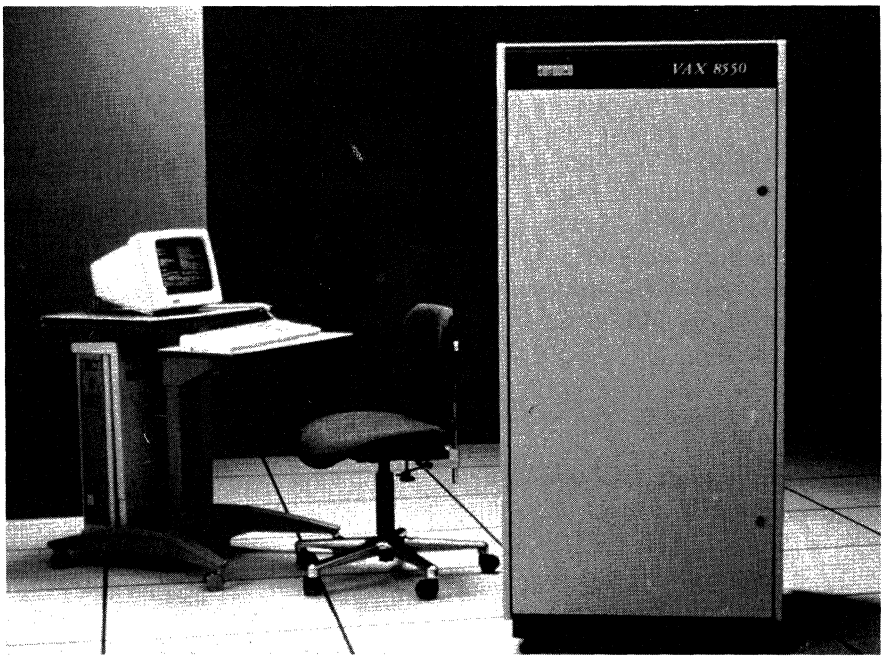
DESTA-AA Networking Option (Required for all Thin Ethernet implementations.)

Check	Quantity	Part Number	Description
☐	1	DESTA-AA	Ethernet-to-Thin Ethernet tranceiver cable adapter
☐	1	BNE3D-05	Ethernet transceiver cable
☐	1	BC16K-10	Thin Ethernet cable

Ethernet Transceiver Networking Options

Check	Quantity	Part Number	Description
☐	—	H4000	Ethernet transceiver
☐	1	BNE3D-20	Ethernet transceiver cable

rtVAX 8550



Digital's rtVAX 8550 computer is a high end VAX system configured for realtime applications. The rtVAX 8550 computer offers optimum system performance by combining the power and capabilities of the VAX 8550 hardware with the responsive VAXELN realtime software environment.

The rtVAX 8550 CPU features virtual memory management, bootstrap loader, standard instructions for packed decimal, floating (F,D,G, and H data types) and fixed-point arithmetic, character and string manipulations, a 64Kbyte direct-mapped write-through cache memory, high precision programmable realtime clock, time-of-year clock with battery backup, and a 16-Kword (144-bit words) writable control store. Standard with the rtVAX 8550 is an Ethernet port and one VAXBI channel. The CPU also includes a console subsystem based upon a PDP-11 micro-
computer with video terminal, 30Mbyte Winchester disk. RX50 floppy-disk drive, and remote diagnostic port.

The rtVAX 8550 systems include the VAXELN runtime license. VAXELN provides an execute only, runtime environment designed for dedicated, realtime applications. Using the VAXELN Toolkit (a VMS layered product) on a VAX/VMS host system, applications can be developed utilizing high-level, implementation languages including PASCAL, C, Ada ® and FORTRAN-77. The finished VAXELN application includes a highly-optimized, memory efficient kernel executive and optionally may include a VMS compatible file service, network communications facilities and I/O device drivers, all provided at pre-generated modules with the Toolkit.

The VAXELN kernel is designed to allow full access to the powerful VAX architecture, while maintaining conceptual simplicity, flexibility and throughput (speed). The optional file and network services provide a level of compatibility with VMS not usually found in other execute-only, realtime environments. The I/O device drivers included with the Toolkit provide immediately usable interfaces to the majority of available VAX peripheral devices as well as function as models for the development of custom device support.

System CPUs/rtVAX 8550

CPU

A fully supported system requires a load device. If your system does not include the appropriate devices, it may not be maintainable. An environmental site audit must be performed prior to delivery. Contact local Field Service for details.

- VAX 8550 CPU
- 8Mbytes of 256K ECC MOS memory
- Integral floating point
- One VAXBI channel
- DRB32-E DMA adapter
- VAXBI Ethernet communications interface
- Console subsystem
- One-year hardware warranty

855BB-CE	8Mbyte paid-up VAXELN runtime license 208 V/ 60 Hz/3 Ph
855BB-CJ	8Mbyte paid-up VAXELN runtime license 240 V/50 Hz

Mass Storage

Choose a data storage device from the following list. The addition of a data storage device requires the addition of: KDB50-AA/AB disk controller.

Available Data Storage Devices are:

- RA81 (1 Disk/Cab)
- RA81 (3 Disks/Cab)
- RA81 (4 Disks/Cab)
- RA60 (1 Disk/Cab)
- SA482 (4 Disks/Cab)

Software

A paid-up VAXELN runtime license is included with 855BB-CE/CJ. Additional layered products are available as required.

VAXELN Media and Documentation

Q2375-HM	VAXELN Toolkit media and documentation recommended for the first VAX system of each CPU type.

Communications Devices

DEBNA Ethernet controller included with system. Connection of system to Ethernet requires an Ethernet transceiver cable (ex. BNE3L-20), and an H4000 or a port on a DELNI or DECOM. See **Communications** and **Cables** sections of the *VAX Systems and Options Catalog* and the *Networks and Communications Buyer's Guide* for additional configuring information.

Standard Network Packages

Refer to the **Communications** section of the *VAX Systems and Options Catalog* and the *Networks and Communications Buyer's Guide* for details on configuring Standard Network Packages.

DEBNA Ethernet Controller	**DEBNA-M**	Maximum three additional per system with total of three per VAXBI channel and four per system. Connection of system to Ethernet requires a transceiver cable (ex. BNE3L-20). Internal VAXBI channels are limited to two H4000 connections. External VAXBI channels are limited to one H4000 connection per channel. Additional connections require a port on a DELNI or DELCOM and cannot be directly connected to an H4000.
DEBNA Cabinet Kit	**CK-DEBNA-LJ**	Required with DEBNA-M if placed on internal VAXBI channel.
	CK-DEBNA-LN	Required with DEBNA-M if placed on external VAXBI channel.
8-Line DECserver 200	**DSRVB-AA**	Each terminal server requires an Ethernet transceiver cable (ex. BNE3L-20), and an H4000 or port on a DELNI or DECOM. Software license is required for each terminal server. Software media and documentation is required for the first terminal server. U.S. country kit included.
8-Line Comm. Printer Controller	**DMB32-M**	Maximum two per VAXBI channel and four per system. See DMB32 description in Communications section of the *VAX Systems and Options Catalog* for ordering details.
DMB32 Cabinet Kit	**CK-DMB32-LJ**	Required with DMB32-M if placed on first VAXBI channel.
	CK-DMB32-LN	Required with DMB32-M if placed on second VAXBI channel.
Additional Mass Storage VAXBI Disk Controller	**KDB50-A**	Maximum two on first VAXBI channel with total of four KDB50-* per system (8-foot cable).
	KDB50-B	Maximum two on second VAXBI channel with total of four KDB50-* per system (15-foot cable).
RA60 (1 Disk/No Cab)	**RA60-AA**	Maximum four disk drives per KDB50, cable included.
RA60 (1 Disk/Cab)	**RA60-FA/D**	
RA81 (1 Disk/No Cab)	**RA81-AA/AD**	
RA81 (3 Disks/Cab)	**RA81-EA/ED**	
RA81 (1 Disk/Cab)	**RA81-FA/D**	
RA81 (4 Disks/Cab)	**RA81-JA/JD**	
SA482 (4 Disks/Cab)	**SA482-AA/AD**	

TU81-Plus Tape Drive

TU81E-BA/BB	Maximum two per VAXBI channel and four per system; cables included.

Console Terminal

A console subsystem is included with this terminal.

LA75 Console Printer

LA75-CA	Optional console printer recommended for improved system diagnostic capability. (A DF112 modem or equivalent is required for Remote Diagnosis.)

Line Printers

Maximum 16 per system. Line printers must connect to an asynchronous line or DMB32, LP11, or DMF32 port. Refer to *VMS Software Product Description* for details.

Print Server

LPS40-AA/A	Suggested Ethernet printer. Connection to Ethernet required.

Line Matrix Printer

LG02-CA	Suggested text and graphics line printer. DMB32 required.

Terminals

Equal to the number of communications lines (not a system maximum or requirement). Refer to VMS SPD for details. A cable (ex. BC22D-25) must be ordered with each terminal unless otherwise provided.

VT320 Video Terminal

VT320-A2/A	Suggested terminal (paper-white screen). North American model includes a 10-foot DEC423 cable and 25-pin adapter.

I/O Expansion

One VAXBI channel included with the system. Maximum of two VAXBI channels and one UNIBUS channel per system. The first VAXBI channel contains two available slots and nine panel units for additional VAXBI expansion.

Second VAXBI Channel

DB88-AD	Adds the second VAXBI channel. Requires a BA32-BA/BB expansion box, and space within an H9652-EC/ED expansion cabinet.

VAXBI Expansion Box

BA32-BA/BB	Provides eleven VAXBI slots for additional VAXBI channel. Required with DB88-AD. Mounts in H9652-EC/ED expansion cabinet.

Expansion Cabinet

H9652-EC/ED	Provides mounting space for one BA32-BA/BB and one BA11-AW/AX expansion box. Maximum one per system. Thirty-seven panel units are available in an H9652 expansion cabinet.

VAXBI-to-UNIBUS Guidelines

See VAXBI-to-UNIBUS Guidelines in the *VAX Systems and Options Catalog.*

Environmental Power System

Power Conditioning System Plus (PCS+)	Supplies clean, regulated, and distributed power to system. PCS is an alternative to conventional wiring and provides extensive monitoring capability to identify power failures, high or low voltage, out of phase rotational problems, or external monitoring devices. For more information, refer to the **Systems Expansion** section of the *VAX Systems and Options Catalog.*

Power Conditioning System Plus

H7318-HB	Supports 30 kVA load, 480 V input with 42 poles output.

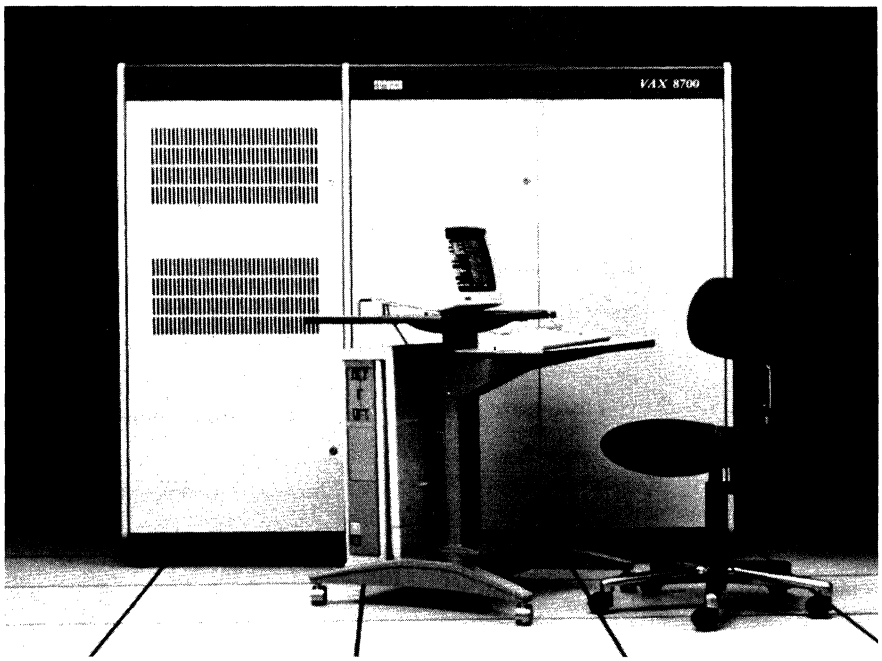
Configuring Information

	Mounting Requirements	dc Amps Drawn @ 5V	dc Amps Drawn @ 12V	dc Amps Drawn @ −12V	dc Amps Drawn @ −5.2V	dc Amps Drawn @ −2V	VAXBI Nodes	I/O Panel Units
VAXBI Channel	5 VAXBI slots	48.00	2.00	2.00	25.00	15.00		12
Used								
DEBNA Ethernet Port	1 VAXBI slot	6.72	0.50	0.00	0.00	0.00	1	1
DRB32-E	2 VAXBI slots	9.8	0.00	0.00	0.00	0.00	1	2
Available	2 VAXBI slots	31.48	1.5	2.00	25.00	15.00		9

Selective Application Product

The rtVAX 8550 is sold only for use in qualified applications and a brief special purchase agreement is required. Contact your Digital sales representative.

rtVAX 8700



Digital's rtVAX 8700 computer is a high end VAX system configured for realtime applications. The rtVAX 8700 computer offers optimum system performance by combining the power and capabilities of the VAX 8700 hardware with the responsive VAXELN realtime software environment.

The rtVAX 8700 CPU features virtual memory management, bootstrap loader, standard instructions for packed decimal, floating (F,D,G, and H data types) and fixed-point arithmetic, character and string manipulations, a 64Kbyte direct-mapped write-through cache memory, high precision programmable realtime clock, time-of-year clock with battery backup, and a 16-Kword (144-bit words) writable control store. Standard with the rtVAX 8700 is an Ethernet port and one VAXBI channel. The CPU also includes a console subsystem based upon a PDP-11 microcomputer with video terminal, 30Mbyte Winchester disk, RX50 floppy-disk drive, and remote diagnostic port.

The rtVAX 8700 systems include the VAXELN runtime license. VAXELN provides an execute only, runtime environment designed for dedicated, realtime applications. Using the VAXELN Toolkit (a VMS layered product) on a VAX/VMS host system, applications can be developed utilizing high-level, implementation languages including PASCAL, C, Ada® and FORTRAN-77. The finished VAXELN application includes a highly-optimized, memory efficient kernel executive and optionally may include a VMS compatible file service, network communications facilities and I/O device drivers, all provided at pre-generated modules with the Toolkit.

The VAXELN kernel is designed to allow full access to the powerful VAX architecture, while maintaining conceptual simplicity, flexibility and throughput (speed). The optional file and network services provide a level of compatibility with VMS not usually found in other execute-only, realtime environments. The I/O device drivers included with the Toolkit provide immediately usable interfaces to the majority of available VAX peripheral devices as well as function as models for the development of custom device support.

CPU

A fully supported system requires a load device. If your system does not include the appropriate devices, it may not be maintainable. An environmental site audit must be performed prior to delivery. Contact local Field Service for details.

- VAX 8700 CPU
- 8Mbytes of 256K ECC MOS memory
- Battery backup
- Integral floating point
- One VAXBI channel
- DRB32-E DMA adapter
- VAXBI Ethernet communications interface
- Console subsystem
- One-year hardware warranty

871BC-CE	8Mbyte paid-up VAXELN runtime license 208 V/60 Hz/3 Ph
871BC-CJ	8Mbyte paid-up VAXELN runtime license 240 V/50 Hz

Mass Storage

Choose a data storage device from the following list. The addition of a data storage device requires the addition of: KDB50-AA/AB disk controller.

Available Data Storage Devices are:

- RA81 (1 Disk/Cab)
- RA81 (3 Disks/Cab)
- RA81 (4 Disks/Cab)
- RA60 (1 Disk/Cab)
- SA482 (4 Disks/Cab)

Software

A paid-up VAXELN runtime license is included with 871BC-CE/CJ. Additional layered products are available as required.

VAXELN Media and Documentation

Q2375-HM	VAXELN Toolkit media and documentation recommended for the first VAX system of each CPU type.

Communications Devices

DEBNA Ethernet controller included with system. Connection of system to Ethernet requires an Ethernet transceiver cable (ex. BNE3L-20), and an H4000 or a port on a DELNI or DECOM. See **Communications** and **Cables** sections of the *VAX Systems and Options Catalog* for additional configuring information.

Standard Network Packages

Refer to the **Communications** section of the *VAX Systems and Options Catalog* for details on configuring Standard Network Packages.

DEBNA Ethernet Controller	**DEBNA-M**	Maximum three additional per system with total of three per VAXBI channel and four per system. Connection of system to Ethernet requires a transceiver cable (ex. BNE3L-20). Internal VAXBI channels are limited to two H4000 connections. External VAXBI channels are limited to one H4000 connection per channel. Additional connections require a port on a DELNI or DELCOM and cannot be directly connected to an H4000.
DEBNA Cabinet Kit	**CK-DEBNA-LJ**	Required with DEBNA-M if placed on internal VAXBI channel.
	CK-DEBNA-LN	Required with DEBNA-M if placed on external VAXBI channel.
8-Line DECserver 200	**DSRVB-AA**	Each terminal server requires an Ethernet transceiver cable (ex. BNE3L-20), and an H4000 or port on a DELNI or DECOM. Software license is required for each terminal server. Software media and documentation is required for the first terminal server. U.S. country kit included.
8-Line Comm, Printer Controller	**DMB32-M**	Maximum two per VAXBI channel and eight per system. See DMB32 description in the **Communications** section of the *VAX Systems and Options Catalog* for ordering details.
DMB32 Cabinet Kit	**CK-DMB32-LJ**	Required with DMB32-M if placed on internal VAXBI channel.
	CK-DMB32-LN	Required with DMB32-M if placed on external VAXBI channel.
Additional Mass Storage VAXBI Disk Controller	**KDB50-A**	Maximum two per internal VAXBI channel with total of eight KDB50-* per system (8-foot cable).
	KDB50-B	Maximum two per external VAXBI channel with total of eight KDB50-* per system (15-foot cable).
RA60 (1 Disk/No Cab)	**RA60-AA**	Maximum four disk drives per KDB50, cable included for connection to KDB50.
RA60 (1 Disk/Cab)	**RA60-FA/FD**	
RA81 (1 Disk/No Cab)	**RA81-AA/AD**	
RA81 (3 Disks/Cab)	**RA81-EA/ED**	
RA81 (1 Disk/Cab)	**RA81-FA/FD**	

RA81 (4 Disks/Cab)	**RA81-JA/JD**	
SA482 (4 Disks/Cab)	**SA482-AA/AD**	
TU81-Plus Tape Drive	**TU81E-BA/BB**	Maximum two per VAXBI channel and four per system; cables included.
Console Terminal	A console subsystem is included with this terminal.	
LA75 Console Printer	**LA75-CA**	Optional console printer recommended for improved system diagnostic capability. (A DF112 modem or equivalent is required for Remote Diagnosis.)
Line Printers	Maximum 16 per system. Line printers must connect to an asynchronous line or DMB32, LP11, or DMF32 port. Refer to *VMS SPD* for details.	
Print Server 40	**LPS40-AA/A3**	Suggested Ethernet printer. Connection to Ethernet required.
Line Matrix Printer	**LG02-CA**	Suggested text and graphics line printer. DMB32 required.
Terminals	Equal to the number of communications lines (not a system maximum or requirement). Refer to *VMS SPD* for details. A cable (ex. BC22D-25) must be ordered with each terminal unless otherwise provided.	
VT320 Video Terminal	**VT320-A2/A3**	Suggested terminal (paper-white screen). North American model includes a 10-foot DEC423 cable and 25-pin adapter.
I/O Expansion	One VAXBI channel included with the system. Maximum of four VAXBI channels and two UNIBUS channels per system. There are eight slots and 25 panel units available for the first VAXBI channel. The system includes a front end cabinet, where two BA32-BA boxes, one BA11-AW box, or one of each can be mounted; 24 panel units are available.	
Internal Second VAXBI Channel	**DB88-AC**	Adds internal second VAXBI channel. Converts first VAXBI channel with 11 slots to two VAXBI channels with five slots each.
External Third VAXBI Channel	**DB88-AE**	Adds the third VAXBI channel. Requires a BA32-BA/BB VAXBI expansion box and space within the front end cabinet or H9652-EC/ED expansion cabinet.

External Second or Fourth VAXBI Channel

DB88-AD	Adds the second or fourth VAXBI channel. Requires a BA32-BA/VAXBI expansion box and space within the front end cabinet or H9652-EC/ED expansion cabinet. For fourth VAXBI channel a DB88-A is required. For second VAXBI channel, a DB88-AD cannot be added if DB88-AC is ordered.

VAXBI Expansion Box

BA32-BA/BB	Provides eleven VAXBI slots for additional VAXBI channel. Required with DB88-AD and DB88-AE. Mounts in the front end cabinet or H9652-EC/ED expansion cabinet.

Expansion Cabinet

H9652-EC/ED	Provides mounting space for two BA32-BA/BB or BA11-AW/AX expansion boxes, or one of each. Maximum two additional per system. Thirty-seven panel units are available in an H9652 expansion cabinet.

VAXBI-to-UNIBUS Guidelines

See VAXBI-to-UNIBUS Guidelines in the *VAX Systems and Options Catalog.*

Environmental Power System

Power Conditioning System Plus (PCS+)	Supplies clean, regulated, and distributed power to system. PCS is an alternative to conventional wiring and provides extensive monitoring capability to identify power failures, high or low voltage, out of phase rotational problems, or external monitoring devices. For more information, refer to the **Systems Expansion** section of the *VAX Systems and Options Catalog.*

Power Conditioning System Plus

H7318-HB	Supports 30 kVA load, 480 V input with 42 poles output.

Configuring Information

	Mounting Requirements	dc Amps Drawn @ 5 V	dc Amps Drawn @ 12V	dc Amps Drawn @ −12V	dc Amps Drawn @ −5.2V	dc Amps Drawn @ −2V	VAXBI Nodes	I/O Panel Units
VAXBI Channel	5 VAXBI slots	48.00	2.00	2.00	25.00	15.00		12
Used								
DEBNA Ethernet Port	1 VAXBI slot	6.72	0.50	0.00	0.00	0.00	1	1
DRB32-E	2 VAXBI slots	9.8	0.00	0.00	0.00	0.00	1	2
Available	2 VAXBI slots	31.48	1.50	2.00	25.0	15.0		9

Selective Application Product

The rtVAX 8700 is sold only for use in qualified applications and a brief special purchase agreement is required. Contact your Digital sales representative.

IVAX Introduction

The Industrial Family of products consists of standard MicroVAX II, RTVAX, PDP-11/83, and PDP-11/53 computers packaged for use in harsh factory environments. Functions of the Industrial Family of computers include supervisory control, factory data collection, process control, shop floor information management, and cell or area control.

Because they are all based on Digital computer platforms, the Industrial Family may also perform general-purpose computing in manufacturing.

Systems are available in the metal chassis only; no cabinets are provided. The mounting styles are flexible because the Industrial Family module slots are accessible from the front of the system. The metal chassis can be mounted in any 19-inch EIA cabinet, or on the rear panel of an industrial cabinet. The metal chassis systems include hardware for rack and panel mounting. Custom packaging is available on request.

The Industrial VAX (IVAX) systems support MicroVMS for multiuser, resource-sharing operations, and the VMS layered product VAXELN for dedicated, realtime operations. In addition, the ULTRIX-32 operating system provides a reliable, demand-paged, virtual memory, timesharing native UNIX operating system for the Industrial VAX.

Most Industrial Family products offer expanded memory and disk storage options, and a variety of communications options including DEC-423, RS-422, and RS-232.

For further information, refer to the individual system menus and the *IVAX Common Options* section.

All systems are backed by Digital's support services groups, including Field Service, Educational Services, and Software Services. All systems carry a one-year onsite hardware warranty.

Industrial VAX 620 (VAXELN Disk-based System)

The Realtime IVAX 620 (VAXELN Disk-based System) comprises the rtVAX (KA620) and the VAXELN runtime license. It is designed for use with a realtime 32-bit computer solutions in an industrial environment.

Using the VAXELN Toolkit (purchased separately), customers develop applications in higher level languages on a VAX host. These applications can be ported down to this target system through network communications or media.

Users with realtime needs and process manufacturing industries will find the IVAX 620 (Disk-based Network Node) suitable for the following applications: automated machine and robot control, process control, process simulation, and data acquisition control.

Industrial VAX 620 (VAXELN Disk-based System)

Note: Selection from Steps 1 through 3 is mandatory for a functioning system.

Step		Check	Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**Packaged System**	Includes rtVAX (KA620) in a 12-slot metal chassis, FPU, 1-Mbyte memory, RD53 71-Mbyte disk drive and RQDX3 disk controller, TK50 95-Mbyte tape and TQK50 tape controller, rack and wall mount kit. U.S. 120-V power cord, 1 DEC423 serial line, BC16E-10 null modem cable, and H8571-A (25 pin D-sub to MMJ) adapter plug. VAXELN KA620 target run-time license (QZZCF-DZ) Ethernet interface (DEQNA).				
		☐	1	DJ-620H2-A2	IVAX 620 system, U.S. power cord, 120 V	Choose one. -A2 model recommended for U.S. English-language documentation and installation diagnostics.
		☐	1	DJ-620H2-A3	Same as DJ-620H2-A2 except 240 V, no power cord, diagnostics, or documentation—see Steps 2 and 3 to order separately	
2	**Power Cords**	☐	1	BN20B-2E	U.S./Japan—208-240 V	Required only for -A3 configuration.
		☐	1	BN20C-2E	Australia/New Zealand—240/230 V	DJ-620H2-A2 includes U.S. 120-V power cord.
		☐	1	BN20D-2E	Central Europe—220 V	Central European countries include: Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, and Sweden.
		☐	1	BN20E-2E	UK/Ireland—240 V	
		☐	1	BN20F-2E	Switzerland—220 V	
		☐	1	BN20H-2E	Denmark—240 V	
		☐	1	BN20J-2E	Italy—220 V	
		☐	1	BN20K-2E	India/South Africa—240 V	All cord lengths are 2.5 meters, 10 A.
		☐	1	BN20L-2E	Israel—230 V	
3	**Diagnostics and Documentation**	☐	1	ZNAHS-C5	English-language diagnostics/documentation on TK50 media	ZNAH5-C5 is optional for -A3. It is included in DJ-620H2-A2. (First remote MDM for KA620 is release 118.) See *Table 1* for appropriate country code.
		☐	1	ZN*HS-C5	*-language diagnostics/documentation on TK50 media	

Note: Selection from Steps 4 through 6 is optional for a functioning system. There are 8 slots available for expansion.

4	**Additional Memory**	☐	—	MS630-BB	4-Mbyte memory	Maximum of two memory modules per system.
		☐	—	MS630-CA	8-Mbyte memory	
5	**Additional Mass Storage**	☐	—	RD53A-SA	71-Mbyte fixed disk	Maximum of three disks per system. Packaged System includes one, so at most order two additional drives. RD53/RD54 may be mixed in the same system.
		☐	—	RD54A-SA	159-Mbyte fixed disk	
6	**Additional Asynchronous Serial Lines**	☐	—	CXA16-AA	16 lines, DEC423	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXB16-AA	16 lines, RS422	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXY08-AA	8 lines, RS-232 w/full modem	Includes two BC19N-12 (12-ft) cables.
		☐	—	DZQ11-SA	4 lines, RS-232	Choose one cable minimum; four cables per module maximum.
		☐	—	BC23H-06	6-ft cable	BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.
		☐	—	BC23H-25	25-ft cable	

Note: For additional system options and field upgrade options, see the *IVAX Common Options* section.
System includes installation and one-year onsite hardware warranty at the DEC Service level. System should be installed in an appropriate cabinet. See *Factory Systems Site Preparation Guide (EK-074AA-SP)* for more information.

Industrial VAX 620 (VAXELN Diskless System)

The Realtime IVAX 620 (VAXELN Diskless System) comprises the IVAX 620 and the VAXELN runtime license, and is designed for realtime 32-bit computer solutions in an industrial environment.

Using the VAXELN Toolkit (purchased separately), customers develop applications in higher level languages on a VAX host. These applications can be ported down to this target system through network communications or media.

Users with realtime needs and process manufacturing industries will find the IVAX 620 (Diskless Network Node) suitable for the following applications: automated machine and robot control, process control, process simulation, and data acquisition control.

Systems Matrix Table—Unsealed Systems

System Name	CPU Type	Slots	Operating Software
Industrial VAX 630 Hardware Only	MicroVAX II	12	None supplied; system supports MicroVMS, VAXELN, and ULTRIX-32
Industrial VAX 630 Complete System	MicroVAX II	12	MicroVMS
BASEWAY Cell Supervisor	MicroVAX II	12	MicroVMS+BASEWAY Device Access and Management
Industrial VAX 620 Disk-based Networked Node	rtVAX	12	VAXELN
Industrial VAX 620 Diskless Network Node	rtVAX	6	VAXELN

Industrial VAX 620 (Diskless System)

Note: Selection from Steps 1 through 4 is mandatory for a functioning system.

Step		Check	Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**Packaged System**	Includes rtVAX (KA620) in a 6-slot metal chassis, FPU, 1-Mbyte memory, and Ethernet interface (DEQNA), 1 DEC423 serial line, BC16E-10 cable, and H8571-A (25 pin D-sub to MMJ) adapter plug. VAXELN KA620 target run-time license (QZZCF-DZ), rack and wall mount kit, U.S. 120-V power cord.				
		☐	1	DJ-620H1-A2	IVAX 620 system, U.S. power cord, 120 V	Choose one. -A2 model recommended for U.S. English-language documentation and installation diagnostics.
		☐	1	DJ-620H1-A3	Same as DJ-620H1-A2 except 240 V, no power cord, diagnostics, or documentation—see Steps 2 and 3 to order separately	
2	**Power Cords**	☐	1	BN20B-2E	U.S./Japan—208-240 V	Required only for -A3 configuration.
		☐	1	BN20C-2E	Australia/New Zealand—240/230 V	DJ-620H1-A2 includes U.S. 120-V power cord.
		☐	1	BN20D-2E	Central Europe—220 V	Central European countries include: Austria,
		☐	1	BN20E-2E	UK/Ireland—240 V	Belgium, Finland, France, Germany,
		☐	1	BN20F-2E	Switzerland—220 V	Netherlands, Norway, Portugal, Spain, and
		☐	1	BN20H-2E	Denmark—240 V	Sweden.
		☐	1	BN20J-2E	Italy—220 V	
		☐	1	BN20K-2E	India/South Africa—240 V	All cord lengths are 2.5 meters, 10 A.
		☐	1	BN20L-2E	Israel—230 V	
3	**Diagnostics and Documentation**	☐	1	ZNAHT-GZ	English-language documentation kit	ZNAHT-GZ is optional for DJ-620H1-A3. It is included in DJ-620H1-A2. (First remote MDM for KA620 is release 118.) See *Table 1* for appropriate country code.
		☐	1	ZN*HT-GZ	*-language documentation kit	

Note: Selection from Steps 4 through 5 is optional for a functioning system. There are 4 slots available for expansion.

4	**Additional Memory**	☐	—	MS630-BB	4-Mbyte memory	Maximum of two memory modules per system.
		☐	—	MS630-CA	8-Mbyte memory	
5	**Additional Asynchronous Serial Lines**	☐	—	CXA16-AA	16 lines, DEC423	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXB16-AA	16 lines, RS-422	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXY08-AA	8 lines, RS-232 w/full modem	Includes two BC19N-12 (12-ft) cables.
		☐	—	DZQ11-SA	4 lines, RS-232	Choose one cable minimum; four cables per module maximum.
		☐	—	BC23H-06	6-ft cable	
		☐	—	BC23H-25	25-ft cable	BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.

Note: For additional system options and field upgrade options, see the *IVAX Common Options* section.
System includes installation and one-year onsite hardware warranty at the DEC Service level. System should be installed in an appropriate cabinet. See *Factory Systems Site Preparation Guide (EK-074AA-SP)* for more information.

E-Series IVAX 620

The E-Series IVAX is a small (six slot) member of the Industrial VAX family. Designed with the same industrial features as the other family members:

- Front access to modules
- Three-cycle ride-through on power loss
- Extended shock and vibration protection
- Added protection of NEMA 12 enclosures

NEMA 12 is a standard established by the National Electrical Manufacturers Association that specifies protection against splashing liquids, dust and oil. No additional cabinetry or protection is required to withstand the rigors of oily machine shops, spray paint booths, or dusty cement plants.

The first E-series family member available is the diskless IVAX VAXELN system. The sealed IVAX uses VAXELN, Digital's compact realtime software kernel. VAXELN provides realtime, event-critical response, multitasking, and concurrent processing capabilities. Either stand-alone or networked to other systems, this system would be a good choice for users who are wary of putting disks on the factory floor.

With such a high level of environmental protection, the E-series IVAX system is well suited for realtime factory floor tasks such as data collection and machine control and monitoring. It is ideal for customers who have experienced reliability problems due to environmental contaminants or for those who have been afraid to put computer equipment on the floor due to the deleterious effects of environmental contaminants.

The E-series diskless Industrial VAX, with an operating temperature of 40°C, offers an alternative footprint to the existing RT950, a NEMA 12 BA23-based VAX. The RT950 can operate at 50°C with a disk because the system is housed in an air-conditioned enclosure.

Typical applications include automated machine and robot control, process control, process simulation and realtime application development.

Features

- NEMA 12 enclosures (similar to European IP52)
- Operating temperature to 40°C without disk
- Passively cooled systems (no air conditioning to maintain or filters to change)
- Three-cycle ride-through on power loss
- Front access to modules
- No cable kits required
- Interchangeability of options among members of the Industrial Family
- Modules held securely from front and back
- Optional monochrome and color graphics terminals (See the Industrial Terminal section of this catalog)
- Customer service available worldwide

Software Support

The sealed realtime IVAX is a diskless MicroVAX II (KA620) that comes with a VAXELN Runtime License. Applications are developed in higher-level languages (ESPASCAL, C or ADA) on a VAX host using the VAXELN Toolkit. These applications can then be ported down to this target system using network communications or media. The VMS host operating system and the VAXELN Toolkit must be purchased separately.

Support Services

Installation service, self-maintenance service, training, and professional software services are available for this system.

Ordering information

Model Number	Description
DJ-620R1-A2/A3	KA620, DEQNA, VAXELN/DECnet, Ethernet cable

Specifications

Memory	Up to 16Mbytes
Backplane	Six slots
Temperature	0 to 40°C
Cooling	External convection; internal fan
Maintainability	Module swap
Vibration	½ g
Shock	10 g in operating; 20 g nonoperating
Dimensions	16 in W by 15.75 in D by 23.5 in H

Industrial VAX 630 (Hardware Only)

The IVAX 630 (Hardware Only) is a standard MicroVAX II designed for the industrial environment and does not include any cabinet, operating system or license.

The IVAX 630 (Hardware Only) can be included in solutions that use 32-bit computer power in an industrial environment. Both discrete manufacturing industries and process manufacturing industries will find the IVAX 630 (Hardware Only) suitable for such typical applications as machine automation, process control, and supervisory/cell control.

Industrial VAX 630 (Hardware Only)

Note: Selection from Steps 1 through 4 is mandatory for a functioning system.

Step		Check	Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**Base Hardware**	Includes MicroVAX II CPU in 12-slot metal chassis, FPU, 5-Mbyte memory (MS630-BB). RD53 71-Mbyte disk drive and RQDX3 disk controller, TK50 95-Mbyte tape and TQK50 tape controller, rack and wall mount kit. U.S. 120-V power cord. 1 DEC423 serial line, BC16E-10 null modem cable, and H8571-A (25 pin D-sub to MMJ) adapter plug.				
		☐	1	DH-630H1-AA	IVAX 630 system, U.S. power cord, 120 V	Choose one. -AA model recommended for U.S. English-language documentation and installation diagnostics.
		☐	1	DH-630H1-A4	Same as DH-630H1-AA except 240 V, no power cord, diagnostics, or documentation—see Steps 2 and 3 to order separately	
2	**Power Cords**	☐	1	BN20B-2E	U.S./Japan—208-240 V	Required only for -A4 configuration. DH-630H1-AA includes U.S. 120-V power cord.
		☐	1	BN20C-2E	Australia/New Zealand—240/230 V	
		☐	1	BN20D-2E	Central Europe—220 V	Central European countries include: Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, and Sweden.
		☐	1	BN20E-2E	UK/Ireland—240 V	
		☐	1	BN20F-2E	Switzerland—220 V	
		☐	1	BN20H-2E	Denmark—240 V	
		☐	1	BN20J-2E	Italy—220 V	All cord lengths are 2.5 meters, 10 A.
		☐	1	BN20K-2E	India/South Africa—240 V	
		☐	1	BN20L-2E	Israel—230 V	
3	**Diagnostics and Documentation**	☐	1	ZNAHH-C5	English-language diagnostics/documentation on TK50 media	ZNAHH-C5 is optional for -A4. It is included in DH-630H1-AA.
		☐	1	ZN*HH-C5	*-language diagnostics/documentation on TK50 media	See *Table 1* for appropriate country code.
4	**Base Software System**	☐	1	QZ001-CZ	VMS license	Choose one minimum. For 1-8, 1-16, or unrestricted VMS user licenses and upgrades, see the VAX/VMS Software Order Table/Optional Software Cross Reference Table. ULTRIX-32 available on TK50 media; requires a minimum 3 Mbytes of memory.
		☐	1	QZ376-DZ	VAXELN runtime license	
		☐	1	QZZEK-UZ	ULTRIX-32 2-user license	

Industrial VAX 630 (Hardware Only)

Note: Selection from Steps 5 through 9 is optional for a functioning system. There are 8 slots available for expansion.

Step		Check	Qty	Part Number	Product Description	Product/Order Limitations or Remarks
5	**Additional Memory**	☐	1	MS630-BB	4-Mbyte memory	Maximum of two memory modules per system, for a total of 16 Mbytes. Hardware System includes one, so select one additional module at most.
		☐	1	MS630-CA	8-Mbyte memory	
6	**Additional Mass Storage**	☐	—	RD53A-SA	71-Mbyte fixed disk	Maximum of three disks per system. Hardware system includes one, so order two additional drives maximum. RD53/RD54 may be mixed in the same system.
		☐	—	RD54A-SA	159-Mbyte fixed disk	
7	**Additional Asynchronous Serial Lines**	☐	—	CXA16-AA	16 lines, DEC423	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXB16-AA	16 lines, RS422	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXY08-AA	8 lines, RS-232 w/full modem	Includes two BC19N-12 (12-ft) cables.
		☐	—	DZQ11-SA	4 lines, RS-232	Choose one cable minimum; four cables per module maximum. BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.
		☐	—	BC23H-06	6-ft cable	
		☐	—	BC23H-25	25-ft cable	
8	**Networking Options**	☐	—	DEQNA-SA	Ethernet communications controller	Maximum of two DEQNAs per system. Select PVC or Teflon cable in appropriate length.
		☐	1	BNE3B-xx	PVC cable with right angle bend	
		☐	1	BNE3D-xx	Teflon cable w/right angle bend	
9	**I/O Options**	☐	1	IBQ01-SA	DECscan BITBUS Controller board and documentation.	Select a driver and appropriate license. Options not supported under ULTRIX-32. User can purchase any standard, shielded RS-485 cable. DEC does not supply.
		☐	1	QZZE1-UZ	DECscan single-use license	
		☐	1	QZZE1-H5	Driver, config and communications	
		☐	1	QZZE1-HZ	Right-to-copy license	
		☐	1	DRQ3B-SA	2-port 16-bit DMA parallel interface	
		☐	1	IEQ11-SA	IEEE 488 interface	
		☐	1	DPV11-SA	1 line synchronous RS232 with modem control	
		☐	1	DRV11-SA	16-bit parallel interface	

Note: For additional system options, operating system media and documentation, and field upgrade options, see the *IVAX Common Options* section. System includes installation and one-year onsite hardware warranty at the DEC Service level. System should be installed in an appropriate cabinet. See *Factory Systems Site Preparation Guide (EK-074AA-SP)* for more information.

Industrial VAX 630 (Complete System)

The IVAX 630 (Complete System) is a standard MicroVAX II packaged for use with 32-bit computer power in an industrial environment. It includes the MicroVMS operating system and VMS license.

Discrete manufacturing industries and process manufacturing industries will find the IVAX 630 (Complete System) suitable for typical applications such as machine automation; process control; supervisory or cell control of devices such as programmable logic controllers, NC controllers, and robots; and data acquisition control and analysis—prior to passing information up to MRP and plant host systems.

Industrial VAX 630 (Complete System)

Note: Selection from Steps 1 through 3 is mandatory for a functioning system.

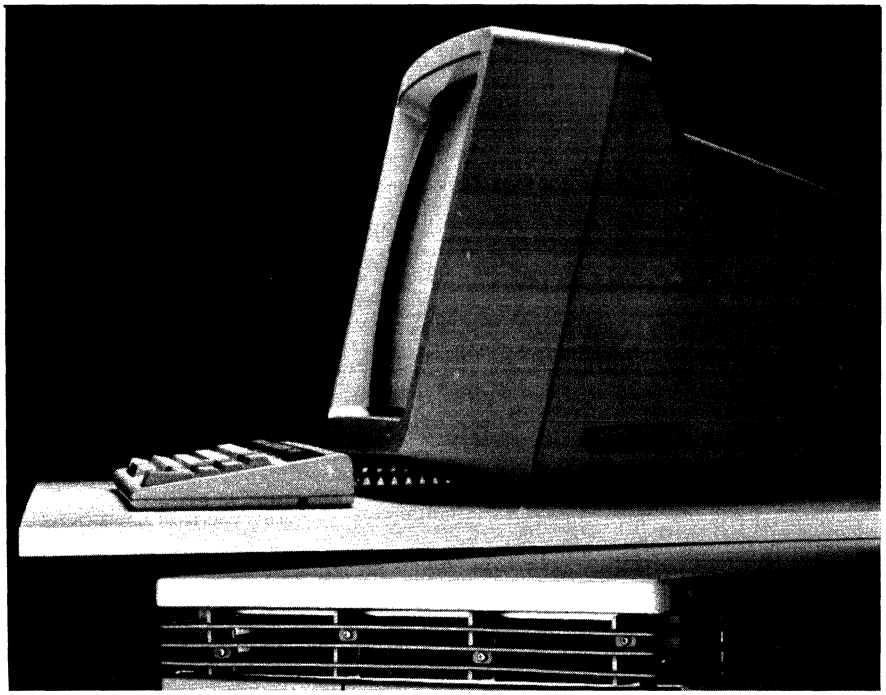
Step		Check	Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**Packaged System**	Includes MicroVAX II CPU in 12-slot metal chassis, FPU, 5-Mbyte memory (MS630-BB). RD53 71-Mbyte disk drive and RQDX3 disk controller, TK50 95-Mbyte tape and TQK50 tape controller, rack and wall mount kit. U.S. 120-V power cord. 1 DEC423 serial line, BC16E-10 null modem cable, and H8571-A (25 pin D-sub to MMJ) adapter plug. VMS 1-2 user license (QZ001-CZ) (includes 90-day limited warranty), and TK50 media (Q3001-H5).				
		☐	1	DJ-630H1-A2	IVAX 630 system, U.S. power cord, 120 V	Choose one. -A2 model recommended for U.S. English-language documentation and installation diagnostics.
		☐	1	DJ-630H1-A3	Same as DJ-630H1-A2 except 240 V, no power cord, diagnostics, or documentation—see Steps 2 and 3 to order separately	
2	**Power Cords**	☐	1	BN20B-2E	U.S./Japan—208-240 V	Required only for -A3 configuration.
		☐	1	BN20C-2E	Australia/New Zealand—240/230 V	DJ-630H1-AA includes U.S. 120-V power cord.
		☐	1	BN20D-2E	Central Europe—220 V	Central European countries include: Austria,
		☐	1	BN20E-2E	UK/Ireland—240 V	Belgium, Finland, France, Germany, Nether-
		☐	1	BN20F-2E	Switzerland—220 V	lands, Norway, Portugal, Spain, and Sweden.
		☐	1	BN20H-2E	Denmark—240 V	
		☐	1	BN20J-2E	Italy—220 V	All cord lengths are 2.5 meters, 10 A.
		☐	1	BN20K-2E	India/South Africa—240 V	
		☐	1	BN20L-2E	Israel—230 V	
3	**Diagnostics and Documentation**	☐	1	ZNAHH-C5	English-language diagnostics/ documentation on TK50 media	ZNAHH-C5 is optional for -A3. It is included in DJ-630H1-A2.
		☐	1	ZN*HH-C5	*-language diagnostics/ documentation on TK50 media	See *Table 1* for appropriate country code.

Note: Selection from Steps 4 through 8 is optional for a functioning system. There are 8 slots available for expansion.

4	**Additional Memory**	☐	1	MS630-BB	4-Mbyte memory	Maximum of two memory modules per system.
		☐	1	MS630-CA	8-Mbyte memory	Packaged System includes one, so order one additional module maximum.
5	**Additional Mass Storage**	☐	—	RD53A-SA	71-Mbyte fixed disk	Maximum of three disks per system. Packaged
		☐	—	RD54A-SA	159-Mbyte fixed disk	System includes one, so order two additional drives maximum. RD53/RD54 may be mixed in the same system.
6	**Additional Asynchronous Serial Lines**	☐	—	CXA16-AA	16 lines, DEC423	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXB16-AA	16 lines, RS422	Includes two BC16D-25 (25-ft) cables and two H3104 8-line distribution units.
		☐	—	CXY08-AA	8 lines, RS-232 w/full modem	Includes two BC19N-12 (12-ft) cables.
		☐	—	DZQ11-SA	4 lines, RS-232	Choose one cable minimum; four cables per mod-
		☐	—	BC23H-06	6-ft cable	ule maximum.
		☐	—	BC23H-25	25-ft cable	BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.
7	**Networking Options**	☐	—	DEQNA-SA	Ethernet communications controller	Maximum of two DEQNAs per system. Select
		☐	1	BNE3K-xx	PVC cable with right angle bend	PVC or Teflon cable in appropriate length.
		☐	1	BNE3M-xx	Teflon cable w/right angle bend	
8	**I/O Options**	☐	1	IBQ01-SA	DECscan BITBUS Controller board and documentation	Select a driver and appropriate license.
		☐	1	QZZE1-UZ	Single-use license	User can purchase any standard, shielded RS485
		☐	1	QZZE1-H5	Driver, config and communications	cable. DEC does not supply.
		☐	1	QZZE1-HZ	Right-to-copy license	
		☐	1	DRQ3B-SA	2-port 16-bit DMA parallel interface	
		☐	1	IEQ11-SA	IEEE-488 interface	
		☐	1	DPV11-SA	1-line synchronous RS232 with modem control	
		☐	1	DRV11-SA	16-bit parallel interface	

Note: For additional system options and field upgrade options, see the *IVAX Common Options* section.
System includes installation and one-year onsite hardware warranty at the DEC Service level. System should be installed in an appropriate cabinet. See *Factory Systems Site Preparation Guide (EK-074AA-SP)* for more information.

VAXlab



The VAXlab product line is a family of MicroVAX systems with the tools for the development of custom realtime data collection and analysis applications in the laboratory. The different VAXlab systems provide a range of price-performance capabilities for different scientific tasks. They range from multiuser VAXlabs that are suitable in realtime applications where cost per user is an important consideration up to single user VAXlabs that are targeted towards realtime applications with medium to high performance I/O rates and significant computational requirements.

Applications

Typical applications for VAXlabs include data acquisition from lab instruments, automated test/simulation, signal processing, vibrational analysis, physiological monitoring, and experimental control.

Features

VAXlab integrates eight key elements into a complete packaged system with unique appeal for scientific users:

- Subroutine libraries that perform realtime I/O, mathematical and statistical analysis, signal-processing, and scientific graphics.
- A forms-driven utility for interactive data acquisition and plotting operations.
- Realtime support for a wide variety of analog input and output, digital I/O, IEEE-488, realtime clock, and serial I/O options from Digital and Digital's complementary solution vendors.
- A KWV11 realtime clock/counter to pace analog measurements, count events, and measure frequency of time events.
- Special termination panels called UDIPs, created for the VAXlab, that allow easy connection of laboratory instruments to the front of the BA123 cabinet or to a table-top or rack mount enclosure.
- An Ethernet controller and DECnet networking software.
- Access via the system's Q-bus to dozens of specialized realtime hardware options from Digital and third party vendors.
- Access via VMS to a broad range of data acquisition and data analysis software from complementary solution vendors.

VAXlab Software Library (Formerly LabStar)

The core of the VAXlab system is the VAXlab Software Library (VSL), a set of subroutines, utilities and device drivers that allow the user to:

- Control the realtime hardware, which consists of A/D converters, D/A converters, digital I/O interfaces, and realtime clocks.
- Perform signal processing operations.
- Perform mathematical and statistical analyses.
- Plot the results on a terminal, workstation, or plotter.

With VSL, programmed I/O rates up to 20Kbytes per second and DMA I/O rates up to 2.6Mbytes per second can be achieved on a MicroVAX II system. Continuous data acquisition transfer rates can reach 350Kbytes per second to the RD53 Winchester disk and 550Kbytes per second to an RA81. On a MicroVAX II system, VSL can typically respond to an external interrupt within 40 microseconds.

The VAXlab Software Library is described in detail in another section of this catalog.

VAXlab Configurations

Four packaged VAXlab systems are available. These packaged systems offer ease of ordering and installation, and yet are fully expandable. However, all components can be ordered separately so that custom configurations can be implemented on any supported VAX processor.

VAXlab/STD Applications

The multi-user configuration of the VAXlab/STD is the best choice where cost per user is an important consideration. The VAXlab/STD is also appropriate in applications where fast response to interrupts or high data throughputs are needed.

Features

The VAXlab/STD includes:

- A BA123 enclosure with a MicroVAX II CPU with floating point unit and 1Mbyte of memory.
- An additional 8Mbytes of memory.
- A 71Mbyte RD53 disk with an RQDX3 controller.
- A 95Mbyte TK50 tape drive with a TQK50 controller.
- A DHQ11-M 8-line serial I/O interface.
- An Ethernet controller.
- A KWV11-C realtime clock.
- A UDIP-KA front panel for the clock.
- A UDIP-BA front panel frame that mounts in the front bay of the BA123 and holds up to three UDIP front panels.

Licenses, TK50 media, and documentation for the following software are also included with VAXlab/STD: MicroVMS with an 8-user license (QZ002), VAX GKS (QZ810), DECnet end node license (QZD04), and the VAXlab Software Library (QZB15).

System CPUs/VAXlab

VAXlab/GPX Applications

The VAXlab/GPX is an exceptionally productive workstation with high performance color graphics that gains its performance advantage from a powerful VLSI graphics coprocessor that offloads text and graphics computation from the MicroVAX II CPU.

Features

The VAXlab/GPX includes:

- A BA123 enclosure with a VAXstation II CPU with floating point unit and 1Mbyte of memory.
- An additional 8Mbytes of memory.
- A QDSS graphics module with 8 color planes.
- A 19-inch monitor with tilt and swivel and a mouse.
- A 71Mbyte RD53 disk with an RQDX3 controller.
- A 95Mbyte TK50 tape drive with a TQK50 controller.
- An Ethernet controller.
- A KWV11-C realtime clock.
- A UDIP-KA front panel for the clock.
- A UDIP-BA front panel frame that mounts in the front bay of the BA123 and holds three UDIP front panels.

Licenses, TK50 media, and documentation for the following software are also included with VAXlab/GPX: MicroVMS (Q4001), Workstation software (Q4A96), VAX GKS (Q4810), DECnet end node license (Q4D04), and the VAXlab Software Library (Q4B15).

VAXlab/3500 Applications

A high performance member of the VAXlab family, with its MicroVAX CPU, the VAXlab/3500 is well suited to be a data acquisition and analysis workstation in applications where large data streams have to be collected and processed.

Features

The VAXlab/3500 includes:

- A BA213 enclosure with a KA650 CPU with floating point unit.
- A QDSS graphics module with 8 color planes.
- 16Mbytes of memory.
- A RA70 disk with an KDA50 controller.
- A TK70 tape drive.
- An Ethernet controller.
- A KWV11-SA realtime clock.
- A UDIP-KB front panel for the clock.
- One UDIP-BA front panel frame that can hold up to three UDIP front panels.
- One UDIP-TA table-top frame adapter that can accommodate one UDIP-BA frame.

Licenses, TK70 media, and documentation for the following software are also included with the VAXlab/3500: MicroVMS with a 20-user license (Q1001), workstation software (Q1A96), DECnet end node license (Q1D04), VAX GKS (Q1810), and the VAXlab Software Library (Q1B15).

Other VAXlab Systems

For information on VAXlab systems configured around the VAXstation 2000, contact your local sales office.

Ordering Guide For the VAXlab/STD, and VAXlab/GPX

- LABVX-AD—VAXlab/STD multiuser
- LABVX-CC—VAXlab/GPX high resolution color graphics

Base System

Terminals

Choose at least one terminal (console) and keyboard for the VAXlab/STD. If ordering terminals for the other base systems, order a DHQ11-M serial line interface as well. Ensure that the number of printers and terminals does not exceed the number of serial lines available.

Realtime Options

Model	Description
AAV11-DA	2-channel, 12-bit, 300kHz D/A
ADV11-DA	16SE/8DI, 12-bit, 50kHz A/D
AXV11-C	16SE/8DI, 20kHz A/D and 2ch. D/A
DRQ3B-AA	16 in/16 out, 1.3 MHz, DMA digital I/O
DRV11-WA	16 in/16 out, 0.5 MHz, DMA digital I/O
DRV11-J	64-bit digital I/O
IEQ11	IEEE-488 interface with 2 busses
KWV11-C	Realtime clock
ADQ32-AA	32SE/16DI, 12-bit, 200kHz A/D

Configuration Guidelines

- A maximum of 4 each of the interfaces—AAV11-DA, ADV11-DA, ADQ32, AXV11-C—can be ordered for each system.
- A maximum of 3 each of the interfaces—DRV11-J/ DRV11-WA, DRQ3B-AA—can be ordered for each system.
- A maximum of 1 IEQ11 should be ordered for each system.
- A maximum of 3 KWV11-Cs should be ordered for each system in addition to the KWV11-C included with the base system.
- The number of options selected must not exceed the number of backplane slots available.
- The power consumed by the options and the base system does not exceed the specified output of the power supplies.
- The correct type and number of distribution panels are chosen.

Configuration Worksheet

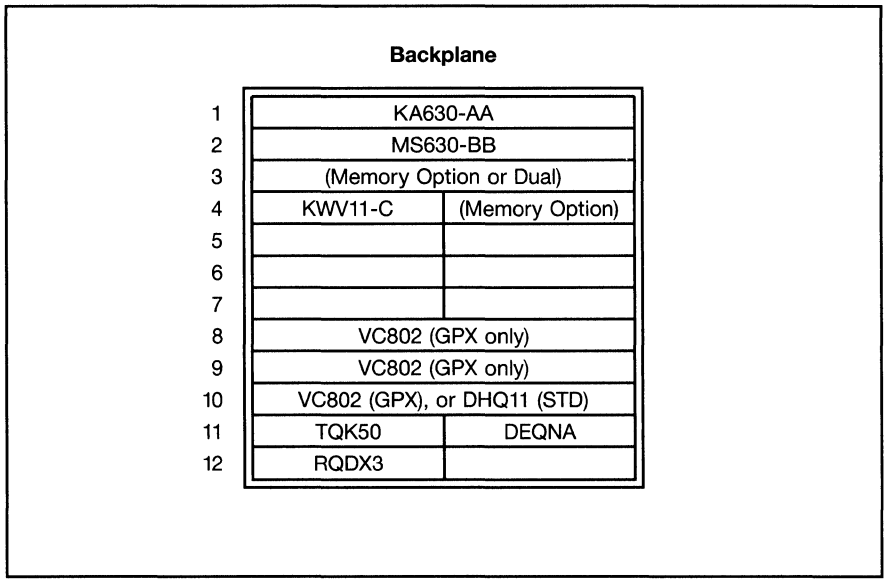
The BA123 enclosure uses two 230-watt power supplies. Regulator A supplies power for slots 1, 3, 5, 7, 9, and 11 and mass storage shelves 3, 4, and 5. Regulator B supplies power for slots 2, 4, 6, 8, 10 and 12 and mass storage shelves 1 and 2. When configuring the system:

- Use the 12-slot configuration worksheet. Write the module and mass storage device names in the left column beside the slot and shelf numbers. When configuring these systems, please note that quad-height modules use both the "AB" and "CD" portions of a slot.
- Slots 1 through 4 are limited to either one-quad- or one-dual-height Q-bus option. However, if a MS630-AA memory option is installed in the "CD" row of slot two or three then the "AB" portion of that slot can accommodate a dual-height option.
- Slots 5 through 12 can accommodate either one quad-height or two dual-height options.
- Use the module information chart to determine the 5V and 12V currents and power required for each module and mass storage device.
- Enter this information in the columns of the appropriate regulator in the worksheet. The column totals must not exceed the limits listed below.
- Due to start-up current limitations, if an RD54 disk drive is connected to the same 12-volt power supply regulator as another RD-type disk drive, then only five of the seven amperes provided by the regulator can be used for powering the two disks and any additional options.

Configuration Worksheet for the VAXlab/GPx and VAXlab/STD

SLOT		MODULE	Regulator A Current (Amps) 5Vdc	Regulator A Current (Amps) 12Vdc	Regulator A Power (Watts)	Regulator B Current (Amps) 5Vdc	Regulator B Current (Amps) 12Vdc	Regulator B Power (Watts)	I/O Inserts B	I/O Inserts A
		KA630	6.2	0.14	32.7				1	0
1	AB									
	CD									
2	AB									
	CD									
3	AB	KWV11-C				2.0	0.01	10	½	
	CD									
4	AB									
	CD									
5	AB									
	CD									
6	AB									
	CD									
7	AB									
	CD									
8	AB									
	CD									
9	AB	VCB02 (GPX)								
	CD	DHQ11 (STD)								
10	AB	TQK50-BA	2.9	0.0	14.5					
	CD	DEQNA-KP	3.5	0.5	23.5					
11	AB	RQDX3-BA				2.48	0.06	13.1		
	CD									
12	AB	signal distribution	0.52		2.60					
	CD									
Mass-storage Shelf Device										
5		TK50	1.4	2.4	35.5				0	0
4		RD53	0.9	2.5	34.5				0	0
3									0	0
2									0	0
1									0	0
Total these columns:										
With RD54 must not exceed:			36A	5A	230W	36A	5A	230W	6	4
Without RD54 must not exceed:			36A	7A	230W	36A	7A	230W	6	4

Backplane Utilization on the Base Systems



Module Information Chart

Module	Size	Current in AMPS +5VDC	Current in Amps +12VDC	Power (Watts)	I/O Panel Type
AAV11-DA	Dual	2.0	0	10	½ B panel for 2 bds
ADQ32	Quad	5.5	0	27.5	1 A panel for 1 bid
ADV11-DA	Dual	3.2	0	16	½ B panel for 2bds
AXV11-C	Dual	2.0	0	10	½ B panel for 2 bds
DEQNA-M	Dual	3.5	0.5	23.5	1 A panel
DHQ11-AP	Dual	1.4	0.23	11.4	2 B panels for 1 bd
DRV11-J	Dual	1.8	0	9	2 A panels for 1 bd
DRV11-WA	Dual	1.8	0	9	2 A panels for 1 bd
VCB02-C	3 Quads	12.6	0.7	71.4	1 B panel

Connection Panels

All the realtime options are available with rear distribution panel kits that bring out the user signals through a distribution panel that mounts on the rear of the system.

Alternatively, the A/D, D/A, and realtime clock options are available with Universal Data Interface Panels (UDIPs) that provide simplified field wiring connections through removable barrier strips.

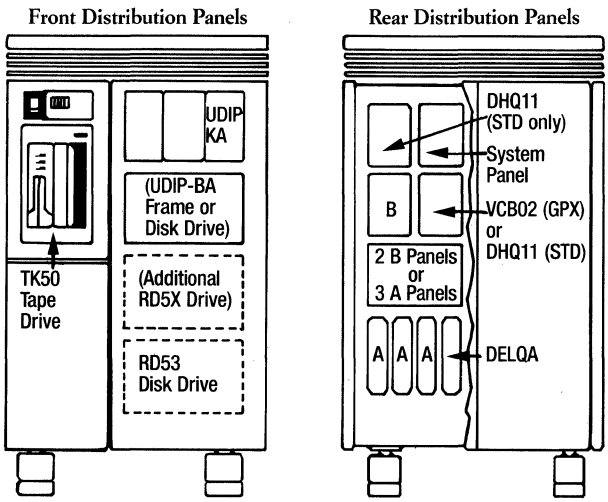
These UDIPs fit may be mounted in the front bay of the VAXlab chassis, on a tabletop frame adapter or on a rack mount frame adapter.

Rear Distribution Panel Kits

When selecting rear cabinet kits for options to be used in the VAXlab/STD, or the VAXlab/GPX, select the BA123 distribution kits.

Information on these kits is to be found in the section on realtime options. The number of available rear distribution panel slots on the VAXlab/STD, and VAXlab/GPX is shown by the following figure. The number of I/O panels required by the realtime options must not exceed the number of slots available.

Front and Rear Distribution Panels on the BA123



STD=VAXlab/STD; GPX=VAXlab/GPX

UDIPS for the Front Bays of the BA123 Chassis

When selecting the UDIP or front-distribution panel kits for the realtime options, select the BA123 version of the kit. Information on these kits is in the section on realtime options.

Each BA123-based VAXlab comes standard with a frame (UDIP-BA) that can fit up to 3 UDIP panels. The frame is mounted in one of the two front bays of the BA123 chassis. The UDIP panel for the realtime clock is mounted on this frame leaving room for two additional UDIP panels.

If additional UDIP panels have to be mounted, a second frame can be purchased for the second front bay of the BA123 chassis.

UDIP-BA	Additional UDIP frame (can hold up to 3 UDIP panels)

UDIPs for the Tabletop Frame Adapter

An alternative to mounting the UDIP frame in the front bay of the BA123 chassis is to mount it in a tabletop frame adapter. Each UDIP-TA tabletop adapter can accommodate up to 3 UDIP panels.

Order additional UDIP-TA tabletop adapters if ordering more than 3 UDIP panels. With each UDIP-TA tabletop frame adapter ordered, order the following:

- The I/O option with the rear distribution panel kit (up to 3).
- The UDIP panel kit for the option that mounts on the tabletop or rack mount frame adapter.
- One UDIP-BA frame for the UDIP panels.
- One (optional) 5-ft. UDIP extension cable—BC19R-05 for each UDIP panel in the UDIP-TA.

UDIPS for the Rack Mount Frame Adapter

The UDIP panels may also be mounted on UDIP-RA rack mount frame adapter. Each UDIP-RA frame can hold two UDIP-BA frames (not included), and each frame can hold three UDIP panels. Order additional UDIP-RA frame adapters if ordering more than 6 UDIP panels. With each rack mount frame adapter, order the following:

- The I/O option with the rear distribution panel kit (up to 6).
- The UDIP panel kit for that option that mounts on the tabletop or rack mount frame adapter.
- Two UDIP-BA frames for the UDIP panels.

Ordering Guide For The Vaxlab/3500

Base System

- LABVX-SA- VAXlab/3500 high-performance workstation

Realtime Options

The Q-bus chassis on the VAXlab/3500 requires realtime options with different handles; different models of the realtime options have to be chosen. The versions of the realtime options compatible with the VAXlab/3500 are listed below:

Model	Description
AAV11-SA	2-channel, 12-bit, 300 kHz D/A
ADV11-SA	16SE/8DI, 12-bit, 50 kHz A/D
ADQ32-SA	32SE/16DI, 12-bit, 200 kHz A/D
AXV11-SA	16 SE/8DI, 20 kHz A/D and 2 ch. D/A
DRQ38-SA	16 in/16 out, 1.3 MHz, DMA digital I/O
DRV1W-SA	16 in/16 out, 0.5 MHz, DMA digital I/O
DRV1J-SA	64-bit digital I/O
IEQ11-SA	IEEE-488 interface with 2 busses
KWV11-SA	Realtime clock

Configuration Guidelines

- A maximum of 4 each of the interfaces—AAV11-SA, ADV11-SA, ADQ32-SA, AXV11-SA—can be ordered for each system.
- A maximum of 3 each of the interfaces—DRV1J-SA, DRV1W-SA, DRQ3B-SA—can be ordered for each system.
- A maximum of 1 IEQ11-SA should be ordered for each system.
- A maximum of 3 KWV11-SAs should be ordered for each system in addition to the KWV11-SA included with the base system.
- The number of options selected must not exceed the number of backplane slots available.
- The power consumed by the options and the base system does not exceed the specified output of the power supplies.
- The correct type and the correct number of distribution panels are chosen.

Connection Panels

The realtime options for the VAXlab/3500 have 50-pin IEEE connectors mounted on their handles. User signals may be brought directly to the 50-pin connector through user-supplied cables without violating FCC regulations.

Alternatively, the A/D, D/A, and realtime clock options are available with Universal Data Interface Panels (UDIP) that can be mounted on a rack mount chassis (provided) or on a tabletop chassis. The UDIP panel kits provide easy access and simplified field wiring connections through removable barrier strips.

UDIPS for the Tabletop Frame Adapter

The VAXlab/3500 is provided with a UDIP-TA tabletop frame adapter. Each UDIP-TA frame adapter can hold one UDIP-BA frame (included) and each frame can hold three UDIP panels.

Order additional UDIP-TA frame adapters if ordering more than 3 UDIP panels.

With each tabletop frame adapter, order the following:

- The "-SA" version of the I/O option (up to 3).
- The UDIP panel kit for that option that mounts on the tabletop or rack mount frame adapter.
- One UDIP-BA frame table-top adapter ordered.
- One (optional) 5-ft. UDIP extension cable—BC19R-05 for each UDIP panel in the UDIP-TA.

Industrial PDP Systems

Digital's Industrial Family of Products offerings include the PDP-11/83 and PDP-11/53 computers packaged for use in harsh factory environments. Functions of the Industrial Family include supervisory control, factory data collection, process control, shop floor information management, and cell or area control. Because they are all based upon Digital computer platforms, the Industrial Family systems and services can also perform general purpose computing in manufacturing.

Industrial PDP-11/83 (Hardware Only)

The General Purpose IPDP (Hardware Only) is a standard PDP-11/83 packaged for an industrial environment. It does not include any operating system or license.

Customers can purchase the IPDP (Hardware Only) with existing PDP-11 applications. Both discrete manufacturing industries and process manufacturing industries will find the IPDP (Hardware Only) suitable for such typical applications as machine automation, process control, supervisory/cell control, data acquisition control, and transfer of information to MRP and plant host systems.

Ordering

Base Hardware includes PDP-11/83 CPU in 12-slot metal chassis, FPU, MSVII-JE 2Mbyte memory, MSVII-JD 1Mbyte memory, RD53 71Mbyte disk drive and RQDX3 disk controller, TK50 95Mbyte tape and TQK50 tape controller, 16 DEC-423 serial lines, (CXA16), 2 H3104 distribution units, 2 BC16D-25 cables, 1 DEC-423 serial line, BC16E-10 null modem cable, H8571-A (25 pin D-sub to MM) adapter, rack and wall mount kit, U.S. 120-V power cord.

Note: Selection from Steps 1 through 3 is *mandatory* for a functioning system.

Step 1—Base Hardware

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**DH-183H1-AA**	IPDP hardware, U.S. power cord, 120 V, English-language documentation and installation diagnostics	Choose one. -AA model recommended for U.S.
1	**DH-183H1-A4**	Same as DH-183H1-AA except 240 V, no power cord, diagnostics or documentation. See Steps 2 and 3 to order separately	

Step 2—Power Cords

Step 2 is required only for the -A4 configuration; DH-183H1-AA includes U.S. 120-V power cord. All cord lengths are 2.5 m, 10A.

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**BN20B-2E**	U.S./Japan: 208–240 V	
1	**BN20C-2E**	Australia/New Zealand: 240/230 V	
1	**BN20D-2E**	Central Europe: 220 V	Central European countries include: Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, and Sweden.
1	**BN20E-2E**	UK/Ireland: 240 V	
1	**BN20F-2E**	Switzerland: 220 V	
1	**BN20H-2E**	Denmark: 240 V	
1	**BN20J-2E**	Italy: 220 V	
1	**BN20K-2E**	India/South Africa	
1	**BN20L-2E**	Israel: 230 V	

Step 3—Diagnostics and Documentation

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**ZY*HH-P5**	*-language diagnostics/documentation on TK50 media	ZYAHH-P5 is optional for DH-183H1-A4. It is included in DH-183H1-AA.

Note: Selection from Steps 4 through 8 is *optional* for a functioning system. There are 7 slots available for expansion.

Step 4—Additional Memory

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**MSV11-JE**	2Mbyte PMI memory	Maximum of two memory modules per system. Base Hardware System includes one, so at most select one additional module.
1	**MSV11-JD**	1Mbyte PMI memory	

Step 5—Additional Mass Storage

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
—	**RD53A-SA**	71Mbyte fixed disk	Maximum of three disks per system. Hardware System includes one, so at most order two additional drives. RD53 and RD54 may be mixed in the same system.
—	**RD54A-SA**	159Mbyte fixed disk	

Step 6—Additional Asynchronous Serial Lines

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
—	**CXA16-AA**	16 lines, DEC-423	Includes 2 BC16D-25 (25-ft) cables and 2 H3104 8-line distribution units.
—	**CXB16-AA**	16 lines, RS-422	Includes 2 BC16D-25 (25-ft) cables and 2 H3104 8-line distribution units.
—	**DRQ3B-SA**	2-port 16-bit DMA parallel interface	Customer must supply device-specific drives for the DRQ3B, IEQ11, DPV11, and DRV11.
—	**IEQ11-SA**	IEEE 488 interface	
—	**DPV11-SA**	1-line synchronous RS-232 w/modem control	
—	**DRV11-SA**	16-bit parallel interface	
—	**CXY08-AA**	8 lines, RS-232 w/full modem	Includes 2 BC19N-12 (12-ft) cables.
—	**DZQ11-SA**	4 lines, RS-232	Choose 1 cable minimum; 4 cables per module max. BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.
—	**BC23H-06**	6-ft cable	
—	**BC23H-25**	25-ft cable	

Step 7—Networking Options

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**DEQNA-SA**	Ethernet communications controller	Maximum of one DEQNA per system.
1	**BNE3K-XX**	PVC cable with right angle bend	Select PVC or Teflon cable in appropriate length.
1	**BNE3M-XX**	Teflon cable with right angle bend	

Step 8—Base Software

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**QR500-UZ**	RSX-11M-PLUS class-H license	All media/documentation kits come on TK50 cartridge tapes.
1	**QR500-H5**	RSX-11M-PLUS TK50 distrib and documentation	

Industrial PDP-11/83 (Complete System)

The General Purpose IPDP (Complete System) is a standard PDP-11/83 packaged for an industrial environment. It contains the RSX-11M-PLUS operating system and license.

Customers can purchase the IPDP (Complete System) with existing PDP-11 applications. Both discrete manufacturing industries and process manufacturing industries will find the IPDP (Complete System) suitable for such typical applications as machine automation, process control, supervisory/cell control, data acquisition control, and transfer of information to MRP and plant host systems.

Ordering

The Packaged System includes PDP-11/83 CPU in 12-slot metal chassis, FPU, MSVII-JE 2Mbyte memory, MSVII-JD 1Mbyte memory, RD53 71Mbyte disk drive and RQDX3 disk controller, TK50 95Mbyte tape and TQK50 tape controller, 16 DEC-423 serial lines (CXA16), 2 H3104 distribution units, 2 BC16D-25 cables, 1 DEC-423 serial line, BC16E-10 null modem cable, H8571-A (25 pin D-sub to MM) adapter, rack and wall mount kit, RSX-11M-PLUS license (QR500-UZ) and RSX-11M-PLUS TK50 distribution (QR500-H5), and U.S. 120-V power cord.

Note: Selection from Steps 1 through 3 is *mandatory* for a functioning system.

Step 1—Packaged System

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**DJ-183H1-A2**	IPDP system, U.S. power cord, 120 V, English-language documentation and installation diagnostics	Choose one. -A2 model recommended for U.S.
1	**DJ-183H1-A3**	Same as DJ-183H1-A2 except 240 V, no power cord, diagnostics or documentation. See Steps 2 and 4 to order separately.	

Step 2—Power Cords

Step 2 is required only for the -A3 configuration; DJ-183H1-A2 includes U.S. 120-V power cord. All cord lengths are 2.5 m, 10 A.

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**BN20B-2E**	U.S./Japan: 208–240 V	
1	**BN20C-2E**	Australia/New Zealand: 240/230 V	
1	**BN20D-2E**	Central Europe: 220 V	Central European countries include: Austria, Belgium, Finland, France, Germany, Netherlands, Norway, Portugal, Spain, and Sweden.
1	**BN20E-2E**	UK/Ireland: 240 V	
1	**BN20F-2E**	Switzerland: 220 V	
1	**BN20H-2E**	Denmark: 240 V	
1	**BN20J-2E**	Italy: 220 V	
1	**BN20K-2E**	India/South Africa	
1	**BN20L-2E**	Israel: 230 V	

Step 3—Diagnostics and Documentation

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**ZYAHH-P5**	English-language diagnostics/documentation on TK50 media	ZYAHH-P5 is optional for DJ-183H1-A3. It is included in DJ-183H1-A2.
1	**ZY*HH-P5**	*-language diagnostics/documentation on TK50 media	

Note: Selection from Steps 4 through 7 is *optional* for a functioning system. There are 7 slots available for expansion.

Step 4—Additional Memory

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**MSV11-JE**	2Mbyte PMI memory	Maximum of two memory modules per system. Packaged System includes one, so at most select one additional module.
1	**MSV11-JD**	1Mbyte PMI memory	

Step 5—Additional Mass Storage

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
—	**RD53A-SA**	71Mbyte fixed disk	Maximum of three disks per system. Packaged System includes one, so at most order two additional drives. RD53 and RD54 may be mixed in the same system.
—	**RD54A-SA**	159Mbyte fixed disk	

Step 6—Additional Asynchronous Serial Lines

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
—	**CXA16-AA**	16 lines, DEC-423	Includes 2 BC16D-25 (25-ft) cables and 2 H3104 8-line distribution units.
—	**CXB16-AA**	16 lines, RS-422	Includes 2 BC16D-25 (25-ft) cables and 2 H3104 8-line distribution units.
—	**CXB16-AA**	16 lines, RS-422	Includes 2 BC16D-25 (25-ft) cables and 2 H3104 8-line distribution units.
—	**CXY08-AA**	8 lines, RS-232 w/full modem	Includes 2 BC19N-12 (12-ft) cables.
—	**DZQ11-SA**	4 lines, RS-232	Choose 1 cable minimum; 4 cables per module max. BC23H cable for use with modems, PLCs. DZQ11 should not be used for terminal support.
—	**BC23H-06**	6-ft cable	
—	**BC23H-25**	25-ft cable	

Step 7—Networking Options

Qty	Part Number	Product Description	Product/Order Limitations or Remarks
1	**DEQNA-SA**	Ethernet communications controller	Maximum of one DEQNA per system.
1	**BC23H-06**	PVC cable with right angle bend	Select PVC or Teflon cable in appropriate length.
1	**BC23H-25**	Teflon cable with right angle bend	

RT950

The RT950 is Digital's family of Q-bus microsystems packaged in industrialized air-conditioned metal cabinets. Available in building block configurations, the RT950 is just slightly larger than the standard micro pedestal outline. The compact packaging makes it an ideal candidate for local workstation applications on the factory floor. The enclosure is sealed to protect the system against dirt, dripping liquids, fibers, metal filings, and oil and coolant seepage.

RT950 microsystems provide computer power where it is needed—out on the shop floor, in the warehouse, on the assembly line or in most any industrial setting where heat, humidity, rough treatment and contaminants can destroy standard computer equipment.

Applications

Typical applications include factory automation, laboratory data collection, instrumentation control, machine tool applications and warehousing.

Features

- Meets NEMA-12 specifications
- Works in operating environment of up to 122°F
- Takes standard Q-bus options
- Field Service support available worldwide

Software support

Since the RT950 systems are Digital's standard computer systems in an industrial enclosure, they run PDP-11 and MicroVAX operating systems and layered software (Micro/RSX, RSX-11M/S, MicroVMS,etc.)

Environmental

Code Standards	NEMA-12, FCC Class A
Operating Temperature	10 to 50°C (50 to 122°F)
Relative Humidity	10 to 95 Max. wet bulb to 32°C (90°F) Min.
Dew Point	2°C (36°F)

Physical

72.4 cm (28.50 in.) high×42.6 cm (16.75 in) wide×76.8 cm (30.25 in) deep.

Electrical

	120 Vac 60 Hz Model	240 Vac 50 Hz Model
Power Source Phasing	Single	Single
Voltage Tolerance	103 to 128 Vac	195 to 256 Vac
Line Frequency Tolerance	57 to 63Hz	47 to 53Hz
Maximum Running Current	10.3A	4A
Maximum Power Consumption	900W	900W

Configuring information

The building blocks are basic configurations to which the customer adds the appropriate mandatory devices and other options to suit his/her needs. The customer selects the system device, load device, memory, diagnostics and software license that best fits the anticipated use. First-time purchases of software license require corresponding media kits. Communications devices, console terminal and software media are optional and must follow guidelines specified in the VAX and PDP Systems and Options Catalogs and the appropiate Software Product Descriptions (SPDs).

Ordering

RT950-C2/C3	MicroPDP-11/73 CPU with 1Mbyte memory, mounted in a BA23 chassis and enclosed in an RT950-AA/AB NEMA-12 enclosure with internal air condtioner.
RT950-C4/C5	MicroPDP-11/73 CPU with 2Mbytes memory, mounted in a BA23 chassis and enclosed in an RT950-AA/AB NEMA-12 enclosure with internal air conditioner.
RT950-F2/F3	MicroVAX II CPU with 2Mbytes memory, mounted in a BA23 chassis and enclosed in an RT950-AA/AB NEMA-12 enclosure with internal air conditioner
RT950-D2/D3	MicroVAX II CPU with 1Mbyte memory, mounted in a BA23 chassis and enclosed in an RT950-AA/AB NEMA-12 enclosure with internal air conditioner

IPQS for Industrial I/O Control

The Packaged Automation Systems (PAS) Family, a series of standalone industrial computer systems, combine the PDP-11 computer with analog and digital I/O capability in a single cabinet. IPQS is the Q-bus version.

A PAS can be used as a standalone, dedicated or distributed intelligent system.

Features

- Fully (factory) integrated system for quick installation and faster start up time
- Digital's PDP strengths and networking capabilities
- Wide variety of I/O interfaces to accommodate most I/O signals
- Expandability/flexibility

Applications

Typical applications include process control, engine testing, pipeline monitoring, energy management, building security, and data acquisition and control.

Standard Equipment

- MicroPDP-11/73 or 11/83, memory, software load media, and Winchester disk
- IPV12-AA/AD I/O Subsystem Master Chassis with I/O control, power supply and mounting space for 10 I/O modules
- A 60-inch high cabinet
- Micro/RSX operating system license
- I/O Subsystem software handler
- FORTRAN license
- Hardware and software documentation
- 90-day warranty

Optional Expansion Capabilities

- Up to two additional H334 10-slot expansion chassis
- Up to three H332 10-slot screw terminal mounting racks
- Up to 30 process I/O modules
- Up to 30 BC40x screw terminal strips
- Add-on cabinets to accommodate a total of eight H334 I/O) chassis

Software Support

Software support is available for the IPQS system under Digital's Micro/RSX operating system which is a disk-based realtime multitasking system. Tasks can be programmed in MACRO-11, FORTRAN-4, and FORTRAN-77.

Also included is a standard driver for the I/O control module and a FORTRAN interface compatible with ISA61.1. Features include online addressing, flexible interrupt handling, and direct addressing for the I/O modules.

Specifications
Physical Characteristics

Height	153.6 cm (60.5 in)
Width	73.6 cm (29.0 in)
Depth	80 cm (31.5 in)

Operating Environment (Meets Digital Standard 102, Class A)

Ambient Temperature	15 to 32°C (59 to 90°F) Mounted in 60-inch high Digital cabinet
Relative Humidity	20% to 80% with Max. wet bulb=25°C (77°F) Min. dew point =2°C (36°F)
Line Voltage	90 to 132 Vac/190 to 254 Vac
Line Frequency	50 Hz to 60 Hz
Wattage	Master Chassis=2880 W Max

Power Supply (IPV12 Q-bus Interface)

Mounting	One (1) Quad SPC slot
Q-bus Loads	One
+5 V Current	2 Amp (Typical), 3 Amp (Max.)

Ordering Information

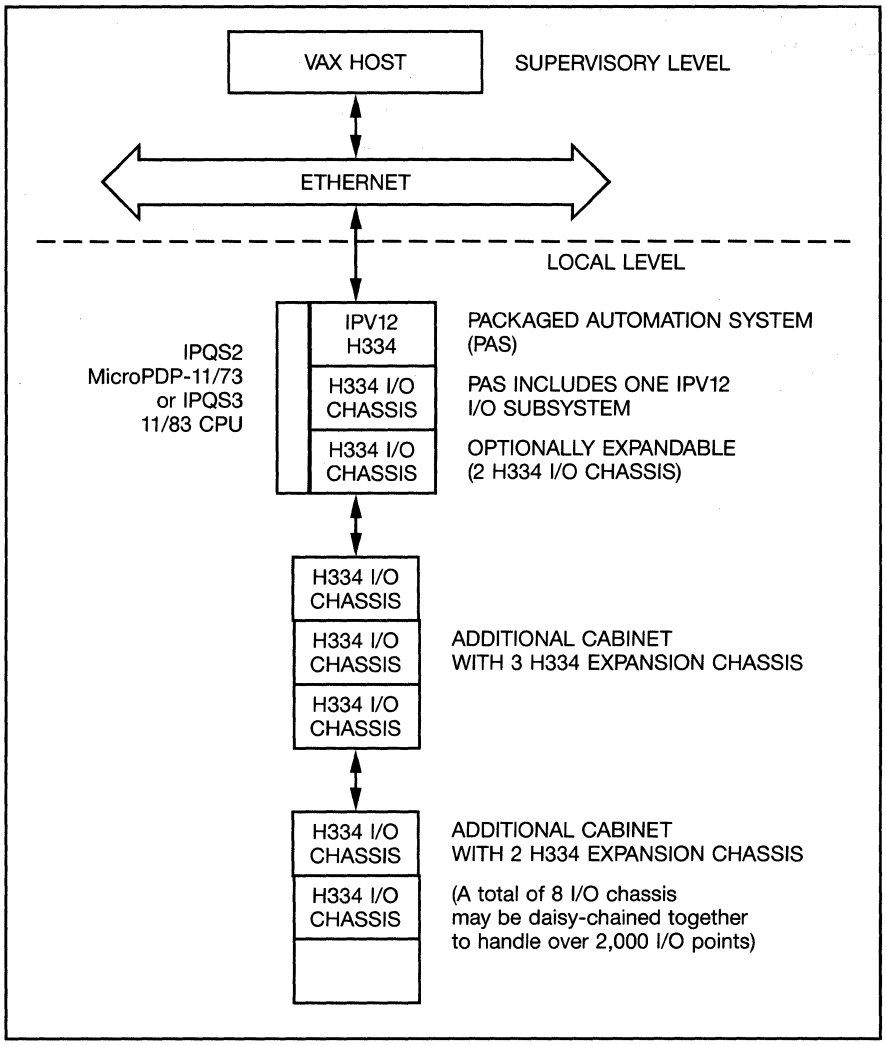
Standard Packages	Power	Description
IPQS2-AA/D	115V/230V	MicroPDP-11/73 CPU, RX50, 1 MB Memory
IPQS2-BA/D	115V/230V	MicroPDP-11/73 CPU, TK50, 1 MB Memory
IPQS3-AA/D	115V/230V	MicroPDP-11/83 CPU, RX50, 2 MB Memory
IPQS3-BA/D	115V/230V	MicroPDP-11/83 CPU, TK50, 2 MB Memory

Additional Information

For in-depth product description and configuration information for the IP family of products (analog and digital I/O, termination strips, etc.) see the following sources.

- *Guide to Digital's Industrial and Scientific Products* (EB-28948-49)
- Call our Industrial Sales Support hot line, 1-800-832-6277.

Local I/O Network Diagram Using IPQS2 or IPQS3 Packaged Automation System for Local Analog and Digital I/O Applications



IPUS for Industrial I/O Control

The Packaged Automation Systems (PAS) Family of standalone computer systems combines analog and digital I/O capability and the PDP-11 computer in a single cabinet to provide a fully integrated configuration that can be used in a wide range of applications.

The IPUS series contain an IP112-AA/AD packaged with a standard Digital UNIBUS PDP-11 system. With the addition of the appropriate I/O modules, terminal strips and mounting chassis, a customer's application needs can be fully satisfied at a very competitive price and can be expanded with additional cabinets to meet even the largest I/O system requirements.

Features

- PDP-11/84 CPU, 1 MB memory
- IP112-AA/AD 120/240V Industrial I/O Subsystem master chassis with I/O control, power supply and mounting space for 10 I/O modules
- RC25 disk subsystem
- H9646 cabinet
- QJ655-XM IP driver software license, sources and documentation
- Hardware and software documentation
- 90 day warranty

Applications

Typical applications are process control, machine control, data acquisition and control, engine testing, pipeline monitoring, and energy management.

Optional Expansion Capabilities

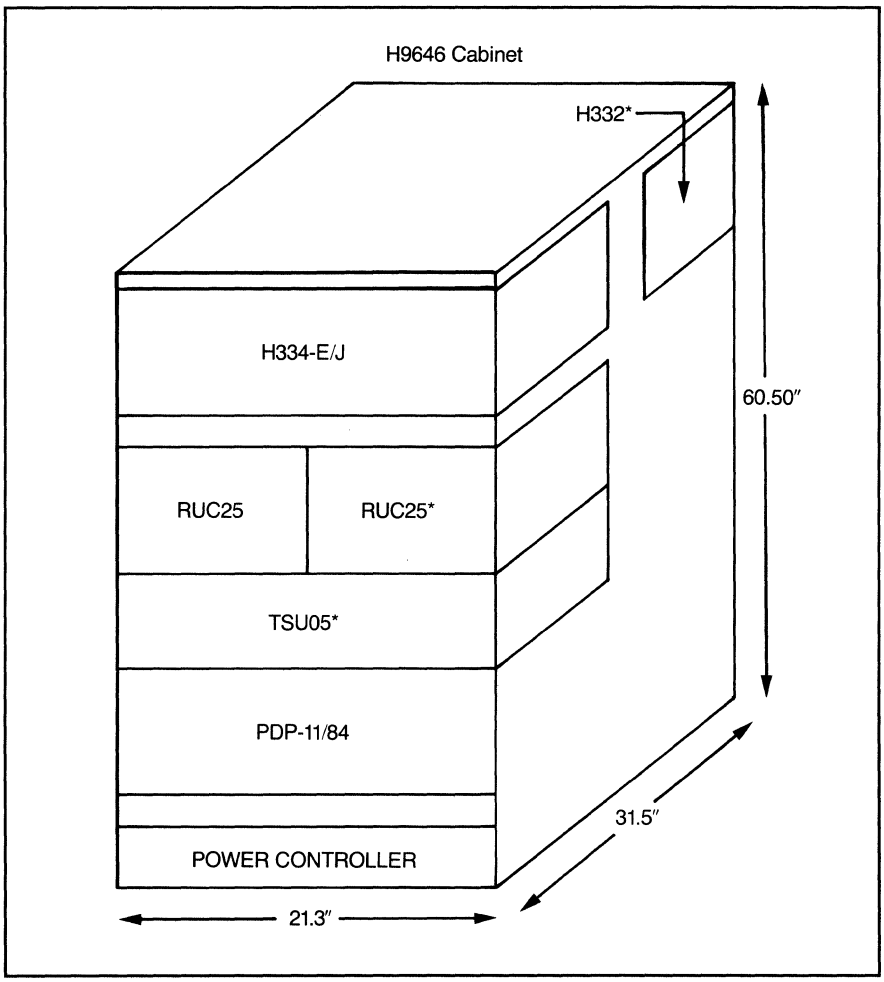
- One additional RC25 disk subsystem
- One TSU05 tape drive
- One H332 10-slot screw terminal mounting rack
- Up to 10 analog or digital I/O modules
- Up to 10 BC40x screw terminal strips
- Add-on cabinets to accommodate up to a total of eight (per processor) H334-E/J I/O Module Chassis, up to eight H332 10-slot screw terminal mounting racks, and associated I/O modules and termination strips

Software Support

Software Support is available under Digital's RSX operating systems which are realtime multitasking systems programmable in MACRO-11 , FORTRAN-4, and FORTRAN-77. Several application software packages are available from Digital's third-party and Cooperative Marketing Program Suppliers.

Also included is a standard driver for the I/O control module and a FORTRAN interface compatible with ISA61.1. Features include on-line addressing, flexible interrupt handling, and direct addressing for the I/O modules.

IPUS Packaged System Configuration



*Optional items, specified per sales order

Ordering

IPUS2-AA/AD	IP Subsystem With PDP-11/84 CPU, 115V/230V

Specifications
Physical Characteristics

Height	153.6 cm (60.5 in)
Width	54.1 cm (21.3 in)
Depth	80 cm (31.5 in)

Operating Environment (Meets DEC Standard 102, Class A)

Ambient Temp.	15 to 32°C (59 to 90°F) Mounted in 60-inch high Digital cabinet
Relative Humidity	20% to 80% with Max. wet bulb=25 C (77 F), Min. dew point= 2°C (36°F)
Line Voltage	90 to 132 Vac/190 to 254 Vac
Line Frequency	50 Hz-60 Hz
Wattage	Master Chassis=2880 W Maximum Powered Expander Chassis=300 W Maximum

IP112 UNIBUS Interface

Mounting	One (1) Quad SPC Slot
UNIBUS Loads	One
+5v Current	2 Amp (Typical), 3 Amp (Max.)

Additional Information

The following sources are listed for in-depth product descriptions (Analog and digital I/O modules available, expansion chassis, screw terminal strips, etc.) and configuration information on the entire IP11 family of products.

1. *Guide to Industrial & Scientific Products* (EB-28948-49)
2. Call our Industrial Sales Support hot line, 1-800-832-6277
3. See the IP112, IPV12 and IPQS sections of this catalog.

CMR21

The CMR (Compact Micro Remote) is a small industrial control system designed for realtime data acquisition from remote, unattended environments. It is a rack-or panel-mountable processing unit consisting of an industry-standard Digital 16-bit PDP-11 processor, ac power supply, CMRcard file with space for up to 16 I/O modules and 16 additional slots for cable-termination/signal-conditioning modules. It can operate on AC or AC/DC power supplies.

The CMR21 can be programmed to operate as a standalone, dedicated I/O system or can function as part of a widely distributed control network. The CMR21 can communicate to your host processor via simple EIA/CCITT lines. Every CMR21 contains firmware that enables the unit to perform as an intelligent controller. It will interpret commands sent from the host computer over a standard EIA terminal line and will respond with data from field I/O sensors. It can also be programmed to incorporate special functions unique to each application.

Applications

Applications for the CMR21 vary from industry to industry. However, all share two common elements: the need to provide distributed, intelligent control at a remote, unattended location, and the need to report the results of this control to a higher-level operator or system. A standalone CMR21 can monitor up to 256 real-time events and report their status.

Features

- Compatible with PDP-11 series of computers
- 48 KB of memory space for program storage
- Integrated realtime clock
- Watchdog timer for notification of system failure
- Four serial asynchronous communications ports

Software Support

The CMR21 has built-in ROM firmware (called Base Mode) for commonly used I/O functions and maintenance and diagnostics routines for automatic self-test during each power up. User Mode allows the user to go beyond the installed capabilities. User-defined routines can be written at the host level (using MicroPower/Pascal software development tools on a PDP-11 or VAX system) then downline loaded to the CMR and permanently stored in ROM memory for secure and reliable operation.

Optional host utility software for VAX or PDP-11 host system is available. The utilities, not mandatory for CMR21 operation, are diagnostic aids that help you poll a remote multidrop network of CMR21 units to determine network configuration and the status of each remote unit.

Cabling

Paddleboards are available with split lugs (M9050) or with a 40-pin connector (M9052) for connection to the field wiring. The A806 analog subsystem and the D806 digital subsystem include a special paddleboard (M9055), a BC02D-08 cable, and a conditioning panel assembly for field wiring and connectors for signal conditioning blocks from OPTO 22.™*

*OPTO 22 is a trademark of OPTO 22, Huntington Beach, CA.

Ordering

CMR21-Ax*	CMR21 Processor, including 16KB RAM memory, four communications ports, built-in firmware diagnostics, and resident base mode command language, rack-mount chassis with space for 16 I/O modules, AC or AC/DC power supply.
CMR21-Bx*	CMR21-A option including host utility software for PDP-11 host systems.
CMR21-Cx*	CMR21-A option including host utility software for VAX host systems.

*Denotes power variations:

A 120 Vac 60 Hz; B 240 Vac 50 Hz; C 120 Vac or 12 Vdc; D 240 Vac or 12 Vdc

Analog and Digital I/O Modules

The following I/O options are currently available for the CMR21:	
A805	12-bit A/D converter
A1004	8-channel relay MUX, 2-wire
A1005	8-channel relay MUX, 3-wire
A6005	2-channel D/A, 10-bit
M8986	16-bit digital output Mercury Relay normally closed
M8987	16-bit digital output Dry Reed, 10VA
M8993	16-bit isolated digital input
M8994	16-bit digital output normally open
M8997-YA	4-channel pulse counter
M9050	General purpose signal conditioning paddle board
M9052	M9050 except 40 pin 12-09441-02

Options

The following subsystems include an analog or digital intelligent I/O controller module, an M9055 32-line paddle-board, one BC02D cable and a conditioning panel for mounting OPTO 22 I/O blocks. The "R" versions include a 19-inch wide rack for mounting the conditioning panel. The "XA" expansion consists of an additional cable and conditioning panel necessary to fully utilize each subsystem. One OPTO 22 block is required for each I/O channel.

Analog and Digital Subsystems

A806P-AA	Analog subsystem—panel mount
A806R-AA	Analog subsystem—rack mount
A806P-XA	Expansion option—panel mount
A806R-XA	Expansion option—rack mount
A806R-IN	Analog input subsystem (15 channel)
A806R-OT	Analog output subsystem (8 channel)
A806R-IO	Analog input/output subsystem
D806P-AA	Digital subsystem—panel mount
D806R-AA	Digital subsystem—rack mount
D806P-XA	Expansion option—panel mount
D806R-XA	Expansion option—rack mount
D806R-IN	Digital input subsystem
D806R-OT	Digital output subsystem
D806R-IO	Digital input/output subsystem

Specifications

Dimensions	Height: 30.5 cm (12 in) Width: 48.3 cm (19 in) Depth: 27.9 cm (11 in) Weight 23 kg (50 lb) without I/O cards 27 kg (60 lb) with I/O cards

Mechanical

Processor Memory	Digital DCT11-AA microprocessor. 16 KB RAM installed plus 4 sockets for addition of up to 40 KB RAM/ROM/EPROM. Maximum addressable memory: 56KB
Realtime Clock	Selectable to 50/60/800 Hz
Watchdog Timer	Programmable timer, with externally accessible relay contacts. Selectable time periods from 16.7 microseconds to 18 minutes.

Electrical

90 to 127 Vac @ 47 to 63 Hz
Optional 12 Vdc @ 25A max.

Environmental

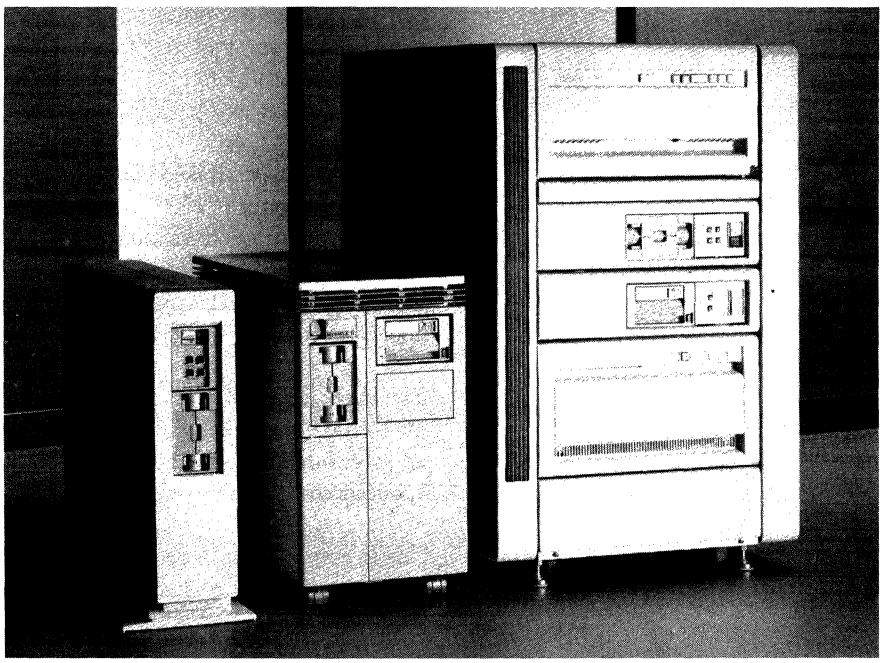
Operating Environment	41°F to 122°F 5°C to 50°C
Relative Humidity	10 to 90 noncondensing

Additional Information

For in-depth product description and configuration information for the CMR family of products see the following sources for additional information:

- *Guide to Digital's Industrial and Scientific Products* (EB-28948–49)
- Call our Industrial Sales Support hot line 1-800-832-6277
- *CMR21 User Guide* (EK-CMR21-UG)

MicroVAX II



The MicroVAX II super-microcomputer, the pioneer member of Digital's 32-bit VAX family configured using the extended Q-bus, supports a wide range of realtime applications. The CPU features:

- The MicroVAX 32-bit central processor chip
- Floating Point Unit (or FPU chip)
- One Mbyte of on-board memory
- Q22 Bus interface
- Q22 map for DMA transfers
- Interval timer, boot and diagnostic facility
- Console serial line unit
- Time of year clock with battery back-up support

Processor:	MicroVAX II
Realtime Operating Systems:	MicroVMS, VAXELN
Mass storage Options:	RD54, RD55, RX50, TK70, TK50, RA81, RA60, TSV05
RAM:	2-16Mbyte
I/O Bus:	Q-bus

See the VAX Systems and Options Catalog for more detailed information.

MIRA Microsystems

A MIRA system comprises dual MicroVAX II computers, each supplied from its own power source and mounted in a single cabinet (or two cabinets for larger configurations). The configurations of each computer are normally identical, so that one computer serves as a backup for the other in the event of failure.

The computers are linked via Ethernet and MIRA unique hardware. The software controls the status of each computer: Master, Standby, or Idle; it detects a computer failure and changes the status of the system accordingly. Designated devices that were previously connected to a failed Master computer will be connected to the Standby computer, the status of which changes to Master. A user can then restart applications on the new Master and continue operation.

The two MicroVAX II computers operate independently; process and volume shadowing are not currently features of MIRA. A MIRA system provides the hardware and software environment required for the development of high-availability control applications.

The Ethernet link can be utilized by the application programs to exchange status information and to back up critical data on the Standby computer. Each computer has a unique Ethernet address and node name.

For automatic recovery, the user application is required to maintain the Standby in a state of readiness where it can assume Mastership. The user application is also required to recover communication with the devices that have been switched and for the restart/recovery of the Master application.

Switched Devices

Switched Devices are configured to allow them to connect to either computer. They are connected to the MIRA system via a common I/O distribution panel and the hardware and software controls to which they are assigned at any time.

The operator specifies whether a device should be connected to the Master or Standby computer via a utility that creates the Switch Map File. The MIRA switch controls hardware and software exchange status messages via a watchdog. If the Master computer fails to send its message, a system Failover will occur. In the event of a system Failover, the switched devices on the Standby are disconnected, and the Master Devices connect to the Standby processor. The full MIRA switch control software can perform a system Failover in less than two seconds. After the System Failover is complete, the user's application programs are responsible for failure recovery.

Customer-written application programs or the operator also can swap the status of the system should they detect an application error.

Hardware

The MIRA base system comprises two MicroVAX IIs; each includes:

- MicroVAX II CPU
- 5Mbytes of main memory
- 71Mbytes (RD53) Winchester disk
- TK50 (tape cartridge) load device
- DEQNA (Ethernet interface)

Expansion Options

Memory	As much as 9Mbytes maximum with the addition of an MS630-BB 4Mbyte increment.
I/O Lines	The following items may be added as switched devices: DHV11-AB DMV11-AW DMV11-BB DMV11-CB DMV11-FB DPV11-AB DZQ11-DB KMV1A-AB KMV1A-EB KMV1A-FB

Note: All the other I/O devices may be added as non-switched devices.

Expansion Box	An upgrade (DS-UPGRD-A2) is needed to go from a small MIRA configuration to a large MIRA configuration.

Ordering Information

To simplify the ordering of MIRA systems, special "DS" packaged systems and options have been created. A MIRA system is configured and ordered in the same way as a standard MicroVAX II system; all MIRA special hardware is then configured and automatically included.

DS-630Q1-A2	MIRA Dual MicroVAX II; small configuration, 120 V, in one cabinet. Each MicroVAX II has one BA23 with 5Mbytes of memory, RQD disk controller, RD53 71Mbyte Winchester disk, TQK tape controller, TK50 streamer tape, and DEQNA.
DS-630Q2-A2	MIRA Dual MicroVAX II; large configuration, 120 V, in two cabinets. Each MicroVAX II has one BA23 with 5Mbytes of memory, RQD disk controller, RD53 71Mbyte Winchester disk, TQK tape controller, TK50 streamer tape, and DEQNA, plus a BA23 expansion box.
DSKIT-XX	MIRA country kit (includes 2 power cords)—only applicable in Europe: XX: AE=UK/IRELAND AI=ITALY AT=ISRAEL AD=DENMARK CA=CENTRAL EUROPEAN CB=SWITZERLAND
DS-UPGRD-A2	Upgrade kit; DS-630Q1 to DS-630Q2, MIRA 120 V (cabinet with expansion BA23s and extended switching capacity).

Options Supported

DSDHV-AB	MIRA	DHV11-AB	8 lines asynch MUX
DSDMV-AW	MIRA	DMV11-AW	Multi-port RS-232
DSDMV-BB	MIRA	DMV11-BB	Multi-port V.35
DSDMV-CB	MIRA	DMV11-CB	Multi-port COAX
DSDMV-FB	MIRA	DMV11-FB	Multi-port RS-423
DSDPV-AB	MIRA	DPV11-AB	1 line synch
DSDZQ-DB	MIRA	DZQ11-DB	4 lines asynch MUX
DSKMV-AB	MIRA	KMV1A-AB	1 line synch RS-232
DSKMV-EB	MIRA	KMV1A-EB	1 line synch RS-422
DSKMV-FB	MIRA	KMV1A-FB	1 line synch RS-423
DSNET-Q1	Ethernet		Minimum length Ethernet kit; H4000s for private inter-processor link.

Software

MIRA— QZZDM-AZ	MicroVAX switch control software license. Two licenses are required for a MIRA system.
QZZDM-H5	Software distribution (TK50) and documentation. **Note:** Two MicroVMS licenses (QZ00X-C5) are required for each MIRA system. Because there are two MicroVAXes per system, all layered software requires two licenses.

Configuring Information

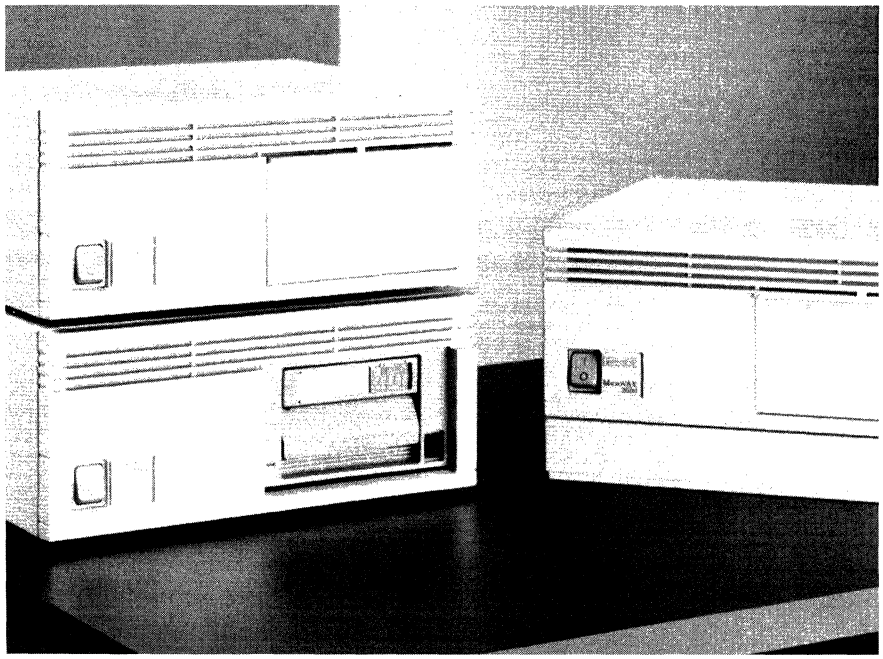
The MicroVAX II systems are integrated in BA23 boxes. The Micro-System BA23 Q-bus backplane has eight slots. It contains a 230-watt power supply and dedicated space for the two 5.25-inch (13.3-centimeter) mass storage devices. When configuring BA23 systems:

- Use the template for the eight-slot configuration. Write the module and mass-storage device names in the left column beside the slot and shelf numbers. When configuring these systems, note that quad-height modules use both the AB and CD portions of a slot.
- Slots two and three can accommodate either one dual-height or one quad-height Q-bus option. If a dual-height module is plugged into slot AB, slot CD cannot be used.
- Slots four through eight can accommodate either two dual-height options or one quad-height option.
- Enter the +5 V and +12 V currents, power, the ac and dc bus loads, and I/O panel inserts required for each module and mass storage device. The totals must not exceed the limits listed at the bottom of the configuration template.

MIRA-Specific Configuration Rules

- Each small (single-cabinet) system has one switched I/O door and two unswitched I/O doors.
- Each large (dual-cabinet) system has two switched I/O doors and four unswitched I/O doors.
- Each switched I/O door has at least 11 type B panels and two type A panels available.
- Each unswitched I/O door has at least eight type B panels and six type A I/O panels available.

MicroVAX 2000



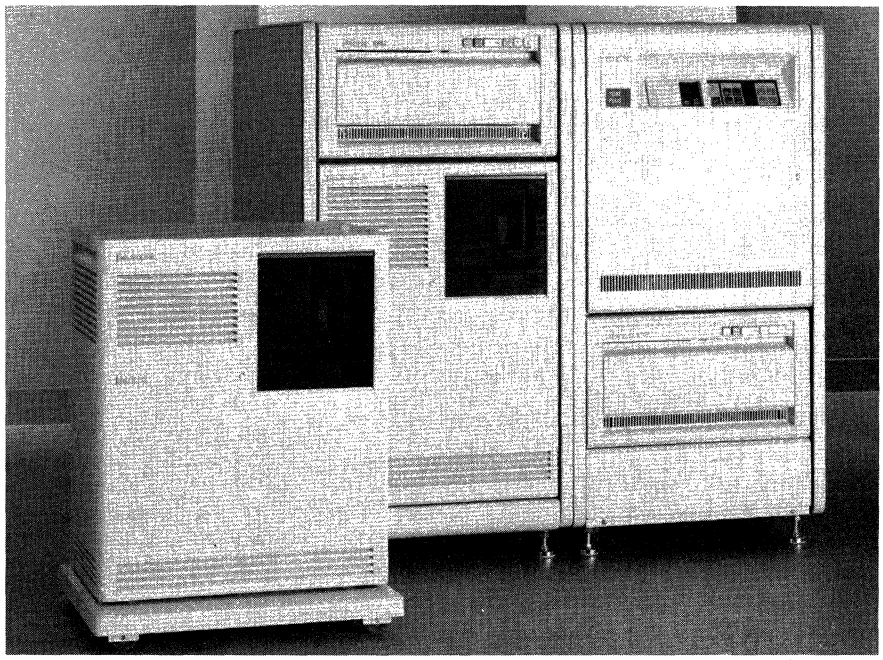
The MicroVAX 2000, a multiuser, general purpose 32-bit VAX system, offers the compute-performance of a MicroVAX II in an extremely cost-effective package. It incorporates a full VAX system on a single integrated board that eliminates the expense of a Q-bus and is fully compatible with all other members of the VAX family.

The MicroVAX 2000 uses the MicroVAX II CPU and FPU processor chipset and provides up to 6Mbyte of memory in a configuration so compact that it can sit on a table or shelf. It supports four serial lines, including one modem/data line and three data-only lines.

Processor:	MicroVAX II
Realtime Operating System:	MicroVMS
Mass Storage Options:	RX33, RD32, RD53, RD54, TK50
I/O Bus:	Integral, not accessible

See the VAX Systems and Options Catalog for more detailed information.

MicroVAX 3500/3600 Systems



The MicroVAX 3500 and 3600 timesharing systems are high-performance system complements to MicroVAX II, based on CMOS chip technology. CMOS chip technology enables these systems to speed the processing of data to three times faster than that of the MicroVAX II CPU.

In addition, the 32Mbytes of ECC memory double the capacity of the MicroVAX II—and an advanced caching make these systems the new standard of comparison for large system performance in a small package. And, the new MicroVAX 3500/3600 systems, like the pioneer MicroVAX II and the recently introduced MicroVAX 2000, offer complete software compatibility with all the other members of the VAX family.

The MicroVAX 3500 is ideal for office environments in its 27-inch-high pedestal enclosure. The MicroVAX 3600, engineered primarily for the computer room and laboratory environments, comes in a 40-inch-high cabinet. Both systems include total hardware/software system integration packaging, and allow you to choose either a fully integrated VMS or ULTRIX-32 hardware/software system.

MicroVAX 3500 Hardware Standard Features

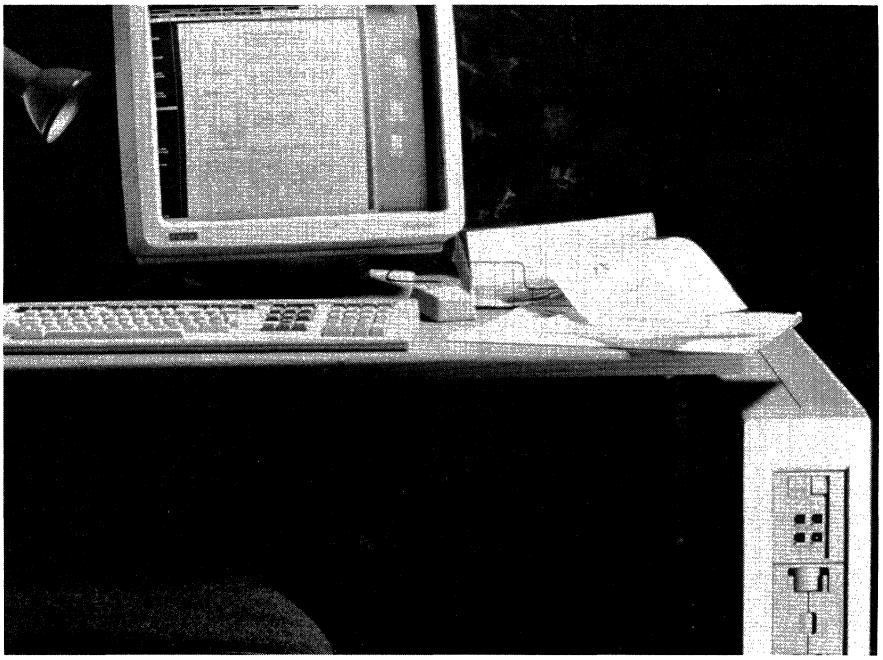
- KA650-AA board
- 16Mbyte ECC memory (with ability to expand to 32Mbytes)
- BA213-BA S-Box pedestal enclosure
- TK70 296Mbyte cartridge tape
- KDA50 disk controller
- RA70 280Mbyte 5.25-inch fixed disk
- DELQA-SA Ethernet controller
- Diagnostics/documentation (only in -AA configurations)
- One-year system warranty
- Choice of VMS or ULTRIX-32 operating system licenses
- Related system software

MicroVAX 3600 Hardware Standard Features

- KA650-AA CPU board
- 32Mbytes of ECC memory
- H9644 40 inch-high cabinet enclosure with BA213 chassis
- TK70 296Mbyte cartridge tape
- KDA50 disk controller
- RA82 622Mbyte disk
- DELQA Ethernet interface
- Diagnostics/documentation (only in-AA configuration)
- One-year system warranty
- Choice of VMS or ULTRIX-32 operating system licenses
- Related system software

See the VAX Systems and Options Catalog for more detailed information.

VAXstation II



The VAXstation II, based on the MicroVAX II CPU, is a high-powered, single user graphics workstation with 2Mbytes of memory expandable 16Mbyte. Fully compatible with other VAX computers, the VAXstation runs MicroVMS or ULTRIX-32 system software. Dozens of third party software developers port their high performance graphics application products to the VAXstation, a standard platform in the technical workstation marketplace.

The VAXstation II features:

- High resolution, 19-inch 1,024-by-864 pixel, 60 Hz non-interlaced monitor.
- One of the fastest floating-point accelerators in the super-micro class.
- Standard Q-bus hardware compatibility with the quad-form factor.
- VAX GKS V2.0 (level 2b) industry standard application programming interface standard with VMS systems. ULTRIX systems include license for GKS level 0b.
- VAX Workstation Windowing Software for VMS environment and the X Window System for ULTRIX environments—providing multiple windows for the viewing and control of multiple tasks executing concurrently.
- VT200 and Tektronix 4014 terminal emulation for access to the many existing VAX-based software applications.
- DEQNA Ethernet interface as standard equipment.
- Three-button mouse for manipulating windows or images.
- VMS or ULTRIX system software license and workstation software license included in the price of the packaged systems.

System CPUs/VAXstation II

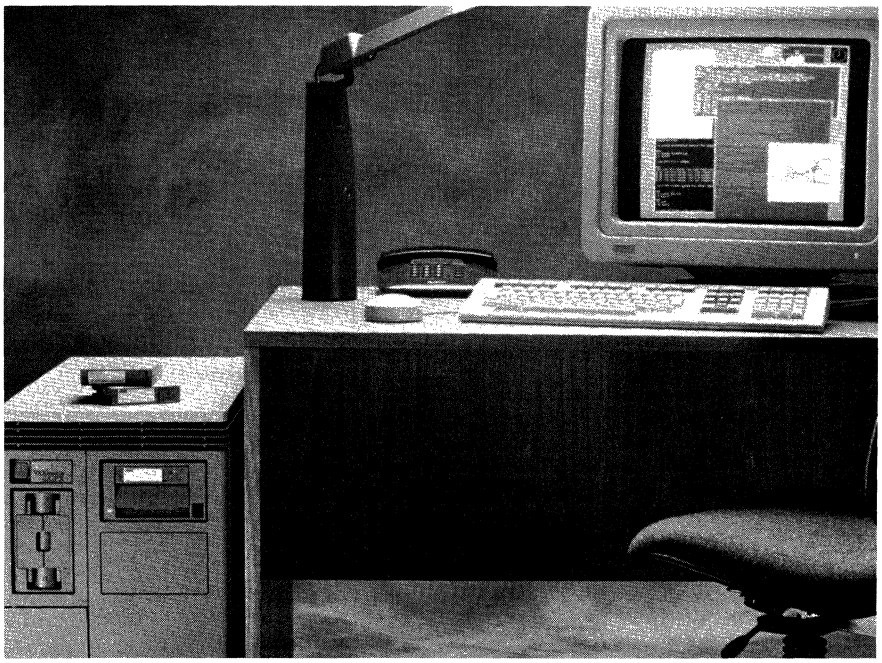
The VAXstation II is available in the following configurations:

- VAXstation II
- ADA Workstation
- Artificial Intelligence Workstation
- System Building Blocks

Processor:	MicroVAX II
Realtime Operating System:	MicroVMS, ULTRIX-32 system software
Mass Storage Options:	RX50, RD53, RD54, TK50
RAM:	2-16 bytes
I/O Bus:	Q-bus

See the VAX Systems and Options Catalog for more detailed information.

VAXstation II/GPX



The VAXstation II/GPX color graphics workstation is a powerful member of the VAXstation family. The VAXstation II/GPX gains its performance advantage from a VLSI graphics coprocessor that offloads text and graphics computation from the MicroVAX II CPU. The VAXstation II/GPX is fully compatible with the VAXstation 2000 and the VAXstation II. Available in either the 8-slot BA23 enclosure or the 12-slot BA123 enclosure (which supports up to three Winchester drives for a total of 477Mbyte of storage), the VAXstation II/GPX's memory is expandable to 16Mbyte.

The VAXstation II/GPX features:

- Choice of two operating systems—MicroVMS or ULTRIX—32-with windowing software.
- An ULTRIX-based MicroVAX II configuration that supports two graphic displays, each with its own dedicated graphics co-processor.
- Capability to display 16 simultaneously colors (4-plane system) or 256 colors (8-plane system) from a palette of over 16 million colors.
- Extensive networking capabilities; Ethernet controller is standard on all package systems.
- VT220 and Tektronix 4014 terminal emulation.

Processor:	MicroVAX II
Realtime Operating System:	MicroVMS, ULTRIX
Mass Storage Options:	RD53, RD54, TK50
RAM:	5–16Mbyte
I/O Bus:	Q-bus

See the VAX Systems and Options Catalog for more detailed information.

VAXstation 3500

The VAXstation 3500, along with the VAXstation 3200, extends the VAXstation family of high-performance workstations into high-performance 2-D and entry-level 3-D applications. These systems, the first VAXstations based on the CMOS technology CPU and FPU chipset, offer more than three times the performance of previous VAXstations. The VAXstation 3500 is housed in the new BA123 enclosure. It comes with the new 280Mbyte RA70 disk and can support up to 560Mbytes of disk storage.

Features

- Four or eight graphics planes
- 32Mbytes of main memory maximum
- A single-board Ethernet interface, enabling the VAXstation 3500 to be a full-featured member of a local area network
- Twelve backplane slots
- The new 280Mbyte RA70 disk and 296Mbyte TK70 cartridge tape
- New, quieter and more accessible system enclosure for office operation and ease of maintenance
- Two operating systems VMS or ULTRIX-32

See the VAX Systems and Options Catalog for more detailed information.

VAXstation 3200

The VAXstation 3200 extends Digital's family of workstations into high-performance 2-D and entry-level 3-D applications. The VAXstation 3200 and VAXstation 3500 are the first VAXstations based on the new CMOS technology CPU and FPU chip-set. This enables the VAXstation 3200 to perform more than three times faster than earlier VAXstations. The VAXstation 3200 is housed in the same BA23 pedestal enclosure that houses the VAXstation II.

Features

- Four to eight graphics planes
- 8 or 16Mbytes of main memory
- Supports up to 318Mbytes of storage
- A single-board Ethernet interface enabling the VAXstation 3200 to be a full-featured member of a local area network
- Eight backplane slots
- Two operating systems: VMS or ULTRIX-32

See the VAX Systems and Options Catalog for more detailed information.

VAX 8530

Digital's VAX 8530 computer systems are midrange members of the VAX family of computers. These high-performance systems implement the VAX architecture, continuing complete software compatibility with all other VAX systems. The central processor uses 32-bit architecture with 4Gbytes of virtual addressing space.

Features

The VAX 8530 CPU features:

- Virtual memory management
- Bootsrap loader
- Standard instructions for packed decimal, floating (F, D, G, and H data types) and fixed-point arithmetic, character and string manipulations
- 64Kbyte direct-mapped write-through cache memory
- High precision programmable realtime clock
- Time-of-year clock with battery backup
- A 16-Kword (144-bit words) writable control store
- Memory controller for a full 256Mbytes of memory capacity for VMS, and 128Mbytes for ULTRIX-32
- Ethernet port
- One VAXBI channel
- Console subsystem based upon a PDP-11 microcomputer with video terminal, 30Mbyte Winchester disk, RX50 floppy-disk drive, and remote diagnostic port

VAX 8550

Digital's VAX 8550 computer systems are high-end members of the VAX family of computers. These high-performance systems implement the VAX architecture continuing complete software compatibility with all other VAX systems. The central processor uses 32-bit architecture with 4Gbytes of virtual addressing space.

The VAX 8550 features:

- Virtual memory management
- Bootstrap loader
- Standard instructions for packed decimal, floating (F, D, G, and H data types) and fixed-point arithmetic, character and string manipulations
- 64Kbyte direct-mapped write-through cache memory
- High-precision programmable realtime clock
- Time-of-year clock with battery back-up
- 16-Kword (144-bit words) writable control store
- Memory controller for a full 256Mbytes of memory capacity for VMS and 128Mbytes for ULTRIX-32
- Ethernet port
- One VAXBI channel
- Console subsystem based upon a PDP-11 microcomputer with video terminal, 30Mbyte Winchester disk, RX50 floppy-disk drive, remote diagnostic port

System CPUs/VAX 8550

VAX 8550 Systems can be ordered with a VMS or ULTRIX-32 operating system.

Processor	VAX 8550
Realtime Operating System	VMS, ULTRIX-32
Mass Storage System	RA60, RA81, SA482, TU81-Plus
RAM	48-256Mbytes
I/O Bus	UNIBUS, VAXBI
Expandability	Expansion cabinets and backplanes available

VAX 8700

Digital's VAX 8700 computer systems are high-end members of the VAX family of computers. These high performance systems implement the VAX architecture, continuing complete software compatibility with all other VAX systems. The central processor uses 32-bit architecture with 4Gbytes of virtual addressing space.

The VAX 8700 features:

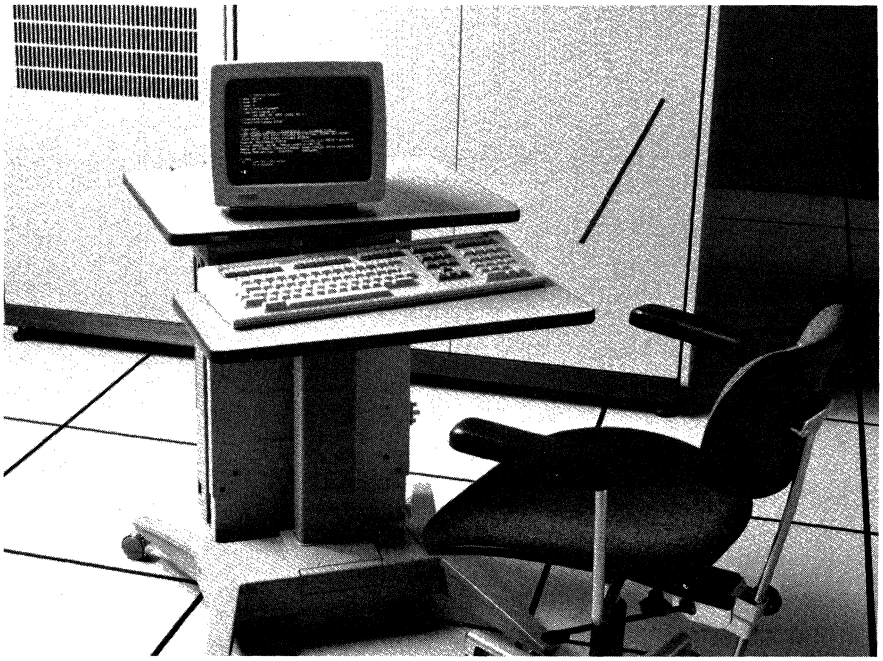
- Virtual memory management
- Bootstrap loader
- Standard instructions for packed decimal, floating (F, D, G, and H data types) and fixed-point arithmetic, character and string manipulations
- 64Kbyte direct-mapped write-through cache memory
- High-precision programmable realtime clock
  - Time-of-year clock with battery back-up
  - Memory controller and memory backup for a full 256Mbytes of capacity for VMS, and 128Mbytes for ULTRIX-32
- Ethernet port
- One VAXBI channel
- Console subsystem based on a PDP-11 microcomputer with video terminal, 30Mbyte Winchester disk, RX50 floppy disk drive, remote diagnostic port.

VAX 8700 systems can be ordered with a VMS or ULTRIX-32 operating system.

System CPUs/VAX 8700

Processor	VAX 8700
Realtime Operating System	VMS, ULTRIX-32
Mass Storage System	RA60, RA81, SA482, TU81
RAM	48–256Mbyte of memory
I/O Bus	UNIBUS, VAXBI
Expandability	Expansion cabinets and backplanes are available

VAX 8800



Digital's VAX 8800 computer systems are high performance members of the VAX family of computers. These high-performance systems implement the VAX architecture, continuing complete software compatibility with all other VAX systems. VAX 8800 systems are tightly coupled multiprocessing systems comprising two CPUs that access 256Mbyte of shared memory. The central processor uses 32-bit architecture with 4Gbytes of virtual addressing space.

Features

The VAX 8800 features:

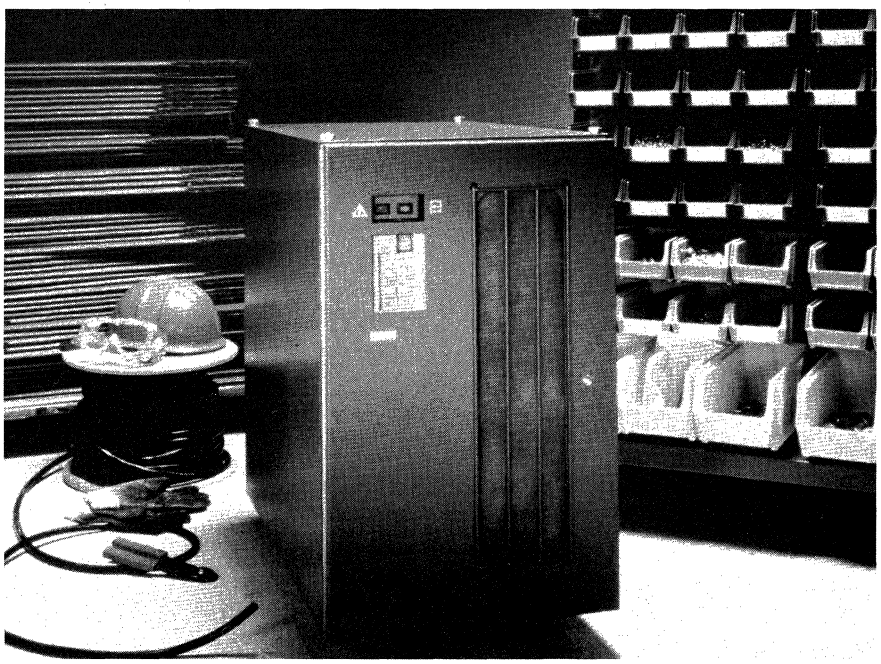
- Virtual memory management
- Bootstrap loader
- Standard instructions for packed decimal, floating (F, D, G, and H data types) and fixed-point arithmetic, character and string manipulations
- Two 16 Kword (144-bit words) writable control stores
- Memory controller and memory battery back-up for a full 256Mbytes of memory for VMS and 128Mbytes for ULTRIX-32
- VAXcluster port
- Ethernet port
- Two VAXBI channels
- Console subsystem based on a PDP-11 microcomputer with video terminal, 30Mbyte Winchester disk, RX50 floppy-disk drive, remote diagnostic port

VAX 8800 can be ordered with a VMS or ULTRIX-32 operating system.

System CPUs/VAX 8800

Processor	VAX 8800
Realtime Operating System	VMS, ULTRIX 32
Mass Storage System	RA60, RA81, SA482
RAM	64–256Mbytes of memory
I/O Bus	UNIBUS, VAXBI

MicroPDP-11 Systems



Digital's PDP-11 systems, based on a compatible set of processors, use a common architecture and a common instruction set. PDP-11 systems offer the widest selection of operating systems, languages, data management, communications, and applications software in the industry. In addition, they can be connected easily to our larger VAX systems, to personal computers, to other vendors' mainframes, and into an Ethernet local area network.

For more information on the Micro PDP-11 systems described in this catalog see the PDP Systems and Options Catalog.

MicroPDP-11/53 and Micro PDP-11/53 PLUS

The MicroPDP-11 is at the entry level of the MicroPDP-11 family of computers. Packaged to fit easily under a desk or work table, on a tabletop, or as a rack mountable box enclosure, it can be expanded to support up to 14 terminals and four to six active users.

The MicroPDP-11/53 CPU module is quad-height and features a 15MHz J11 chip, 512 KB on-board parity memory, two serial line units, and executes the full MicroPDP-11/73 floating point instruction set. The MicroPDP-11/53 systems feature low cost half-height storage technologies.

The MicroPDP-11/53 PLUS CPU module is identical in functionality to the 11/53 CPU module, but includes an additional megabyte of on-board memory for a total of 1.5 MB. The added memory can provide performance improvements of up to 30 over the MicroPDP-11/53 in certain memory intensive applications. The Micro-PDP-11/53 PLUS systems also include the higher performance and higher capacity full-height storage technologies.

Processor	J11
Realtime Operating Systems	Micro/RSX, RSX-11M+, RSX-11M/S , RT-11
Mass Storage Options for MicroPDP-11/53	RX33, RD31, RD32 (internal) TK50, RD53, RD54 (external)
Mass Storage Options for MicroPDP-11/53 PLUS	TK50, RD32, RD53 (internal) RD54 (external)
RAM	1.5 MB to 4 MB in PDP-11/53 Plus .5 MB to 4 MB in PDP-11/53
I/O Bus	Q-bus
Enclosures	BA23 pedestal, rackmount
Expandability	The backplane can be expanded to an additional 8 slots with BA23 expander box. I/O connectivity can be increased with the H3490-A I/O Distribution Panel. And the enclosure can be upgraded to the H9642-JA Microsystems Cabinet

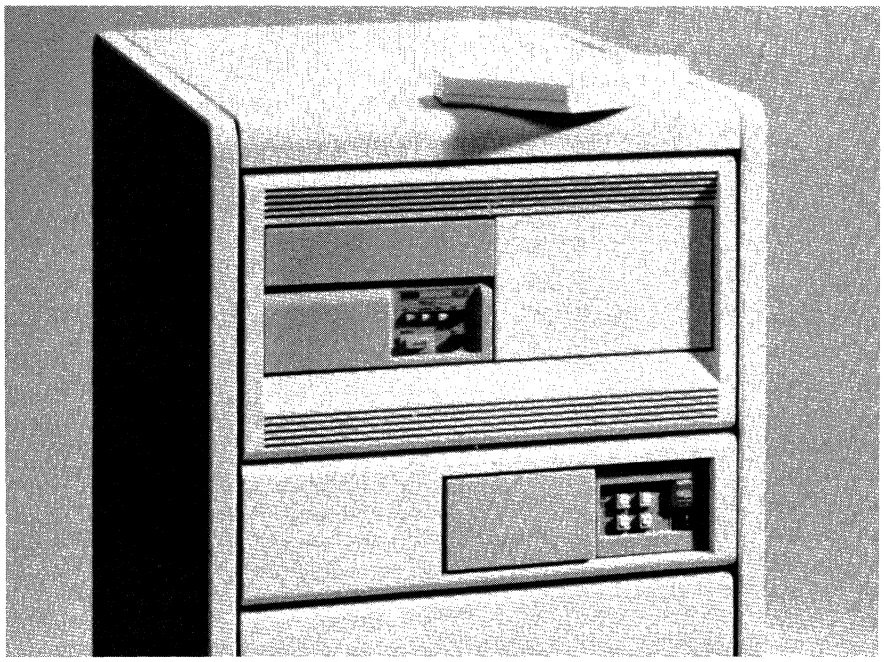
Space and Power Available for Realtime Options

The MicroPDP-11/53 -BA23 backplane has a total of eight slots. Slot one is always reserved for the CPU. Of the remaining slots one is usually reserved for the disk controller and at least one can be used for additional memory above the .5MB–1.5MB included on the CPU board. This leaves up to 5 quad slots for realtime options.

MicroPDP-11/53 and MicroPDP-11/53 PLUS

Available Slots	DC Amps Available at +5 V	DC Amps Available at +12 V	Power (Watts)	Bus Loads AC	Bus Loads DC	I/O Panel Units B	I/O Panel Units A
8 Quad	36	7	230	22	20	4	2
8 Quad	36	7	230	22	20	4	2

MicroPDP-11/73



The MicroPDP-11/73 is a high-performance multi-user Q-bus computer. The CPU module features 15MHz J11 chip, an 8KB direct-mapped cache, a serial line unit, and a 32KB boot strap/diagnostic ROM. The MicroPDP-11/73 is available in pedestal, tabletop, and rackmount. The smaller enclosure can be ordered in floorstand, tabletop, or rackmount version. The larger enclosure is a pedestal style.

Processor	J11
Mass Storage Options	RD53, RD54, RX50, RX33, RD32, RD52, TK50, RA81
RAM	1 MB to 4MB
Realtime Operating Systems	Micro/RSX, RSX-11
I/O bus	Q-bus
Expandability	The backplane can be expanded to an additional 8-slots with the BA23 expander box. I/O connectivity can be increased with the H3490-A I/O Distribution Panel. And the enclosure can be upgraded to the H9642-JA MicroSystems Cabinet.

Space and Power Available for Realtime Options

In the BA23 enclosure the MicroPDP-11/73 backplane has a total of eight slots. The first slot is reserved for the CPU. Of the seven remaining slots, one is usually used for the disk controller (RQDX3) and at least one is used for memory (MSV11). This leaves five quad slots for more memory and realtime options following the guidelines below.

The backplane in the BA23 enclosure has a total of twelve slots. The first slot is reserved for the CPU. Of the remaning slots, one is usually used for the disk controller (RQDX3) and at least one is used for memory (MSV11). This leaves nine good slots for more memory and realtime options with the following guidelines.

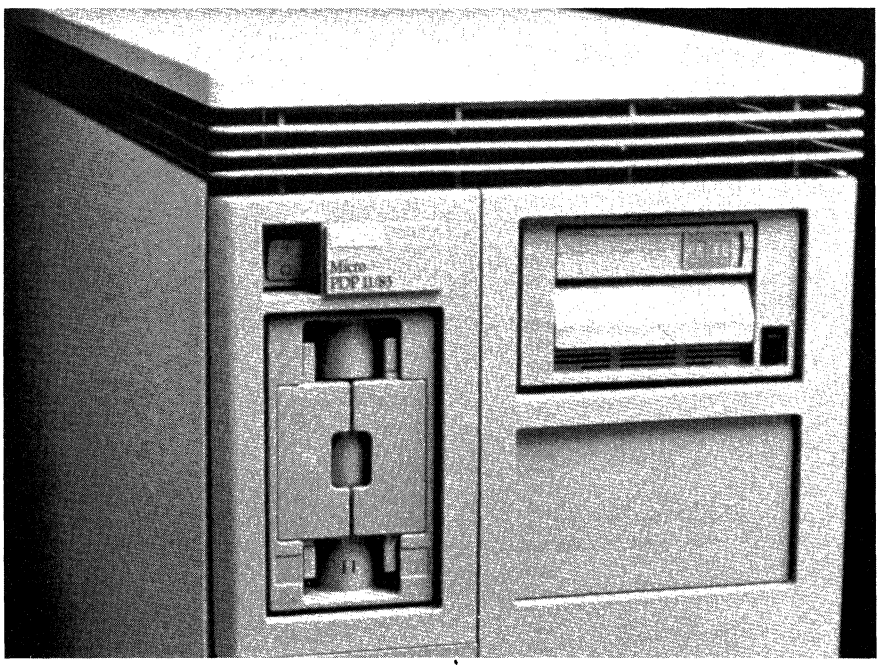
MicroPDP-11/73 BA23

Available Slots	DC Amps Available at +5 V	DC Amps Available at +12 V	Power (Watts)	Bus Loads AC	Bus Loads DC	I/O Panel Units B	I/O Panel Units A
8 Quad	36	7	230	32	20	4	2

MicroPDP-11/73 BA123

Available Slots	DC Amps Available at +5 V	DC Amps Available at +12 V	Power (Watts)	Bus Loads AC	Bus Loads DC	I/O Panel Units B	I/O Panel Units A
12 Quad	72	14	460	38	20	6	4

MicroPDP-11/83



The MicroPDP-11/83 is a powerful MicroPDP-11 multi-user, Q-bus computer. With an 18MHz J11 chip, a floating-point accelerator, a private memory interconnect, the MicroPDP-11/83 excels in realtime performance. And, depending on the enclosure chosen, it can accommodate more than 30 users.

Processor	J11
Realtime Operating Systems	Micro/RSX, RSX-11M/S, RSX-11M+ , RT-11
Mass Storage Options	RX50, RX33, RD32, RD53, RD54, RA60, RA81, TK50
RAM	2MB to 4MB
I/O bus	Q-bus
Expandability	The backplane can be expanded to an additional 8-slots with the BA23 expander box. I/O connectivity can be increased with the H3490-A I/O Distribution Panel. And the enclosure can be upgraded to the H9642-JA MicroSystems Cabinet.

Space and Power Available for Realtime Options

In the BA23 enclosure the MicroPDP-11 backplane has a total of eight slots. The first slot is reserved for the CPU. Of the seven remaining slots, one is usually used for the disk controller (RQDX3) and at least one is used for memory (MSV11). This leaves five quad slots for more memory and realtime options following the guidelines below.

The backplane in the BA23 enclosure has a total of twelve slots. The first slot is reserved for the CPU. Of the remaining slots, one is usually used for the disk controller (RQDX3) and at least one is used for memory (MSV11). This leaves nine good slots for more memory and realtime options with the following guidelines.

System CPUs/MicroPDP-11/83

In the H9642 cabinet the MicroPDP-11/83 has 16 slots. Each kernel comes with a 2 MB memory board.

MicroPDP-11/83 BA23

Available Slots	DC Amps Available at +5 V	DC Amps Available at +12 V	Power (Watts)	Bus Loads AC	Bus Loads DC	I/O Panel Units B	I/O Panel Units A
8 Quad	36	7	230	22	20	4	2

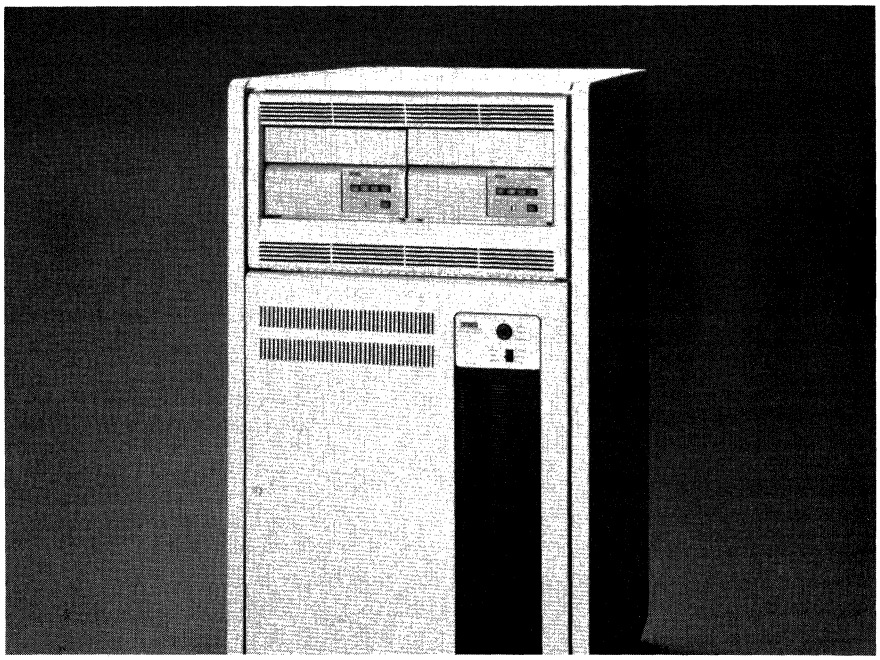
MicroPDP-11/83 BA123

12 Quad	72	14	460	38	20	4	2

MicroPDP-11/83 H9642

Available Slots	DC Amps Available at +5 V	DC Amps Available at +12 V	Power (Watts)	Bus Loads AC	Bus Loads DC	I/O Panel Units B	I/O Panel Units A
16 Quad	72	14	460	34	20	11	6

PDP-11/84



The PDP-11/84, a high end member of the PDP-11 family, delivers PDP-11/70-class performance for a fraction of the cost. Both powerful and cost-effective, the PDP-11/84 spans the entire range of traditional PDP-11 applications. It combines all the advantages of today's technology with a proven architecture and more than a decade of system engineering enhancements.

The PDP-11/84 covers a wide range of upgrade possibilities and enhancements for virtually any previously installed UNIBUS processor. It is also compatible with an extensive range of previously installed UNIBUS peripherals and options. Existing UNIBUS PDP-11 applications can be upgraded to the processing power of the PDP-11/84 with both box and cabinet-level upgrade options. These upgrade paths offer unbeatable hardware and software investment protection.

Digital's continued investment and commitment to the PDP-11 family and our installed base of PDP-11 customers is reflected in the enhanced PDP-11/84 system packaging designs.

All PDP-11/84 D and E series of product variations provide the comprehensive set of standards highlighted as follows and they can be easily tailored to match your unique realtime application requirements.

Features

- Powerful, high performance single-board CPU features Digital's 18-MHz J11 chipset.
- The full PDP-11 instruction set including floating-point and EIS instructions, plus an integral floating-point accelerator.
- 22-bit memory management, dual register set, separate instruction and data space, and three system modes: kernel, supervisor and user.
- 8Kbyte CPU cache memory speeds program execution.
- 2- or 4Mbytes of memory, expandable up to 4Mbytes in 1 MB increments with high-density PMI ECC MOS memory.
- Private Memory Interconnect (PMI) architecture for high-speed data transfers between CPU and memory.

- 32Kbyte bootstrap/diagnostic ROM facility and 8-kbyte EEPROM.
- Program-controlled line-frequency clock.
- One switch-selectable EIA/CCITT serial-line asynchronous interface for console terminal connection.
- ASCII console logic for system control and debugging with optional console terminal.
- DMA cache that delivers fast memory access for DMA peripheral devices.
- Concurrent processing that allows the simultaneous execution of instructions and DMA transfers.
- Programmable bus management that offers the CPU bus mastership regardless of pending DMA I/O requests.
- Compact design that requires less power and floor space and offers more expansion capacity and flexibility than comparable system configurations.
- 9-slot backplane housed in 5.25 inch and 10.5 inch enclosures, expandable to 27 slots in the 10.5 inch OEM Design center.
- Enhanced system packaging for more configuration flexibility and growth capacity.
- Three base systems are available using standard H9462, H9645 and H9647 series system cabinets.

Note: For additional specifications and ordering information consult the PDP Systems and Options Catalog.

Space and Power Available for Realtime Options

The PDP-11/84 provides a total of nine slots in 5.25 in. box configurations. Three slots are reserved for the CPU and 2 or 4 MB of memory, one dual slot is used by the UNIBUS terminator. This leaves four hex slots and one quad slot available for realtime and other options with the following power.

Available Slots	DC Amps Available at +5 V	DC Amps Available at +15 V	DC Amps Available at −15 V	Bus Loads	I/O Panel Units
4 Hex 1 Quad	46.6	1.9	3.0	19	Configuration dependent

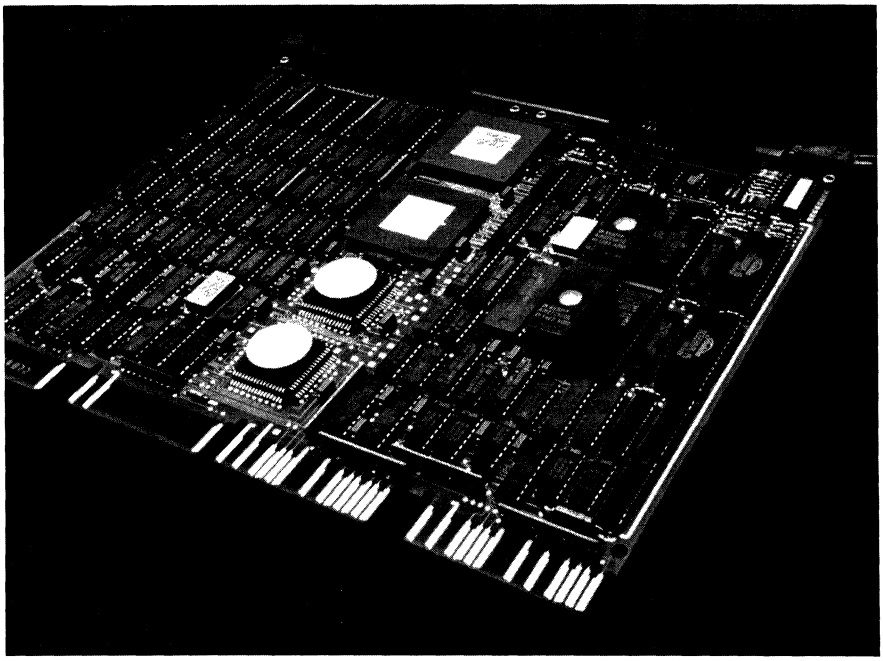
The PDP-11/84 can be expanded to 27 slots in 10.5 in. box and system configurations. Three slots are used by the CPU and 2 or 4 MB of memory, one dual slot is used by the UNIBUS terminator. This leaves four hex slots and quad slot available for realtime and other options with the following power in the CPU backplane.

Available Slots	DC Amps Available at +5 V	DC Amps Available at +15 V	DC Amps Available at −15 V	Bus Loads	I/O Panel Units
4 Hex 1 Quad	46.6	4.9	6.0	20	Configuration dependent

Each additional DD11-DK provides the following power less (*) from previous backplane.

Available Slots	DC Amps Available at +5 V	DC Amps Available at +15 V	DC Amps Available at −15 V	Bus Loads	I/O Panel Units
4 Hex 2 Quad	32.0	*	*	*	*

KA620-BA



The KA620-BA is a quad size single board computer with a modified MicroVAX MPU (78R32), 1 MB DRAM, SLU, PMI expansion and a Q-bus interface. The difference between this product and the MicroVAX CPU is that the KA620-BA operates using only VAXELN.

The KA620-BA meets the needs of the realtime marketplace that requires a predictable response to time-critical events.

The KA620-BA is the first 32-bit Q-bus module available through all channels. This product reinforces Digital's commitment to provide total solutions for our customers.

Applications

The KA620-BA on the Q-bus is well suited for applications that require 32-bit performance as well as large virtual memory addressing capability. A sample of KA620-BA applications includes automated test equipment, data acquisition and distributed factory automation. These applications require the computer to be an integral part of a larger special purpose device or process that is task oriented versus user oriented.

Hardware

The KA620-BA is a single quad-height module that includes the following features:

rtVAX 78R32 Microprocessor Chip

This modified MicroVAX CPU chip requires no special clock generator or support chips. At its maximum frequency the rtVAX CPU chip achieves a 200 ns microcycle and a 400 ns I/O (memory) cycle. The rtVAX CPU chip contains a 32-bit extension of the industry standard microprocessor interface.

The rtVAX CPU chip includes a VAX compatible, demand paged Memory Management Unit (MMU). The MMU provides direct access to four gigabytes (2**32) of virtual memory and one gigabyte (2**30) of physical memory. Virtual mapping of system space addresses is accomplished through single-level page tables. Virtual mapping of process space addresses is accomplished through single-level page tables.

rtVAX FPU Chip

The rtVAX Floating Point Unit (FPU) chip provides support for F-floating, D-floating and G-floating data types, but it does not support H-floating data types or instructions. H-floating data types can be provided by macrocode emulation.

Local Memory

The KA620-BA CPU module contains 1Mbyte of on-board memory, and supports one or two MS630 memory expansion modules for a maximum of up to 16Mbytes of additional local memory. The KA620 provides byte parity generation for all local memory.

Boot and Diagnostics ROMS

The KA620-BA boot and diagnostic ROM provides 64Kbytes of power-up diagnostics, boot programs for standard devices, and a subset of the VAX console program.

Console Serial Line Unit (SLU)

The console SLU is accessed by the processor using four VAX Internal Processor Registers and features selectable baud rates.

Extended LSI-11 Bus Interface

VAXELN Software

VAXELN is a fully modular software system that lets programmers build dedicated realtime applications on VMS development hosts. The VAXELN Toolkit uses the PASCAL C, Fortran 77, and ADA languages. After development, a VAXELN application runs in a minimal configuration (1Mbyte) without the presence of any other operating system.

For a complete listing of Q-bus options supported by VAXELN, refer to the VAXELN SPD (Software Product Description).

Compatible System Enclosures

The KA620-BA is compatible with the following Digital enclosures.

BA11-S

The BA11-S contains a 4-row×9-slot backplane with 22-bit addressing on slots A/B. The C/D rows contain the CD interconnect. The backplane can contain up to nine dual-height or nine quad-height modules. Dimensions are 13.2×48.3×57.8 cm. (5.2×19×22.7 in.) The power supply includes a master console and provides 36A @ +5V and 5A @ +12V.

BA23-A

The BA23-A contains a 4-row×8-slot 22-bit address backplane. Slots 1 through 3 provide 22-bit addressing on the A/B rows and the CD interconnect on the CD rows. Slots 4 through 8 provide 22-bit addressing on both the A/B and C/D rows. Up to 8 quad-height, or 3 quad-height and 10 dual-height modules can be mounted in the back-plane. The BA23-A has mounting space for two 13.2 cm. (5.25 in.) mass storage devices. The power supply includes a master console and provides 36A @ +5V and & 7A @ +12V per regulator.

The BA23-A is also available in an H9462 cabinet, that provides 8 additional backplane slots and space for two 26.5 cm (10.5 in) mass storage devices.

BA123-A

The BA123-A contains a 4-row×12-slot 22-bit address backplane. Slots 1 through 4 provide 22-bit addressing on both the A/B rows and the CD interconnect on the CD rows. Slots 5 through 12 provide 22-bit addressing on both the A/B and the C/D rows. The BA123-A has mounting space for five 13.2 cm. (5.25 in.) mass storage devices. The power supply includes the master's console and two regulators that provide 36A @ +12V per regulator. The total power from each regulator must not exceed 230 W.

Interconnect Modules

The KA620-BA communicates with the console device through either a configuration module or a CPU I/O distribution panel. The description of these two parts are as follows:

KA630 CNF Configuration Board

The KA630CNF board is supplied with each KA620 module and mounts directly onto the CPU. The user configures the KA620 CPU by setting the 10 switches to select the features necessary for the system. The features available to the user are the halt, CPU operation, power-up, and loopback test modes, and the baud rate. More detail on the operation and set up for this board is described in the *User's Guide.*

CK-KA630-A CPU Distribution Panel Insert

The CK-KA630-A CPU distribution panel is an option that may be purchased in place of the KA630CNF board. The CK-KA630-A distribution panel insert is mounted on the rear I/O distribution panels for rtVAX systems. It is used to select the configuration features for the system from the exterior of the enclosure. Additional information for this option is contained in the *KA620 User's Guide.*

Electrical

Maximum Currents +5 Vdc	Maximum Currents +12 Vdc	Q22-Bus Loads AC	Q22-Bus Loads DC
6.2 A	0.14 A	2.7	1.0

Environmental

Specification	Range
Ambient Storage	−40° to +65°C −40° to +149°F
Operating Temp (in an enclosure)	5° to 50°C (41° to 122°F) @ 250 ft/min air flow
Relative Humidity in Storage	10% to 90% noncondensing; 10% to 90% noncondensing derate maximum temperature by IC for each 1000 m (1F for each 1,000 ft) of altitude

Ordering Information

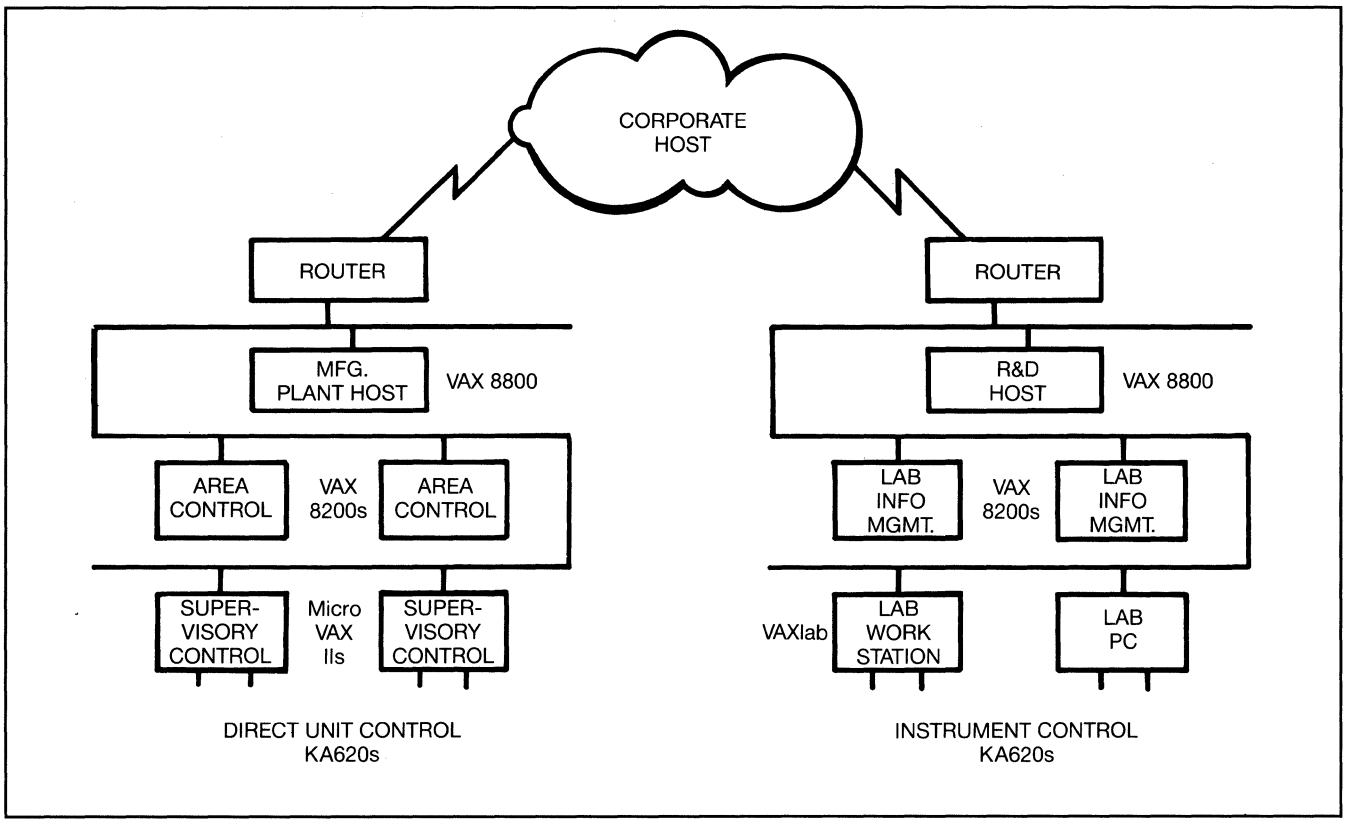
The KA620-BA is ordered as a single line item. It consists of the following items:

- 1 KA620 CPU Model
- 1 CNF Interconnect Module
- 1 EK-KA620-UG User's Guide
- 1 VAXELN Runtime License
- 1-Year Return-To-Factory Warranty

Single Board Processors/KA620-BA

Also available for individual purchasing are the following items:

EK-KA620-UG	*rtVAX KA620-A CPU Module User's Guide*
CK-KA630-A	Distribution Panel Insert



KXJ11-CA

The KXJ11-CA is a 16-bit peripheral processor including a powerful processor, the DCJ11, as the central compute engine. There is plenty of memory for most applications: 512Kbytes of RAM and 64Kbytes of PROM. Several types of I/O structures are provided to support most forms of data acquisition and network communication protocols. DMA capabilities were designed in to link each of the sections together. This is a single board computer for the Q-bus that runs in either 16- or 32-bit environments.

As a peripheral processor, the KXJ11-CA can enhance the performance of a Q-bus system acting as either a data acquisition/control processor, a coprocessor or an I/O communications processor. As a data acquisition/control processor, it provides predictable response to interrupts for data collection, CPU power for local data reduction, sufficient memory for temporary storage and data transfer mechanisms (DMA, shared memory) for easy host access to data. In coprocessing applications, it offers the DCJ11 power on a local bus with 512Kbytes of memory for working space. In I/O communications applications, the advantages of several high speed SLU's or the 20-bit parallel interface can be used for DMA operations and network communication protocol support.

Hardware DCJ11-AC

The J11 16-bit CMOS microprocessor delivers the architecture and functions of Digital's most popular minicomputer, the PDP-11, in a 60-pin package. It offers 16-bit I/O and 32-bit internal data path and addresses memory with on-chip pipelined memory management with three levels of memory protection. The J11 supports the full PDP-11 instruction set, including hardware multiply, divide (EIS) and all 46 floating-point instructions.

Memory

512Kbytes of DRAM with dual-ported access can be shared between the local J11 bus and the Q-bus. This is Digital's only I/O device which is also able to place a significant amount of memory into Q-bus memory space. This facilitates the ability to easily pass large amounts of data to or from the KXJ11-CA. 64Kbytes of PROM space are provided through two 28-pin sockets; 16Kbytes for native firmware and self-test, leaving the remaining 48Kbytes available for user application code.

I/O Capabilities

- **Synchronous/Asynchronous Serial I/O**—A dual-channel, multi-protocol controller is provided with send/receive, RS422 and RS423 EIA and modem control lines. It supports asynchronous and character or bit-oriented synchronous protocols. This line features programmable character-oriented size, parity, framing error detection, auto hunt and externally or internally programmable baud rates from 150 to 76.8K baud. A secondary synch/asynch channel is provided with DT (data and timing only) RS422 and RS423 electrical interface.
- **Asynchronous Serial I/O**—One line provides DL-compatibility, baud rate generation, program or shunt selectable baud rates (300 to 38.41K baud), 8-data bits, no parity, one stop bit and break detection that causes the DCJ11 to RESTART trap. The 10 pin interface features RS232-C, RS422 and RS423 EIA interfaces.
- **Parallel I/O**—The twenty line programmable I/O channel features two 8-bit ports and a 4-bit control port with three interrupt requests and handshake control for either polled, interrupt conditional control, three-wire, or bi-directional operation. Three programmable 16-bit timers are provided with either internal control and interrupt or with external buffered control lines.

Peripheral Processor Control

The Q-bus interface includes a 16-word CSR. The registers are the primary means by which the Q-bus arbiter controls and communicates with the KXJ11-CA. The registers can be accessed by both the local DCJ11 and the Q-bus.

DMA Communications

A 16-bit DMA controller facilitates data transfers to or from the local I/O devices, local memory and Q-bus addresses. It supports two channels of DMA and can perform transfers between any local 22-bit address and any 16-, 18-, or 22-bit Q-bus address. DMA operations can be interleaved with the local processor and the other DMA channel.

Multiple Processing or Stand-alone Capability

The KXJ11-CA can provide extensive I/O expansion capabilities on the Q-bus with up to 14 KXJ11-CA's per single Q-bus CPU arbiter. Each KXJ11-CA can be added modularly with its own dedicated task to increase the application's overall performance and efficiency.

The KXJ11-CA can be configured for stand-alone operation or for multiple operation on the Q-bus. When in the stand-alone mode, the KXJ11-CA will not respond to any Q-bus signals. It will use only the power and ground signals.

Software

The KXJ11-CA is supported by five operating systems for the arbiter processor. Tool kits are available for MicroVMS, RSX11-M, RSX11-M PLUS, MicroRSX and RT-11 operating systems. The arbiter can be a host operating system or a target operating system.

Each toolkit contains a device handler and a load utility. The device handler manipulates the CSRs so that the application running in the main CPU/arbiter can communicate with the application software on the KXJ11-CA. The load utility transfers the application program into the KXJ11-CA, performs debugging, initiates the self tests and then starts execution.

MicroPower/Pascal (MP/P) is the supported application and development software for the KXJ11-CA. MP/P is both a runtime environment and a highly structured programming language for any PDP-11 processor. On the KXJ11-CA, MP/P provides drivers for all on-board devices and a utility that permits the application to pass variable length messages to and from the arbiter system by emulating a traditional Q-bus slave. As an alternative, MACRO-11 can be used to program the KXJ11-CA.

In the future, other software development toolkits will be announced to support programming in traditional PDP-11 languages.

Ordering Information for Software

Product Name	Option	SPD No.	Part No.
Peripheral Proc. Toolkit MicroVMS	QZZ91	28.29.xx	AE-JV00A-TE
Peripheral Proc. Toolkit RSX11-M	QJV52	13.25.xx	AE-BG39D-TC
Peripheral Proc. Toolkit RSX11-M PLUS	QJV52	13.25.xx	AE-BG39D-TC
Peripheral Proc. Toolkit MicroRSX	QYV52	18.48.xx	AE-GJ26B-TC
Peripheral Proc. Toolkit RT-11	QJV51	12.70.xx	AE-BG38C-TC

Ordering Information Operating Systems Toolkits

The KXJ11-CA is supported by six operating systems for the arbiter, host, processor. Toolkits are available for the following:

Product Name	Option	SPD No.	Part No.
MP/P-RT Host	QJ029	19.12.xx	AE-M520L-TC
MP/P-MicroRSX Host	QY029	18.24.xx	AE-DF47F-TC
MP/P-RSX Host	QP029	14.83.xx	AE-BK29F-TC
MP/P-VMS VAX 11/730 Host	QC029	26.24.xx	AE-X5471-TE
MP/P-VMS VAX 11/750 Host	QE029	26.24.xx	AE-X5471-TE
MP/P-VMS VAX 8600, 8650 Host	QK029	26.24.xx	AE-X5471-TE

KXT11-CA

The KXT11-CA is a quad-height slave Q-bus single board computer. It features the T11 16-bit processor executing the PDP-11 base-level instruction set, 32Kbytes of static RAM, and two 28-pin sockets for up to 32Kbytes of user ROM or static RAM. The KXT11-CA also includes 20 lines of parallel I/O, and three programmable serial line units, one asynchronous console line, and two synchronous/asynchronous (one with modem control) with rates up to 76.8 Kbaud. The module also contains two channels of DMA, three programmable interval timers, system-line time clock, and on-board diagnostic with LED indicators.

The KXT11-CA can operate as either a single-line board computer or as a peripheral processor. As a peripheral processor, up to 4 KXT11-CAs may be configured on a single Q-bus with a host processor such as the KDJ11 or KDF11. This product is fully supported by MicroPower/Pascal and associated toolkits. It comes with a 12-month return-to-factory warranty.

Peripheral Processor Toolkit

The Peripheral Processor Toolkit is a Digital development utility for use with the KXT11-CA and KXJ11-CA peripheral processors. The toolkit resides on a Q-bus arbiter system running VMS, RT-11, RSX or Micro/RSX operating systems. It facilitates program loading, booting, and communications with peripheral processors that share the Q-bus with the arbiter system.

The KXT11 and KXJ11 peripheral processors enhance the performance of Q-bus systems that support realtime, I/O intensive, or compute-intensive tasks. They can act as realtime processors, coprocessors, or I/O processors, and provide a cost-effective increase in system power. Software running on the peripheral processors are typically applications developed with MicroPower/PASCAL, but may be applications written in MACRO-11 as well.

Single Board Processors/KXT11-AB

KXT11-AB

The KXT11-AB is a SBC-11/21 FALCON-PLUS single board, 16-bit dual-height central processor. Its features include 16Kbytes of static RAM, 64Kbytes of direct addressing capability, Q-bus interface, PDP-11 base-level instruction set, and 50, 60, or 800 Hz realtime clock. The KXT11-AB also includes 24-line parallel I/O, two asynchronous serial I/O ports, four 28-pin memory sockets for up to 16Kbytes of additional RAM and 16Kbytes of ROM, or an extra 32 kbytes of RAM or 32Kbytes of ROM.

KDF11-AA

The KDF11-A is a single board processor with memory management unit (MMU). This 16-bit dual-height central processor features 4Mbyte addressing, four-level vectored interrupts for fast response without device polling, and 87 standard PDP-11 instructions including EIS.

KDF11-AC

The KDF11-AC is a PDP-11/23 single board (without MMU), 16-bit central processing unit. This dual-height module features 64Kbyte addressing, four-level vectored interrupts for fast response without device polling, 87 standard PDP-11 instructions including EIS, and 46 optional floating-point instructions.

Single Board Processors/KDJ11-AB

KDJ11-AB

The KDJ11-AB is a high-performance, dual-height PDP-11 processor with 8Kbyte cache memory, floating-point, memory management, and system registers. It includes Q-bus 18- or 22-bit addressing, four jumper-selectable powerup options, and onboard diagnostics with four microdiagnostic LEDs. A floating-point unit instructs arithmetic, logical and conversions operations, and the MMU allows the processor to operate in kernel, supervisory, or user processor mode.

KDJ11-AC

The KDJ11-AC is the same as KDJ11-AB, except the FPJ11-AA is installed on the module.

Single Board Processor Options/KEF11-AA

KEF11-AA

The KEF11-AA is a single- and double-precision floating-point option for use with the KDF11-AA. The KEF11-AA performs hardware operations on 32-bit and 64-bit floating-point numbers, provides up to 17 digits of precision as well as integer-to-floating-point conversions. It has 40-pin DIP IC. The KEF11-AA mounts on the KDF11 CPU board and requires a KTF11.

FPF11

The FPF11 performs hardware options on 32-bit and 64-bit floating point numbers, provides up to 17 digits of precision as well as integer to floating-point conversions, and executes instructions approximately six times faster than the KEF11-AA. It is a single- and double-precision floating-point option for use with the KDF11-A board. This quad-height module is mounted next to the CPU.

FPJ11-AA

The FPJ11-AA is a floating-point coprocessor option for use with the KDJ11-AB/AC modules. This single-chip option is designed to significantly improve the performance three or four times in computation-intensive applications. The FPJ11 is compatible with other PDP-11 systems with floating point. The 40-pin package is installed on the CPU board.

Single Board Processor Options/KTF11-AA

KTF11-AA

The KTF11-AA is a memory management chip for use with the KDF11-AC. It features 4Mbytes of 22-bit addressing, memory segmentation, built-in memory protection, and 40-pin DIP IC.

KXT11-A5

This two-chip EPROM set provides a number of special utilities used for developing, debugging, and downline-loading software to the KXT11-AB using Micro-Power/Pascal.

KDF11-B3

The KDF11-B3 is a bootstrap ROM upgrade kit for use with the KDF11-BA/BF. It provides bootstrap capability for RD52, RQC25, TK50, and TSV05, in addition to RX50/RD51, and RX01/RX02, and DECnet devices.

Single Board Processor Configuring Information

Option Number	Amps @ +5V	Amps @ +12V	Max Watts	Bus Loads AC	Bus Loads DC	Form Factor	System Size	Address Range
KXT11-AB (FALCON-PLUS)	2.5	60mA	13.2	2.7	0.5	Dual	N/A	64Kbyte
KXT11-CA (I/O Processor)	3.5	60mA	18.2	2.7	1.0	Quad	Q18/Q22	64Kbyte
KDF11-AC (LSI-11/23)	2.0	0.2	12.4	2.0	1.0	Dual	Q18/Q22	64Kbyte
DKDF-11AA (LSI-11/23)	2.0	0.2	12.4	2.0	1.0	Dual	Q18/Q22	4Mbyte
KDJ11-A (LSI-11/73)	4.5	0.0	22.5	3.4	1.0	Dual	Q18/Q22	4Mbyte
KXJ11-SA (CI/O Processor)	6.0	2.0	54.0	3.0	0.5	Quad	Q18/Q22	Arbite Programmable

DCT11-AA

The DCT11-AA (T11) is Digital Equipment Corporation's PDP-11 single chip microprocessor. Its instruction set is compatible with that of the LSI-11.

The DCT11-AA supports most industry standard peripheral chips and can operate at a maximum clock rate of 7.5 megahertz. It fully supports both static and dynamic memories.

The DCT11-AA incorporates DMA support as well as an internal and external interrupt structure. The chip uses a time multiplexed address/data bus and a time multiplexed address/interrupt bus.

Through the use of a programmable mode register loaded during power up, the DCT11-AA can be adapted to a wide variety of applications.

Features

- Basic PDP-11 Instruction Set (less Mark and EIS/FIS)
- Vectored Interrupts on Four Priority Levels
- 15 Internally Generated Vectors
- Full Dynamic Memory Support
- Dynamic Memory Address
- RAS and CAS Strobes
- Refresh Counter
- Automatic Refresh Cycles
- TTL Compatible Signals
- Signal +5V Power Supply
- Internal Clock Oscillator Circuit
- Bus Compatibility with Most Industry Standard Peripheral Chips
- Programmable Mode Register Featuring:
  - 8- or 16-bit Data Bus
  - Automatic Start/Restart Addresses
  - Static or Dynamic Memory Support
  - Bus Synchronous or Constant Frequency Clock Output
  - Normal or Lengthened Bus Transactions

Applications

The DCT11-AA package is a 40-pin ceramic DIP. Its unique adaptability allows the designer to optimize the DCT11-AA to the application. Pin functions are modified by an external register that is accessed by the chip during power up. Selection of either static or dynamic 8- or 16-bit mode determines the functionality of mode-dependent pins.

Characteristics

Maximum Power Dissipation	1.1 Watt
VDD	+5V (+0.25 V)
Operating Frequency (max)	7.5 MHz
Ambient Temperature Operating Range	0°C to +70°C
Storage Temperature Range	−55°C to +125°C
IOL Max @ VOL	.4V @ CL 80pI

DC349

Digital's DC349 Octal ART (Asynchronous Receiver/Transmitter) is a VLSI device for new generations of asynchronous serial communications designs and for microcomputer systems. Housed in a 68-pin quadriform ceramic chip carrier (CERQUAD), the Octal ART delivers versatility to designers of asynchronous systems. Fabricated in HMOS, the DC349 uses a single +5V supply.

The DC349 performs the basic operations necessary for simultaneous reception and transmission of asynchronous messages on eight independent data channels. Designed to be compatible with many 8-, 16-, and 32-bit microprocessors, the DC349 register set is bit compatible with many Signetics 2661 single-channel communications devices. One chip-baud generation allows the designer to select and program any one of 16 rates between 50 and 19,200 baud.

Baud rates are selectable independently for each receiver and transmitter. A unique built-in flag scanning mechanism (an arrangement of cooperating counting, synchronization, and logic circuits) provides a powerful alternative to the customary polling of status registers.

Features

- Eight independent serial data channels, each with Data Set Ready (DSR), Data Carrier Detect (DCD), Tx and Rx lines
- On-chip baud rate generators
- Baud rates program-selectable in both directions from one of 16 rates (50 to 19,200 baud), on a per line, per direction basis
- Six registers for each data channel: Rx, Tx, Command, Status, Mode 1, Mode 2
- Receiver-priority data channel interrupt scanner mechanism that monitors receiver/transmitter interrupt requests and supports programmable interrupts for modern status changes
- Data Set Change summary register that allows a single read to ascertain change in DSR or DCD for any (all) lines
- Interrupt summary register that allows a single read to report interrupt requests for receiver/transmitter activity on any data line
- FIFOs for buffering Rx and Tx data streams

Applications

- Telecommunications
- Terminal Concentrators
- Personal Computers
- Data Networks

Characteristics

Maximum Power Dissipation	1 Watt
VDD	+5v
Operating Temperature Range	0°C to 70°C
Storage Temperature Range	−55°C to +125°C

Ordering Information

The Octal Art is offered in two package variations:

78808-GA	A cerquad package with gull wing bends leads Used for surface mount technology
78808-FA	A cerquad package with straight leads Used for plated through hole technology Requires a socket (see note below)

Note: Sockets for the 78808-FA are available from: Cannon Division of ITT (714) 964-7400. The DCK11 series of LSI integrated circuits is available to Q-bus system users in sets called kits. The kits contain the ICs needed to build the foundation of nearly any Q-bus interface, and are available either with or without a Digital wire-wrappable board and plug-in cable.

Chip kits minimize the chip count required to implement bus circuitry. This permits the designer to build an interface foundation on the dual-height wire-wrappable board provided and still have ample room left for special circuitry. The comparatively small chip count results in backplane space savings, increased system reliability, lower system cost, and a greater opportunity for value to be added to the finished product.

The following table lists the available chip kits. Kits DCK11-AA and DCK11-AC are intended for building the foundations of program control Q-bus interfaces. They are functionally similar to the DRV11-P bus foundation module. Kits DCK11-AB and DCK11-AD are intended for building the foundations of DMA Q-bus interfaces. They are functionally similar to the DRV11-B general purpose DMA interface module.

Q-bus Chip Kits

- **DCK11-AA**—Program control bus interface chip kit, consisting of:
  - (one) DC003 interrupt chip
  - (one) DC004 protocol chip
  - (four) DC005 transceiver/address decoder/vector select chips
- **DCK11-AC**—Program control bus interface chip kit, consisting of:
  - (one) DC003 interrupt chip
  - (one) DC004 protocol chip
  - (four) DC005 transceiver/address decoder/vector select chips
  - (one) W9512 dual-height, extended-length, wire-wrappable module
  - (one) BC07D-10 ten-foot, 40-conductor plug-in cable
- **DCK11-AB**—DMA bus interface chip kit, consisting of:
  - (one) DC003 interrupt chip
  - (one) DC004 protocol chip
  - (four) DC005 transceiver/address decoder/vector select chips
  - (two) DC006 word count/bus address chips
  - (one) DC010 DMA control chip
- **DCK11-AD**—DMA bus interface chip kit, consisting of:
  - (one) DC003 interrupt chip
  - (one) DC004 protocol chip
  - (four) DC005 transceiver/address decoder/vector select chips
  - (two) DC010 DMA control chips
  - (one) W9512 dual-height, extended-length, wire-wrappable module
  - (one) BC07D-10 ten-foot, 40 conductor plug-in cable

DC003 Interrupt Chip

The DC003 interrupt chip is an 18-pin, 0.762 cm center×2.349 cm long (maximum) (0.3 in center×0.925 in long) dual-in-line package (DIP) device that provides the circuits to perform an interrupt transaction in a computer system that uses a daisy chain type of arbitration scheme.

The device is used in peripheral interfaces to provide two interrupt channels labeled A and B, with the A section at a higher priority than the B section. Bus signals use high-impedance input circuits or high-current open-collector outputs, that allow the device to directly attach to the computer system bus. Maximum current required from the VCC supply is 140 mA.

DC004 Protocol Chip

The DC004 protocol chip is a 20-pin, 0.762cm center×2.74 cm long (0.3 in center×1.08 in long) DIP device that functions as a register selector, providing the signals to control data flow into and out of up to four word registers (eight bytes). Bus signals can directly attach to the device because receivers and drivers are provided on the chip.

An RC delay circuit is provided to slow the response of the peripheral interface to data transfer requests. The circuit is designed so that if tight tolerance is not required, only an external IK +20 percent resistor is necessary. External RCs can be added to vary the delay. Maximum current required from the VCC supply is 120 mA.

DC005 Transceiver Chip

The 4-bit DC005 transceiver is a 20-pin, 0.762 cm center×2.74 cm long (0.3 in center×1.08 in long) DIP, low-power Schottky device. Its primary use is in peripheral device interfaces to function as bidirectional buffer between a data bus and a peripheral device logic bus.

It also includes a comparison circuit for device address selection and a constant generator for interrupt vector address generation. The bus I/O port provides high-impedance inputs and high-drive (70 mA) open-collector outputs to allow direct connection to a computer data bus structure. On the peripheral device side, a bidirectional port is also provided, with standard TTL inputs and 20 mA, tristate drivers. Data on this port are the logical inversion of the data on the bus side.

Three address jumper inputs are used to compare against three bus inputs to generate the MATCH signal. The MATCH output is an open collector, allowing the output of several transceivers to be wired-ANDed to form a composite address match signal. The address jumpers can also be put into a third logical state that disables jumpers for "don't care" address bits. In addition to the three address jumper inputs, a fourth high-impedance input line is used to enable or disable the MATCH output.

Three vector jumper inputs are used to generate a constant that can be passed to the computer bus. The three inputs directly drive three of the bus lines, overriding the action of the control lines.

Two control signals are decoded to give three optional states: receive data, transmit data, and disable.

The maximum current required from the VCC supply is 120 mA.

DC006 Word Count/Bus Address Chip

The DC006 word count/bus address (WC/BA) chip is a 20-pin, 0.762 cm center×2.74 cm long (0.3 in center×1.08 in) DIP, low-power Schottky device. Its primary use is in DMA peripheral device interfaces. This IC is designed to connect to the tristate side of the DC005 transceiver. The DC006 has two 8-bit binary up-counters, one for the word (or byte) count and another for the bus address. Two DC006 ICs can be cascaded to increase register implementation.

The chip is controlled by the address latch protocol chip (DC004), the DMA chip (DC010), and a minimum of ancillary logic. Both counters can be cleared simultaneously. Each counter is separately loaded by LD and the corresponding select line from the protocol chip. Each counter is incremented separately. The WC counter (word/byte counter) is always incremented by one; the BA counter (bus address) can be incremented by one or two for byte or word addressing, respectively.

Data from the DC006 is placed on the tristate bus via internal tristate drivers. Each counter is separately read by RD and the corresponding select line.

DC010 Direct Memory Access Chip

The DC010 Direct Memory Access Chip is a 20-pin, 0.762 cm center×2.74 cm long (0.3 in center×1.08 in long) DIP, lower power Schottky device primarily for use in DMA peripheral device interfaces using the Q-bus.

This device provides the logic to perform the handshaking operations required to request and to gain control of the system bus. Once bus mastership has been established, the DC010 generates the required signals to perform a DATI, DATO, or DATIO transfer as specified by control lines to the chip. The DC010 IC has a control line that will allow either multiple transfers or a maximum of four transfers to take place before giving up bus mastership.

For additional information on chip kits see the document titled *Chip Kit User's Manual;* order number EK-01387-92.

Chapter 2
Realtime
Options

Options

Chapter Two: Realtime Options

A wide variety of options are offered by Digital and selected third parties for use with our processors. This chapter contains detailed descriptions of many of these products. They are grouped in the following manner.

Q-bus Options
VAXBI Options
UNIBUS Options
Networking Options
Industrial Terminals

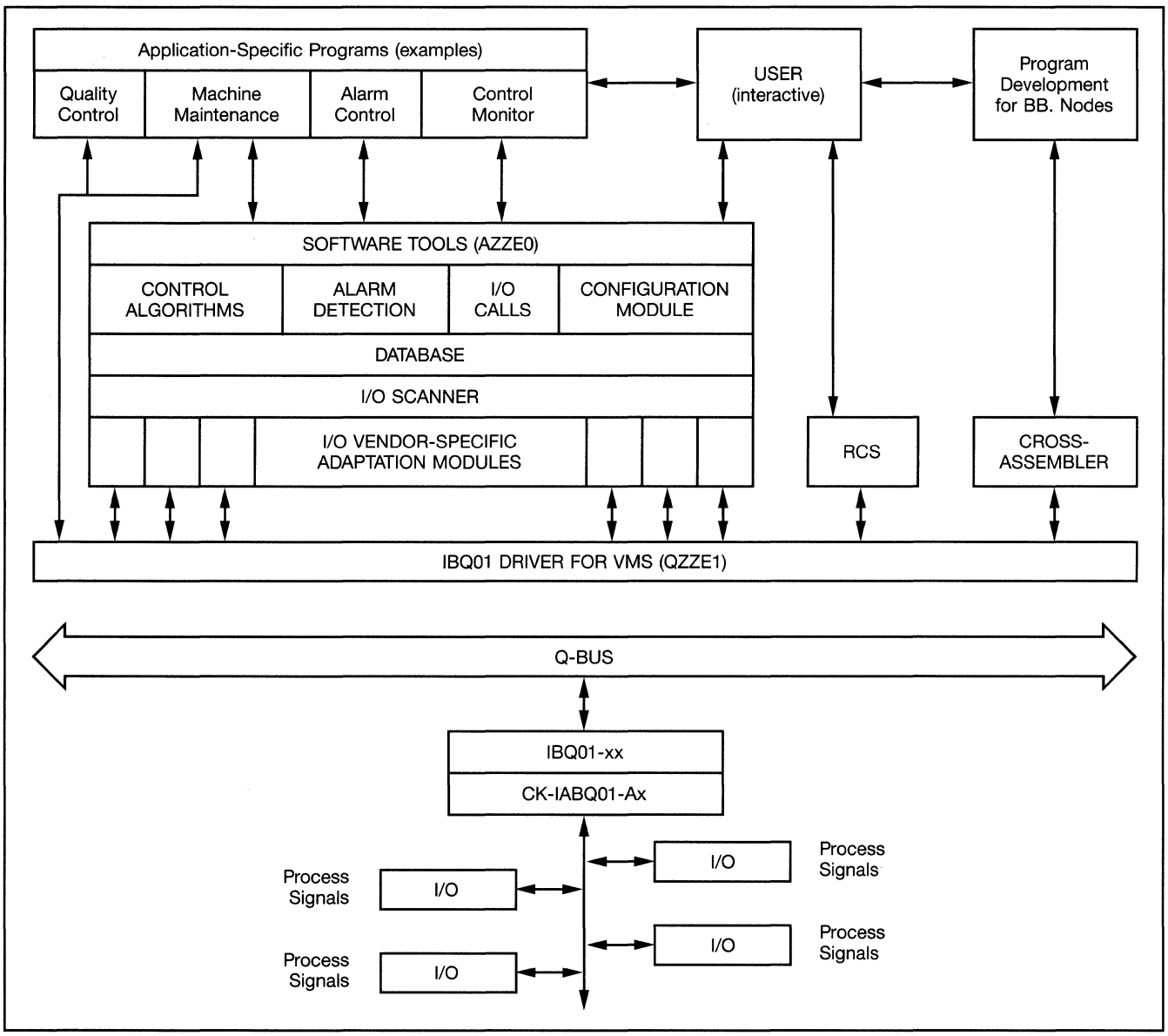
These terminals are built specifically for use in ruggedized environments, such as those found on the factory floor. Information on Digital's other terminal products may be found in the *VAX* and *PDP Systems and Options Catalogs.*

Third Party Options

Here, we describe options designed and built by other manufacturers which can be used to enhance the functionality or performance of our systems in various application configurations.

DECscan™ Software Toolkit

Functional Architecture of DECscan



DECscan is a family of Factory Automation/Shopfloor Integration products. It provides the capability for connecting a wide variety of industrial measurement and control devices to the IVAX (BA213/214) and MicroVAX II (BA23/123) based process monitoring and control applications via INTEL's BITBUS® open architecture interconnect.

This capacity is provided through the integrated combination of:

- IBQ01—IVAX Q-bus to BITBUS interface module
- QZZE1—standard VMS driver interface to the hardware
- QZZE0—software toolkit to simplify development of application software
- Plus a selection of BITBUS-compatible I/O hardware provided by third-party vendors. (See the list of I/O vendors in the Third Party section of this chapter.)

Q-bus Options/DECscan™ Software Toolkit

DECscan is applicable for a wide variety of both process and discrete manufacturing applications. It provides realtime access to data from BITBUS-compatible devices on the factory floor.

The BITBUS is a serial I/O expansion bus that provides a low-cost, high-speed, open-architecture, multidrop interconnect for transferring short control and data messages between tasks running in the distributed BITBUS devices, e.g. from the MicroVAX host being the master to a BITBUS slave device. The BITBUS uses an inexpensive twisted-pair cable to send and receive data based upon the RS-485 specification. The communications protocol is a modified SDLC (synchronous data link control). A single BITBUS system has one master and up to 250 slave nodes.

Features

- Connects realtime interfaces and devices to Digital's computers
- Provides a realtime data management subsystem
- Maximizes realtime reaction performance
- Minimizes programming complexity

IBQ01 BITBUS to Q22 Bus Interface Module

The IBQ01 module provides the hardware and firmware support for an Industrial VAX/MicroVAX II Q-Bus to the BITBUS interface, and handles all message transactions between the supervisory host system and the industrial process I/O devices that are distributed along a BITBUS. It is the master controller in a BITBUS system and supports transmission rates of 2.4 megabits/second (at 30 meters), 375 kilobits/second (at 300 meters), and 62.5 kilobits/second (at 13,200 meters). It responds to commands from the IVAX only when a host-commanded task has been completed or when a priority exception occurs.

This highly autonomous functionality of the IBQ01 is the result of two onboard microprocessors. One functions as a supervisor to control and monitor data flow to and from the BITBUS communications port, and to send data and status to the IVAX via DMA. The second microprocessor functions as an SDLC serial interface unit to support the BITBUS protocol. It connects to the supervisor and is subordinate to it, while simultaneously functioning as the supervisor or master of the BITBUS network.

Software Support

The IBQ01 driver package, QZZE1, provides the standard VMS interface to the hardware and the following utilities:

- BITBUS configuration utility and communications exerciser to allow interactive BITBUS message generation (called BCS, BITBUS Configuration Service)
- 8044 cross assembler

The driver uses the fast DMA access channel to the IBQ01 interface and relieves the IVAX/MicroVAX host of most of the networking actions, such as communications/configuration fault detection, message retries etc. The menu-driven software toolkit, QZZEO, acts as the mechanism to control the flow of realtime data in and out of a IVAX/VMS system. It significantly reduces the time required to develop application solutions by providing functions such as:

- Basic operator interface displays with no coding required by the user
- Transparent data acquisition through logical addressing
- Alarm handling and reporting
- Event sequence control
- Basic closed-loop regulatory control
- Runtime application interface
- On-line help file

Q-bus Options/DECscan™ Software Toolkit

An I/O scanner handles periodic scanning of input points and node health status. The obtained input values and status are stored in the database, where they can be accessed by user-written applications of Toolkit-defined applications, like PID control. The Toolkit also offers a very high speed, realtime interface to access synchronous or asynchronous I/O at the I/O vendor nodes. DECscan includes "protocol emulation" code to allow for the inclusion of additional device handling routines.

Module Specifications

Operating Temperature	15°C to 60°C 59°F to 140°F
Relative Humidity	20 to 80 (non-condensing)
Altitude	2.4 km 8,000 ft
Heat Dissipation	90 BTU per hour

Option	Mounting Requirements	DC Amps Drawn @ 5V 12V	Bus Loads Drawn DC	I/O Panel Units
IBQ01	One Quad Slot	5.0 0.3	1.0	B

Ordering

IBQ01-AA	DECscan/BITBUS controller interface with hardware documentation. For system installation, select one of the following cable kits.
CK-IBQ01-AA	Cable kit for use with MicroVAX II in BA123 encl. (21 in.)
CK-IBQ01-AB	Cable kit for use with MicroVAX II in BA23 encl. (12 in.)
CK-IBQ01-AF	Cable kit for use with MicroVAX II in H9642 encl. (36 in.)
IBQ01-SA	Factory installed DECscan/BITBUS controller interface with hardware documentation for Industrial MicroVAXes in BA213/214 enclosures. (Cable kit not required.)
IBQ01-SF	Field/customer installable IBQ01-SA
QZZE1-H3	VMS DECscan/BITBUS Driver, configuration utility, communications exerciser, and 8044 cross-assembler. Binaries and documentation on RX50. (QZZE1-UZ License required.)
QZZE1-H5	VMS DECscan/BITBUS Driver, configuration utility, communications exerciser and 8044 cross-assembler. Binaries and documentation on TK50. (QZZE1-UZ License required.)
QZZE1-UZ	VMS DECscan/BITBUS Driver, Single Use License
QZZE1-HZ	VMS DECscan/BITBUS Driver, Right to Copy License
QZZE0-H3	DECscan I/O Toolkit, Binaries on RX50 media and documentation (QZZEO-UZ License required) (Prerequisites QZZE1)
QZZE0-H5	DECscan I/O Toolkit, Binaries on TK50 media and documentation (QZZE0-UZ License required) (Prerequisites QZZE1)
QZZE0-UZ	DECscan I/O Toolkit, Single Use License
QZZE0-H5	DECscan I/O Toolkit, Right to Copy License

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DRQ3B-AA

The DRQ3B is a high-performance Direct Memory Access (DMA) parallel Q-Bus interface for MicroVAX II or VAXlab systems. It is a quad-height module with continuous transfer capability of speeds up to 2.6 MB/S into system memory.

In typical applications the DRQ3B interfaces high-speed graphics display and imaging, telemetry, structural and performance testing, and seismic data collection.

The DRQ3B transfers data in and out of system memory through two independent channels, each with sixteen parallel data lines. Data can be transferred by the DRQ3B under program control or through Direct Memory Access (DMA). In DMA, the device can transfer data in single 16-bit words, four word bursts, or sixteen word blocks. In most applications, the DRQ3B can transfer data as fast as the system can send or accept it.

Data sent to the DRQ3B is buffered at the board in 512-word FIFO buffers. These buffers enable the DRQ3B to accept incoming data immediately, even while it is waiting for permission to transfer data onto the user device or into system memory. The DRQ3B can accept data from a user device into the FIFO buffer at 3.4 megabytes per second (up to the maximum buffer capacity of 512 words) allowing the DRQ3B to capture short bursts of data at a very high rate of speed.

Features

- Two independent, unidirectional I/O channels
- 16-bit parallel data transfers (in and out)
- Single cycle, burst mode, and block mode DMA or program controlled transfers
- 512 word FIFO buffer on each channel
- 1.3 Megawords (2.6 Megabytes) per second maximum transfer rate
- Continuous data transfer capability
- MicroVAX II and MicroVMS support
- Buffer Chaining

Software Support

The module is supported under Version 1.1 of Digital's VAXlab Software Library, an embedded feature in the VAXlab system. The software model number is Q*B15 XX (where * specifies the CPU, and XX is the media and service type). The DRQ3B also offers its own device driver under model number QZZE8-UZ.

Cabling

Cabling to a user device requires two BC19T-25 or -50 cables and must be ordered separately.

Installation of DRQ3B requires the purchase of the appropriate CK-DRQ3B cabinet mount kit, also sold separately.

Operational Specifications

Data Transfer Rate	Up to 2.6 MB/S in extended block mode
Transfer Mode	DMA or program-control interrupts

Environmental

Temperature	10°C–50°C 50°F–122°F
Relative Humidity	29-50 non-condensing

Figure BITBUS™ Specifications

Electrical	RS485
Cable	10-conductor flat ribbon or 1 to 2 wire shielded twisted pair
Bus Elements (nodes)	Master device, slave device, or a repeater
Master Device (IBQ01)	1 per BITBUS system; initiates transactions by sending orders to slave devices; polls for replys
Slave Device	Up to 250 per system; responds to orders from master device
Repeater	Used in self clocked mode only; extends distance or node count by regenerating the BITBUS signal.
Modes of Operation	Synchronous and Self Clocked
Synchronous Mode	High Performance, short distance
Self Clocked Mode	Longer distance operation via segments linked by repeaters
Remote Access and Control	Read, Write, and other standard I/O operations on up to 256 I/O ports at each slave node. Slave node tasks may be down-loaded, uploaded and controlled from the master device.
Data Link Control	Synchronous Data-Link Control—SDLC
Message Formats	Compatible with iDCX format command/response/status
Common Command Sequences	Integral remote Access and Control (RAC) function

Figure BITBUS™ Interconnect Specifications

Mode of Operation	Data Transmission Rate	Segment Length M/ft	Maximum Number of Repeaters	Total Distance M/ft	Total Number of Nodes
Synchronous	2.4 MHz	30/100	0	300/1000	28
Self Clocked	375 KHz	300/1000	2	900/3000	28
Self Clocked	62.5 KHz	1200/1400	10	13,200/44,000	250
Option	**Mounting Requirements**	**DC Amps Drawn @ 5V**	**DC Amps Drawn @ 12V**	**Bus Loads Drawn DC**	**I/O Panel Units**
IBQ01	1 Quad Slot	5.0	0	1.0	B

Q-bus Options/DRQ3B-AA

Configuring Information

Option	Mounting Requirements	DC Amps Drawn 5V .5V .15V	Bus Loads AC DC	I/O Panel Insert Size
DRQ3B	One Quad Slot	4.5 0.0 0.0	2.0 1.0	2×A
DRQ3B-SF,SA	One Quad Slot	4.5 0.0 0.0	2.0 1.0	2×A

Ordering

DRQ3B-AA	Q-bus DMA parallel interface for VAXlab or MicroVAX A systems in BA23, BA123, and H9642 cabinets (with documentation). Plus one cable from the following:
CK-DRQ3B-KA	BA23 cabinet mounting kit
CK-DRQ3B-KB	BA123 cabinet mounting kit
CK-DRQ3B-KF	H9642 cabinet mounting kit. Plus two BC19T cables
BC19T-25	25-ft extension cable
BC19T-50	50-ft extension cable
DRQ3B-SF	IVAX field upgradable option with special handles to fit in the IVAX.
DRQ3B-SA	Factory-installed SF version
QZZE8-UZ	DRQ3B/MicroVMS device driver single-use license. Binaries (media) and documentation must be ordered separately.
QZZE8-H3	RX50 driver binaries and documentation
QZZE8-H5	TK50 distribution media. QZZE8-UZ license is required.
QZZE8-X3	RX50 driver sources, sources license, documentation, and 90-day warranty.
QZZE8-X5	TK50 driver sources, sources license, documentation, and 90-day warranty.
EK-047AA-UG	*DRQ3B Parallel DMA Input/Output Module User's Guide*

IPV12-AA for Q-bus PDPs

The IPV12-AA, an I/O subsystem equivalent to the IP112-AA, functions as a local peripheral for Q-bus based MicroPDP-11 systems. The IPV12-AA is used for local process monitoring and control in industrial I/O applications. It interfaces directly to the PDP-11 Q-bus by means of a software driver interface and operates under PDP-11 control.

The IPV12-AA includes an I/O control module (IOCM) and a 19 inch rack-mountable H334 chassis with power supply and mounting space for up to 10 I/O modules. Up to 7 H334 I/O expander chassis may be added to one IP11 master chassis to provide capability for handling up to 2032 I/O points. A maximum of 4 IPV12-AA, each with a full complement of up to 2032 I/O points, can be connected to a single CPU.

The IP11 subsystem interfaced with the MicroPDP-11 computer provides realtime monitoring and control capability with minimal computer overhead. It is suitable for many process and discrete I/O applications, from simple monitoring functions to control of complex closed-loop systems.

Features

- IOCM provides I/O control for address decoding, timing, and control of all process interface modules.
- Independent I/O bus connects directly to I/O modules
- Designed to allow free convection cooling of all I/O modules
- Can operate at temperatures as high as 60°C
- Complete flexibility in the configuration of process monitoring systems.
- Each I/O chassis has its own power supply.

Software Support

Realtime software support is available under Digital's RSX-11M, RSX-11M+ and RSX-11S operating systems. Tasks can be programmed in MACRO-11, FORTRAN IV and FORTRAN 77 operating under RSX-11.

A standard driver for the I/O control module and a FORTRAN interface compatible with ISA61.1 are included with each IP11. Features include online addressing, flexible interrupt handling, and direct addressing for the I/O modules.

Cabling

Connection to field wiring is provided via a separate screw terminal chassis (H332) and dedicated screw terminal strip connects to its corresponding I/O module via a cable and connector provided. If screw termination is not required, direct connection can be made to a 50-pin connector on each I/O module.

Ordering

IPV12-AA/AD	I/O interface (Q-bus) + chassis, 115v/230v
IPQS2-AA/AD	Micro PDP-11/73 Q-bus Packaged Automation System w/IPV112, 115v/230v
IPQS3-AA/AD	Micro PDP-11/83 Q-bus Packaged Automation System w/IPV112, 115v/230v

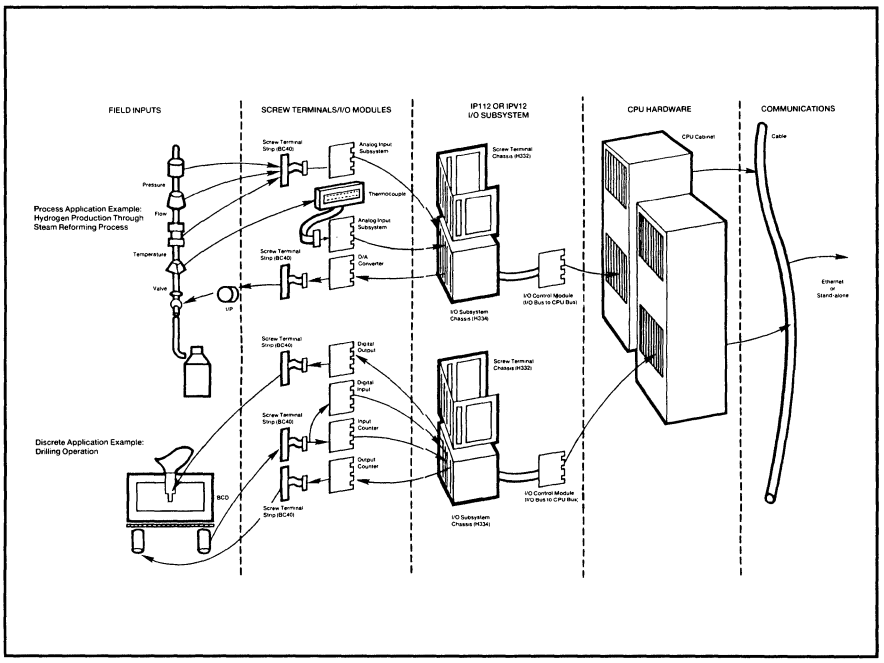
Specifications
Environmental

Operating Temperature		5°C to 60°C free-standing	
Operating Temperature		5°C to 50°C rackmounted	
Relative Humidity		10 to 95 with maximum wet bulb, 32°C; minimum dew point 2°C	
Mounting Requirements	DC Amps Drawn at +5V	DC Amps Drawn at +12V	Bus Loads Drawn
One Quad Slot	.9	.2	.1

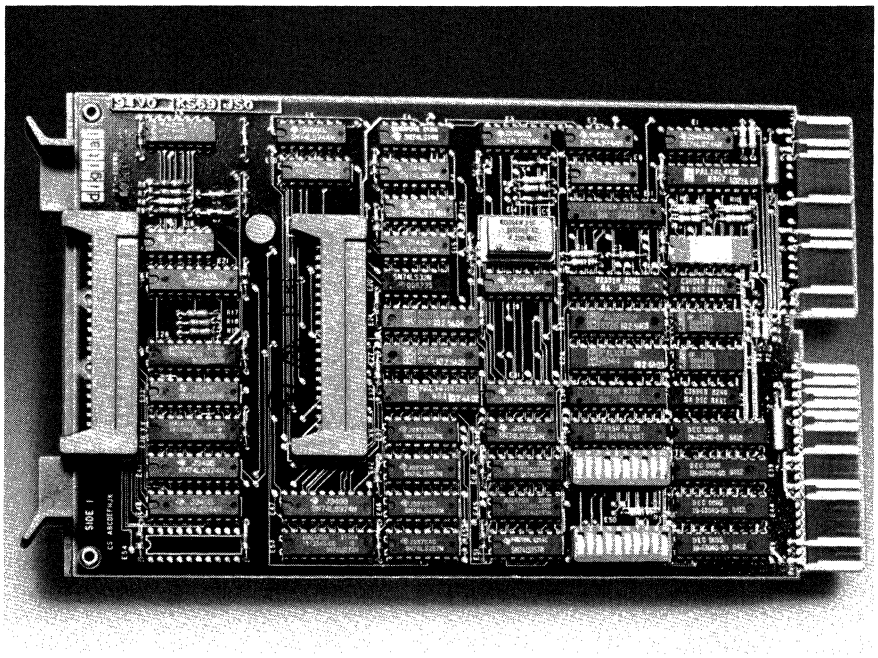
Additional Information

The following sources are listed for in-depth product descriptions (Packaged Automation Systems, I/O modules, terminal strips, mounting chassis) and configuration information on the IP11 family of products:

- *Guide to Industrial & Scientific Products (EB 28948-49)*
- Call our Industrial Sales Support Hotline—1-800-832-6277.
- See the *IPQS*, *IPUS*, and *IP112* sections of this catalog.



DRV11-W



The DRV11-WA, a general purpose, direct memory access (DMA) interface transfers 16-bit data words directly between the MicroPDP-11 or MicroVAX memory and a user's I/O device.

In typical applications the DRV11-WA interfaces high-speed graphics terminals, data acquisition devices and machine tool controls to the host processor.

Features

- Dual size module
- Backward compatible with DRV11-B
- Switch selectable 18- or 22-bit addressing mode
- Switch selectable device and vector addresses
- Burst mode, byte addressing, and read-modify-write operation support

Software Support

The module is supported within the VAXlab Software Library, an embedded feature in the VAXlab system. This software is model number Q*B15-xx (where * specifies the CPU, and xx is the media and service type).

The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX and RT-11 operating systems.

Cabling

A cable kit must be ordered with the DRV11-WA.

The cables listed below connect the bulkhead to the user devices. These cables are terminated (one or both ends) with H856 40-pin connectors. Cable selection is determined by the type of connections used on the users' device. The desired cable length must be specified when ordering. Lengths longer than 25 feet are not recommended for use with the DRV11-WA. For cabling from the CPU bulkhead to the user device, the following cables are recommended.

Cable Number	Connectors	Type
BC08R-xx	H836 to H856	Shielded flat
BC04Z-xx	H856 to open end	Shielded flat

Environmental

Temperature	−40°F to 150°F −40°C to 50°C
Relative Humidity	10 to 90 noncondensing

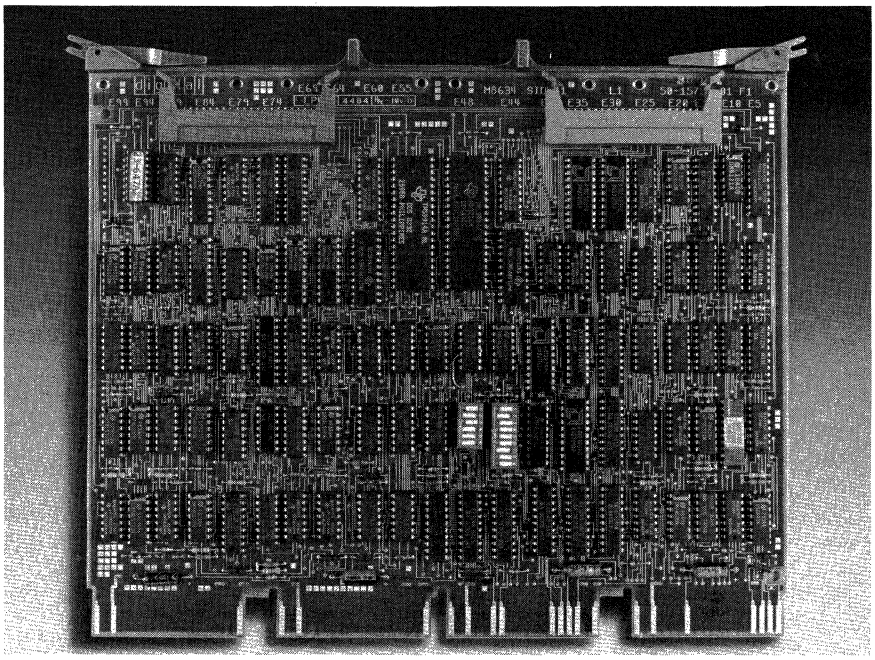
Configuring Information

Option	Mounting Requirements	DC Amps Drawn at +5V +12V	Watts Drawn	Bus Loads AC DC	I/O Panel Size
DRV11-WA	One Dual Slot	1.8			

Ordering

DRV11-WA	General purpose DMA interface upgrade option plus one cable kit from the following:
	CK-DRV1W-KA (for MicroPDP-11, MicroVAX) CK-DRV1B-KB (for 11/23S) CK-DRV1B-KC (for 11/23+)

IEQ11A



The IEQ11, an interface between the Q-bus and the General Purpose Interface Bus (GPIB), conforms to IEEE Standard 488 1978 specifications.

The IEQ11 provides an interface to laboratory instrumentation devices for programmable power supplied, signal generators, digital multimeters, function generators, and spectrum analyzers.

The IEQ11 is a device to interface between a MicroPDP-11 or MicroVAX system and microprocessor controlled instrumentation.

Features

- One quad board supports two independent GPIBs
- DMA available for each GPIB
- Full IEEE Standard 488 1978 interface support
- 14 devices supported plus the controller itself
- EOI byte count or matched characters data transfer termination

Software Support

Software is supplied as a separate device driver for the RSX, RT and VMS operating system.

This driver allows programs written in MACRO and FORTRAN to communicate with IEEE 488 devices connected to an IEQ11-A. This communication is implemented through direct QIC calls to the executive or by using a set of subroutines callable from a high level language. The IEQ11-A Device Driver provides the following hardware controls:

- Controller (C1, C2, C3, C4, C5)
- Talker and Extended Talker (T5, TE5)
- Listener and Extended Listener (L3, LE3)
- Automatic Source Handshake (SH1)
- Automatic Acceptor Handshake (AH1)
- Service Request (SR1)

- Remote/Local (RL1)
- Parallel Poll (PP1, PP2)
- Device Clear (DC1)
- Device Trigger (DT1)

Driver software functions are available to control the IEEE 488 interface. The driver allows the IEQ11 interface to be either attached to a single task or shared between several tasks.

Software Support

The IEQ11-A Device Driver requires the RSX-11m, RSX-11M+, VMS, MicroRSX or RT-11 operating system and can be used with:

- FORTRAN IV/RSX, PDP-11 FORTRAN 77/FSX or MicroRSX for systems running one of the RSX operating systems
- FORTRAN IV/RT-11 for systems running the RT-11 operating system

Hardware Requirements

A valid MicroPDP-11 computer with any if the operating systems listed under software support requires a minimum of 8KB of user memory for one IEQ11-A.

Cabling

A cable for connecting one IEEE 488 is included. Also available is shielded instrument bus cable (bulkhead to user device), one IEEE 488 connector both ends, two meters long (BNO1A 02).

Environmental

Temperature 5°C to 50°C
Relative 10 to 90 noncondensing humidity

Configuring Information

Option	Mounting Requirements	DC Amps Drawn at +5V +12V	Watts Drawn	Bus Loads AC DC	I/O Panel Size
IEQ11-AB	One Quad Slot	3.5	17.5	2 1	B
IEQ1-AB	One Quad Slot	3.5	17.5	2 1	B
IEQ11-SF	One Quad Slot	3.5	17.5	2 1	B
IEQ11-SA	One Quad Slot	3.5	17.5	2 1	B

Ordering

IEQ11-AB	Dual DMA IEEE 488 interface for PDP-11/23 and 23+. Includes option module, test cable, and bulkhead/test cable assembly (allows access to one IEEE 488 controller)
IEQ11-AD	Dual DMA IEEE 488 interface for MicroVAXand MicroPDP. Includes bulkhead cable assembly for BA23 configuration. Can be used in BA123 if mounted closed to back bulkhead
IEQ11-AF	Dual bit DMA serial Q-bus controller for IEEE 488 1978 instruments. Includes interface module, test cable and bulkhead cable assembly for BA123 and H9642.
IEQ11-SF	Field upgrade Option for the IVAX and Industrial PDP-11 Series. This variation is the same as the AD but equipped with special harness to fit the IVAX and industrial PDP-11. Includes a loopback cable.
70 20161-01	Bulkhead to second IEEE controller cable on IEQ11-AB
BN11L-OC	Bulkhead to second IEEE controller cable on IEQ11-AD
BNO1A-02	Shield instrument bus cable (2m) to user device
QJS36-xx*	RT-11 operating system device driver
QJS37-xx*	RSX-11M/M+ and MicroRSX operating system device driver
QZ519-xx*	VMS operating system device driver

*xx represents distribution media and software support

ADQ32

The ADQ32 is a 12-bit A/D subsystem for the Q-bus that can convert and transfer data at a maximum speed of 200,000 samples per second. Designed with operational flexibility as the primary goal, the ADQ32 provides a range of sampling and triggering mechanisms to meet the requirements of most research and laboratory applications.

Features

- 32SE/16DI channels with 12-bit resolution
- Maximum (single channel) throughput of 200 kHz
- Programmable gains of 1, 2, 4, and 8
- Vernier DACs for programmable calibration of the A/D
- On-board parameter list for random channel, gain, and SE or DI selection
- On-board realtime clock that can provide a variety of triggering modes
- Continuous data collection through block mode DMA engine with dual channels and buffer chaining
- Switch-selectable four-level interrupts
- On-board 512 word FIFO to minimize impact of bus latency

Applications

The ADQ32 can be used to interface laboratory instruments to the computer. Designed for the efficient transfer of large blocks of data at high speeds, the ADQ32 can be used in speech processing, electronic and material testing, aerospace research, and vibrational analysis.

Functional Description

The ADQ32 can be broken down into six functional subsystems—the analog to digital conversion circuitry, the calibration circuitry, the Dynamic Parameter list (DPLST), the clock sub-system, the A/D data FIFO, the DMA engine, and the interrupt circuitry. These subsystems are described as follows:

The A/D Subsystem

The A/D subsystem consists of two input multiplexers that provide 32 single-ended or 16 differential channels or any combination in between, a programmable amplifier that provides gains of 1, 2, 4, and 8, and an A/D converter with 12-bit resolution and 3 microsecond conversion time. All input channels are provided with +35V protection with power on and +20V protection with power off.

The Calibration Subsystem

The ADQ32 includes vernier DACS which allow for software calibration of the programmable amplifier and the A/D. Three reference voltages are provided by the ADQ32—Analog Ground, +Full Scale −1.5 LSB, and −Full Scale +0.5 LSB. Calibration routines can be written that compare the reference voltages to the output of the A/D and determine the four offset drifts (one for each gain) and the gain drift.

These values are then loaded into the calibration RAM on the ADQ32 and are automatically compensated for with each sample taken. Software calibration overcomes the need for opening up the computer and manually tweaking the potentiometers on the A/D before each collection run.

The Dynamic Parameter List

The ADQ32 includes a 512 byte FIFO that acts as a dynamic parameter list (DPLST). The DPLST offers the user a sophisticated and highly versatile scheme for defining the channels to be sampled. The user pre-loads the sequence of channels to sampled into the FIFO. This sequence can be any number of channel entries upto 512 and can be in any order.

Along with each channel number, the gain at which each channel is to be sampled and whether the channel is single-ended or differential may also be specified. After reading the last user channel, the DPST logic can either return automatically to the beginning of the channel list or generate an interrupt. This permits the user to perform either single scans or multiple scans of the channels.

The Clocking Subsystem

The ADQ32 includes a highly versatile realtime clock based on the AMD 9513A clock chip. The timing source for the clock can be either an external frequency source or the on-board 5MHz oscillator. The clock subsystem contains five 16-bit counters that can be connected in a variety of different ways to generate the clock signal for the A/D converter. The clock signal to the A/D converter is also brought out through the I/O connector. This last feature permits the user to synchronize the data collection process with other external events.

The ADQ32 includes an external gate/trigger line. This line may be used to trigger the A/D directly. In this mode, the delay between the onset of the trigger and the start of the A/D conversion is reduced to less than 20 nanoseconds. Alternatively the external gate/trigger may be used as a gate to enable/disable the pulse train from the counters.

The ADQ32 also provides a trigger line for doing pre-event/post-event sampling. In this mode, data can be captured before as well as after a major event. Before the event, the ADQ32 transfers the data to one set of buffers in memory. When the event occurs, a pulse is transmitted to the ADQ32 through this line. The ADQ32 then switches DMA channels so that data collected after the event are transferred to a second set of buffers.

The VAXlab Software Library (VSL) supports a subset of the ADQ32's clocking capabilities. These are described below.

- **Initiating the Collection**—The data collection process may be started either through software or upon the inception of an external trigger pulse. A process is defined as a collection of one or more channel sweeps where a sweep is one scan of the channels loaded into the DPLST.
- **Initiating a Sweep**—Each sweep may be started by an external trigger, by an on-board clock or as soon as the previous sweep is complete.
- **Collecting Each Value**—Conversion on each channel in a sweep can be initiated by an external trigger, by an on-board clock or as soon as the previous sweep is complete. Since the ADQ32 supports only one external trigger line, external triggering can be used to initiate only one of the three—process, sweep, or value during a data collection run. The VSL, however, does provide a second clock to control the conversion rate while the first clock controls the sweep rate.
- **Gating the Clock Pulses**—When the ADQ32 is used in the mode where the process is initiated through software and each sweep starts as soon as the previous sweep is complete, the VSL permits the external trigger line to be used to enable/disable the clock pulses to the A/D. Both level gating and edge gating are supported.

Other modes of the ADQ32 also supported by the VSL are pre-event/post-event data collection and time stamping where the value of the clock counter is read and transfered for each data value collected. Time stamping is only available with external triggering for each sample and non-DMA data transfer. The VSL also provides sub-routines that calibrate the ADQ32.

ADC Data FIFO

The ADQ32 contains a 512-word input FIFO to minimize the effects of bus latencies. When the A/D finishes a conversion, it places the data into the front-end of the FIFO. The user can access this data by reading the back-end. Each time a word is read from this location, the FIFO makes the next value available.

DMA Engine

The ADQ32 contains a powerful block-mode DMA engine for fast, efficient Q-bus transfers. Other slower but more conventional methods of Q-bus DMA transfers are also available for use with DMA slaves that do not support block-mode transfer. The DMA engine can transfer data to a buffer in memory or to a single address location on the Q-bus such as the data register of an array processor. When transferring data to memory, the user can take advantage of a feature called buffer chaining to minimize CPU overhead while loading control parameters. With buffer chaining, the ADQ32 can read buffer starting addresses and word-lengths directly from memory without processor intervention.

Interrupt Circuitry

The ADQ32 can interrupt on one of two Q-bus vectors. The first reserved for DMA controller interrupts and the second for A/D error conditions and FIFO status conditions, with the second having priority over the first. The ADQ32 can interrupt at one of four priority levels where the levels are switch selectable.

Cabling

Two cabling options are available. Mass terminations in the form of 50-pin IEEE connectors mount on the back panel of a MicroVAX II or other system. Also available is an easy-to-connect front panel which uses removable barrier strips.

Software Support

For the VMS operating system, this module is supported within the VAXlab Software Library, which is a component of the VAXlab system. The VSL may also be ordered separately under the model number Q*B15-xx (where * is either Z or 4 depending on the CPU, and xx is the media and service type).

The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX, and RT-11 operating systems.

Ordering Guide

ADQ32-AA	32 channel ADC module only, no panels or cables provided. For the BA123 or BA23 chassis.
ADQ32-SA	32 channel ADC module only, no panels or cables provided. For the BA213 chassis.
UDIP-DC	Easy-to-connect front distribution panel kit for the BA123 version of VAXlab. Requires UDIP-BA if used with other BA123 systems. The ADQ32 UDIP panel is a double-width panel.
UDIP-DD	Easy-to-connect front distribution panel kit for the UDIP-RA rackmount frame adapter or the UDIP-TA tabletop frame adapter. Requires the appropriate rear distribution panel kit. The ADQ32 is a double width panel.
UDIP-BA	Frame, holds three single-width UDIP panels, mounts in disk bay of BA123.
CK-ADQ32-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.
CK-ADQ32-KB	Rear distribution panel kit (21-inch cable) for BA123 cabinets.
CK-ADQ32-KF	Rear distribution panel kit (36-inch cable) for the BA23 with expansion chassis.
CK-ADQ32-KF	Rear distribution panel kit for the BA23 expansion chassis (mass termination).
BC19R-05	Optional 5ft. UDIP extension cables for UDIP-RA and UDIP-TA frame adapters. Order two for each option.

Specifications (At 25°C unless otherwise specified)
Analog Input

No. of Channels	32SE/16DI
Resolution	12-bit
Programmable Gain (PGA)	1, 2, 4, 8
Aggregate Throughput	200 kHz @ Gain=1 (single channel)
Input Range	−10V to +10V
Output Coding	Sign Extended 2's complement

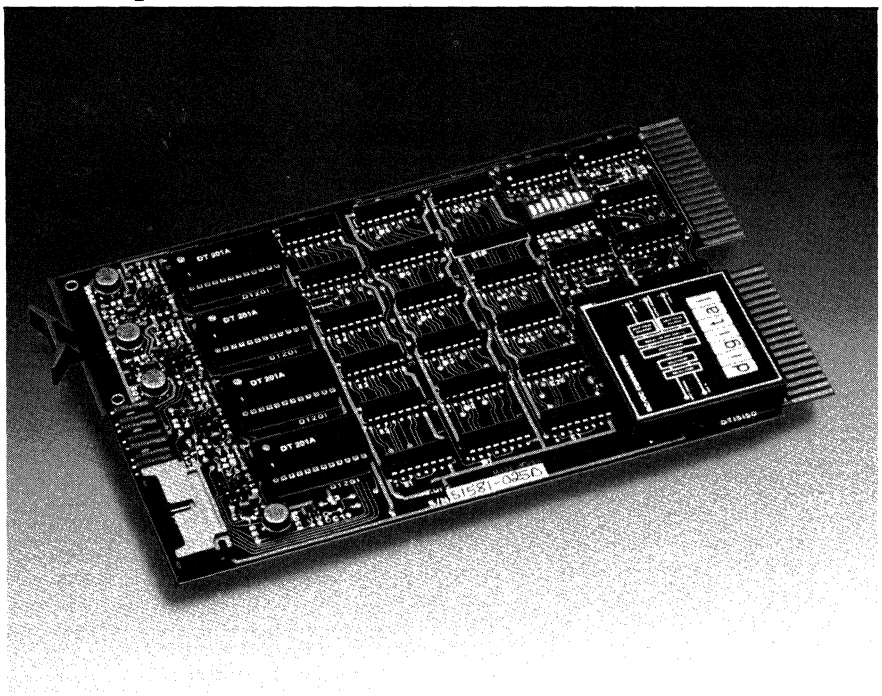
PGA Accuracy

Gain=1	to within 0.010 FSR
Gain=2	to within 0.015 FSR
Gain=4	to within 0.020 FSR
Gain=8	to within 0.025 FSR
Integral Nonlinearity	1.5 LSB, max.
Differential Nonlinearity	–.8 to +1 LSB
Input Impedance	10 Megaohms, min.
Input Protection, Power On	+35V
Input Protection, Power Off	+20V
ADC Scale Error	Adjusted by autocalibration
Offset Error	Adjusted by autocalibration
Input Offset Drift	15 microvolts per degree C
Output Offset Drift	25 microvolts per degree C

Interface Parameters

Mounting Requirements	One Quad Slot
Power Requirements	5.5 Amps at +5V
AC Bus Load	2.0
DC Bus Load	0.5
I/O Panel Units	1 A panel

AAV11-C



The AAV11-C is a dual-height, multi-channel analog output board designed to interface analog instrumentation to Q-bus based MicroPDP-11 or MicroVAX systems. It has four individually addressable digital-to-analog converters (DAC), each with 12- bits of input data resolution. Each DAC can be written or read in either word or byte format. Jumpers permit selection of the analog output voltage range for each register and its operating mode, either unipolar or bipolar. One of the registers, DAC D, also has four digital output bits for creating signals to an analog device such as a CRT.

Features

- Four DAC converter circuits, separately controlled
- Twelve-bit digital resolution
- Read/write, word or byte addressable registers
- Unipolar or bipolar output
- Output voltage range selection +10V or 0 to 10V
- Four-bit digital output for CRT control signals intensity, blank, unblank, erase

Applications

The AAV11-C is used in applications requiring a computer generated signal in the +10V range such as acoustics, process control, and flight simulation.

Digital-to-Analog Conversions DAC A, B, C

Identical circuits perform digital-to-analog conversions in the first three DACs. They have a holding register to store the digital input, a DAC IC that generates a current and an amplifier that changes its input current into a proportional voltage to its input.

Each DAC has an offset potentiometer to adjust the amplifier to negative full-scale range and a range gain potentiometer to adjust for positive and negative full-scale range.

DAC D

DAC D is identical to DAC A, B, and C except that bits 0– from its holding register go to the I/O connector as well as to the DAC IC. These bits can be used to transmit control signals to external equipment.

Control signals in these bits will affect any DAC conversions that occur at the same time using DAC D.

Software Support

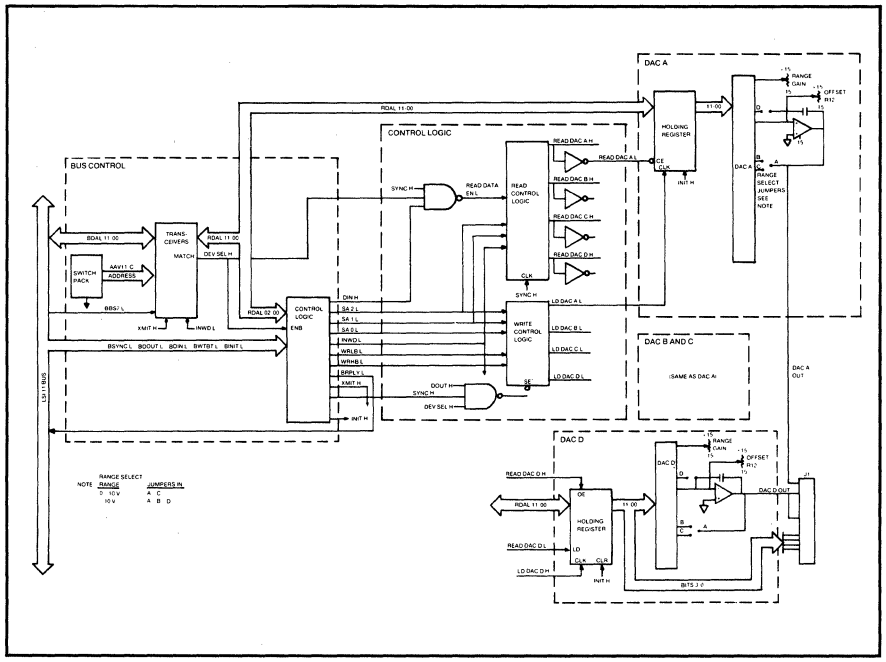
The customer must supply the necessary device driver under all operating systems except Micro-Power/Pascal.

Cabling

A 25-pin D subminiature female connector and cable are required to interface to the rear distribution panel.

Ordering

AAV11-C	Module only, no panel or cable included.
AAV11-CP	Module with Rear Distribution Panel kit for the BA23 cabinet.
CK-AAV1C-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.


DAC A
CONTROL LOGIC
BUS CONTROL
RDAL 11 00
HOLDING REGISTER
READ DAC A H
READ DAC A L
READ DAC B H
READ DAC C H
READ DAC D H
READ CONTROL LOGIC
SYNC H
READ DATA ENL
TRANS-CEIVERS
MATCH
DEV SEL H
SWITCH PACK
AAV11-C ADDRESS
BBS7 L
XMIT H
INWD L
RDAL 52 00
CONTROL LOGIC ENB
DIN H
SA 2 L
SA 1 L
SA 0 L
INWD L
WRBE L
WRHB L
SRPLY L
XMIT H
INIT H
DOUT H
SYNC H
DEV SEL H
WRITE CONTROL LOGIC
LD DAC A L
LD DAC B L
LD DAC C L
LD DAC D L
DAC B AND C
(SAME AS DAC A)
DAC A OUT
RANGE GAIN
OFF SET R12
RANGE SELECT JUMPERS SEE NOTE
DAC D
DAC D OUT
READ DAC D H
READ DAC D L
LD DAC D H
BITS 3 0
BSYNC L
BDOUT L
BDIN L
BWTBT L
BINIT L
LSI-11 BUS
RANGE SELECT
NOTE RANGE JUMPERS IN
0 10 V A C
10 V A B D

Specifications

Electrical

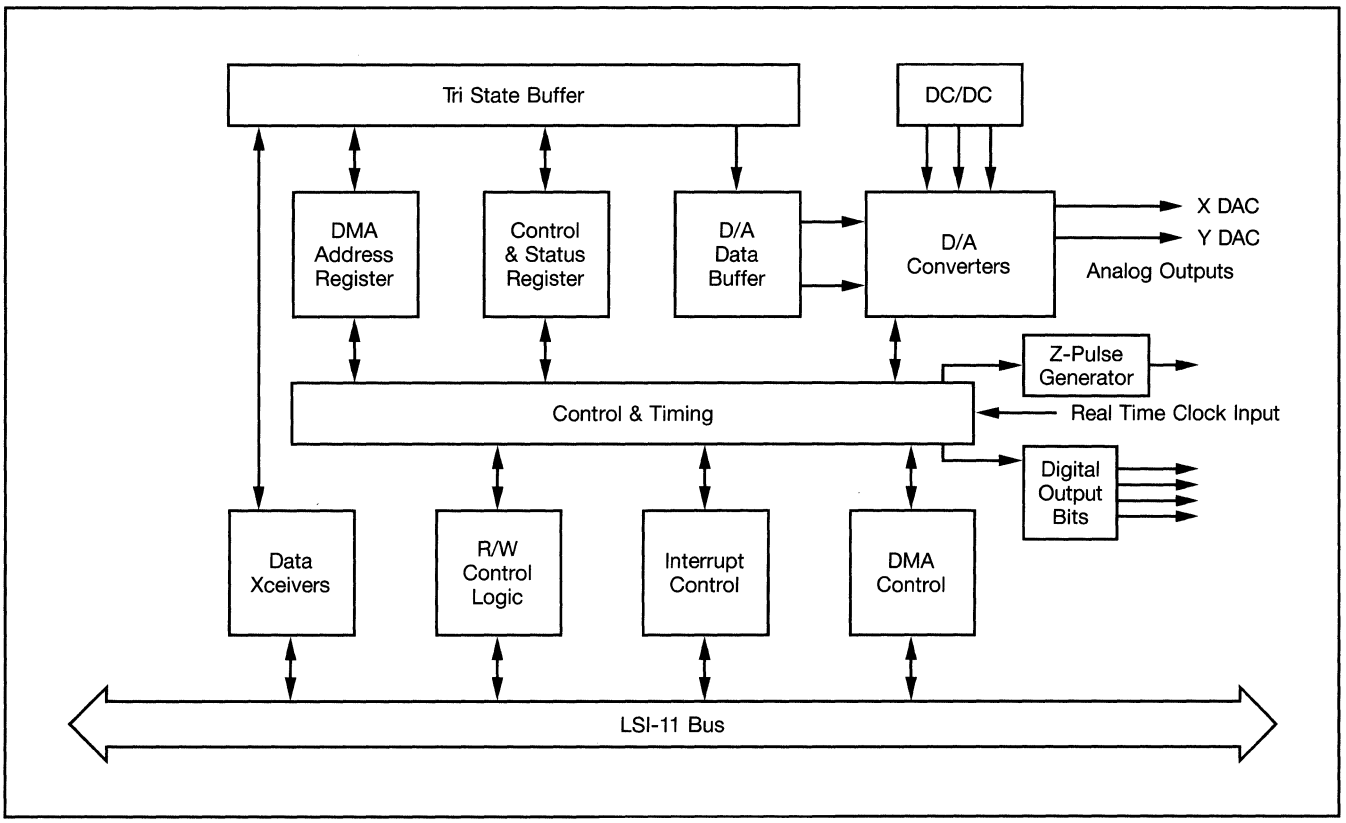
DAC Resolution	12-bit
Number of Digital-to-Analog Converters	4
Digital Input	12 Bits (binary encoded for unipolar output; offset binary for bipolar mode)
Digital Storage	Four separate read/write DAC registers for word or byte storage
Analog Output Voltage	+10V at 10 mA; 0V to 10V at 10 mA
Gain Accuracy	Adjustable to (-) full-scale value
Gain Drift	+30 PPM per °C, maximum
Offset Drift	+15 PPM per °C, maximum
Offset Error	Adjustable to zero
Linearity (0–V)	+½ LSB; +1.2mV at full-scale range
Differential Linearity	+½ LSB
Output Impedance	0.5 ohm
Output Current	10 mA at 10V minimum
Settling Time	6us to 0.1 for a 20V p.p output change

Interface Parameters

Option Code	A6006
Mounting Requirements	One dual slot
Power Requirements	2.5 Amps @ +5V
DC Bus Load	1
AC Bus Load	0.9
I/O Panel Units	½ B panel for two AAV11-Cs

AAV11-DA

AAV11-DA Block Diagram



The AAV11-DA is a high-speed analog output board designed to control experiments and analog instrumentation with the MicroVAX II, VAXstation II, or any Q-bus based Digital systems. Two output channels are provided with ranges of +10V, + 5V, 0–V. Data conversion with 12-bit resolution is provided under programmed I/O or DMA mode. In DMA mode the option is capable of rates up to 200,000 outputs per second (single channel) or 300,000 words per second (dual channel).

Features

- High performance DMA analog output system with support for 22-bit memory addressing and 4 level interrupts
- Two independent high-speed 12-bit D/A channels with Z-axis control
- Continuous (no gap) output from disk, software drivers and subroutines are available and included with the VAXlab Software Library
- High aggregate data output rate–up to 200,000 values per second in single-channel mode or 300,000 in dual channel mode
- Two data conversion start schemes, two channel selection modes, two data conversion modes
- Four lines of digital output

Q-bus Options/AAV11-DA

Applications

The AAV11-DA is used in realtime applications requiring high speed signal output or high speed instrument control in the +10V range such as aerospace research and testing, materials testing, structural analysis, speech processing, and electronic testing.

The AAV11-DA is a high speed dual channel analog output system on a Q-bus dual-height board. Two independent D/A channels, with 12-bit resolution, are provided. The AAV11-DA may be used to provide one or two independent D/A channels, or to provide a pair of analog channels (X and Y) plus a Z-axis pulse for CRT support. Data transfer rates from memory at an aggregate rate up to 300,000 values per second are available via the interface.

The DMA interface provides the control and address generation circuitry to implement DMA transfers on both 18- and 22-bit systems. DMA buffers may be set up anywhere in memory. They may be up to 65,536 words long in the single channel mode or up to 131,072 words in the X/Y mode. DMA transfers are word oriented in single channel mode and word-pair oriented in X/Y mode. In extended systems, the upper address bits may change dynamically to insure contiguous buffers even across memory boundaries. Or, they can be jumper configured to wrap on any 64K word boundary.

The board uses two interrupt vectors that can be individually enabled or disabled under software control. The base interrupt vector is set by user selectable jumpers and corresponds to the DONE interrupt. The Error interrupt is then four higher than the base vector. The board can be made to interrupt any of the four levels available on the Q-bus by user selectable jumpers.

The D/A output scheme can be either X/Y mode or single channel mode on a user specified channel. In the X/Y mode, both channels will be updated simultaneously. All conversion or bursts of conversions are initiated by either the realtime clock input or by a software start.

Each analog output is fully buffered by power amplifiers to alleviate the common CRT display problem of position distortion caused by extended cabling to the display. The Z-axis power amplified TTL-pulse (jumper selectable width) intensifies to point on the screen after a jumper selectable "set-up" delay which begins after both the X and the Y D/A converters have been loaded. Because the AAV11-DA can refresh as many as 4K points without "flicker," many applications can use a simple X-Y scope instead of a more expensive storage scope.

Cabling

Two cabling options are available for the AAV11-DA. Mass terminations in 25-pin D-subminiature connectors mount on the rear panel of a MicroVAX II or other system. Also available is a easy-to-connect front distribution panel which utilizes removable barrier strips.

Software Support

For the VMS operating system, this module is supported within the VAXlab Software Library, which is a component of the VAXlab system. The VSL may also be ordered separately under the model number Q*B15-xx (where * is either Z or 4 depending on the CPU, and xx is the media and service type). The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX, and RT-11 operating systems.

Ordering

AAV11-DA	Two channel DAC module only, no panel or cable provided. For the BA123 or BA23 chassis.
AAV11-SA	Two channel DAC module only, no panel or cables provided. For the BA213 chassis.
UDIP-DA	Easy-to-connect front distribution panel kit for the BA123 version of the VAXlab. Requires UDIP-BA if used with other BA123 systems.
UDIP-DB	Easy-to-connect front distribution panel kit for the UDIP-RA rack-mount frame adapter or for the UDIP-TA table-top frame adapter. Requires appropriate rear distribution panel kit.
UDIP-BA	Frame, holds three UDIP panels, mounts in disk bay of BA123.
CK-ADV1D-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.
CK-ADV1D-KC	Rear distribution panel kit (30-inch cable) for BA123 cabinets and BA23 with expansion chassis.
BC19R-05	Optional 5ft. UDIP extension cables for UDIP-RA and UDIP-TA frame adapters. Order one for each option.

Specifications (At 25°C unless otherwise specified.)

Number of Channels	2
Resolution	12-bit
Output Voltage Ranges	+10V. +5V. 0 to +10V (jumper selectable) at 16mA maximum
Linearity	+1/2 LSB +0.012FSR
Differential Linearity	+1/2 LSB
Relative Accuracy	+0.025
Gain and Offset Error	Both D/A converters adjustable to zero with on-board potentiometers
Gain Drift	+25 ppm/°C in Unipolar mode; +15 ppm/°C in Bipolar mode
Full Scale Settling Time to:	0.12.us 0.014.0us 0.01(1 LSB step) 1.0 us
Slew Rate	14V/us
Reference Voltage	+10V @ 1mA
DC Output Impedance	0.05 Ω
Coding of D/A Data	Two's Complement, Binary, or Offset-binary (jumper selectable)

Digital Control Lines

Z-Output	LO is 0.8V, HI is 2.4V
Z-Polarity	Jumper Selectable
Z-Pulse Width	620 ns (jumper selectable) or 35 ns to 35 ms with external RC
Z-Rise Time	ns into 50 feet of terminated coaxial cable
Set-up Delay (from Beam start command to leading edge of Z-pulse)	350 ns or 3.5 ms (jumper selectable) or 350 ns to 35 ms with an external RC
Digital Output Line Use for scope set-up functions of store/non-store , write-through, and erase	Four (4) TTL-level lines with 10 TTL loads drive, per line (low when asserted)

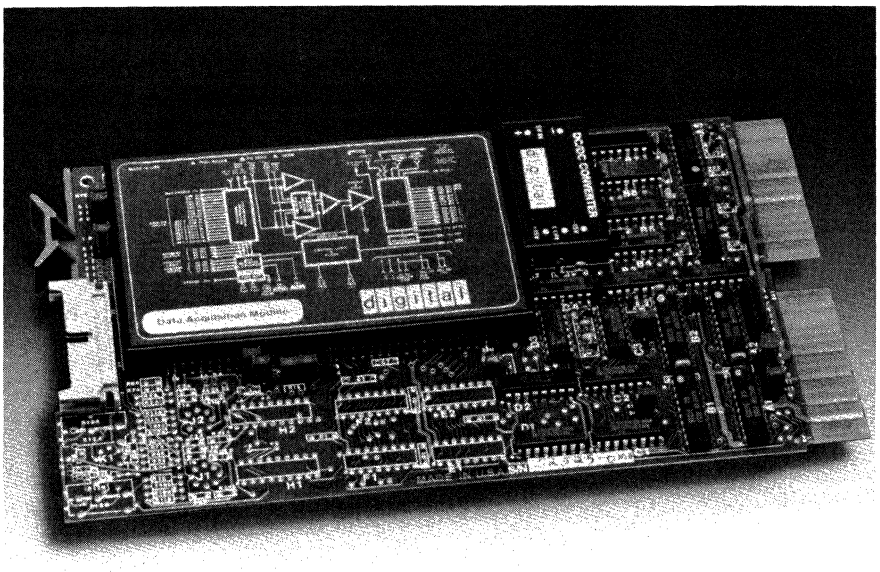
External Trigger

Origin	KWV11-C programmable clock, or user device
Function	To control interval between points during DMA or programmed operations. Should be normally low and pulsed high.
Loading	1 TTL load

Interface Parameters

Mounting Requirements	One Dual Slot
Power Requirements	2.0 Amps @ +5V
AC Bus Load	1
DC Bus Load	1
I/O Panel Units	½ B panel for 2 AAV11-DAs.

ADV11-C



The ADV11-C is a dual-height, analog-to-digital converter, for Q-bus compatible MicroPDP-11 and MicroVAX systems. Its features include 16 single-ended or 8 differential input channels that are jumper selectable, software-programmable gains of 1, 2, 4, or 8, and a maximum throughput of 25,000 samples per second.

The user program specifies the channel to be sampled and the gain at which it is to be sampled. analog-to-digital conversions may be started by a program command, an external trigger, or a realtime clock input. The digital representation of the analog data is stored in a data register. Data may be represented in binary, offset binary, or two's complement format. The user program can poll the ADV11-C to determine if the data is available, or the user can set the board (through jumpers) to interrupt the CPU when a data point is available.

In addition to providing an interrupt vector that indicates that data is available, the ADV11-C also provides an interrupt vector to flag error conditions. The ADV11-C can detect attempts to trigger a conversion while the multiplexer is settling or while conversion is in process or an attempt to read the data register while the conversion is in process.

Features

- 16SE/8DI analog input channels
- Software programmable gain amplifier with gains of 1, 2, 4, 8
- 12-bit resolution and a maximum throughput of 25,000 samples/second
- Initiation of data conversion by program start, realtime clock input or by external trigger input
- Polled or interrupt driven I/O

Applications

The ADV11-C can be used in applications involving data acquisition of analog signals in the range of +10V and for interfacing analytical instruments such as gas chromatographs to Q-bus computers.

Q-bus Options/ADV11-C

Software Support

The customer must supply the necessary device driver under all operating systems except MicroPower/Pascal.

Cabling

A 25-pin D subminiature female connector and cable are required to interface to the rear distribution panel.

Ordering

ADV11-C	16 channel ADC module only, requires cabinet kit.
ADV11-CP	Module with rear distribution panel kit for the BA23 cabinet.
CK-ADV1C-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.

Specifications (At 25°C unless otherwise specified)

Number of Analog Inputs	16SE/8DI
Analog Input Rrange	0 V to +10V –V to +10V
Maximum Input Signal	+10.5 V (signal + common mode voltage)
Resolution	12-bit unipolar, 11-bit bipolar plus sign
Data Notation	Binary, offset binary, or two's complement

Input Impedance

Off Channels	100 M ohm minimum in parallel with 10 pF maximum
On Channels	100 ohm minimum in parallel with 100 pF maximum
Power Off	1 K ohm in series with a diode
Input Protection	Inputs are current-limited and protected to + 30 V overvoltage without damage.

Sample and Hold Amplifier

Aperture Uncertainty	Less than 10 ns
Aperture Delay	Less than 0.5 us from start of conversion to signal disconnect
Front End Settling	Less than 15 us to + 0.01 of full-scale value for a 20 V p-p input
Input Noise	Less than 0.2 mV rms

ADC Converter Performance

Linearity	+1/2 LSB
Stability (temperature co-efficient)	+30 ppm/°C
Stability, long term	+0.05 change per six months
System Accuracy	Input voltage to digitize value +0.03
Conversion Time	25 us from end of front-end starting to setting the ADC DONE bit.
System Throughput	25K channel samples per second

Interface Parameters

Mounting Requirements	One Dual Slot
Power Requirements	2 Amps @ +5V
AC Bus Load	1.3
DC Bus Load	1.0
I/O Panel Units	½ B panel for 2 ADV11-Cs

VSV21

The VSV21 Color Graphics Controller is a single-board color raster graphics module that is used on Q22-bus processors. It is a medium resolution device that can be used by OEMs as a building block to create multiple workstations/CPUs for the process control industry, low-end CAD/CAM and scientific/engineering applications.

The VSV21 contains an advanced graphics controller chip and an onboard microprocessor. This combination gives the device high performance, high functionality and fast screen updating.

System software is supplied separately for the VSV21 to run on MicroRSX, RSX-11M-PLUS, and MicroVMS. Additional applications, such as third-party display management software/editors and graphics industry standards, can be layered.

Features

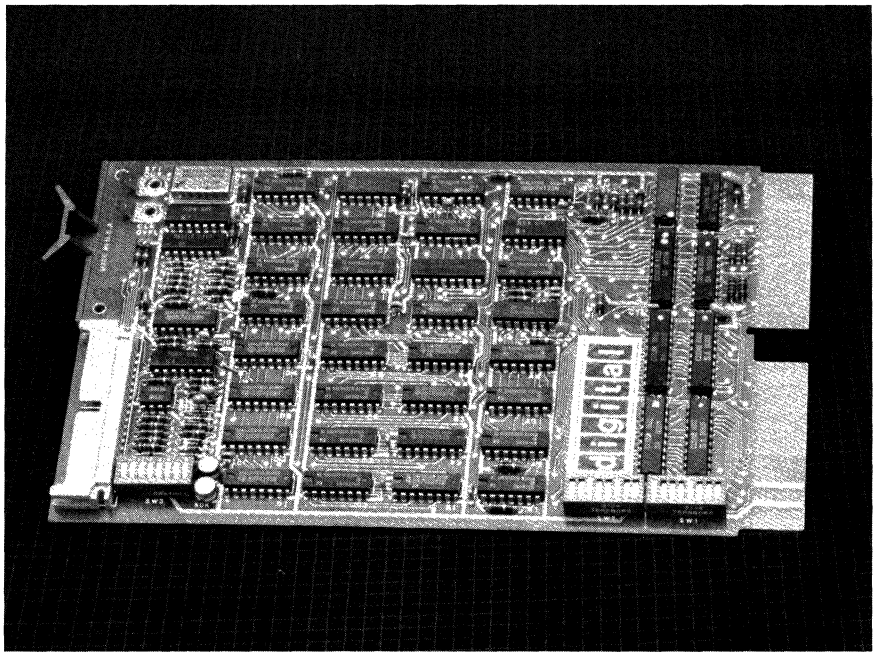
- Single quad-height Q-bus board with two powerful onboard processors.
- A Direct Memory Access (DMA) link to the host processor's Q22-bus for the fast transfer of data and rapid bit-mapped display updates
- Four switch-selectable, 60-Hz noninterlaced screen resolutions for flicker-free high-picture-quality (640 by 480, 640 by 240, 512 by 512, 512 by 256)
- 16-color simultaneously display from a palette of 4,096 colors
- Four RS232-C serial ports for connecting keyboard, printer, and pointing devices
- VT220 emulation firmware for host interface

Ordering Information

VSV21-AA	VSV21 module
VSV21-AB	BA23 distribution kit
VSV21-ACA	BA123 distribution kit
VSV21-AD	BA11-S distribution kit
VSV21-AE	25-foot video cable
VSV21-AF	14-foot keyboard cable
VSV21-AG	Host cable—PDP.
VSV21-AH	25-foot printer cable
VSV21-AJ	Loopback kit
VSV21-AK	Host cable—MicroVAXII
VSV21-AL	Data tablet adapter
VSV21-BB	VSV21-AA plus VSV21-AB
VSV21-BC	VSV21-AA plus VSV21-AC
VSV21-BD	VSV21-AA plus VSV21-AD

Note: You must initially purchase a license/warranty, a GZ documentation kit, and an H-kit for the appropriate operating system. System planning should include 7 A (max.) on the 5 Vdc bus and 0.01 on the 12 Vdc bus.

KWV11-C



The KWV11-C is a programmable realtime clock for Q-bus compatible MicroPDP-11 and MicroVAX systems. It can be used to determine time intervals or to count events. It can also be used to trigger A/D or D/A boards or to interrupt the CPU at pre-determined intervals.

Features

- Five internal base frequencies: 1 MHz, 100 kHz, 1 kHz, and 100 Hz
- 16-bit clock divider
- Four operational modes
- Two Schmitt triggers
- Line frequency input from BEVNT bus signal (50/60 Hz)
- Can trigger the ADV11-DA, the AAV11-DA, the ADV11-C, and the AXV11-C

Applications

The KWV11-C is used to trigger analog data collection or output, measure time intervals, count events or measure frequency.

Q-bus Options/KWV11-C

Description

The clock counter on the KWV11-C has 16-bits of resolution and can be programmed to count from any one of five internal crystal controlled base frequencies, from the line time clock bus line (BEVNT line), or from the firing of a Schmitt trigger by an external event.

The KWV11-C has two Schmitt triggers that can be set to operate at any level between +12V on either the positive or negative slope of the external input signal. Schmitt trigger 1 (ST1) can used as an external time base input or an external input for signals to be counted. Schmitt trigger 2 (ST2) can be used to start the counter or to generate an interrupt to the processor.

The KWV11-C's four modes of operation are the single interval, repeated interval, external event timing, and external event timing from zero base modes.

The single interval mode is used to generate a known delay for an application. The clock counter is loaded with the two's complement of the number by which the base frequency is to be divided. The KWV11-C can start immediately or can wait for an external event on ST2 to start the count. The counter increments until it reaches zero (overflows). At this point it sets the overflow flag and waits for the next command.

The repeated interval mode is used to generate a fixed frequency pulse train with any period within the range of the base frequencies and the clock counter. This mode is identical to the single interval mode except that the KWV11-C automatically resets the clock counter with the initial count and starts counting down again. In this mode of operation, the overflow flag is set at repeated intervals. It is the clock overflow line that is used to trigger A/Ds and D/As.

The external event timing mode is used to measure the time between a series of events, to count external events, or to monitor one series of external events with respect to another. The input to Schmitt trigger 1, the BEVNT line, or one of the five base frequencies is used as the clock frequency. The KWV11-C can either start couting up from zero immediately or wait for an external event on the ST2 line.

Once counting has started, the next event on ST2 causes the contents of the counter to be stored and interrupt to be generated. The program can then read the stored information and record the time of the event. If the counter overflows before the external event occurs, the overflow flag is set and counting continues.

The external event timing from zero base is identical to the external event timing mode except that the counter is reset to zero after every ST2 pulse.

The KWV11-C provides two interrupt vectors, both at priority level 4. The first vector can be used to interrupt the processor after a clock overflow while the second vector can be used to interrupt the processor after an event on the ST2 line. Both interrupts can be enabled or disabled individually by the application program. The outputs of ST1, ST2, and the clock overflow are brought out on the I/O connector to permit the user to synchronize other devices with the KWV11-C.

Cabling

A 25-pin D subminiature female connector and cable are required to interface to the rear distribution panel.

Software Support

For the VMS operating system, this module is supported within the VAXlab Software Library which is a component of the VAXlab system. The VSL may also be ordered separately under the model number Q*B15-xx (where * is either Z or 4 depending on the CPU, and xx is the media and service type).

MicroPower/Pascal supplies the device driver for this module. The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX, and RT-11 operating systems.

Ordering

(Note: All VAXlab systems include one KWV11-C and a UDIP)

KWV11-C	Clock-counter module only, no panel or cable provided. For the BA123 or BA23 chassis.
KWV11-SA	Clock-counter module only, no panel or cable provided. For the BA213 chassis.
KWV11-CP	Module with rear distribution panel kit for the BA23 cabinet. Module with rear distribution panel kit for the BA23 cabinet.
UDIP-KA	Easy-to-connect front distribution panel kit for the BA123 version of the VAXlab. Requires UDIP-BA if used with other BA123 systems.
UDIP-KB	Easy-to-connect front distribution panel kit for the UDIP-RA rack-mount frame adapter or for the UDIP-TA table-top frame adapter. Requires appropriate rear distribution panel kit.
UDIP-BA	Frame, holds three UDIP panels, mounts in disk bay of BA123.
CK-KWV1C-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.
CK-KWV1C-KC	Rear distribution panel kit (30-inch cable) for BA123 cabinets and BA23 with expansion chassis.
BC19R-05	Optional 5ft. UDIP extension cables for UDIP-RA and UDIP-TA frame adapters. Order one for each module.

Specifications
Clock

Crystal Oscillator	10 MHz base frequency
Output Ranges	1 MHz, 100 kHz, 10 kHz, and 100 Hz
Oscillator Accuracy	0.01
Other Sources	Line frequency or input at Schmitt trigger 1

Schmitt Trigger Input Signals

No. of Inputs	2
Input Range	+30V (max. limits)
Triggering Range	−12V to +12V adjustable
Triggering Slope	Positive or negative, switch selectable
Source	User device
Response Time	Depends on input waveform and amplitude; for TTL logic levels, typically 600 ns.
Hysteresis	Approximately 0.5V, positive and negative
Input Impedance	Single-ended input with 100 K Ohms impedance to ground

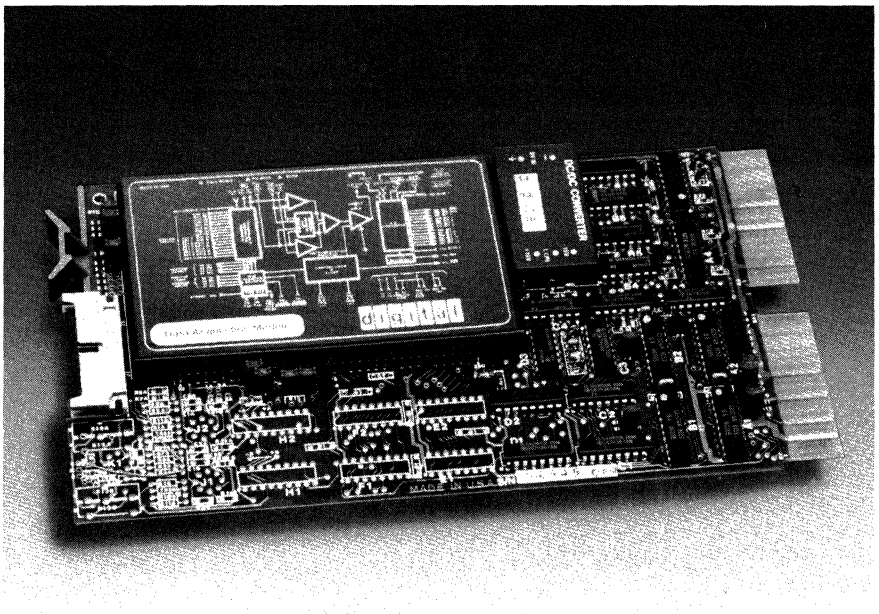
Clock and Schmitt Trigger Output Signals

Asserted Level Low Duration	Approximately 500 ns
Line Driver	TTL compatible, open collector circuit with 470 Ohms pullup resistor to +5V.
Max Source Current	5 mA when output is high (>2.4V), measuring from source through load to ground.
Max Sink Current	8 mA when output is low (<0.8V), measuring from external source voltage through load to output.

Interface Parameters

Mounting Requirements	One Dual Slot
Power Requirements	2.2 Amps @ +5V 0.013 Amps @ +12V
AC Bus Loads **DC Bus Loads**	1 1
I/O Panel Requirements	½ B panel for each KWV11-C

AXV11-C



The AXV11-C is a Q-bus compatible, analog input and output option for Micro-PDP-11 or MircoVAX systems.

Features

- 12-bit, 25 kHz, ADC subsystem with 16 single-ended or 8 differential input channels.
- Two 12-bit DAC.
- Programmable gain of 1, 2, 4, or 8 for the ADC.
- ADC conversions can be started by a program, an external trigger, or a realtime clock.
- ADC results can be received by a programmed I/O transfer or by servicing an interrupt request.
- Output data notation in binary, offset binary or two's complement format.

Applications

The AXV11-C can be used for data acquisition and output of analog signals in the range of +10V, e.g. acoustic applications, process control, and flight simulation. It can also interface analytical instruments such as gas chromatographs to Q-Bus systems.

Description

The AXV11-C is a low-cost, high-performance, analog input/output interface that includes a complete 16SE/8DI (jumper-selectable), 12-bit, 25 kHz, ADC and two independent 12-bit D/A converters. The ADC includes a programmable amplifier with gains of 1, 2, 4, or 8 and can accept both unipolar and biploar inputs of 10V. The two DACs are both 10V DACs with 12-bit resolution, a settling time of 65 microseconds, and jumper-selectable unipolar or bipolar outputs.

Analog-to-Digital conversions can be started by a program command, an external trigger, or an input pulse from a realtime clock. The realtime clock input line is brought out on a separate pin for easy installation of a wire jumper from the KWV11-C realtime clock. Digital-to-Analog conversions are started by writing the information to the data register of the selected DAC.

The user can either poll the data register of the ADC to read the converted data or the KWV11-C can be programmed to interrupt the CPU after each data point has been collected.

After the converted value has been read, the user can either specify the next channel to be sampled along with the sampling gain or continue to collect data on the current channel at the current gain.

The AXV11-C can also interrupt on an error. A second vector is provided for handling error conditions such as starting a conversion while the multiplexer is settling, or while the A/D conversion is still in process, or before the host program has read the previous conversion.

Software Support

For the VMS operating system, this module is supported within the VAXlab Software Library which is a component of the VAXlab system. The VSL may also be ordered separately under the model number Q*B15-xx (where * is either Z or 4 depending on the CPU, and xx is the media and service type). MicroPower/Pascal supplies the device driver for this module.

The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX, and RT-11 operating systems.

Cabling

A 25-pin D subminiature female connector and cable are required to interface to the rear distribution panel.

Ordering

AXV11-C	Analog I/O module only, no panel or cable provided. For the BA123 or BA23 chassis.
AXV11-SA	Analog I/O module only, no panel or cable provided. For the BA213 chassis.
AXV11-CP	Module with rear distribution panel kit for the BA23 cabinet.
UDIP-KA	Easy-to-connect front distribution panel kit for the BA123 version of the VAXlab. Requires UDIP-BA if used with other BA123 systems.
UDIP-KB	Easy-to-connect front distribution panel kit for the UDIP-RA rack mount frame adapter or for the UDIP-TA table-top frame adapter. Requires appropriate rear distribution panel kit.
UDIP-BA	Frame, holds three UDIP panels, mounts in disk bay of BA123.
CK-AXV1C-KA	Rear distribution panel kit (12-inch cable) for BA23 cabinets.
CK-AXV1C-KC	Rear distribution panel kit (30-inch cable) for BA123 cabinets and BA23 with expansion chassis.
BC19R-05	Optional 5ft. UDIP extension cables for UDIP-RA and UDIP-TA frame adapters. Order one for each module.

Specifications
(At 25°C unless otherwise specified)
Analog Input

Number of Analog Inputs	16 single-ended or 8 differential
Input Range	0V to +10V, −10V to +10V
Input Gain (programmable) **Gain Range (+.05%)**	
1	10.0V
2	5.0V
4	2.5V
8	1.25V
System Throughput	25K channel samples per second
System Accuracy	Input voltage to digitized value +0.03%
Maximum Input Signal	10.5V (signal + common mode voltage)
Input Impedance: Off Channels	100M Ohms in parallel with 10 pF max
On Channels	100M Ohms in parallel with 100 pF max
Common Mode Rejection Ratio	80 dB at 10V full-scale range at 60 Hz
Aperture Uncertainty	Less than 10 ns
Aperture Delay	Less than 0.5 microseconds from start of conversion to signal disconnect
Front End Settling	Less than 15, us to +0.01% of full-scale value for a 20V p-p input
Conversion Time	25 microseconds
Input Noise	Less than 0.2mV rms
Linearity	+1/2 LSB
Stability	+30 ppm/°C coefficient
Stability, Long Term	+0.05% change per 6 months

Analog Output

Number of DAC Converters	2
Resolution	12-bit unipolar, 11-bit bipolar plus sign
Data Notation	Binary, offset binary, or two's complement
Analog Output	+10V or 0V to +10V
Output Current	+5V mA maximum
Settling Time	65, us to 0.1% for a 20V p-p output change
Output Impedance	0.1 Ohms
Differential Linearity	+½ LSB
Non-linearity	0.02% of full-scale value
Offset Error	Adjustable to zero
Offset Drift	+30 ppm/°C maximum
Gain Accuracy	Adjustable to full-scale value
Noise	0.1% full-scale value
Capacitive Load Capability	0.5 microfarads

Interface Parameters

Mounting Requirements	One Dual Slot
Power Requirements	2.0A @ +5V
AC Bus Load	1.0
DC Bus Load	1.3
I/O Panel Units	½ B panel for two AXV11-Cs

ADV11-DA

The ADV11-DA is a high speed DMA analog input board designed to interface instrumentation to any Q-bus based MicroPDP-11 and MicroVAX system. The ADV11-DA's features include 16 single-ended or 8 differential input channels (jumper selectable), 12-bit resolution, and a maximum throughput of 50,000 samples per second.

Features

- 16SE/8DI channels
- 12-bit, 50 kHz, ADC
- Support for 22-bit memory addressing and 4 level interrupts
- Data Transfer via Programmed I/O or DMA
- Two data acquisition start schemes
  - Software start
  - Realtime clock start
- Two channel selection schemes
  - Single channel
  - Automatic increment from specified start channel
- Two data conversion modes
  - Single conversion per start
  - Multiple conversion per start

Applications

The ADV11-DA can be used in realtime applications involving high speed instrument interfacing or signal acquisition. Applications which require transferring large blocks of data at high speed will benefit from the device's DMA capabilities, in such fields as aerospace research and testing, materials testing, structural analysis, speech processing, and electronics testing.

Description

Two modes of channel sampling are available. Either a single channel may be sampled repetitively or the auto-increment mode may be selected. In the auto-increment mode, the channel number is automatically incremented with every sample request until the last available channel is reached. The board then wraps around to channel 0 and the process continues until sampling is terminated.

Data conversions may be started by a program command, or by a realtime clock. With a software start, data conversion begins as soon as a bit is set in the control register. With a realtime clock start, the system waits for a signal from an external realtime clock to initiate data conversion.

Two modes of data conversion are available. In the single conversion mode, one data point is collected for each start event. Under DMA, a multiple conversion mode is also available. In this mode, a start event (either through software or through a realtime clock pulse) starts a series of conversions that proceed automatically without further triggers and stops when the number of points specified by the DMA point count register have been collected and transferred. This is the board's fastest mode of operation as each conversion begins as soon as the previous one is complete.

Data may be transferred from the ADV11-DA to host memory either through programmed I/O or through DMA. In the programmed I/O mode, the board can either generate an interrupt or be polled. In the DMA mode, up to 64 Kwords can be transferred without program intervention to any location in the 22-bit Q-bus address space. The board releases the bus after each word transfer (or after two transfers if another word was waiting in the pipeline when the first transfer occurred). This gives other devices access to the bus and host memory.

Q-bus Options/ADV11-DA

The ADV11-DA also provides a unique feature that can be used in conjunction with software such as the VAXlab Software Library to do continuous DMA transfer. The upper six bits of the 22-bit DMA address can be made static or dynamic through a jumper on the board. With the upper six bits dynamic, both address registers are incremented by the A/D system allowing up to 4Mbytes of data to be stored contiguously as a SINGLE BLOCK in memory. If the upper six bits are kept static, the data is stored contiguously until a 64K word boundary is reached, when the address register automatically wraps around to the other end of the memory segment. This 64K memory is then divided into at least three buffers. All the software has to do is to keep emptying the buffers as fast as the ADV11-DA fills them.

Cabling

Two cabling options are available for the ADV11-DA. Mass terminations in the form of 25-pin D-subminiature connectors mount on the rear panel of a MicroVAX II or other system. Also available is a easy-to-connect front distribution panel which utilizes removable barrier strips.

Software Support

For the VMS operating system, this module is supported within the VAXlab Software Library which is a component of the VAXlab system. The VSL may also be ordered separately under the model number Q*B15-xx (where * is dependent on the CPU, and xx is the media and service type.)

The customer must supply the necessary device driver for the RSX-11M/M+, MicroRSX, and RT-11 operating systems.

Ordering

ADV11-DA	DMA ADC module only, no panel or cable provided. For the BA123 or BA23 chassis.
ADV11-SA	DMA ADC only, no panel or cables provided. For the BA213 chassis.
UDIP-AA	Easy-to-connect front distribution panel kit for the BA123 version of the VAXlab. Requires UDIP-BA if used with other BA123 systems.
UDIP-AB	Easy-to-connect front distribution panel kit for the UDIP-RA rack mount frame adapter or for the UDIP-TA table-top frame adapter. Requires appropriate rear distribution panel kit.
UDIP-BA	Frame, holds three UDIP panels, mounts in disk bay of BA123
CK-ADV1D-KA	Rear distribution panel kit (12" cable) for BA23 cabinets.
CK-ADV1D-KC	Rear distribution panel kist (30" cable) for BA123 cabinets and BA23 with expansion chassis.
BC19R-05	Optional 5-ft. UDIP extension cables for UDIP-RA and UDIP-TA frame adapters. Order one for each option.

Specifications
(AT 25°C unless otherwise specified)

Analog Input

No. of channels	16SE/8DI
Resolution	12-bit
Programmable Gain	1, 2, 4, 8
Measurement Error @ G=1	±0.03% FSR
Measurement Error @ G=8	±0.05% FSR
Max. throughput @ G=1	50,000 samples/second
Max. throughput @ G=8	40,000 samples/second
Input Impedance	100 Mohm, 100 pF (on channel)
Input Voltage Ranges	0 to 10V, ±10V
Input Protection (Power On)	±35V
Inpout Protection (Power Off)	±20V

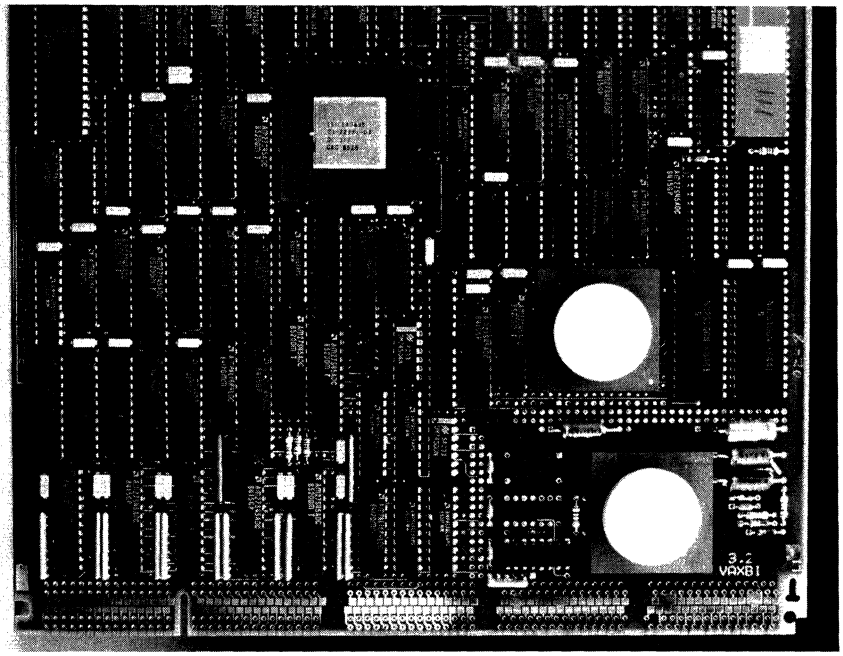
Trigger Input

Logic Compatibility	TTL
Origin	A realtime clock such as the KWV11-C
Loading	1 TTL load to the user driver

Interface Parameters

Mounting Requirements	One Dual Slot
Power Requirements	3.2 Amps @ +5V
AC Bus Load	1

DRB32



The DRB32 is a high-speed (up to 6.7Mbytes per second), asynchronous DMA parallel interface to the VAXBI. The DRB32 uses a 32-bit half-duplex bidirectional I/O path to transfer data to and from the user device and two 8-bit unidirectional paths for control data. A dual register set permits "limitless" data transfers. One version is compatible with the DR11-W providing a UNIBUS migration path to the VAXBI. Extensive software and documentation makes user designs fast and easy.

Ordering Information

Hardware

DRB32-M	VAXBI parallel interface; connects to user device within the same cabinet system as the VAXBI system.
DRB32-W	DR11-W emulator module plus DRB32-M; connects to user device within the same cabinet system at the VAXBI system.
DRB32-E	Long-line module plus DRB32-M; connects to user device or another DRB32-E up to 40 feet outside the system cabinet; a BS17Y external cable must be ordered separately.

DRB32s include base option module(s) only. All require one of the following cabinet kits:

CK-DRB32-LJ	Cabinet kit with 5-foot cables for VAX 8530, 8330, 8700, and 8800.
CK-DRB32-LM	Cabinet kit with 8-foot cable for VAX 8250 and 8350.
CK-DRB32-LN	Cabinet kit with 15-foot cables for VAX 8530, 8550, 8700, and 8800 expansion cabinets

Software

All DRB32 software is included in one package. Customers buy the package only once in order to modify the code to support their unique devices. No other software or licenses are required.

Q*Z95-Y#	VMS drivers and sources for DRB32-M/-E and DRB32-W and AA-HZ25A-TE manual.
***=CPU Type**	5=VAX 8250, 7=8350, 9=8530, 2=8550/8700, M=8800
#=Media Type	M=magtape, 3=RX50
EK-DRB32-OV	Introduction to the DRB32 adapter; ordered separately. Provides enough information for a make/buy decision.
EK-DRB32-TM	DRB32 Technical Manual; ordered separately. Hardware specifications.
AA-HZ25A-TE	DRB32 Programmer's Reference Manual; ships with Q*-Z95-Y#; ordered separately. Software specifications.

Selective Application Product

The DRB32 is sold only for use in qualified applications and a brief special purchase agreement is required. Contact your Digital sales representative for further information.

IP112-AA For UNIBUS PDPs

The IP112-AA, an industrial I/O subsystem, mounts adjacent to and operates as a local peripheral for UNIBUS based PDP-11 computer systems. It interfaces directly to the PDP-11 UNIBUS by means of a software driver interface and operates under PDP-11 control.

The IP112-AA includes an I/O control module (IOCM) and a 19 inch rack-mountable H334 chassis with power supply and mounting space for up to 10 I/O modules. Up to 7 H334 I/O expander chassis may be added to one IP11 master chassis to provide capability for handling up to 2032 I/O points. A maximum of 4 IP112-AA, each with a full complement of up to 2032 I/O points, can be connected to a single CPU.

The IP11 is ideal for those who want the capability to collect, manipulate and transmit data from their process and share it with systems throughout their facility. Applications range from simple monitoring functions to control of complex closed-loop systems.

Process and discrete manufacturers in industries such as chemicals, pharmaceuticals, petroleum, pulp and paper, food processing, paint, steel, glass, rubber, electronics, automotives, and others who need to monitor and/or control a process to optimize productivity will find their application needs fully satisfied by the IP11 family of I/O products.

Features

- IOCM provides I/O control for address decoding, timing, and control of all process interface modules.
- Independent I/O bus connects directly to I/O modules
- Designed to allow free convection cooling of all I/O modules
- Can operate at temperatures as high as 60°C
- Complete flexibility in the configuration of process monitoring systems
- Each I/O chassis has its own power supply.

Software Support

Realtime software support is available under Digital's RSX-11M, RSX-11M+ and RSX-11S operating systems. Tasks can be programmed in MACRO-11, FORTRAN IV-PLUS and FORTRAN 77 operating under RSX-11.

A standard driver for the I/O control module and a FORTRAN interface compatible with ISA61.1 are included with each IP11. Features include:

- Online addressing
- Flexible interrupt handling
- Direct addressing for the I/O modules.

Cabling

Connection to field wiring is provided via a separate screw terminal chassis (H332) and dedicated screw terminal strips (BC40A/B/L). Each screw terminal strip connects to its corresponding I/O module via a cable and connector provided. If a screw termination is not required, direct connection can be made to a 50-pin connector on each I/O module.

UNIBUS Options/IP112-AA For UNIBUS PDPs

Ordering

Order Code	Description
IP112-AA/D	I/O Interface (UNIBUS) + chassis 115v/230v
IPUS-AA/AD	PDP-11/84 UNIBUS Packaged Automation System (includes one IP112) 115v/230v

Analog I/O Modules

A014	Solid-state 12 bit A/D converter
A020	Isolated 14 bit A/D converter
A156	High-level A/D MUX for A014
A157	Prog. Gain MUX for A014
A631	Isolated 4-channel D/A converter
AM158	RMS to DC multiplexer
ATR16	Thermocouple temp. reference junction

Cables

BC40A	Screw terminals with 14 in. cable 16/32
BC40A-3D	BC40A with 40 in. cable
BC40B	Screw terminals for M5013, M6012, M6013
BC40B-3D	BC40B with 40 in. cable
BC40L	Special screw terminals w/Signal Conditioning Board
BC40l-D	BC40L with 40 in. cable

Chassis

H332	Screw terminal chassis
H334-E	10 slot expander I/O module chassis, 120V
H334-J	H334-E, but 240V, 50 Hz

Digital Input Modules

M5010	32-bit non-isolated DC input board
M5011	16-bit non-isolated DC interrupt
M5012	16-bit isolated DC interrupt
M5012-YA	M5012 TTL compatible
M5013	8-bit isolated AC input
M5014	16-bit dual input counter
M5016	8-bit quad input counter
M5031	16-channel isolated DC input

Digital Output Modules

M6010	32-bit non-isolated digital output
M6010-YA	M6010 TTL compatible
M0611	16-bit non-isolated single shot output
M6012	8-bit isolated DC output
M6013	8-bit isolated AC output
M6014	16-bit dual output counter
M6015	16-bit retentive DC output counter
M9019	Continuity (jumper) module for empty slot

Specifications
Electrical

Line voltage	90 to 120 VAC @ 47 to 63Hz
Wattage of master chassis	500 watts maximum

Environmental

Operating Temperature	5°C to 60°C free-standing
Relative Humidity	10 to 95 with maximum wet bulb, 32°C, minimum dew point 2°C

Option	Mounting Requirements	DC Amps Drawn at +5V +15V −15V	Bus Loads Drawn	I/O Panel Units
IP112-AA	One Quad Slot	1.5 0.15 0.00	1	1

Physical (Expander Chassis)

Dimension	15.75 in (40 cm) H by 19.0 in (48.26 cm) W by 10.74 in (27.28 cm) D
Weight	w/power 40 lb (18.14 Kg); w/o power 12 lb (5.44 Kg)

Physical (Screw Terminal Chassis)

Dimension	15.75 in (40 cm) H by 19.0 in (48.26 cm) W by 10.69 in (27.15 cm) D
Weight	17 lb (7.71 Kg)

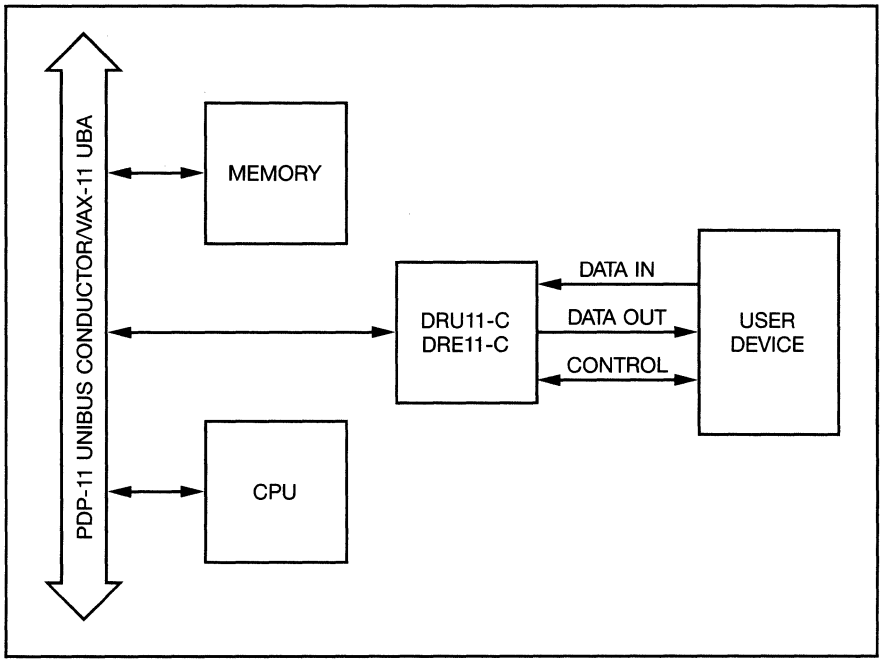
Additional Information

The following sources are listed for in-depth product descriptions and configuration information on the IP11 family of products.

- *Guide to Industrial & Scientific Products (EB 28948-49)*
- Call our Industrial Sales Support hotline—1-800-832-6277.
- See *IPQS*, *IPUS* and *IPV12* sections of this catalog.

DRU11-C

DRU11-C System Block Diagram



The DRU11-C, a general purpose Direct Memory Access (DMA) interface for continuous, high-speed data exchange can also function as an interprocessor link. The DRU11-C is designed for use with UNIBUS PDP-11 systems.

This realtime I/O device collects data for such typical applications as engine testing, radar or satellite tracking, and high speed data acquisition for tomographic imaging devices in research laboratory applications.

The DRU11-C interface contains two sets of address registers and word-count registers. The user's software controls these registers to divide the processor memory into two buffer areas. As continuous DMA data transfers occur, if one buffer is filled (DMA IN) or emptied (DMA OUT), the interface automatically switches to the second buffer area. A word-count overflow generates an interrupt to indicate the buffer is available to the user's software for processing.

The user's software processes the data in the first buffer area while data continues to be transferred either to or from the second buffer area.

Features

- DMA access for applications dependent on host computer operation
- Data transfer rate of 500k words per second
- Continuous processing using data transfer cycling between segments of main memory
- Two sets of address and word-count registers for automatic switching if one buffer is filled or empty
- Interprocessor Link Operation allows use between two computers.

Operation

The interface consists of four basic registers:

- Status and Command Register (SCR)
- Control Register
- Bus Address Register (AD)
- Data Buffer Register (DBR)

The AD is a multiplexed register that can be addressed to control and monitor the address and word-count register sets used for alternate buffer operation.

Operation is initialized under program control by:

- Loading the word counts with the two's complement of the number of transfers (e.g., buffer sizes)
- Specifying the initial memory or bus addresses of the two buffer areas where the transfer of each block begins
- Loading the status and command bits

The user device must recognize these command bits and set the control inputs in response. If the user device requests data from memory, the DRU11-C performs a UNIBUS data transfer (DATI) and loads its data register with the information held at the referenced bus address.

The output of this register is available to the user device. The output data is buffered.

If the user device requests that data be written into memory, the DRU11-C performs a UNIBUS data transfer (DATO), moving data from the user device to the referenced bus address. This input data is not buffered and must be held for the duration of the UNIBUS transfer.

Transfers normally continue at a user-defined rate until the specified number of words are transferred.

The operation, in alternate buffer mode, requires two sets of address and word-count registers.

- BARE—Bus Address Register for buffer Area 1
- BAR2—Bus Address Register for buffer Area 2
- WCR1—Word Count Register for buffer Area 1
- WCR2—Word Counter Register for buffer Area 2

These registers always contain their initial value, which is then loaded into the actual address and word counter (ACO and WCO) at the beginning of each transfer to or from one of the buffers.

- ACO—Actual bus address counter
- WCO—Actual word counter

The size of the buffers can be up to 64K words and must be located between zero and 128K words.

Interprocessor Link Operation

The DRU11-C can be used between two computers. All possible variation of links are allowed. Any link configuration operates in half-duplex mode only.

Because of their on-board handshake synchronization, a cable can connect the two interfaces to set up a computer link, without modification. The maximum transfer rate is only limited by the processor bus throughput. In addition, adjustments on each interface can reduce the rate to a maximum of 100K words per second.

Software Support

The DRU11-C device driver supports the DRU11-C (UNIBUS) interface under the RSX-11M, RSX-11M+ and RSX-11S operating systems. The driver enables the user to communicate with the interface using the $QIO system service, which is callable from MACRO, FORTRAN and other high level languages.

The DRU11-C device driver also features:

- Support of data transfer requests in DMA mode: Read/write block transfers, terminated by a specified buffer count or by issuing a CANCEL System Service Call.
- Support of programmed single word transfers: Read/write from or to data buffer register.
- Function/Status bit control services: The driver provides access to the following hardware capabilities for the transfer of information on the current status between the interface and the external device:
  - Three latching digital inputs
  - One pulsed digital input
  - Three latching digital outputs
  - One pulsed digital output
- Device status information: This function provides the user with the actual contents of all hardware registers.
- Event recognition services: Asynchronous System Trap (AST) Executive Services are available for user notification of a pulsed digital interrupt in between buffer transfers. The AST service is not available in high level languages, notably FORTRAN.
- Data path selection: Set mode functions available for selection of a direct or buffered data path.

Note: The driver does not support burst DMA mode or alternate buffer direction change mode.

Hardware Requirements

Any valid UNIBUS based RSX-11M or RSX-11M+ system configuration that includes the DRU11-C. Up to eight DRU11-C interfaces per system can be mounted.

Cabling

DRU11-C	BCO8R-XX flat ribbon
DRU11-CD	22 gauge twisted pair

Maximum Cable Length

DRU11-C	15 m (50 ft)
DRU11-CD	300 m (990 ft)

Environmental

Operating Temperature	41°F to 122°F, 5°C to 50°C
Storage	−40°F to 151°F, −41°C to 66°C
Humidity	10% to 90% noncondensing with maximum wet bulb 32°C (90°F) and minimum dew point 2°C (36°F)

Configuring Information

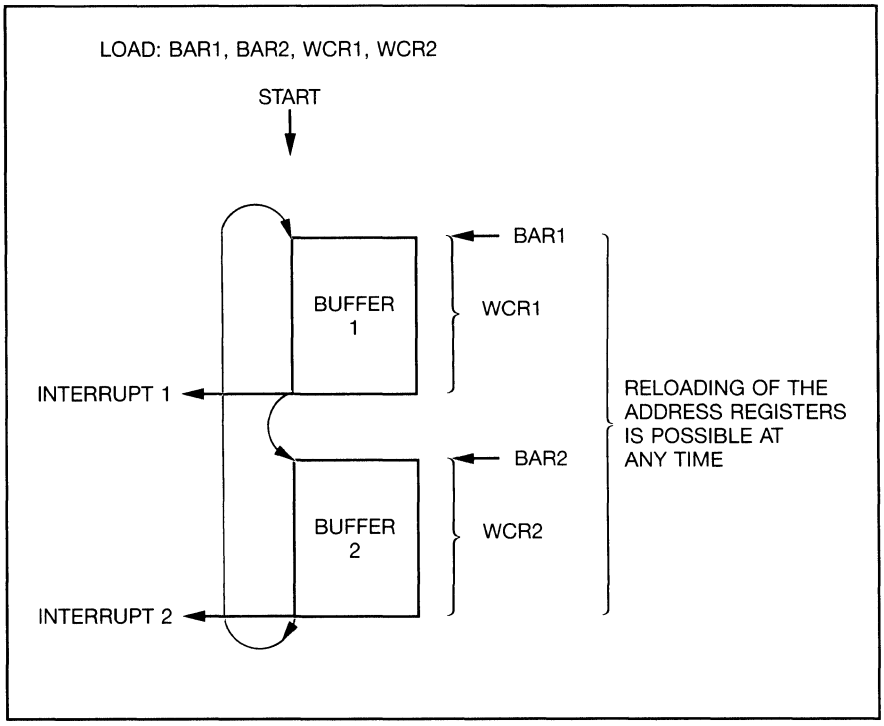
Option	Mounting Requirements	DC Amps Drawn at +5V	+15V	−15V	Bus Loads Drawn	I/O Panel Units
DRU11-C	One Quad Slot	1.5			1	2
DRU11-CD	One Hex Slot	2.2			1	2

Ordering Information

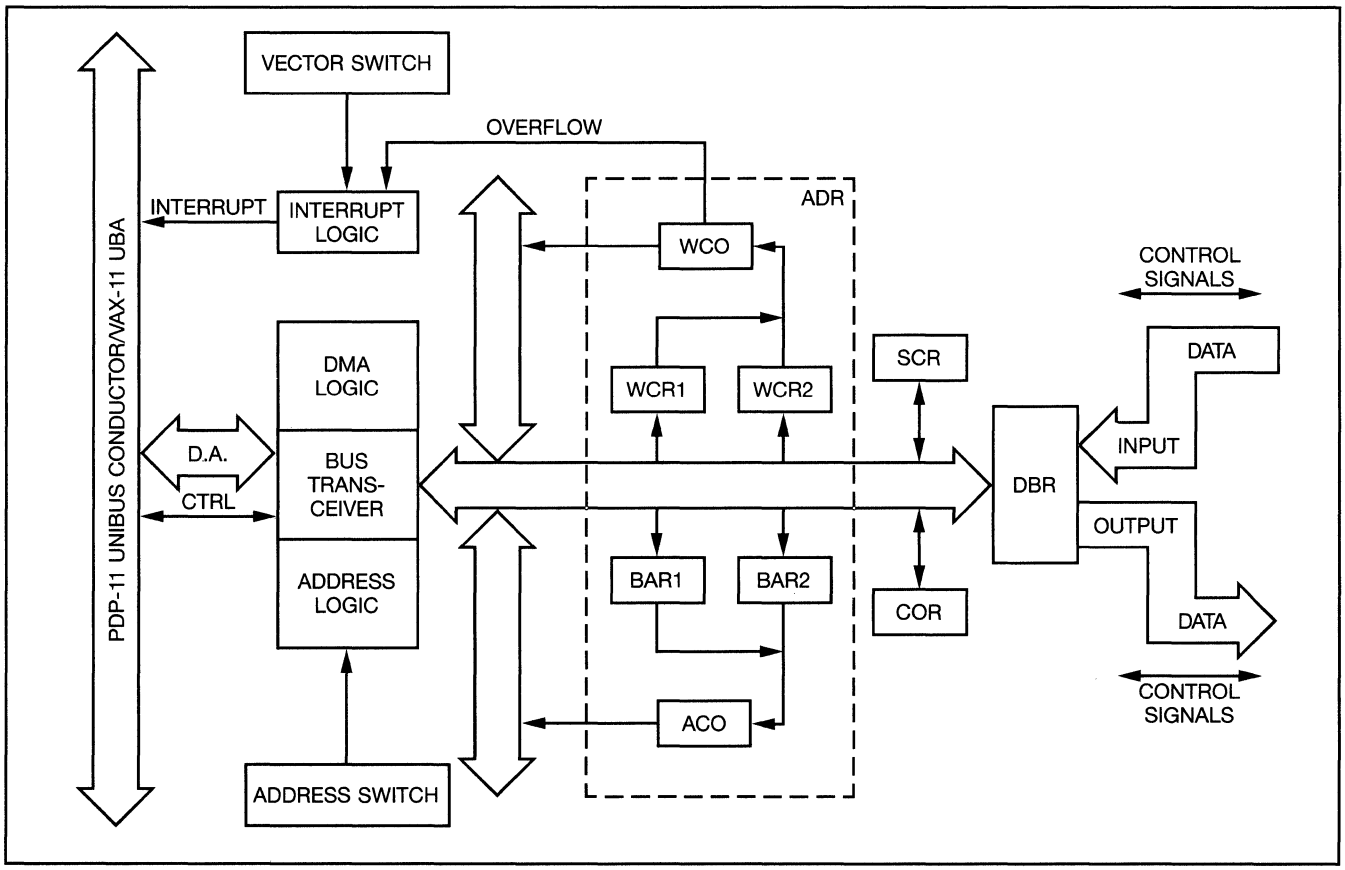
DRU11-CC	General-purpose DMA interface
DRU11-CD	General-purpose DMA interface for 300 meters
QJS33-xx*	DRU11 RSX-11 device driver

*xx Indicates the distribution media and software support.

DRU11-C Alternate Buffer Principle



DRU11-C Simplified Schematic Diagram



Notes for Schematic diagram
SCR = Status and Command Register
COR = Control Register
DBR = Data Buffer Register
ADR = Address Register

The ADR consists of
BAR1/BAR2 = Bus Address Registers 1 and 2
WCR1/WCR2 = Word-Count Registers 1 and 2
WCO = Word Counter
ACO = Address Counter

DRS11/DSS11

The DRS11 and DSS11 are plug-in I/O modules for realtime monitoring and control applications. The DRS11 module is dedicated to output, and the DSS11 to input. A combination of DRS11 and DSS11 modules can be mounted in a UNIBUS system provided the total does not exceed 16, and the normal constraints of mounting space, bus loads and 5 volt power are observed.

Using the separate modules for input and output to create a digital I/O subsystem, the DRS/DSS can be used with laboratory instruments, digital indicators, switches, relays, push buttons and lamps.The DRS11 Digital Output Module is an SPC-compatible module that provides 48 buffered outputs. The DRS11-A type offers TTL-compatible outputs. The DRS11-B type offers open collector drivers. Both include one RS-filtered interrupt input. Their output is organized in three 16-bit words loaded under computer program control.

The DSS11 Digital Input Module is an SPC-compatible module that provides 49 optically-isolated inputs (48 non-buffered sense data inputs and one interrupt input). The DSS11-A type offers TTL inputs and the DSS11-B offers 24V inputs. The inputs are organized in three 16-bit words and are read under computer program control.

Features

- 48 buffered outputs
- 40 optically-isolated inputs

Software Support

The DRS11/DSS11 modules are supported under RSX-11M/M+. A layered device driver is required for VMS.

Cabling

The DRS11 and DSS11 each come with two 10 foot flat ribbon cables (50 conductors) terminated into 50-pin Berg connectors for connection to field output signals.

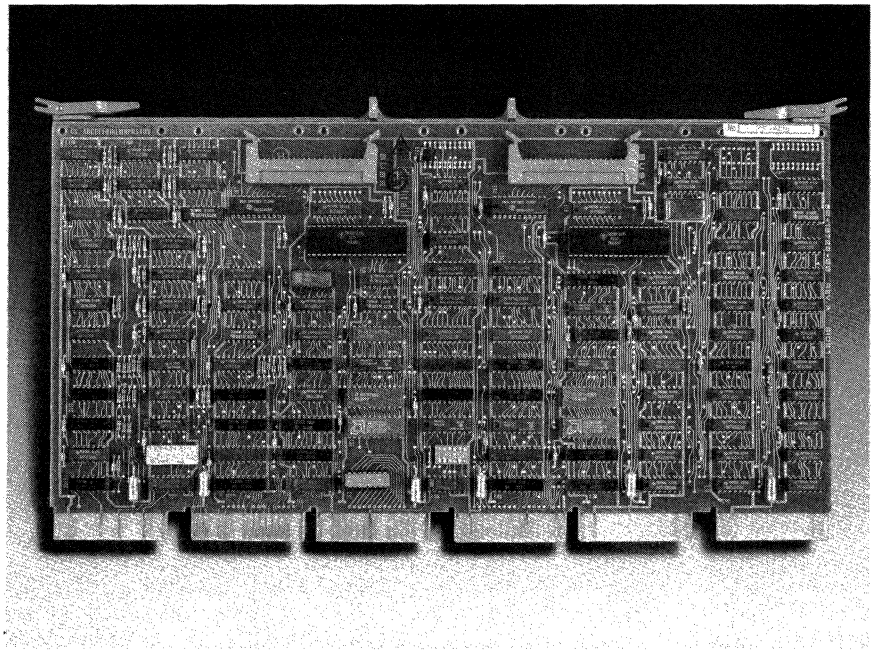
Configuring Information

Option	Mounting Requirements	DC Amps Drawn at +5V +15V −15V	Bus Loads Drawn	I/O Panel Units
DRS11-A	One Quad Slot	1.6	1	2
DRS11-B	One Quad Slot	2.5	1	2
DSS11-A	One Quad Slot	2.5	1	2
DSS11-B	One Quad Slot	1.6	1	2

Ordering

DRS11-A	Digital output device (TTL). Includes one RC filtered interrupt input, two 3m (19.6 feet) flat ribbon cables (50 connectors) terminated into 50 pin BERG connectors for connection to field output signals.
DRS11-B	Digital output device with open collector drivers. Includes one RC filtered interrupt input, two 3m (19.6 feet) flat ribbon cables (50 conductors) terminated into 50 pin BERG connectors for connection to field output signals.
DRS11-MP	Optically isolated DC drivers with open collectors; prerequisite is DRS11-B.
DSS11-A	Digital input device (TTL). Includes two 3m (19.6 feet) ribbon cables (50 conductors) terminated into 50 pin BERG connectors for connection to field input signals.
DSS11-MP	Contact sense input. Prerequisite is DSS11-A.
QCS04-AG	VAX-11/730 VMS Driver
QDSO4-AG	VAX-11/750 VMS Driver
QESO4-AG	VAX-11/780 VMS Driver

IEU11-A



The IEU11-A, an interface for realtime devices and other equipment, operates on the IEEE Bus (also known as the General-Purpose Interface Bus). The IEEE Bus meets the requirements established by the IEEE-488 Standard (1978) for digital interfacing to programmable instrumentation.

The IEU11-A contains two independent IEEE controllers on one hex module. Each controller offers DMA capability and can support up to 14 instruments in addition to the controller itself.

The IEU11-A interface module permits realtime applications performed in areas such as equipment testing, component evaluation and medical research.

Features

- Two independent instrument buses on each module
- DMA available for each instrument bus
- Full IEEE-488/1978 interface support for all specified functions

Software Support

Software support is supplied as a separate device driver for the VMS, RSX, and RT-11 operating systems.

This driver allows programs written in MACRO and FORTRAN to communicate with IEEE-488 devices connected to an IEU11-A. This communication is implemented through direct QIC calls to the executive or using a set of subroutines callable from a high-level language.

The IEU11-A Device Driver provides the following hardware controls:

- Controller (C1, C2, C3, C4, C5)
- Talker and Extended Talker (T5, TE5)
- Listener and Extended Listener (L3, LE3)
- Automatic Source Handshake (SH1)
- Automatic Acceptor Handshake (AH1)
- Service Request (SR1)
- Remote/Local (RL1)
- Parallel Poll (PP1, PP2)
- Device Clear (DC1)
- Device Trigger (DT1)

Various driver software functions are available to control the IEEE-488 interface. The driver allows the IEU11-A interface to be either attached to a single task or shared between several tasks.

The following driver software functions are available:

- Non-controller-in-charge functions
- Controller-in-charge functions
- System controller functions

Hardware Requirements for VMS Operating Systems

Any valid UNIBUS-based VAX system configuration (except the VAX system configuration (except the VAX-11/725) running the VMS operating system with:

- At least 6KB nonpaged pool memory for the driver
- 1500 blocks disk space for installation of the driver only (excluding the Simplified User Interface or exerciser program and 15 blocks for execution of the driver only)
- At least one IEU11-A
- A minimum of an RA80/RL02 configuration is required for VAX-11/730 systems
- IEU11 must be mounted in an expansion cabinet due to cabling constraints for the VAX-11/730

UNIBUS-based VAX systems can accommodate up to four IEU11-A interfaces.

Hardware Requirements for RSX Operating Systems

Any valid RSX-11M or RSX-11M+ system based on a UNIBUS PDP-11 with:

- At least one IEU11-A
- A minimum of 8 KB of user memory

The following additional hardware can also be added:

- Up to four IEU11-A controllers (a total of up to eight IEEE-488 buses)
- Any device supported by the prerequisite software

Hardware Requirements for RT– Operating System

Any valid RT-11 system based on a UNIBUS PDP-11 with:

- At least one IEU11-A
- A minimum of 8 KB memory per handler installed

Software Requirements

The IEU11-AA device driver requires the VMS, RSX-11M, RSX-11M+ or RT-11 operating system and can be optionally used with any of the following:

- FORTRAN IV/RSX or PDP-11
- FORTRAN-77/RSX for systems running one of the RSX operating systems; FORTRAN IV/RT-11 for systems running the RT-11 operating system

Cabling

BN11D-02 connects the second controller on the IEU module to the bulkhead. Cabling access to the first controller is supplied with the IEU11-A. From the bulkhead to the user device use BN01A cable. The BN01A cables can be daisy chained.

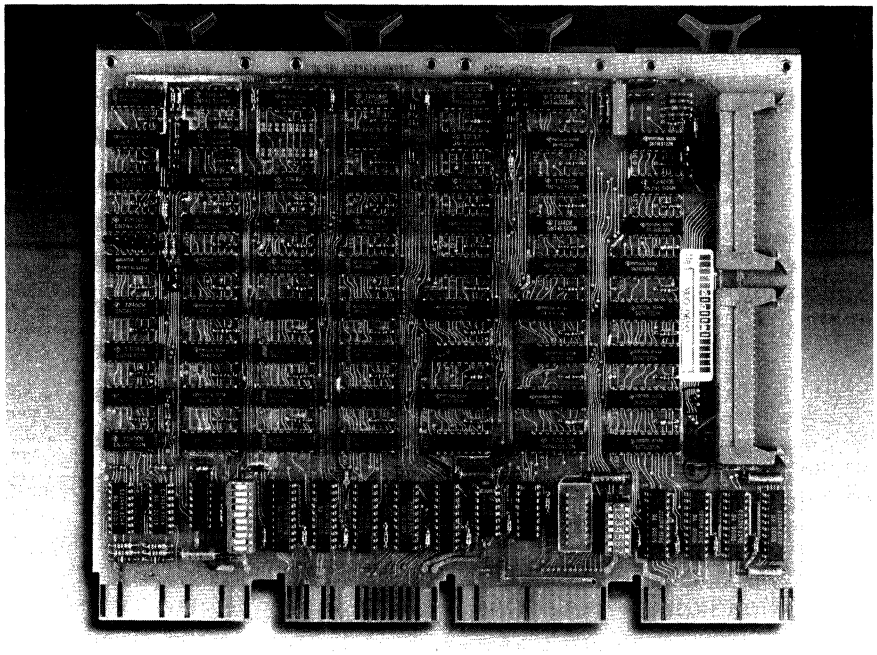
Ordering

IEU11-AB	UNIBUS IEEE interface; includes interface module, test cable and bulkhead/cable assembly for connecting to one of the IEEE controllers on the module.
Q8519-xx**	VMS device driver
QJS37-xx**	RSX device driver
QJS36-xx**	RT-11 device driver

*Indicates VAX system type.

**xx Indicates distribution media and software support.

DRE11-C



The DRE11-C, a general purpose 16-bit parallel Direct Memory Access (DMA) interface for continuous, high-speed data exchange, can also function as an interprocessor link. Designed for VAX systems, the DRE11-C requires the UNIBUS Adapter (UBA).

This I/O device collects data for such typical applications as engine testing, radar or satellite tracking, and high speed data acquisition from tomographic imaging devices in research laboratories.

Features

- DMA access for applications dependent on host computer operation.
- Data transfer rate of 600k words per second
- Continuous processing using data transfer cycling between segments of main memory.
- Two sets of address and word-count registers for automatic switching if one buffer is filled or emptied
- Interprocessor Link Operation for use between two computers.

Software Support

The DRE11-C Device Driver supports the DRE11-C interface.

The driver enables the user to communicate with the interface using the functions in a VAX computer MACRO language program. The driver also provides a number of controls:

- Support of data transfer requests in DMA mode
- Support of programmed single word transfers
- Function/Status Bit Control Services
- Device Status Information
- Event Recognition Services
- Data Path Selection

Note: The driver does not support burst DMA mode or alternate buffer direction change mode.

Cabling

DRE11-CC	BC08R-XX flat ribbon
DRE11-CD	22 gauge twisted pair

Maximum Cable Length

DRE11-CC	15 m (50 ft).
DRE11-CD	300 m (990 ft).

Configuring Information

Option	Mounting Requirements	DC Amps Drawn at +5V +15V −15V	Bus Loads Drawn	I/O Panel Units
DRE11-C	One Quad Slot	1.5	1	2
DRE11-CD	One Hex Slot	2.2	1	2

Environmental

Operating Temperature	41°F to 122°F, 5°C to 50°C
Storage Temperature	−40°F to 151°F, −41°C to 66 °C
Humidity	90 noncondensing with maximum wet bulb 32°C (90°F) and minimum dew point 2°C (36°F)

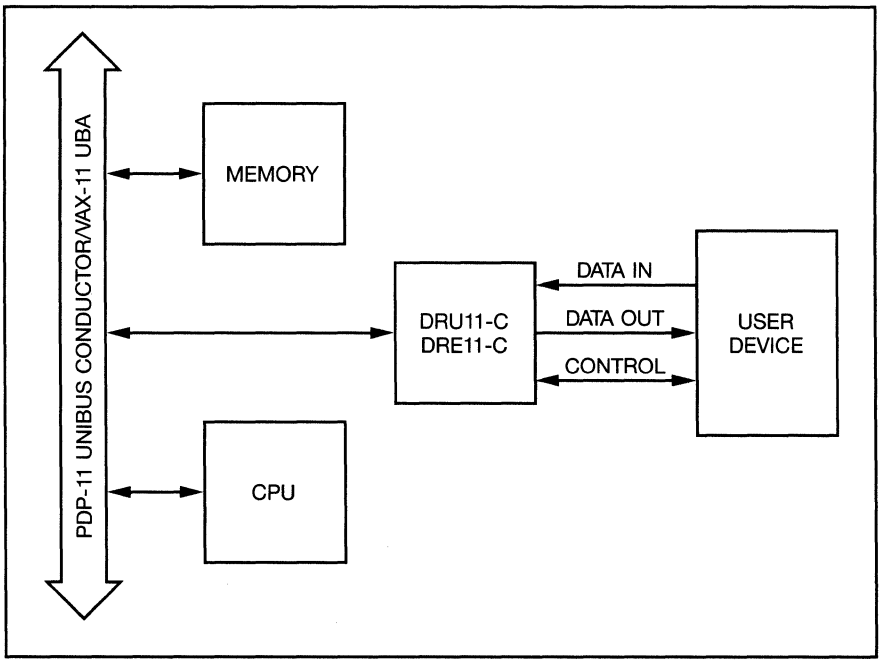
Ordering

DRE11-CC	General-purpose UNIBUS interface
DRE11-CD	General-purpose UNIBUS interface for 300 meter lengths
Q*911-xx**	Device driver

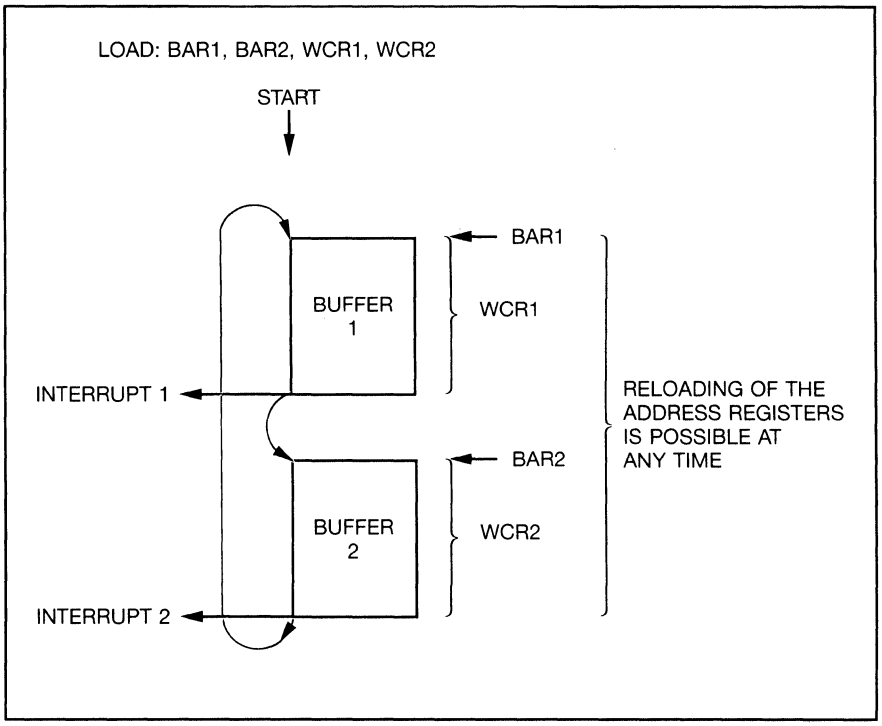
*Indicates system type.

**xx Indicates media and service type.

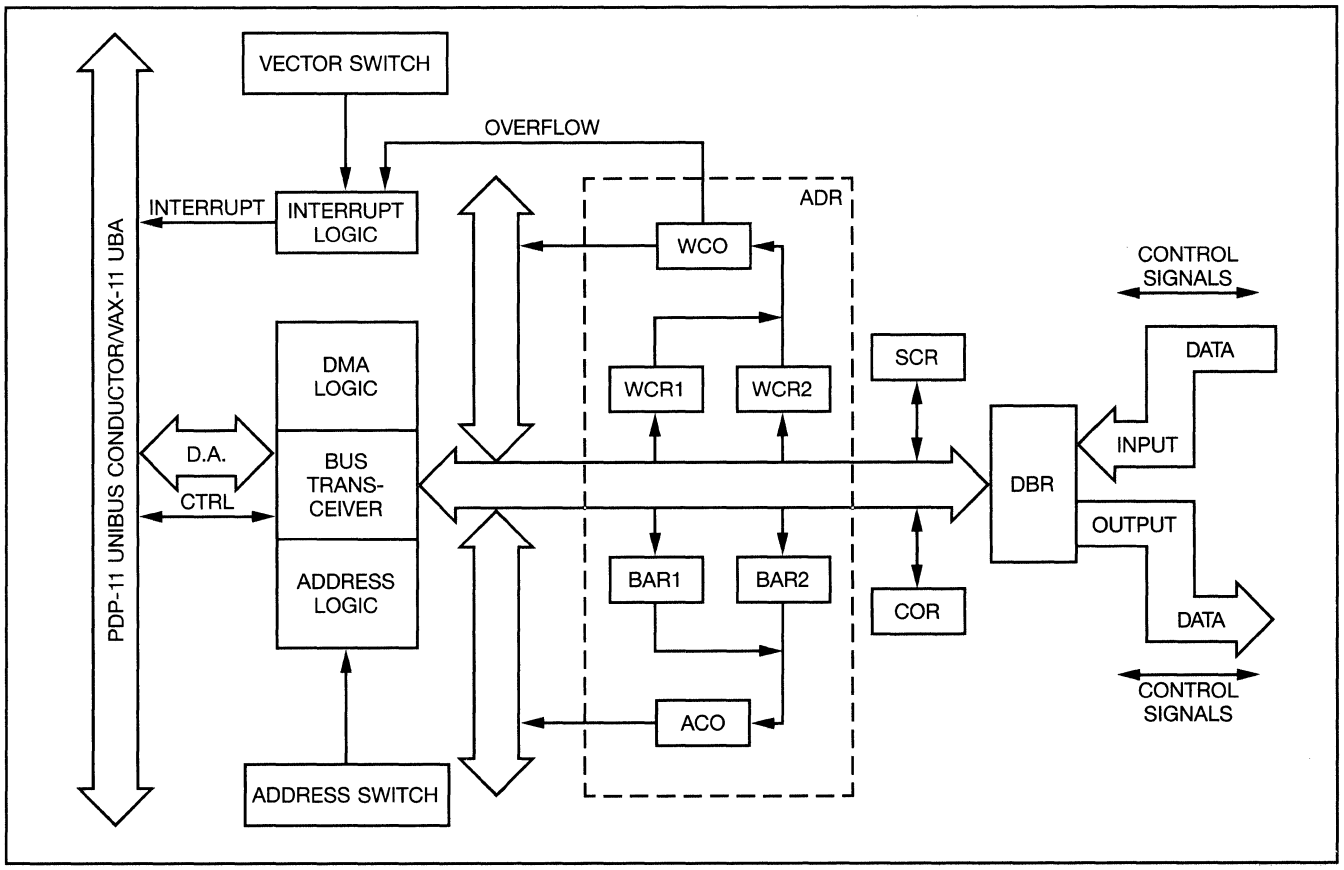
DRE11-C System Block Diagram



DRE11-C Alternate Buffer Principle



DRE11-C Simplified Schematic Diagram



Notes for Schematic diagram

SCR = Status and Command Register
COR = Control Register
DBR = Data Buffer Register
ADR = Address Register

The ADR consists of
BAR1/BAR2 = Bus Address Registers 1 and 2
WCR1/WCR2 = Word-Count Registers 1 and 2
WCO = Word Counter
ACO = Address Counter

DEBNA

This Ethernet/IEEE 802.3-to-VAXBI high-performance network adapter connects VAXBI systems to both Ethernet V2.0 and IEEE 802.3 local area networks. The DEBNA uses include adding multiple Ethernets to VAXBI systems and connecting VAXBI systems to Local Area VAXclusters or IEEE 802.3 networks. One DEBNA is included with each VAXBI system. The DEBNA supports one Ethernet port, providing physical and data-link communication layers and has up to 5Mbits per second of "raw" hardware throughput capability. Actual device speed and throughput is dependent on the system configuration, packet sizes, and application in use.

Ordering Information

DEBNA-M includes base module only. For system installation, select one of the following cabinet kits:

CK-DEBNA-LJ	For use with VAX 8800, 8700, 8550, and 8530 internal VAXBI channels.
CK-DEBNA-LM	For use with VAX 8350, 8300, 8250, and VAX 8200.
CK-DEBNA-LN	For use with VAX 8800, 8700, 8550, and 8530 external VAXBI channels.

Note: Each cabinet kit consists of an internal Ethernet 802.3-compatible cable, an I/O Connector Panel, and a boot-enabler jumper for Ethernet.

Configuring Information

Option	Mounting Requirements	DC Amps Drawn @ 5V	DC Amps Drawn @ 12V	DC Amps Drawn @ −12V	DC Amps Drawn @ −2V	DC Amps Drawn @ −5.2V	VAXBI Nodes	I/O Panel Units
DEBNA-M	VAXBI Slot	6.72	0.00	0.00	0.00	0.00	1	none
CK-DEBNA-LJ	none	0.00	0.50	0.00	0.00	0.00	0	1
CK-DEBNA-LM	none	0.00	0.00	0.00	0.00	0.00	0	2
CK-DEBNA-LN	none	0.00	0.00	0.00	0.00	0.00	0	2

Prerequisite Hardware

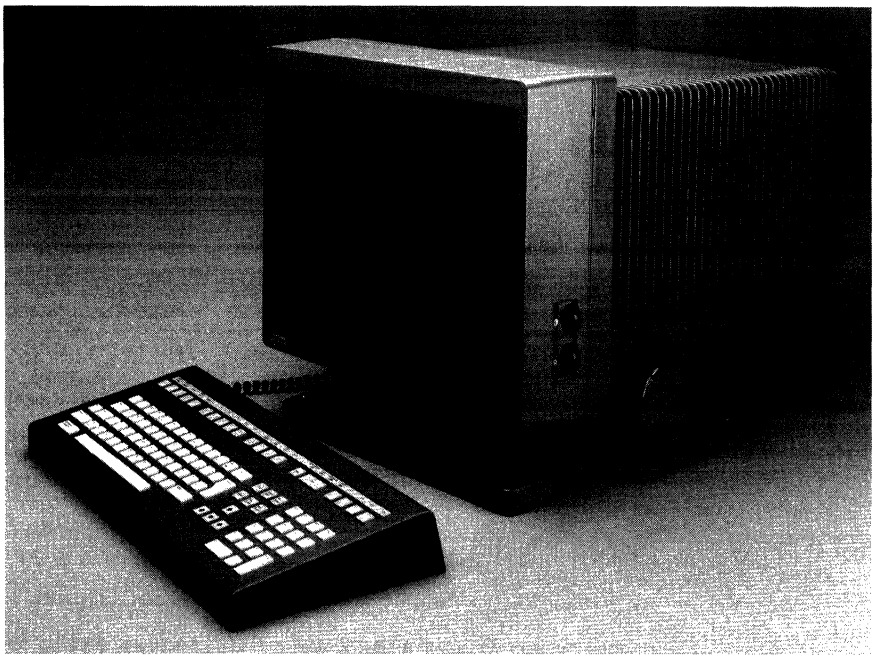
The DEBNA physically and electrically connects to the Ethernet via transceiver cable (BNE3X or BNE4X series) and either a baseband Ethernet transceiver (H4000), a broadband Ethernet transceiver (DECOM), or a local network interconnect (DELNI). The H4000, DECOM, or DELNI must be ordered separately. Transceiver cable can be a maximum of 40 meters (131 feet) and must also be ordered separately.

Each Ethernet controller must be connected to a separate Ethernet, with one exception. Two Ethernet controllers can be connected to the same wire if only one is active; the inactive Ethernet controller is on standby in case the first device fails. This is critical in applications where uptime is critical. Two Ethernet controllers cannot dynamically load share the activities of one Ethernet.

Prerequisite Software

For software configuring information, refer to the Software Product Descriptions for VMS, LAT, DECnet, LAVc, ELN, and ULTRIX software.

IT330/340



The IT330 and IT340 are Digital's industrialized terminals for use in heavy manufacturing environments. Housed in sturdy cast aluminum enclosures, these terminals give you all the features and capabilities of the VT330/340 terminals out on the factory floor. They are up to five times faster and have twice the resolution of the VT240/241 terminals.

Features

- VT330/340 functionality
- Sealed NEMA-12 enclosure (no external fans or filters)
- Detached keyboard
- Optional tilt/swivel base, wall/rack mount

Applications

The IT330/340 industrialized terminals are ideal for use as general-purpose terminals for inventory management and factory data collection on the shop floor or for use in any harsh environment where heavy dust, dirt, grease and other non-corrosive liquids would damage a normal terminal.

Ordering

Industrial Terminals

IT330-A2	Graphics Terminal, NEMA-12 Enclosure, Monochrome, White Phosphor, VT330 Functionality, 120V (No Keyboard)
IT330-A3	IT330-A2 Except 240V (No Keyboard)
IT330-B2	Graphics Terminal, NEMA-12 Enclosure, Monochrome, Green Phosphor, VT330 Functionality, 120V (No Keyboard)
IT330-B3	IT330-B2 Except 240V (No Keyboard)
IT330-C2	Graphics Terminal, NEMA-12 Enclosure, Monochrome, Amber Phosphor, VT330 Functionality, 120V (No Keyboard)
IT330-C3	IT330-C2 Except 240V (No Keyboard)
IT340-A2	Color Graphics Terminal, NEMA-12 Enclosure, Northern Hemisphere, VT340 Functionality, 120V (No Keyboard)
IT340-A3	IT340-A2 Except 240V (No Keyboard)
IT340-A5	Color Graphics Terminal, NEMA-12 Enclosure, Southern Hemisphere, VT340 Functionality, 240V (No Keyboard)

Industrial Keyboard

IT3XX-AA	NEMA-12 Flat Membrane Keyboard for IT330/340

Industrial Terminal Accessories

IT3XX-RA	Rackmount Kit for IT330, IT340
IT3XX-WA	Wallmount Kit for IT330, IT340
IT3XX-TA	Tilt/swivel Base for IT330, IT340

Specifications

Note: All specifications are shared unless specifically assigned to the IT330 or the IT340.

Screen Characteristics

Type	(IT330) 14-inch flat-surfaced anti-glare CRT (IT340) 13-inch convex anti-glare CRT
Resolution	800 pixels×500 lines
Shades	(IT330) 4 shades of gray (IT340) 16 colors from palette of 4096
Display Format	Full screen, 24 lines plus 25th status line; vertical split screens for session 1 and 2; horizontal split screens (variable) for sessions 1 and 2
Session Modes	Single or dual terminal modes. In dual terminal mode, completely independent set-up characteristics can be maintained. Single-wire dual session capability with use of Session Support Utility (SSU) software.

Industrial Terminals/IT330/340

Local Memory

Single Session Mode	6 pages @ 24 lines; 4 pages @ 36 lines; 2 pages @ 72 lines; 1 page @ 144 lines
Dual Session Mode	(per session) 3 pages @ 24 lines; 2 pages @ 36 lines; 1 page @ 72 lines
Graphics Storage	Two full screen graphics image
Graphics Protocols	ReGIS, Sixels, Tektronix 4010/4014
Transmission Modes	Interactive character mode; block mode (enhanced VT131 functions)
Local Editors	Separate user definable key editors for both sessions; 256 character total non-volatile storage per session (IT340) Local color map editing for each of 16 displayable colors including text and screen background
Communications	Full-duplex asynchronous with selectable local echo and full modem control. 7-bit or 8-bit character length 1 or 2 stop bits.
Communications Speed	75, 110, 150, 300, 600, 1200, 2400, 4800, 9600 and 19,200 baud (keyboard selectable). Transmit and receive rates can be set separately.
Parity	Even, odd, mark (7-bit only), space (7-bit only), or none (keyboard selectable). Transmit and receive must be the same. (When running in dual-session mode, actual transmission speeds may be reduced).
Interfaces	EIA RS232C (1 port), DEC423 DECconnect (3 ports: 2 for host communications, 1 for printer)
Printer Port	Full bi-directional communications; assignable to either session or shared between sessions
Monitor Dimensions (without T/S Base)	36.83 cm H×40.64 cm W×55.12 cm D (14.5 in H×16 in W×21.7 in D)
Weight	(IT330) 20.9 kg (46 lb) (IT340) 25.9 kg (57 lb)

Power Requirements

Voltage	120V/240V nominal
Frequency	50–60 Hz
Power Consumption (Maximum)	(IT330) 100 watts max (IT340) 176.5 watts max

Operating Environment	
Code Standards	NEMA-12, FCC Class A
Operating Temperature	5 to 50°C (41 to 122°F)
Relative Humidity	10% or less to 95%
Maximum Wet Bulb	32°C (90°F)
Minimum Dew Point	2°C (36°F)

Storage Environment	
Storage Temperature	−40 to 60°C (−40 to 50°F)
Relative Humidity	0 to 95
Maximum Altitude	9.1 km (30,000 ft)

RT220

The RT220, Digital's industrialized VT220 for use in heavy manufacturing environments, is housed in a sturdy, metal enclosure, which is industry-standard NEMA-12 compliant to protect against dust, falling dirt and dripping non-corrosive liquids.

The RT220 provides all the functionality of the VT220; it has a 12-inch monochromatic screen, 80 or 132 column by 24 line display format, and bidirectional smooth scrolling. For detailed or forms-oriented work, the user can view the total format before printing. A selective erase feature saves time by erasing selected areas on the screen and leaving the form intact for the next user.

Features

- VT220 functionality and features
- Sealed NEMA-12 enclosure
- Detachable keyboard option
- EIA or 20 mA interfaces

Applications

Digital's RT220 terminals can tolerate harsh environments where heavy dust, dirt, grease and other non-corrosive liquids would damage normal terminals. An ideal general-purpose terminal for all the factory basics—inventory control, time and attendance, and industrial data collection—the RT220 can handle almost any manufacturing operation.

Ordering

RT220-DA	VT220-D, 120V, NEMA-12 Enclosure, Printer Port, EIA
RT220-DB	VT220-D, 240V, NEMA-12 Enclosure, Printer Port, EIA
RT220-EA	VT220-D, 120V, NEMA-12 Enclosure, Printer Port, 20 mA
RT220-EB	VT220-D, 240V, NEMA-12 Enclosure, Printer Port, 20 mA
RT2XX-AA	Flat Panel NEMA-12 Keyboard

Note: The RT220 does not come with a keyboard. Keyboards must be purchased separately. In addition to the keyboard listed above, a barcode keyboard with a hand-held wand is also available; information on that can be found in the barcode information in this section.

Specifications
Environmental

Code Standards	NEMA-12, FCC Class A
Operating Temperature	5 to 50°C (41 to 122°F)
Relative Humidity	10 or less to 95
Maximum Wet Bulb	32°C (90°F)
Minimum Dew Point	2°C (36°F)

Physical and Communications

Dimensions	48.2 cm (19 in) H x 72.4 cm (28.5 in) D x 48.2 cm (19 in) W
Weight	36.3 kg (80 lb)
Screen Size	12-in. monochromatic text
Screen Format Characters	24 lines by 80 or 132 characters 7 by 10 dot matrix
Character Size	7-bit or 8-bit
Interfaces	RS232C, RS423, 20mA

Electrical

Power	100V–200V 220V–240V
Frequency	50–60 Hz
Line Current (Maximum)	2.25 A @ 100–120V 2.12 A @ 220–240V

Industrial Terminals/Bar Code Readers

Bar Code Readers

Digital offers two series of Bar Code readers for realtime data input.The RT (RT2XX-BX) series Bar Code reader is a full alphanumeric keyboard with an integral, multiple input Bar Code reader. A hand-held wand is a standard feature. Because the keyboard is encased in a sealed metal housing, the RT2XX-B is suitable for the most rugged factory environment as well as light industrial or commercial use.

The RT2XX-B features a visible-light, hand-held wand as standard equipment. Available options include an IR hand-held wand (VT2X7-AA/AB), and both visible and IR Bar Code slot readers (RT2XX-SR/SI).

The RT2XX-B lets you connect two scanners simultaneously, and both the scanners and the keyboard may be used interchangeably, without programming changes or manual switching. All data from the RT2XX-B is in standard keyboard format, so no special programming or software is required to use the Bar Code Read Function.

The VT (VT2XB-AA/AB) series Bar Code reader is compatible with the VT200 terminal series and can be used with Digital's Rainbow PC100, PRO 350, and PRO 380 personal computers. For easy installation, the VT reader connects between the existing keyboard and the monitor. Dual ports allow two sensors or scanners to be connected. In the manufacturing plant, the RT2XX-B is ideal for monitoring and controlling plant inventory and work-in-process. It is also suitable for time and attendance applications when used with the slot reader option. In short, the RT2XX-B can help make any application requiring counting, packaging or tracking more efficient.

Features

- Full alphanumeric keyboard with integral Bar Code electronics.
- Bar Code device is programmable and operates as a keyboard emulator requiring no special software.
- Keyboard can be used with VT200 series terminals, Digital's industrial RT terminals, PCs (Rainbow, Professional 350/380) or any future device compatible with the VT200 series keyboard.
- Hand-held wand is a standard feature.
- Keyboard allows two devices (wand and/or slot reader) to be connected simultaneously and to be used interchangeably with the keyboard, without programming changes or manual switching.
- Keyboard is available in either flat membrane or full travel, tactile style keys.

Software Support

The RT series Bar Code reader is programmable and operates as a keyboard emulator requiring no special software. The RT2XX-BC and -BD are compatible with VT200 terminals.

The VT readers require no special programming or software. All data from the VT reader is in keyboard format. If desired, it can be programmed to include special function codes.

Specifications

Bar Code Keyboard

Dimensions	48.3 cm W×6.3 cm H×20.3 cm D (19.0 in W×2.5 in H×8.0 in D)
Weight	3.6 kg (8 lbs)
Power	Derived from terminal
Indicators	Four LED's (VT200 standard), keyclick, and bell. Bar Code function has additional audio tone.
Bar Code Ports	Two standard 9 pin sub-miniature D connectors

Bar Code Scanner (Wand)

Dimensions (diameter, length)	1.3×15.2 cm (0.5×6.0 in.)
Coiled Cord	182.9 cm (72.0 in) extended length
Weight	0.2 kg (0.4 lb)
Illumination Source	Visible LED (W.L. approx. 880 nanometers)
Depth of Field	0.191 cm (0.075 in)
Roll Angle	0 to 30
Compatibility	Full LK201-AA (VT220) keyboard compatibility

Performance

Bar Codes Read	Extended Code 3 of 9 (code 39) Codabar UPC Standard 2 of 5 Code 128 Interleaved 2 of 5 EAN Code 11 (with check characters) Code 93
Audio Output (Bar Code)	Eight levels (programmable)*
User Selectable Parameters	Preamble: Up to four characters (programmable) SOH, Terminal ID, Code ID, STX Postamble: Up to four characters (programmable) CR, LF, HT, EXT Intercharacter Delay : 0 to 99 millisecs (programmable)

Ordering

RT2XX-BA	Flat Membrane Bar Code Keyboard for RT Terminal (Dark Gray)
RT2XX-BB	Tactile Style Bar Code Keyboard for RT Terminal (Dark Gray)
RT2XX-BC	Flat Membrane Bar Code Keyboard for VT Terminal (Gray)
RT2XX-BD	Tactile Style Bar Code Keyboard for VT Terminal (Gray)
VT2XB-AA	Bar Code Reader for VT200 Terminal (W/RT2X7-AA Visible Light)
VT2XB-AB	Bar Code Reader for VT200 Terminal (W/RT2X7-AB Infra-red)
RT2XX-SR	Slot Reader Device w/Visible Light
RT2XX-SI	Slot Reader Device w/Infra-red
RT2X7-AA	Hand Held Visible Light Scanner w/6′ coiled cord
RT2X7-AB	Hand Held Infra-red Scanner w/6′ coiled cord

Third Party Philosophy

Third party vendors play an important role in extending the breadth and depth of Digital's hardware and software tools for realtime applications.

Digital provides generic software and hardware tools for professionals in all market segments. These tools require that the user be familiar with computer hardware and interfacing, be a programmer in a high level language, and be knowledgeable about the details of the I/O operation, databases, analysis routines, mathematical algorithms, and graphics.

The third party hardware vendors that we will discuss have extended Digital's solutions in realtime computing by providing input and output peripherals with higher speeds, better resolution and array processors for enhanced computational capabilities. The third party software companies have combined hardware with Digital's software tools to develop non-programmer solutions for customers.

In preparing this description, Digital has taken the third party product descriptions at face value. Digital has not analyzed, reviewed or checked the quality of the products, nor does Digital make any warranties regarding the quality or specifications. All warranty information for products described in this chapter must be obtained from the appropriate vendor. There is usually no such thing as a "plug-in" product, and you should insist on customer references, documentation, and/or a demonstration before you commit yourself to paying for and supporting any of the products or software.

The companies represented do not constitute all the third party vendors manufacturing equipment that interface to Digital's VAXBI bus, UNIBUS, or Q-bus systems.

ADAC Corporation
70 Tower Office Park
Woburn, MA 01801
(617) 935-6668
Contact: Don DiRocco
Relationship with Digital: Referral
Product Class: I/O boards for Q-bus and UNIBUS

ADAC Corporation manufactures data acquisition systems as well as board level products for the Digital Q-bus and UNIBUS. For the Q-bus they produce a number of board level input and output modules. Features for the analog I/O products include 12- to 14-bits of resolution, programmable gains to 1000, cold junction compensation, expansion cards and sampling rates to 200 kHz.

ADAC manufactures a line of parallel digital interface boards for the Q-bus that feature optically isolated input and output, multiple interrupt, up to 64 I/O lines, and the ability to drive lamps or relays. Other Q-bus modules include a general purpose timer, input and output pulse counters, a Q-bus repeater, and a Q-bus to UNIBUS adapter. ADAC produces UNIBUS analog input and output boards. These boards have 16 to 64 single ended or 8 to 32 differential inputs, programmable gains to 10, resolution of 12-bits, DMA controllers, and speeds to 100 kHz. ADAC also supplies FORTRAN and BASIC libraries to support these boards under the RT-11, RSX, and VMS operating systems.

Aeon Systems Incorporated
1704 Moon NE
Albuquerque, New Mexico 87112
(505) 299-9607
Contact: Steve Kadner
Relationship with Digital: Referral
Product Class: VME to VAXBI Interface

Aeon Systems' VIVA is an intelligent interface between the Digital VAXBI bus and the VME bus. The VIVA provides a high-speed data link at moderate distances (50 ft. is standard) featuring a full duplex RS-422 interconnect at 10Mbytes/second, two DMA channels with 8Kbytes of FIFO memory in each direction (4K on each board), a J11 microprocessor on the VAXBI port, a 68020 microprocessor on the VME side and full handshaking to eliminate buffer overrun.

The VMEbus interface is an intelligent 68020-based controller which generates and handles VMEbus interrupts. The VAXBI interface contains a J11 micro-processor which may request data from or write data to the VME side as well as respond to read or write requests from the 68020 microprocessor.

Aeon provides a VAX/VMS software driver for the VIVA product.

Applied Dynamics International, Inc.
3800 Stone School Road
Ann Arbor, Michigan 48104
(313) 973-1300
Contact: Donald Chandler
Relationship to Digital: Referral
Product Class: Simulation computer

ADI manufactures a high performance simulator to enhance Digital VAX computers. The AD 100 is a 64-bit digital computer with a special architecture based on pipelined parallel processing and a high-speed synchronous bus. The 105-bit wide bus supports one transaction every 25 nanoseconds and is capable of speeds of up to 20 million floating point operations per second.

The Digital VAX host computer communicates with the AD 100 using two data paths. A FIFO buffer permits the AD 100 to send data—up to 128 variables per communication interval—to the VAX during a run, for realtime data logging or graphics display. In addition, a bidirectional 64-bit direct data path allows the VAX host to read and/or write to the AD 100 without interfering with the simulation run. The AD 100 supports the Digital DR11-W standard interface. An optional I/O processor gives the AD 100 direct access to up to 256 external parallel devices.

ADI also provides a complete simulation development environment. ADSIM is a high-level simulation language which includes the compiler, libraries of functions and models, and I/O system support. It features a unique interactive environment that lets the user easily modify data, parameters, and algorithms without the need to recompile the program.

Aptec Computer Systems, Inc.
9605 S.W. Nimbus Avenue
Beaverton, OR 97005
(503)-626-9000
Contact: Lois Dokken
Relationship with Digital: Cooperative Marketing Partner (CMP)
Product Class: I/O Computers

Aptec Computer Systems manufactures specialized I/O computers that are designed to handle input/output tasks of VAX/VMS based systems. They interface to the VAX over the Q-bus, UNIBUS or VAXBI bus and manage I/O operations for attached peripherals with minimal involvement of the host CPU, operating system or I/O bus. The internal bus of the I/O computer is 32-bits wide with a bandwidth of 24Mbytes/second and is designed to handle large volumes of multiple, concurrent I/O transfers.

UNIBUS peripherals can be interfaced to the I/O computer with transfer rates to 3Mbytes/second. This interface has a three-way I/O structure which dual ports the peripheral so it may be shared by both the VAX and the I/O computer and allows for direct device-to-device transfers. Non-UNIBUS peripherals can be interfaced with transfer rates to 12Mbytes/second for each device.

This also serves as a communication channel in a multiple I/O computer configuration. A random access mass memory, incorporated into the I/O computer, acts as a shared database and as a Files-11 structured device. Software tools are provided to program the I/O computer in assembly and high level languages, including FORTRAN and their own language, STAPLE.

Catalyss Corporation
7400 S. Tuscon Way
Englewood, CO 80112
(303) 799-9955
Contact: Brian Hall
Relationship with Digital: Referral
Product Class: Data acquisition and analysis software

The REAL ENVIRONMENT is a command-driven package with realtime data acquisition, analysis, and graphics capabilities. The REAL ENVIRONMENT is interactive and interpretive, so action is initiated at the moment the command is entered. Once a series of commands have been found to be successful, the user can store them as a macro with a single command. The CHEF option provides the ability to create a screen-driven interface to the macro.

The REAL ENVIRONMENT supports analog I/O, digital I/O, and realtime clocks. At its simplest, the REAL ENVIRONMENT has realtime function calls which allow a snapshot of an input channel. At its most complex, the REAL ENVIRONMENT can implement a measurement sequence controllable by a combination of triggers, timers, and clocks taking data from different input devices into many arrays while at the same time analyzing the data, displaying it, and generating controls to the process being measured.

Chesapeake Software, Inc.
Brandywood Plaza, Suite 221
2500 Grubb Road, Wilmington, DE 19810
(302) 475-5229
Contact: Steve Allen
Relationship with Digital: Can use LIO library for data collection (LIO compliant)
Product Class: Data acquisition and display software

INSIGHT is a data acquisition and display system designed for automated data collection and manipulation. The system is intended for use by engineers, laboratory scientists and technicians. INSIGHT is menu-driven, but also has a simple command language. All information needed by the INSIGHT system is provided through menus and forms of commands.

INSIGHT is designed to collect serial RS232 and analog signals at frequencies up to 250,000 points/second. Data can be collected simultaneously from up to 64 signals. The sampling rate can be varied during the experiment allowing the user to collect data faster when the signal is changing fast and slower when the signal is changing slow. A maximum of over 131,000 points can be collected and stored for any signal. All data are stored in engineering or scientific units.

All collected data are stored in a standard format that also includes documentation. This documentation consists of items that describe the experiment, such as date, investigator, and experimental conditions, as well as comments. Once data has been stored, it can be displayed through easy-to-use interactive graphics. Up to four curves can be displayed on a single graph and up to four graphs on a single display. A copy of the screen can also be produced through a plotter connected to the terminal. Over 80 graphics devices are supported for graphical display and hardcopy.

The data can be analyzed from user-supplied analysis routines or can be sent to a remote computer for analysis. An interface to RS/1 is available as are subroutines for accessing the data and templates from user-supplied applications programs.

Computer Products, Inc.
Measurement and Control Group
2800 Gateway Drive
Pompano Beach, Florida 33069-4804
(305) 974-5500
Contact: Dave Parkerson
Relationship with Digital: Referral
Product Class: I/O subsystems for simulators

Computer Products manufactures I/O subsystems designed specifically for the simulator market. CPI offers I/O preprocessors and function modules that interface both directly and through DMA communications to Digital Q-bus, UNIBUS, and VAXBI bus interfaces.

Function modules include digital I/O, analog I/O, synchro I/O, and special functions. CPI's Advanced Simulation Linkage System preprocessors handle the high performance I/O tasks for VAX-based systems. They perform scanning of inputs, updating of outputs, fixed to floating point conversions for analog I/O, bit-to-byte conversions for digital I/O, and smoothing @ for analog outputs or synchro drives. ASLS provides realtime diagnostics on-line without intervention by the VAX host.

The ASLS comes with its own Host Software Support package, a set of software modules residing in the VAX host computer that allows the user to configure, document, and support ASLS.

CSP, Inc.
40 Linnell Circle
Billerica, MA 01821
617-272-6020
Contact: Sandy Corbit
Relationship with Digital: Cooperative Marketing Partner (CMP)
Product Class: 32-bit and 64-bit Array Processors

CSP, Inc. manufactures attached 32-bit and 64-bit array processors for the PDP-11 and VAX CPU's. The MiniMAP family of 32-bit array processors provide a performance range from 7-280 MFLOPS peak. The Digital host interface is both a shared and DMA interface to the Q-bus or UNIBUS. Application areas include general signal/image processing, medical imaging, and seismology. Parallel I/O ports are available options for the MiniMAP series.

The MAP-6400 series of 64-bit attached array processors have 7 peak MFLOPS of computational power and attach to Digital's Q-bus and UNIBUS. Key application areas include molecular modeling, reservoir modeling, fluid mechanics, and simulation.

Data Translation, Inc.
100 Locke Drive
Marlboro, MA 01752
(617) 481-3700
Relationship with Digital: Referral
Product Class: A/D, D/A, and Imaging boards for Q-bus A/D and D/A for UNIBUS

Data Translation manufactures data acquisition and imaging boards for Digital's MicroVAX II and other Q-bus systems. These products are supported by Data Translation's subroutine libraries and device drivers for VMS, RSX, and RT-11. The data acquisition products include a family of A/D converters that feature 64SE/32DI channels, programmable gain up to 500, resolution up to 16-bits, and throughputs to 250 kHs. In conjunction with the software, there are DMA boards that may be used to collect data continuously to disk.

Data Translation has D/A boards that feature up to 32 output channels, 12-bit resolution, and throughputs up to 300 kHz. The DMA D/A boards may also be used to output data continuously from disk. The Image processing boards include a 256× 256×6 bit frame grabber and a 512×512×8 bit frame grabber with an on-board ALU for realtime image processing. For more complex operations like convolutions, the output from the 512×512 board may be transferred to a frame processing board with a 16-bit ALU.

Data Translation also offers an intelligent single board subsystem for the UNIBUS that includes an A/D, a D/A, digital I/O, and a timer. In conjunction with the software library, data may be acquired or written at throughputs up to 250 kHz. The board also features on-board signal averaging, histogramming, and pre-event data collection.

Design Analysis Associates
75 W 100 S
Logan, Utah 84321
(801) 753-2212
Relationship with Digital: Referral
Contact: Joe Corbett
Product class: VAXBI to MilSpec 1553 bus interface (avionics)

Design Analysis Associates manufactures products to interface Digital computers with standard buses and custom devices. DAA manufactures an Avionics Laboratory Integration Device that interfaces to Digital Q-bus, UNIBUS, and VAXBI systems. The ALID integrates avionics and aircraft computer hardware on a MilSpec 1553 avionics bus with Digital computers driving the simulation, graphics, and data logging functions.

The ALID VAXBI interface allows control information to be passed to the data logger and 1553 interface units. It fields interrupts from external interfaces and passes them to the processors on the VAXBI. The interface can be used to issue interrupts to other processor interfaces in the realtime network.

DAA provides a VAX/VMS software driver for the ALID product.

DSP Technology, Inc.
48500, Kato Road
Fremont, CA 94538
(415) 657-7555
Contact: Doug Abbott
Relationship with Digital: Referral
Product class: CAMAC I/O subsystems

DSP Technology is a supplier of CAMAC instrumentation modules, crates, and computer interfaces to LSI, PDP, MicroVAX, and VAX computer systems. DSP builds turnkey data acquisition and control systems based on Digital platforms including in-crate LSI-11 based computer systems. Software drivers are provided under RT-11, RSX, and VMS.

DSP manufactures over 170 CAMAC modules covering high-speed digitizers up to 250 Mhz (resolution of 8×16 bits), hardware signal averagers, multichannel A/D, D/A, digital I/O, IEEE-488 interfaces, stepping motor controllers, amplifiers, counters/timers, and trigger conditioners.

Using the CC-DR11 crate controller, a DR11-W, a DRV11-WA, or a DRB32 may be used to transfer data to UNIBUS, Q-bus, and VAXBI systems respectively at a maximum throughput of 1 MHz. The CAMVMS driver allows CAMAC commands to be executed from the system prompt and provides multiuser protection.

Grant Technology Division
321 Billerica Road
Chelmsford, MA 01824
(617) 256-8881
Contact: Fred York
Relationship with Digital: Referral
Product Class: I/O boards for Q-bus

Grant Technology, a division of Computer Products, Inc., Measurement & Control Group, is a supplier of Q-bus compatible board level products. The product line consists of a wide range of application/solution-driven products for the Digital Q-bus and others.

Grant has a line of A/D boards where one specific board will have a combination of the following features channel capacities from 16 to 32 single ended inputs, resolution of 12-bits, programmable gains to 1000, speeds (depending on gain) to 250 kHz, and DMA interfaces. They produce analog output boards with either current or voltage output boards with resolution of 12 bits.

Grant manufactures several serial interface boards and parallel interfaces with transfer rates to 2.4Mbytes in block mode DMA. They also produce an IEEE 488 board, a realtime clock and a calendar with battery backup.

Imaging Technology, Inc.
600 West Cummings Park
Woburn, MA 01801
(800) 531-3500
in Massachusetts (617) 938-8444
Relationship with Digital: Referral
Product Class: Imaging boards for Q-bus

Imaging Technology provides board level image processing hardware and software that is compatible with the Digital Q-bus system and others. Features of these boards are realtime processing of images, including image subtraction, averaging, arithmetic and logical operations; a feedback-input look-up table (4096×12-bits) for transforming of images prior to storage, implementation of graphic overlays, display windows, and area-of-interest processing, addition or subtraction of a constant from a full screen image, and to add, subtract, or average images to six bits of accuracy; digitize analog video signals to 8-bits at 10 MHz; accepts RS-170/330 or CCIR Video input, including VCR; 512×512×12 bit on-board from memory; direct memory mapping with programmable window size; separate memory plane protection for CPU access and image acquisition; hardware zoom of 2, 4, and 8; pixel-by-pixel pan and scroll; three output channels (RGB), each with 16 256×8 bit LUT's; full color imaging to 12-bits/pixel using 3 boards; three camera inputs supported; and 16 status/control registers for easy host computer interfacing.

Software is available for MicroVAX/VMS, RSX and RT-11 operating systems for diagnostics as well as a library of 100 image processing routines.

Kinetic Systems Corporation
11 Maryknoll Drive
Lockport, IL 60441
(815) 838-0005
Contact: Bill Martin
Relationship with Digital: Has driver that is callable from LIO library (LIO compliant)
Product Class: CAMAC, Fastbus subsystems

Kinetic Systems Corporation (KSC) manufactures CAMAC (Computer Automated Measurement and Control) and FASTBUS crates, modules and drivers that interface to Digital's UNIBUS, Q-bus, and VAXBI buses. KSC supplies serial, enhanced serial, and parallel CAMAC highway drivers as well as providing LSI-11, RS232, IEEE 488, and Ethernet crate controllers. CAMAC systems can be configured to contain from one to 62 crates per system.

KSC manufactures analog input modules that have resolutions from 12- to 16-bits, with sampling speeds to 2 MHz and crate channel capacities to 2048 single ended channels (depending on the speed). KSC produces analog output modules with resolutions from 10- to 16-bits, current or voltage outputs and with crate channel capacities to 176 channels.

Digital I/O modules are available with optical isolation, relays, and with current outputs to 2 amps and 350 volts. Other CAMAC modules include color display drivers, stepper motor controllers, power supply controllers, counters, timers, IEEE 4888 controllers, RS-232 communication modules, watchdog timers, PROM programmers, and thermocouple monitors with junction compensation.

KSC supplies software drivers and FORTRAN subroutine libraries for all modules for the RT-11, RSX, and VMS operating systems. KSC also supplies process control software packages that allow non-programmers to acquire and store data as well as provide closed loop feedback control.

LeCroy Corporation
700 South Main Street
Spring Valley, NY 10977
(914) 425-2000
Contact: David Lentsch
Relationship with Digital: Referral
Product Class: CAMAC, FASTBUS, Instruments

LeCroy specializes in high speed analog-to-digital conversion technology and fast pulse instrumentation. The company manufactures CAMAC (Computer Automated Measurement and Control) and FASTBUS equipment as well as standalone instruments. Their waveform recorder products offer sampling rates from 100 kHz to 1.3 Ghz, resolution to 12 bits and signal bandwidths from DC to 250 MHz.

Other LeCroy products involve high precision measurement and fast decision-making. Time intervals as long as milliseconds are measured to picosecond accuracy, and ADCs measure up to a 15-bit dynamic range with sensitivities as low as 50 fC. Modular threshold discriminators/comparators make go/no-go decisions within 5 nsec, and a variety of multiple input gate modules permit rapid coincidence detection. Memory lookup units recognize a 12 to 16 bit pattern and yield a predetermined digital output within 60 nsec. All modules are remotely programmable and/or exercisable for testing and calibration purposes. Utility modules are available to permit fabrication of complete systems, and a fiber optic transmitter/receiver module allows CAMAC crates to be serially linked over long distances on fiber optic cable.

Microtex Digital Imaging
80 Trowbridge Street
Cambridge, MA 02138
(617) 491-2874
Contact: Nicholas Bedworth
Relationship with Digital: OEM
Product Class: Imaging Systems

Microtex Digital Imaging manufactures scientific imaging workstations that are based on the MicroVAX II and the VMS operating system. The image acquisition subsystem is expressly designed for solid state image sensors, has from 8 to 12 bits of digitization, pixel rates to 10 MHz, frame rates to several hundred frames per second, flexible selection of image format, dual-ported image memory to 128 Mega-pixel, external line or frame triggering for asynchronous operation, is compatible with laser scanners and SEMs, has realtime arithmetic and logical processing, and can be configured with grated image intensification for low light levels.

The display processor and monitor has resolution of 1280 X 1024 pixels, 8 bits (256 colors) per pixel, hardware cursor and alphanumerics, a mouse pointer, hardware pan and zoom, DMA interface, flicker-free 60 Hz display refresh, remote mounting via fiber optic cable to 3 km, and monochrome or color hard copy of images.

There is a data storage and retrieval subsystem with a 474 Mbyte Winchester, a 1.0 Gbyte optical disk with removable cartridge, or a 9 track 1600/3200 bpi autoloading magnetic tape.

This workstation is a fully configured DECnet end node. Microtex integrates all hardware and software functions in an imaging system user environment that allows incorporation of existing programs.

National Instruments
12109 Technology Blvd.
Austin, TX 78727
(800) 531-5066
in Texas (512) 250-9119
Contact: Don Nadon
Relationship with Digital: Referral
Product Class: IEEE-488 boards for Q-bus

National Instruments produces a family of products that interface Digital computers to the IEEE-488 bus. Both DMA and non-DMA capabilities are available for the UNIBUS and Q-bus. The standard software for these interfaces includes general purpose device handlers for the RSX, RT-11, and TSX operating systems. Optionally available are handlers for VMS, MicroPower/Pascal, VAXELN and ULTRIX. The software is provided in source code for easy customization.

The handler has a modular architecture so that unneeded capabilities can be deleted to conserve memory. The user interface to the handler has two levels of functionality, both of which are directly accessible to application programs written in BASIC, FORTRAN, and Macro. The high level functions automatically handle the GPIB management protocol, such as addressing, that is needed to communicate with instruments. Using these functions will minimize program development time. When greater flexibility is required, the low level primitive routines can be used to manage the GPIB directly.

Along with the handler, the software package includes an interactive control program that can be used to learn how to program GPIB devices, to debug application programs, or to locate malfunctioning devices. The software license fee is included in the hardware price.

Neff Instrument Corporation
700 S. Myrtle Ave.
Monrovia, CA 91016
(800) 423-7151
in California (818) 357-2281
Contact: Lee Ladwig
Relationship with Digital: Referral
Product Class: A/D and D/A subsystems

Neff Instrument Corporation offers data acquisition subsystems that interface to Digital equipment through a parallel DMA digital interface which resides in the VAXBI, Q-bus or UNIBUS.

Neff manufactures several types of analog multiplexers that operate from 12 to 16 bits of resolution with sampling rates from 50 kHz to 300 kHz (depending on the resolutions) and up to 2048 channels. Other features of these multiplexers are an amplifier per channel design that enable channel gain and bandwidth to be set individually for each channel; a choice from several types of input amplifiers, including parallel sample and hold and 300V common mode models; input ranges from plus or minus 5 millivolts to plus or minus 10.24 volts; programmable or automatic diagnostics; input and output data buffering; and automatic calibration.

Neff produces signal conditioners for operation with specific transducer types. These units deliver constant current or constant voltage excitation from separate regulators on each channel. Optionally, a user can configure a module to provide a digital interface for multiplexers and a serial controller that operates up to eight remote multiplexers.

Neff provides software drivers to interface to Digital computers running under the RSX and VMS operating systems.

Numerix Corp.
20 Ossipee Road
Newton, Massachusetts 02164
(617) 964-2500
Contact: Larry Zagorsky
Relationship with Digital: Referral
Product Class: Array Processor systems

Numerix manufactures a family of high-speed Array Processors that interface to Digital Q-bus, UNIBUS, and VAXBI buses. Numerix offers both 32-bit and 64-bit floating point APs to accommodate varying system requirements. The processors can reach speeds of up to 30 million floating point operations per second in single precision. Numerix provides high speed communication to any Digital VAXBI host via the DRB32-E DMA parallel interface. The DRB32 DMA interface can transfer data at rates up to 6.7Mbyte/sec. Numerix also provides DMA interfaces to Q-bus and UNIBUS systems. Their APs can communicate directly with peripheral devices via a pair of buffered I/O ports capable of transferring data at continuous sustained rates of 24Mbytes/sec.

Numerix fully supports its processors with software at the system, utility, and applications level. Numerix's FORTRAN Development System features a vectorizing pre-compiler, an optimizing compiler, a linker, and a symbolic interactive debugger to provide high-level language access to their APs. Since the pre-compiler accepts VAX FORTRAN and the development system provides a full library of signal processing routines, Numerix provides nearly seamless integration with the VAX development environment.

Phoenix Data, Inc.
3384 West Osborn Road
Phoenix, AR 85017
(602) 278-8528
Contact: Larry Snow
Relationship with Digital: Has driver that is callable from LIO library (LIO compliant)
Product Class: A/D and D/A subsystems

Phoenix Data manufactures data acquisition subsystems that interface to Digital's VAXBI, Q-bus and UNIBUS by way of a parallel digital DMA interface.

Phoenix produces analog input digitizers with both simultaneous sample and hold for time correlated data and multiplexer input. These digitizers have resolutions from 12- to 16-bits, rates from 10 kHz to 10 MHz (depending on the resolution), and channel capacities from 1 to 4096 differential inputs. Additional features include programmable gain ranging for both multiplexed and simultaneous sampling, 4K×16 FIFO data buffering, continuous to disk capability of 500 kHz, full scale input ranges from 10 millivolts to ±10 volts, an RS232 local control port, programmable crystal clock, maskable interrupt control, signal conditioning and filtering.

Phoenix produces analog output units that have resolutions from 12- to 16-bits, settling times of 5 microseconds with 1 to 1024 channels. Discrete input and output modules are available with up to 512-TTL inputs or outputs organized into 16 bit words, input rates to 500 kHz, the ability to sink up to 300 mA from 3 to 35 volts on output, and optional optical isolation.

Phoenix supplies drivers for the RT-11, RSX, and VMS operating systems with source and object code.

Preston Scientific Halear, Inc.
805 East Cerritos Ave.
Anaheim, CA 92805
(714) 776-6400
Contact: Charlie McGuire
Relationship with Digital: Has driver that is callable from LIO library (LIO compliant)
Product Class: A/D and D/A subsystem

Preston Scientific Halear builds data acquisition subsystems that interface to Digital's UNIBUS, Q-bus, and VAXBI bus through DMA/non-DMA parallel digital interfaces.

Preston manufactures several types of multiplexer/sample-and-hold/A-D combinations that have resolutions from 13- to 15-bits with conversion speeds from 40 kHz to 1 MHz (depending on the model) and with up to to 1024 channels. Additional features of these systems are an amplifier per channel with programmable gains from 1 to 1000, filters per channel, signal conditioning for strain gauges and RTD transducers, bridge completion and balance, simultaneous sample-and-hold, scan tables, and input and output buffer memories.

Digital inputs and outputs can also be configured into these systems with data buffering, parallel to serial conversion, a free running counter, and optical isolators. Analog outputs are available with resolution of 12- to 16-bits, with four-quadrant multiplying capability, dual rank registers, full scale outputs of ±10V @ 50 mA or ±100V @ 30 mA and short circuit protection.

Preston supplies software to interface their equipment to Digital's RSX operating systems.

Recognition Concepts, Inc.
924 Incline Way
P.O. Box 8510
Incline Village, NV 89450
(702) 831-0473
Contact: Steve Meaders
Relationship with Digital: OEM
Product Class: Image Processing Systems

Recognition Concepts manufactures either a turnkey image processing system with an internal LSI-11 or MicroVAX processor, or a peripheral image processing system that would interface over the Q-bus or UNIBUS. Images can be acquired in monochrome, binocular, color or multispectral form from a camera, CCD array, infared sensor or from video tape. The data can be line can or array data to 4096×4096 points in either analog or digital form to 12.5 MHz and 8-, 10-, or 12-bits of resolution. The digital input can be configured for two ports to acquire 32 bits of data in parallel at 50Mbytes per second. The image can be stored in up to 16Mbytes of dual ported image memory from one to 32-bits per pixel. Full images can be to 4096×4096 pixels. There is an optional realtime disk storage of up to 6800 images.

A software library of ready-to-use image processing and analysis functions is available with features of realtime logical and arithmetic processing, convolution, warping, FFT, morphological and machine vision processing, continuous interpolated magnification/minification, high speed vector generation, and a realtime histogram generator. A user programmable 32-bit signal processor can be included.

Turnkey and custom software is available with support in FORTRAN, C, Pascal, and assembly language for the RT-11, RSX, VMS, and ULTRIX operating systems.

Signal Technology, Inc.
5951 Encina Road
Goleta, CA 93117
(800) 235-5787
Relationship with Digital: Co-operative Marketing Partner (CMP) and can use LIO library for data collection (LIO compliant)

Signal Technology, Inc. produces and markets ILS (Interactive Laboratory System). ILS is an interactive laboratory software system for applications involving digital signal processing in VAX/VMS and MicroVMS environments.

ILS supports data acquisition, file management, data manipulation, and graphics. Signal processing functions provided are: editing, digital filtering, spectral analysis, speech processing, and pattern classification. The two modes of user interface, menu mode and command mode, fill the needs of any level of user.

Simpact Associates, Inc.
9210 Sky Park Court
San Diego, California 92123
(619) 565-1865
Contact: J. A. Buell
Relationship with Digital: Referral
Product class: Communication Processors

Simpact manufactures a family of communications products for Digital computers. The firm offers programmable front-end processors for the DEC VAXBI, Q-bus, and UNIBUS systems. Simpact's ICP1600, ICP1622, and ICP1632 series products are high performance, multi-channel, single board communication interfaces based on Digital's Micro/T-11 chip. These products are programmed to implement special communications protocols and to offload interrupt-intensive communications tasks from the VAX host computer. To aid users who wish to write their own application programs for the front-end processor products, Simpact offers an ICP Software Development Tool Kit.

Simpact's products have been used to develop protocol converters for the Defense JINTACCS to RAINFORM joint tactical communications systems, collection of information for the Army All Sources Analysis (AASA) system (meeting MIL-STD 188 interface requirements), and for the FED-STD 1003A interface for the Automatic Weather Distribution System (AWDS).

SKY Computers, Inc.
Foot of John Street
Lowell, MA 01852
(617) 454-6200
Contact: Mike Drumm
Relationship with Digital: Cooperative Marketing Partner (CMP)
Product Class: Board-level array and signal processors

SKY manufactures and markets board-level array processors, accelerators, and signal processors designed to accelerate signal and image processing applications. The WARRIOR is a board-level 32-bit floating point array processor for the MicroVAX II. The base configuration includes 2 quad boards. A third quad board provides an additional 2 Mb of shared memory.

The WARRIOR provides 15 peak MFLOPS of 32-bit performance and 0.5 peak MFLOPS of 64-bit performance. Software includes a subroutine library, assembler, linker, and debugger.

Third party software companies such as Sierra Geophysics, Geoquest International (Seismic), Logica (image processing), and New Methods Research (spectroscopy) have ported some of their applications onto a VAXstation/GPX-WARRIOR system.

Other products include the SKYMNK-Q fixed point array processor and the SKY320-Q fixed point signal processing board. They attach tothe PDP-11 Qbus and provide very low cost high-speed processing for signal processing applications.

Star Technologies, Inc.
515 Shaw Road
Sterling, Virginia 22170
(703) 689-4400
Contact: Bob Collins
Relationship with Digital: Cooperative Marketing Partner (CMP)
Product Class: Array and Signal Processors

Star Technologies manufactures array and signal processors that interface to the Digital Q-bus, UNIBUS, and VAXBI buses. The ST-100 is a 32-bit processor based on a synchronous parallel, pipelined architecture. The hardware supports one transaction every 40 nanoseconds and is capable of speeds of up to 100 million floating point operations per second (MFLOPS). The ST-100 may be expanded to 32Mbytes of memory and includes a FORTRAN-like control language as well as application library modules. The I/O channel supports up to 7 device adapters transferring data at 12.5Mbyte/sec.

Star Technologies' VAXBI interface supports burst transfer rates of 10Mbytes per second on a dedicated VAXBI bus and up to 5Mbytes on a shared VAXBI bus. Multiple VAX's (Q-bus, UNIBUS, or VAXBI interfaces) may share one array processor.

The ST-100 software system consists of the Development, Production, and Maintenance software segments. The Development Software System is comprised of a high-level control language, macro assemblers, a simulation/debugger, a linker and a library maintenance program. The Operating Software and Maintenance Software systems handle the execution and monitoring of the ST-100 run as well as the identification and isolation of faults.

Storage Concepts
3198-G Airport Loop Drive
Costa Mesa, California 92626
(714) 557-1862
Contact: Dick Edwards

Storage Concepts produces specialized dual-ported disk subsystems for realtime applications. In addition to a Q-bus or UNIBUS interface through a disk controller, the Concept systems also provide an external 16-bit data port. With sustained transfer rates of 8 and 10.5Mbytes per second over an external port and 0.5 to 2.75Gbytes of storage, the Concept systems are ideal for use in realtime applications such as high-speed data acquisition, medical imaging, telemetry and animation.

The Concept series resides in 20 inches of standard 19 inch rack space and is connected via cable to a quad-height adapter in a Q-bus or UNIBUS backplane. Data is written to the Concept series through a separate 16-bit parallel port and may be read back through the Q-bus.

A VMS driver is available.

Chapter 3
Realtime
Software

Software

Realtime Software/Introduction

Introduction

An important part of the development and performance of a Realtime computing solution is the software environment and tools used. Digital offers a variety of operating systems, layered products, and applications software for our VAX and PDP-11 product lines which are useful for Realtime applications. This chapter describes these products, and is organized as follows:

Realtime Operating/Development Systems

Described here are products which serve as operating environments, as well as development tools which allow programmers to efficiently and easily develop runtime software for their Realtime applications.

Layered Products

Designed to work with our operating systems and development tools, these products, which include high level languages and applications software, provide application-specific subroutine libraries and high level language and database capabilities often used by Realtime programmers.

VAX/VMS

VAX/VMS is a layered operating system which provides multilevel services for process scheduling and control, memory management, and I/O operations. Digital-supplied or user-defined command language interfaces are used to interact with the system at the highest level. At the application programming level, VAX/VMS services are accessed using system service calls and Run Time Library procedures. Extensive on-line help is available for all operating system features.

VAX/VMS offers a variety of features and services for controlling the operating environment and the distribution of system resources. Many of these features and services are not ordinarily available to time-sharing users, but they are easily accessible by privileged users who wish to implement realtime applications under VAX/VMS.

In addition to its realtime features, VAX/VMS provides a rich software development environment which minimizes the time and investment required for project completion. The networking capabilities of the VAX/VMS environment make it possible to share information and workload throughout the organization, optimizing the utilization of computing resources.

VAX/VMS Multitasking Services

Under VAX/VMS, computable realtime processes are scheduled strictly on the basis of user-assigned process priorities. Processes assigned realtime priorities (16–31) undergo neither time-slice scheduling nor automatic priority adjustment, as do time-sharing processes. At the user's option, realtime processes may be synchronized with the system timer through the use of various system services.

VAX/VMS also provides services for synchronizing process execution with other processes on the same system. A suitably privileged process can dynamically alter its own scheduling priority and state or those of another process. Multiple processes can share access to a common set of event flags which may be used to change processes' scheduling state or to signal sub-task completion. VAX/VMS provides services for the management of multi-level locks on particular system resources as a means of interprocess synchronization.

VAX/VMS Memory Management Services

VAX/VMS takes full advantage of the virtual addressing features of the VAX architecture. Each process has access to 1 Gigabyte of virtual address space. Virtual-to-physical address translation is completely transparent to the application programmer.

Critical sections of code or data can be made resident in physical memory to guarantee availability and eliminate device overhead associated with paging. Furthermore, the privileged user has complete control of the allocation of physical memory resources through management of process quotas.

VAX/VMS offers services for dynamically creating, mapping, and deleting shared global sections—areas of physical memory which are contained within the virtual address spaces of multiple processes. This makes it possible for several processes to use shared physical memory for common data pools or interprocess message passing.

VAX/VMS I/O Services

A user program can interfere with the VAX/VMS I/O subsystem at any of several levels. High-level language support is provided through the VAX Common Runtime Procedures Library. Programs can also perform I/O using the VAX Record Management System (RMS) or the Queued I/O (QIO) system service calls. These services may be used to perform either synchronous or asynchronous I/O.

The Connect-to-interrupt utility enables users to program device interrupts without writing a full device driver. Privileged users can read and write device registers directly from a program, by-passing the I/O subsystem altogether.

VAX/VMS supports all the I/O features of the VAX architecture, including prioritized device interrupts, multiple I/O busses, and direct vectoring of device interrupts.

Disk I/O can be optimized for realtime access by creating files in contiguous blocks or in specific regions of a disk volume in order to minimize head movement overhead.

The VAX/VMS Program Development Environment

VAX/VMS supports a comprehensive software development environment, including language compilers, linker, language-sensitive editors, and symbolic debugging tools. In addition, there are many VAX/VMS layered and third-party software products for code/configuration management, and automated regression testing. These tools greatly reduce the time and expense associated with large project development as well as reducing the lifetime cost of project maintenance.

Communications

The networking capabilities of the VAX/VMS environment enable the sharing of information throughout the organization with unsurpassed ease-of-use. The DECnet layered product supports not only file-transfer and inter-host login capabilities, but transparent task-to-task communication across nodes, as well. Realtime users can by-pass the upper levels of DECnet protocol and use direct calls to the Ethernet device driver to enhance performance.

In addition to its networking capabilities, VAX/VMS supports drivers for a variety of Digital-supplied and third-party communication interfaces, including IEEE-488, MIL STD 1553, NTDS, and a large number of synchronous and asynchronous serial communication protocols, such as X.25.

VAXELN

VAXELN is a fully modular software system for the development of dedicated, realtime applications for the VAX family. The system lets programmers build dedicated, realtime applications on VMS development systems. It is not intended to be a general purpose system.

VAXELN consists of a TOOLKIT, which is installed on the host VMS development system. The VAXELN TOOLKIT can be thought of as having two sets of modules and utilities. One set runs as programs on the host VMS system. The other set of modules and utilities can be included in the VAXELN target system and run, under the control of the VAXELN executive kernel, on the target VAX.

VAXELN SYSTEMS include only those services that are needed to support the functions required by the applications. This allows very small and efficient applications to be developed. (As an example, many applications do not require disks and/or a network.) Since neither disk nor a network is required by the VAXELN kernel, these systems only include the software support for the devices required by the application.

After development, VAXELN applications run stand-alone on VAX or MicroVAX target systems via the kernel executive.

VAXELN Kernel

The VAXELN executive has been optimized for speed and efficiency, and was developed for fast, realtime, dedicated applications. In addition to providing the interface between the user program and the processor hardware, the VAXELN kernel provides for the controlled sharing of system resources. It synchronizes communication between the various PROCESSES of the application. It maintains all information about the system and each PROCESS component.

Communications

Local area network support, based on Ethernet, is designed into VAXELN's basic architecture. Data transmission facilities are provided to make it easy to distribute an applicant's component programs among several participating network nodes. Changing the node location of a program does not require rewriting the program. Programs initially written to execute on the same processor may be distributed among nodes on the network.

This transparent network support allows a program running on a VAXELN node to open, read and write files located on another system, transparently to the application. This includes VMS nodes connected to the local area network. VMS nodes can also easily access VAXELN nodes.

Target Loading

Completed VAXELN SYSTEM applications can be loaded from FILES-11 format disk media, tape, or downloaded through Ethernet from the VMS host to the target VAX. Additionally, any VAXELN application can be blasted into read-only memory (ROM) for installation and execution on the target system.

High Level Language Support

VAXELN SYSTEMS, including special device drivers, can be developed entirely in high-level languages. The VAXELN TOOLKIT contains an extended version of ANSI/ISO PASCAL (EPASCAL). Runtime libraries are provided in the TOOLKIT to support programs written using the VAX C or VAX FORTRAN 77 compilers. An optional product, VAXELN/Ada provides support for programs written using the VAX Ada compiler.

Symbolic Debugger

The VAXELN TOOLKIT provides a remote symbolic debugger that allows the programmer to debug the target application from the host computer via an optional Ethernet connection. The remote debugger is capable of debugging applications composed of several jobs, even when the jobs are located on more than one processor. If the Ethernet is not available, the application may be debugged directly on the target hardware using the local, nonsymbolic debugger included in the VAXELN TOOLKIT.

VAXELN File Services

VAXELN provides the ability to create, read, and write ODS A, FILES-11B compatible disk files from the application. Files are limited to VMS sequential files (sequential and random access) via an RMS-compatible calling interface. Indexed, multikeyed and relative access to RMS files are not supported.

Host Support

Because the VAXELN TOOLKIT runs as a layered product under VMS, the TOOLKIT is supported on a valid VMS system that provides the necessary memory and disk space.

Target Support

A VAXELN target application can be run on a subset of the VAX family. VAX processors supported as target are: KA620, rtVAX 1000, MicroVAX I, MicroVAX II, VAX-11/725, VAX-11/730, VAX-11/750, VAX 8500, VAX 8530, VAX 8550, and VAX 8700.

For more information, please refer to the following VAXELN Literature:

- ED 30906-47 *VAXELN Information Sheet*
- EA 29580-68 *VAXELN Technical Overview*
- AA-GS98A-TE *VAX ADA and VAXELN ADA Technical Summary*
- ED 29917 41 *VAX Rdb/ELN Information Sheet*

MicroPower/Pascal

MicroPower/Pascal is an advanced software toolkit for developing Q-bus-based microcomputer applications. It includes a high-performance Pascal compiler, a modular executive, and a variety of tools to create concurrent, realtime applications programs.

MicroPower/Pascal has two system environments to accomplish this development. The host system creates and builds the software. The target system executes the software. Each application is custom-designed for its target system and includes the appropriate set of operating system services. The host, using the symbolic debugger, controls the execution of the target application during development.

There are three MicroPower/Pascal products. MicroPower/Pascal-RT, MicroPower/Pascal-Micro/RSX, and Micropower/Pascal-RSX develop applications using a PDP-11 host system. The host development environment for each of these products includes an extended, realtime Pascal compiler, a symbolic debugger, several build utilities, and a MACRO-11 interface. The target environment includes a library of software modules for process synchronization, communications, scheduling, exception and interrupt handling, timer services, and device and file I/O.

The application program is created and linked with the appropriate runtime software in the host system. It is then transported to the target system by one of three methods—writing it into read-only memory, downline loading it over a serial line, or recording it onto removable storage media such as a floppy disk or tape cartridge and then bootstrapping it on the target system.

MicroPower/Pascal is very compact and can reside in as little as 8Kbytes of memory for small application programs. For complex applications, MicroPower/Pascal can address as much as 4Mbytes of memory.

For more information, please refer to:

- *SPD 19.12 for MicroPower/Pascal-RT*
- *SPD 14.83 for Micropower/Pascal-RSX*
- *SPD 18.24 for Micropower/Pascal-Micro/RSX*

RT-11

The RT-11 operating system is a single-user realtime operating system designed for interactive program development of online application execution on Professional 300 Series, PDP-11 and LSI based systems. Although it is a single-user system, RT-11 supports both single job (SJ)and foreground/background (FX/XM) modes of processing, as well as a number of system jobs. In addition to a variety of system and program utilities, RT-11 supports a number of job-level language processors including BASIC-PLUS and FORTRAN-77.

The emphasis in RT-11 is on efficient use of system resources, minimizing system requirements in the CPU, and on the mass storage devices, and maximizing system throughput.

For more information, please refer to *SPD 12.01.*

RSX-11S

RSX-11S is a memory-based realtime operating system designed to run on a PDP-11 or MicroPDP-11 disk-based operating system. RSX-11M-PLUS, or VAX/VMS with VAX-11 RSX host system generation and program development.

For more information, please refer to *SPD 9.21.*

RSX-11M

RSX-11M, a disk-based realtime operating system, runs on any UNIBUS PDP-11 processor and on most Q-bus PDP-11 and MicroPDP-11 processors. It provides an environment for the development and execution of multiple realtime tasks (program images) using a priority-structured event driven scheduler. System generation on either a host PDP-11 or VAX processor running VMS with VAX-11 RSX allows the user to tailor the software for systems ranging in size from small 32-Kbyte systems to large 3, 840-Kbyte systems. Program development and realtime tasks can execute concurrently in systems with at least 56 Kbytes of memory. The system's software priority levels enable the user to compile/assemble, debug, install, and execute tasks without affecting realtime response.

For more information, please refer to *SPD 14.35.*

RSX-11M-PLUS

The RSX-11M-PLUS is a high performance superset of the RSX-11M operating system, designed to take advantage of the expanded addressing capability of today's larger-memory PDP-11s. RSX-11M-PLUS maintains the superior reliability and successful architecture of RSX-11M to ensure compatibility and ease of transition between systems. This realtime, multiprogramming, multiuser operating system offers the same features as RSX-11M and many others in addition to those listed below.

For more information, please refer to *SPD 14.70.*

Micro/RSX

Micro/RSX is an extended subset of the multiuser, multitasking RSX-11M-PLUS operating system, tailored for the MicroPDP-11 family of computers. Micro/RSX is available on RX50 diskettes and TK50 cartridge tapes. It is preSYSGENed and can be installed by the customer, with no prior experience, in less than an hour. Micro/RSX offers the Digital Command Language (DCL) and also allows user-written command language interpreters. Micro/RSX will run most programs written for RSX-11M or RSX-11M-PLUS without modification. Micro/RSX is divided into two parts.

Base Kit

The base kit provides the RSX-11M-PLUS executive, appropriate utilities, device drivers, and support for program development with high-level languages. The base kit has complete tutorial and reference documentation. Customers who wish to program in high-level languages need only buy the base kit and the appropriate Micro/RSX language kit. RMS and the EDT editor are included in the base kit.

Advanced Programmers Kit

The Advanced Programmers Kit is an optional addition to the Base Kit. It includes the MACRO-11 assembler, tools for developing privileged code (or "systems programming" such as user-written device drivers), support for ANSI magtape handling, a point-to-point communications and file-transfer capability, and additional documentation.

Additional Software for Micro/RSX

Most of the major programming languages and tools, utilities, and communications and networking products available as separate products for RSX-11M-PLUS are also available for Micro/RSX. A partial list of these software products includes BASIC-PLUS-2, FORTRAN-77, COBOL-81, DIBOL-83, Pascal, DATATRIEVE, SORT/MERGE, the PDP-11 Symbolic Debugger, and DECnet.

Support for Terminal Servers

Terminals or terminal servers on an Ethernet can connect to Micro/RSX on the Ethernet. For this capability, DECnet is prerequisite on the Micro/RSX system.

TSA Support

Micro/RSX also supports the Digital Terminal Services Architecture (TSA).

For more information, please refer to *SPD 14.28.*

Peripheral Processor Toolkit

The Peripheral Processor toolkit is a Digital development utility for use with the KXT11-CA and KXJ11-CA peripheral processors. The toolkit resides on a Q-bus arbiter system running VMS, RT-11, RSX or Micro/RXS operating systems. It facilitates program loading, booting, and communications with peripheral processors that share the Q-bus with the arbiter system.

The KXT11 and KXJ11 peripheral processors enhance the performance of Q-bus systems that support realtime, I/O intensive, or compute-intensive tasks. They can act as realtime processors, coprocessors, or I/O processors, and provide a cost-effective increase in system power. Software running on the peripheral processors are typically applications developed with MicroPower/Pascal, but may be applications written in MACRO-11 as well.

VAXlab Software Library

Q-bus Systems VAXlab Software Library (formerly LabStar)

The VAXlab Software Library (VSL) is a set of subroutine libraries for realtime data acquisition, mathematical and statistical analysis, and scientific plotting. It is designed to be a tool kit for the laboratory or realtime user who can access its capabilities from any VMS-compatible high-level language.

VSL is available on a range of MicroVAX and VAX systems. As the user application grows and faster computational speeds or I/O throughputs are required, it may be transported without major changes to the user program.

In addition to being a stand-alone product, VSL is also an integral component of the VAXlab systems for laboratory data acquisition and analysis.

The major components of VSL are:

- Laboratory Input/Output Subroutine (LIO) Library.
- Interactive Data Acquisition Tool (IDAT).
- Laboratory Signal Processing Library (LSP).
- Laboratory Graphics Package (LGP).
- Scientific Subroutine Package (SSP).

Each VSL component is described below:

Laboratory Input/Output (LIO) Subroutines

The LIO library is a collection of subroutines that permit application programs written in high-level languages to perform data collection and control.

It is designed to optimally perform many of the low-level functions associated with data collection such as mapping device registers, performing VMS QIOs, and locking buffers into physical memory. This frees the user from the complex task of realtime programming without having to sacrifice I/O performance.

The LIO calling interface is the same across all the I/O devices supported. Furthermore, since this calling interface is an open architecture, it is supported by a variety of third party hardware and application software products. This permits user applications to be easily ported across I/O devices and I/O bus structures with minimal changes. In the third party section of this catalog, the third party products that are compatible with the LIO subroutine library are listed as LIO compliant.

LIO's subroutines permit the user to do the following:

- Attach a device and set it up for QIO, connect-to-interrupt I/O or mapped I/O.
- Specify the setup parameters of an I/O device.
- Verify the setup parameters of an I/O device.
- Release a buffer from the user queue to the device queue.
- Fill a buffer with data from a device.
- Empty a buffer of data to the device.
- Obtain a buffer from a device queue and put it in the user queue.
- Detach a device and shut down the I/O process in an orderly fashion.

The devices supported by LIO include I/O hardware, realtime clocks, disk files, the memory queue device, and the realtime plotting device. The memory queue may be used to communicate between asynchronous parts of a program, to allocate buffers dynamically from virtual memory, or to manage buffers in a global section shared by several processes. The realtime plotting device (only on VAXstations) allows plotting to occur concurrent with the data acquisition process. The data is plotted in strip chart form.

The following table shows the I/O hardware supported by the LIO routines. (Detailed descriptions of these interfaces are provided in the section on Q-bus and VAXBI options.) In column titled "Mode supported," P denotes programmed I/O reads by the CPU, I denotes interrupt-driven programmed I/O, and D denotes Direct Memory Access or DMA.

Device	Description	Mode(s) Supported
Q-Bus Options		
AAV11-DA	2-channel, 12-bit, 300 kHz D/A	P, I, D
ADV11-DA	16SE/8DI, 12-bit, 50 kHz A/D	P, I, D
ADQ32-AA	32SE/16DI, 12-bit, 200 kHz A/D	P, I, D
AXV11-C	16SE/8DI, 12-bit 20 kHz A/D and 2-channel, 12-bit D/A	P, I
DRQ3B-AA	32-line (16 in/16 out), 1.3 MHz parallel digital interface	D
DRV11-WA	16-line, bi-directional, 0.5 MHz parallel digital interface	D
DRV11-J	64-bit (bi-directional in groups of 16) parallel digital interface with bit interrupt capability on 16 lines	P, I
IEQ11	IEEE-488 interface with 2 busses to control a total of 28 devices	I, D
KWV11-C	Realtime clock with four operating modes and five base frequencies	P, I
DZQ11	4-line serial digital interface with rates up to 9600 baud	I
DHQ11-M	8-line DMA serial digital interface with DMA on output and hardware rates up to 19,200 baud	I, D
Preston GMAD A/D	1 MHz A/D (with DRQ3B) with up to 1024 input channels	D
VAXBI Options		
DRB32-M **DRB32-W** **DRB32-E**	32-bit half-duplex bi-directional parallel DMA interface with max throughput of 5.7 MBytes/s (on VAX 8200 class machine)	D
Preston GMAD A/D	1 MHz A/D (with DRB32-W) with up to 128 input channels	D

The Interactive Data Acquisition Tool (IDAT)

For the user who prefers to work in an interactive mode of data collection, the VSL provides the IDAT utility. IDAT is a form-driven environment within VSL for routine laboratory operations. From within IDAT, the user employs a series of screen forms to set the analog data acquisition and control parameters, obtain input data, compute the power spectrum, write output data, store the data on disk, and plot the data on the terminal or on a hard copy devices, and to convert binary data into RS/1 tables. IDAT supports the AXV11-C (input and output), the AAV11-DA, the ADV11-DA, the ADQ32 analog input and output devices. IDAT also supports input and output on the DRQ3B, DRV11-J, and DRV11-WA parallel digital interfaces. IDAT supports the collection, processing, and output of data, one buffer at a time.

IDAT can also be used for plotting. Using a series of screen forms, the user may specify a plot, set the labels, lengths, co-ordinates for the axes, the line type and color, and specify if a terminal or hard copy device should be used.

All the terminals and hard copy devices supported by the LGP routines are accessible through IDAT.

Laboratory Signal Processing (LSP) Subroutines

The LSP subroutines are a set of subroutines designed to perform a variety of standard signal processing tasks commonly encountered in the laboratory. The capabilities of the different routines are listed below:

- FFT of n real values
- FFT of n complex values
- FFT of n×m complex values
- Power spectrum of n values
- Windowing function with 5 windows
- Cross- and auto-correlation functions
- Modulus and phase angle computation of n complex values
- Modulus and phase angle computation of n×m complex values
- Non-recursive highpass, lowpass, bandpass, or bandstop filters
- Polynomial smoothing filter
- Polynomial filter with first derivative output
- Polynomial filter with second derivative output
- Polynomial filter with third derivative output
- Conversion of A/D data into floating point voltage
- Conversion of floating point voltage into D/A voltage
- Conversion of thermocouple voltages into temperatures (7 thermocouple types supported)
- Interval histogram analysis with floating point input
- Interval histogram analysis with integer input

Graphics Package (LGP)

Two levels of graphics support are provided with VAXlab. VAX/GKS (Graphical Kernel System) is a flexible set of primitives provided for the creation of custom graphics. The LGP routines are layered on top of GKS and provide a more convenient interface for the generation of 2-D and 3-D graphs in most routine laboratory applications. Using LGP, up to 16 separate plots can be displayed at any one time. LGP may also be used to perform on-line plotting on VTxxx graphics terminals while data collection is occurring.

The LGP routines allow the user to perform the following tasks:

- Create a 2-D linear axis system and plot an array.
- Create a 2-D logarithmic axis system (x, y, or both) and plot an array.
- Update a 2-D plot by erasing old data and adding new data
- Plot additional data sets on a previously defined graph.
- Plot a previously stored metafile.
- Plot a point in one of 10 geometric shapes.
- Print the screen on an attached printer.
- Produce a hard copy of the plot displayed on the screen.
- Create a 2-D contour projection. Add an additional 2-D contour projection to an existing one.
- Create a shaded 2-D contour projection.
- Draw a histogram.
- Write a text string to a specified location on a plot.
- Plot standard deviation markers on data points.
- Plot a 3-D array with hidden line removal.
- Set up the axis system for a 3-D graph.
- Clear all or part of a window.
- Obtain the co-ordinates of a cursor or input device.
- Compute the autoscaling parameters for linear and logarithmic plots.
- Fit a cubic spline to a set of data points.
- Return the value selected from a menu.
- Prompt the user for a text string.
- Collect a series of x-y pairs from an input device.
- Collect a series of values within a specified range from a valuator type input device.

The Laboratory Graphics package will intrinsically support the display and hard copy devices listed below. Other devices can be supported provided the customer develops and installs the appropriate GKS device handler.

- HP7550
- LA12
- LA34
- LA50
- LA75
- LA100
- LA210
- LCP01
- LNO3 PLUS
- LPS40
- LVP16 (8.5×11)
- LVP16 (11×17)
- Tektronix 4014
- VAXstation II
- VAXstation II/GPX
- VT125
- VT240
- VT241
- VT330
- VT340

Scientific Subroutine Package (SSP)

The Scientific Subroutine Package, containing over 115 subroutines, is provided at no charge on an unsupported basis to assist the user in performing mathematical and statistical analysis on realtime and static data.

- *Matrices*—Arithmetic operations between two matrices, arithmetic operations between scalars and matrices, inversion, transposition, replication, computation of eigenvalues, eigenvectors, and row vectors, partition of matrices, and various operations on rows, columns, and elements.
- *Polynomials*—Arithmetic operations between two polynomials, arithmetic operations between a polynomial and a constant, integration, substitution of a polynomial for the variable of another, determination of the roots by the Newton-Raphson technique.
- *Integration and Differentiation*—Elliptic integrals of the first and second kind, Fresnel integrals, exponential integrals, integration by Romberg's method, integration of a first order differential equation by the Runge-Kutta method, commutation of the sine and cosine integrals.
- *Solution of Equations*—Mueller's iteration, Newton's iteration, Wegstein's iteration, solution of a set of simultaneous linear equations, Runge-Kutta method of solving a set of first order differential equations.
- *Mathematical Functions*—Mathematical Functions—I, J, K, and Y—Bessel functions, fitting the coefficients of the Fourier series to match a function, the GAMMA function, Legendre polynomials.

- *Statistical Functions*—Autocovariances, calculus of a factorial experiment, variance analysis, cannonical correlations, cross-covariances, indices of classification for discriminate analysis, exponential smoothing, Kendall rank correlation, factor analysis operations, statistical moments, sum of squares and degrees of freedom, multiple linear regression analysis, Cochran Q-test, Spearman rank correlation, creation of a conditional subset from a data matrix, analysis of a conditional subset, correction factor resulting from rank ties, T-statistics, Friedman two-way analysis, Mann-Whitney U-test, Kendall degree of association test.
- *Peak Processing*—This routine allows the user to take a linear average of the data, filter the result through a digital filter, and then detect trends and peaks in the data. The output from the routine is the area, height, width, and position (beginning, crest, ending) of the peak. The routine also reports how each peak ends—on a baseline or at a valley.

Prerequisite Software

- VMS Operating System (the full VMS environment is required).
- VAX GKS (at a minimum of Version 2.0) is a prerequisite for the LGP graphics library. Either the complete library or the just the runtime version may be used.

Software Product Descriptions

For warranty, license, and installation information, refer to the VAXlab Software Library software product description (*SPD 28.30.xx*).

For ordering information, refer to the VAX/VMS System Software Order Table/Optional Software Cross Reference Table (*SPD 28.98.xx*).

VAX FORTRAN

VAX FORTRAN is an optimizing FORTRAN compiler designed to achieve high execution speed. It is an implementation of full language FORTRAN-77, which is based on ANSI FORTRAN X3.9-1978. The shareable reentrant compiler takes full advantage of the VAX floating-point and character instruction set and the VMS virtual memory operating system. It includes switch-selectable support for programs conforming to the previous standard, ANSI X3.9-1966. VAX FORTRAN also provides a number of extensions beyond the current ANSI standard, including language elements for keyed and sequential access to VAX RMS multikey ISAM files and a set of data types beyond those specified for full language FORTRAN-77.

For more information, please refer to *SPD 25.16.*

VAX PASCAL

VAX PASCAL is an implementation of the Pascal language that accepts programs compatible with either level of the ISO specification for computer programming language Pascal (draft proposal 7185). Pascal is a structured high-level language that provides a modular, systematic approach to computerized problem solving. VAX PASCAL is an optimizing compiler providing numerous extensions, including separate compilation, character string manipulation, random access to VAX relative files and keyed access to VAX multikey indexed files.

For more information, please refer to *SPD 25.11.*

VAX Ada

VAX Ada is Digital's validated implementation of the full ANSI-MIL-STD-1815-A-1983 Ada language. The VAX Ada compiler runs under the VMS and MicroVMS operating systems, and generates optimized, shareable and position-independent code. As a native-mode VMS language, VAX Ada is integrated into the VMS common language environment. All VMS system services and utilities are thus available to programs written in VAX Ada. VAX Ada supports VAX Record Management Services (RMS) including, sequential, relative, and indexed file organizations and associated access methods. VAX Ada programs can invoke modules written in other VMS languages. Additionally, programs written in other languages can invoke VAX Ada modules.

For more information, please refer to *SPD 26.60.*

VAX C

VAX C is a general purpose programming language featuring modern control and data structures with concise operations. It is an integrated VMS language and programmers have available to them all of the services and program development aids that the VMS system provides. It is based on "The C Programming Language," described by Kernighan and Ritchie, and developed by Bell Laboratories. VAX C offers optimized, shareable, position-independent native VAX code, fast compilation speeds, and the ease and flexibility of development that comes with the VAX/VMS environment.

For more information, please refer to *SPD 25.38.*

VAX BASIC

VAX BASIC provides the benefits of a highly interactive programming environment and a high-performance development language. It combines the features of a compiled, structured BASIC and the RSTS/E BASIC-PLUS language with the performance benefits provided by a VAX language that is fully integrated with the VMS development environment. The VAX BASIC language is a highly extended implementation language. It provides powerful mathematical and string-handling facilities, support for symbolic variable names/debugging, and full RMS indexed, sequential and relative I/O operations. VAX BASIC can be used as if it were either an interpreter or a compiler. While a fast RUN command and support for direct execution of unnumbered statements (immediate mode) gives you the feel of an interpreter, this product also can be used in compilation mode, where it generates object modules like the other VAX compilers. In either case, the VAX BASIC system generates optimized VAX native-mode instructions that have extremely fast execution times.

For more information, please refer to *SPD 25.36.*

VAX-11 RSX

VAX-11 RSX is an emulator of the RSX-11 operating system. VAX-11 RSX executes on VMS. It provides capabilities that enable PDP-11 users to develop programs for execution in the following environments: VMS compatibility mode, RSX-11M-PLUS, RSX-11M, RSX-11S, Micro/RSX and P/OS. VAX-11 RSX supports the performing of RSX SYSGENS and NETGENS. VAX-11 RSX also allows for the migration of many existing RSX-11 applications to VAX/VMS.

For more information, please refer to *SPD 26.73.*

VAXELN Ada

VAXELN Ada is a VMS layered product that allows users to develop Ada applications for an embedded "standalone VAXELN" environment. The execution environment of VAXELN Ada applications is based on VAXELN, a compact and efficient runtime executive for VAX systems.

VAXELN Ada is a full, validated, production-quality implementation of the Ada language that is well integrated in the VMS and VAXELN TOOLKIT environments on VAX systems, where the VMS operating system serves as the host and VAXELN serves as the target.

For more information refer to *SPD 27.22.*

Ada is a registered trademark of the U.S. Government (Ada Joint Program Office)

VAX Rdb/ELN

VAX Rdb/ELN is a relational database management system designed for dedicated applications on systems running in the VAXELN application environment. VAX Rdb/ELN applications are developed using the VAXELN TOOLKIT on a host VAX/VMS or MicroVMS system. The resulting bootable VAXELN-based Rdb/ELN application is then moved to the VAXELN target system using disk media, or an Ethernet local area network link. The application program executes on the target system as a dedicated database system. The network link to the host development system may be used for remote debugging. VAX Rdb/ELN implements the Digital Relational Interface.

For more information refer to *SPD 28.03.*

FORTRAN IV

FORTRAN IV is an extended superset of the ANSI X3.9-1966 standard for this scientific and engineering programming language. Its high-speed, one-pass optimizing compiler works very efficiently in small-memory environments, making FORTRAN program development possible on smaller PDP-11 systems. Because it can produce absolute binary code suitable for stand-alone PDP-11 systems or for loading into ROM or PROM memory, Digital's FORTRAN IV is especially useful for such industrial applications as control programs for automated equipment.

Other features of FORTRAN IV include the ability to use general expressions in all meaningful contexts, mixed-mode arithmetic, the byte data type for character manipulation, commenting at the end of each source line, and list-directed input/output.

For more information, please refer to:

- *SPD 12.10 for RT-11*
- *SPD 12.41 for RSTS/E*
- *SPD 14.63 for RSX*
- *SPD 14.77 for IAS*
- *SPD 40.40 for Professional (P/OS)*

FORTRAN-77

FORTRAN-77 is much more than just a scientific and engineering language. It combines the efficient numerical computation for which FORTRAN is known with provisions for keyed and sequential access to RMS multikey ISAM files. This makes FORTRAN-77 ideal for writing programs that must manipulate and perform calculations on masses of data, as in accounting or statistical packages. FORTRAN-77 runs on RSTS/E, Micro/RSTS, RT-11, RSX-11, RSX-11M, RSX-11M-PLUS, and Micro/RSX-based PDP-11 systems. Runtime operations are supported on RSX-11S. FORTRAN-77 is also available as a compatibility mode compiler running on VAX/VMS via VAX-11 RSX. Source programs can be compiled and task-built under VAX-11 RSX and then transported to an RSX system for execution.

FORTRAN-77 is built on the ANSI subset FORTRAN X3.9-1978 standard with the following extensions: Type and Accept input/output statements, the BYTE data type, hexadecimal and octal constants, virtual memory arrays (on systems equipped with memory management), and language elements to perform RMS multikey ISAM. To use RMS files and utilities, FORTRAN-77 programs utilize the RMS Object Time System (RMS OTS); a File Control Services OTS (FCS OTS) is also available. The compiler produces direct PDP-11 machine code optimized on systems equipped with a floating-point processor.

FORTRAN-77 interacts with the PDP-11 Symbolic Debugger. This tool aids in the location of programming errors in successfully compiled programs that behave abnormally when executed, thereby increasing programmer productivity.

RMS file capabilities are not available for FORTRAN-77 running under RT-11.

For more information, please refer to:

- *SPD 14.31 for RSX-11M-PLUS, RSX-11M, and RSX-11S*
- *SPD 14.49 for RSTS/E*
- *SPD 18.04 for Micro/RSX*
- *SPD 18.10 for Micro/RSTS*
- *SPD 40.21 for PRO/Tool Kit*
- *SPD A3.55 for RT-11*

PDP-11 PASCAL

PDP-11 PASCAL is a high-level language for developing business, manufacturing, research, and educational programs. Its English-like commands, logical grammar, and block structure help developers produce programs that have clear organization and linear flow.

PDP-11 PASCAL accepts programs compatible with Level 0 of the ISO Specification for Computer Programming Language Pascal [ISO 7185-1983(E)] as well as to the ANSI/IEEE 770X3.97-1983 (December,1983) Standard. PDP-11 PASCAL runs on all RSX-11M and RSX-11M-PLUS-based PDP-11 systems that have the Extended Instruction Set (EIS). It also runs on Micro/RSX systems that are configured with either KEF11-AA floating-point chip option or the FPF11 dot floating-point processor card. PDP-11 PASCAL/RSX uses FCS for file I/O and supports sequential or direct record access, plus fixed-length or variable-length records. PDP-11 PASCAL/RSX supports many RSX features, including cluster libraries and I and D space separation, and it provides access to the RSX executive directives.

For more information, please refer to:

- *SPD 14.18 for RSX-11M-PLUS and RSX-11M*
- *SPD 18.07 for Micro/RSX.*

BASIC-PLUS-2

BASIC-PLUS-2 is a high level software implementation language derived from the original Dartmouth BASIC. Like the original, BASIC-PLUS-2 is a highly approachable language with an interactive user-interface, online help text, and simple English-like language elements. Unlike many other BASICs, though, BASIC-PLUS-2 is a compiled language with modern block-structured programming constructs, sophisticated file access methods, and a host of program development tools aimed at increasing programmer productivity. This combination makes BASIC-PLUS-2 practical for a wide range of uses, from developing data processing applications to training new programmers. Also, since BASIC-PLUS-2 is a close subset of VAX BASIC, the two languages can be used together in projects with a mix of PDP-11 and VAX systems. BASIC-PLUS-2 provides sequential, relative, indexed, and Record File Address (RFA) file access via the RMS Record Management System. Other features include a RUN command that allows immediate compilation and execution of the program currently in memory, a LOAD command that places previously compiled BASIC-PLUS-2 modules in memory for use by RUN, immediate-mode program debugging statements, the ability to omit line numbers and use mnemonic statement labels, and 31-character variable and constant names.

For more information, please refer to:

- *SPD 14.11 for RSX-11M-PLUS*
- *SPD 14.54 for RSTS*
- *SPD 18.06 for Micro/RSX*
- *SPD 18.09 for Micro/RSTS*
- *SPD 40.23 for PRO/Tool Kit*

BASIC-PLUS/RT-11

BASIC-PLUS/RT-11 is an interactive, incremental compiler operating under the RT-11 operating system that uses simple English-like statements and familiar mathematical notations to perform operations. The BASIC-PLUS compiler produces a compact pseudocode that is interpreted by the runtime system. Being an incremental compiler, it checks each program line for syntax errors and immediately returns an appropriate message if an error is found.

BASIC-PLUS/RT-11 is a follow-on version to BASIC-11/RT-11. Its significantly enhanced features and functionality make it an appropriate choice for users in the technical development and educational markets.

For more information, please refer to *SPD 12.05.*

Chapter 4
Services and
Publications

Services

Introduction

With the implementation of a one-year hardware maintenance warranty on all hardware products, effective March 1, 1987, Optimum Service Packages are no longer required to meet the first-year needs of a customer purchasing a new system. The Startup Package component of Optimum Service now becomes the primary service package for new system sales. It includes all the remaining elements of Optimum Service Packages except hardware maintenance.

Startup Service

Digital Services combine an integrated set of services to provide consistent, comprehensive support for the software and training needs of our end user customers. Startup Services is part of a program that provides integrated services for the life cycle of a customer's system. Our most satisfied customers are those who have purchased the highest level of service from the leading provider of comprehensive service solutions, and the Startup Service program provides the highest level of support services from Digital to ensure success.

Software Services

Startup Packages provide customers with the support necessary to successfully install, operate, and maintain software during the first year. Startup Service includes the following (most dependent Digital products are eligible):

- Media and documentation for software licenses purchased with the system.
- Concurrent installation of the operating system and dependent products.
- DECstart Services that provide startup consulting service for system orientation, documentation review, system management, direct assistance, and hands-on experience with system operation and setup.
- DECsupport or Basic Service for Software covering the operating system and dependent products for one year.

Educational Services/Training

The training component consists of a DECplan account with a specific amount of training dollars used to purchase training appropriate to a customer's needs.

Services	Startup Services (Recommended Solution)
Software	Startup Package Level III Software media and documentation Software installation DECstart Plus DECsupport Service for Software, 12 months
Training	DECplan Training Account

Startup Packages

For customers buying new systems, Startup Packages have been configured to provide customers with the support necessary to successfully install their software, learn to use the system effectively; and maintain their software during the first year.

Digital offers three comprehensive Startup Packages. Each service package provides training (available immediately upon purchase), DECstart where applicable, and one year of service for the operating system and eligible dependent software.

These packages are priced at the system; that is, they cover all eligible Digital licensed software operating on a particular system at no additional charge. Prices are targeted to be less than the sum of the service pieces for typical software configurations. Also, Startup Packages are eligible to participate in the DBA discount structure.

Startup Package III

Package III is the recommended solution for providing technical assistance and training to get system users off to quick and productive starts. It contains the most comprehensive full year of service support for operating systems and dependent software.

Startup Package II

Package II is appropriate for a customer's technical staff who have the time and the resources to support the new system after Digital has trained the staff, installed the product, and oriented the staff concerning basic system operation.

Startup Package I

Package I is appropriate for a technical staff requiring minimal training and having the time, resources, and skill to install and support the new system. Digital provides telephone advisory support and media updates to maintain the software at its most current level.

Package III	Package II	Package I
SPS DECsupport Service	SPS Basic Service	SPS Basic Service
Initial Media/Documentation	Initial Media/Documentation	Initial Media/Documentation
Training	Training	Training on selected systems
DECstart Plus	DECstart	
Software Installation	Software Installation	

Startup Package Components
Installation Component

Installation covers the operating system and qualified dependent products installed concurrently. Some communications products are exceptions to the courtesy installation and will carry additional installation fees. Software Product Descriptions indicate installation specifics. Dependent products installed at a later time will incur the normal add-on and travel charges.

Media and Documentation Component

Media and documentation are provided with the service package of the operating system and qualified dependent products purchased with the system at no additional charge. Software products purchased for a system at a later time will require the customer to purchase the appropriate documentation and media kit, if desired.

Training Component

In most Startup Packages, customers will receive an amount of training dollars and a DECplan account from Digital's Educational Services. This enables customers to choose the training solution that meets the educational needs of their organization.

A DECplan account representative will provide customers with assistance in determining the most beneficial ways to allocate their DECplan dollars and purchase the training to meet their needs.

The training component in certain packages contains a specific educational product (e.g., a Computer-based Instruction course, a Digital Press book, etc.)

A DECplan account can also be initiated any time training is purchased in advance from Educational Services. Customers always have the option of purchasing/prepaying for additional training at discount rates.

Service for Software Component

Service for software agreements covers the operating system and dependent products for one year commencing with the installation of the operating system. Dependent products installed at a later date will be covered for the period remaining on the operating system service agreement.

DECstart Component

DECstart Services are provided with most Level II and III Startup Packages. DECstart is a startup consulting service delivered onsite to the customer's staff by a Digital Software Specialist. The service is designed to familiarize the customer with the new operating system and provide hands-on experience with system setup, management, and operations.

For those customers who need a level or combination of services that differ from the Startup Packages, all traditional software services are available in an "a la carte" manner. Packages may be augmented by purchasing additional service items.

Introduction

Software Services offers a wide range of comprehensive services to support Digital's system customers during any aspect of their system analysis, software development, or implementation efforts. These services start with the personal attention of a Digital software consultant and continue for as long as the customer owns the system.

Professional Services

Digital's Professional Services organization offers a full range of consulting services to help customers analyze, develop, implement, and productively use their Digital computer systems. These services benefit customers at all stages of a system's life cycle from planning and design, to the development and delivery of solutions through a successful system startup and user implementation. In addition, Professional Services offers productivity services such as performance monitoring and capacity planning, and migration and conversion services.

Professional Services consultants possess extensive practical experience in areas such as manufacturing, office automation, information systems, artificial intelligence, and networks.

Strategic Management Consulting Services

Strategic Consulting Services (SCS) are delivered from a centralized expertise center to assist the customer in performing specialized software design, analysis, enhancements, and performance; or in specialized training tasks and projects in complex areas of strategic or mature technologies and applications. These services include AI advisory consulting, SNA programming interface, difficult conversions, and mature product consulting.

QS850-SZ	Strategic Consultant I: AI knowledge engineer, 3NA programming interface expertise, mature products consulting, conversions consulting
QS950-SZ	Strategic Consultant II: Management consulting, information systems consulting, CIM planning, senior AI knowledge engineer
QS990-SZ	Corporate Consultant: A senior consultant who is recognized as outstanding in a particular field

Planning and Design Services

Planning and Design Services assist customers in evaluating their needs by determining the best approach to estimate the structure, systems, environment, and cost factors to provide the optimal solution. Areas of concentration include long-range growth planning, networks, office systems, and specific applications.

Network Planning and Design Services help customers construct a new network or reconstruct an existing one to meet information flow requirements based on business needs, organization structure, and operational procedures.

Office Analysis and Design Services provide critical management analysis and planning tasks that precede the implementation of an office automation system. A Digital consultant studies how each department in the customer's organization works, and determines the technology and applications that will most effectively achieve specific business goals.

Artificial Intelligence Planning and Design Services provide critical data to help customers select AI applications with the highest potential payoff and the lowest potential risks to meet business objectives.

Custom Applications Consulting and Projects

By working with customers to understand and analyze their unique computing needs and applications, Professional Services provides solutions designed for specific applications. A large-scale project could result in an entire turnkey solution; a smaller-scale project could mean the building of a new application or the expansion of an existing one.

DECstart Consulting Services

DECstart Consulting Services consists of several levels of fixed-price consulting services and automated system management tools that prepare customers to effectively use and manage their systems. They are available for all major Digital operating systems, ALL-IN-1, networks, and for some layered products.

Office Application Support Services

Office Application Support Services provide customized support and individualized onsite consulting for office staff. This includes orientation in the use of office products, support for the transition to an automated office, office procedures consulting, and training on customized applications installed on customer's systems.

Performance and Capacity Planning

Performance and Capacity Planning helps customers monitor their systems, evaluate performance, resolve problems, and make recommendations on how to optimize system utilization. Specific areas of focus are system performance monitoring and capacity planning, and network management control and DECnet monitoring.

Migration and Conversion Services

RPG Migration Assistance Service assists in the organization, planning, and implementation of the conversion of RPG source programs, data files, and command procedures from IBM System/3, System/34, or System/36 environments to the Digital VAX environment.

Conversion services enable customers to move from one operating system to another or from other vendors' software to Digital's.

Networking Services

Software Product Service agreements apply to Digital's software networking products.

Personal Computer Services

For large installations, PC services can be tailored to a Master Service Agreement for multiple systems.

Supplementary Service

SPS provides service options supplementary to systems already under a service agreement.

Media Update Service

The Media Update Service is a subscription service that provides SPS customers with a means of obtaining additional copies of the machine readable media provided with a service agreement for most 16- and 32-bit operating systems and dependent products. Customers may elect their choice of available distribution medium for additional systems. A prerequisite for this Service is that customers have a DECsupport, Basic, or Self-maintenance Software Product Services agreement with Digital.

Documentation Update Service

The Documentation Update Service supplies service customers with additional copies of the documentation portion of a Software Product Services contract. This service is available for most Digital 16-, 32-, and 36-bit products that offer DECsupport, Basic, and Self-Maintenance Service for Software. The documentation provided is the same as that delivered with the service contract.

Service Right-to-Copy

This option allows customers with a Software Product Services agreement to automatically copy updates to the product under an SPS agreement onto a single, additional CPU.

Additional Telephone Support Center Contact Service

This service allows customers who have a Basic or DECsupport Service agreement to add names to the list of people entitled to call Digital's Customer Support Center.

Additional Software Dispatch Subscription Service

Customers who have a Digital Software Product Services agreement can obtain an additional copy of dispatches and technical newsletters supplied under the agreement.

Service Bureau Services (Timesharing)

- Enhanced Application Network Services combines terminals/micros, customer systems, Digital's timesharing systems and our nationwide network into an integrated application that is delivered nationwide.
- Hardware/Software Evaluation Service makes available the VAX and their associated software for customer evaluation delivered via our nationwide network.
- Project Resource Services provides VAX computing resources and associated software delivered via nationwide network for major Software Services professional consulting projects.
- Incremental Computer Resources provides VAX computing resources delivered via our nationwide network for special customer needs such as peak load processing.

Disaster Back-up Services

Back-up and disaster recovery services allow customers to anticipate and plan for disruptions involving their computer facilities, and to continue processing critical applications at computer facilities other than their own.

- RESTART-Disaster Back-up Services for VAX computing resources available within hours for emergency processing.
- Disaster/Plan-80-A contingency planning methodology available to assist customers in developing their own contingency plan.

Facility Management Services

- A long-term customized/dedicated packaging of service offerings consisting of computing resources and operational staff available on the customer's site or Digital's. Facility Management Services will free customers from the need to develop operations resources to support information systems.

Introduction

Digital's Field Service organization supports Digital customers with more than 22,000 service professionals in over 450 locations worldwide, providing both hardware and software maintenance service. Supporting every Field Service office are the resources to provide back-up materials and technical support whenever needed. These include vast parts inventories, a computerized logistics network, customer support centers, and technical specialists at the district, area, and headquarters levels.

Agreements for VAX Customers

Field Service offers a wide variety of services through various contractual and non-contractual arrangements. For VAX customers, Field Service offers DECservice and Basic Service Agreements.

DECservice Agreement

Our onsite service agreements are available with coverage for 8 to 24 hours a day for up to seven days a week. Digital's most comprehensive onsite service includes a written commitment to respond to your call for service within a specified time: within two hours for VAX 8800, VAX 8700, VAX 8650, VAX 8600, VAX 8550, and VAX 8530, and within four hours for all other hardware, provided your site is within 50 miles of a Digital Service Branch. Once a service representative is onsite, repairs are made quickly and remedial work will continue until your system is operational again. Automatic "problem escalation" is also part of the DECservice Agreement, drawing upon back-up support as required to achieve timely repairs.

Scheduled preventive maintenance, parts, labor, and materials are provided under the DECservice Agreement. Under this agreement, Digital will install the latest engineering modifications to keep equipment up to date. In addition, a field service representative is assigned responsibility for your system's maintenance and remedial service, and a comprehensive site management guide is provided at your site.

Basic Service Agreement

If you do not require a fixed response time and continuous remedial efforts, Field Service also offers a Basic Service Agreement. Basic Service typically provides next day response and continuous effort of repair during coverage hours (8:00 A.M. through 5:00 P.M., Monday through Friday). Problem escalation, preventive maintenance, parts, labor, materials, installation of engineering modifications, assigned service representatives, and a comprehensive site management guide are also provided.

Remote Diagnosis

Remote Diagnosis (RD) is an integral part of the standard VAX systems coverage. When hardware problems occur, Digital's Remote Diagnosis provides your system with fast, accurate diagnostic capability from one of Digital's Remote Diagnosis Centers. Customers may call the Digital Diagnosis Center at any hour, on any day to report system problems or outages. Typically, in less than fifteen minutes from the time the problem is reported, diagnostics have begun. Digital's Remote Diagnosis pinpoints system failure to the device level and often determines faulty operational factors over the phone so the system is up and running without the need for an onsite service visit. When onsite service is required, the right Field Service Specialist with the right parts is dispatched in a minimum amount of time. To make use of this service, customers provide a direct-dial phone line in their computer room. Domestic phone connection is via an FJ11-C voice-grade jack; for both Europe and Canada the customer provides a Bell 103-type (or equivalent) full-duplex, low-speed modem and the associated voice grade telephone line.

Software Product Services

Digital's Software Product Services (SPS) organization provides advisory, preventive, and remedial service to help customers before, during, and after software installation. These services include Startup Packages for the first year of a new system and ongoing support to keep software up-to-date and running smoothly.

Service Agreements

For customers requiring ongoing support there are DECsupport, Basic, and Self-Maintenance annual service contracts.

DECsupport Service for Software

DECsupport is the ideal solution for maximum user productivity and system utilization. It provides high-level personalized advisory support and saves customers the time and associated costs of doing their own routine software maintenance and installation of updates and also provides critical onsite assistance when required.

Basic Service for Software

Basic Service is designed for customers who have the time, technical expertise, and resources to maintain their own systems, but who need highly responsive answers to questions or problems crucial to their business. Basic Service provides access to software specialists and online applications.

Self-Maintenance Service for Software

Self-Maintenance is for customers who have highly technical staffs with the time and resources to maintain their own system software and who require only updates and written communication channels with Digital.

DECsupport	Basic	Self-Maintenance
Installation of Updates		
Preventive Maintenance		
Remedial Support		
Telephone Support	Telephone Support	
Digital's Software Information Network	Digital's Software Information Network	
Software Media and Documentation Updates	Software Media and Documentation Updates	Software Media and Documentation Updates
Technical Newsletters	Technical Newsletters	Technical Newsletters

Service Agreement Components

Digital installation of new software releases and interim updates for all operating system and dependent products under contract are Service Agreement Components.

Installation of Updates

Products may be installed centrally by a Customer Support Center Specialist assigned to the customer's account or installed onsite by a local Specialist. Central delivery advantages include fast installation pretested to the customer's unique system configuration and scheduled at a time that is convenient. Central delivery is available on applicable products and scheduling is subject to the approval of the Customer Support Center (CSC).

Remedial Support

Remedial support includes remote diagnostics, fault isolation and correction of problems with installations of solutions or workarounds. Onsite Remedial Support is available during contracted hours of coverage for problems which cannot be resolved by telephone and, which by mutual agreement, are critical.

Telephone Support

Toll-free advisory assistance is provided by Digital's Customer Support centers 24 hours a day, 7 days per week for most Digital operating systems.

Digital's Software Information Network

Customers may access this easy-to-use service database for software information. Flash messages alert the user to any high-impact software problems and their timely solution.

Software Media and Documentation Updates

The customer automatically receives new software releases and interim updates with corresponding documentation for all operating system and dependent products under contract.

Technical Newsletters

Technical newsletters and dispatches contain information about new software developments and enhancements, programming notes, and documentation updates.

Special Services
VAXcluster Services

These services are cluster-level services especially designed for interactive computing needs. They are VAXcluster Startup and ongoing services. There is a fixed price for each cluster, plus a per nod charge.

Cluster services are:

- VAXcluster Startup Packages II and III for new customers
- VAXcluster Startup Packages II and III for current VMS customers converting from stand-alone VAX systems to VAXcluster
- VAXcluster DECsupport and Basic Agreements
- VAXcluster Software Installation
- VAXcluster DECstart Services

Software Product Services for Resellers

The reseller programs allow resellers to offer improved system support while channeling more time and resources into product development and marketing.

The programs combine the reseller's market and application knowledge with Digital's strength in production, distribution, and centralized customer support. There are two major programs: Tailored Service and Sell-through Service.

Tailored Service

Tailored Service is designed for OEMs who provide most of the end user's support themselves. Under this agreement, the OEM can delegate certain routine services to Digital, freeing its own staff and resources for more profitable tasks. The details of the program depend upon the OEM's particular needs.

Tailored Service options include priority shipment of software updates to OEMs; media updates produced and shipped by Digital; layered-products-only support for end users; 24-hour telephone support for both OEMs and end users; and marketing support for the OEM.

Sell-through Service

Sell-through Service allows OEMs and Authorized Digital Distributors to offer full software support on Digital's products without having to maintain a large service organization. Digital will provide support services directly to the reseller's customer according to the terms of a service agreement by the OEM.

Digital offers a financial incentive to the reseller for each service agreement sold, both for initial sales and for renewals. Digital will also provide the reseller with practical assistance in the sales effort, including a direct telephone line for answers on pricing, order preparation, and other service questions.

A La Carte Options

The availability of these supplementary options for single and multiple systems may vary by country. Customers should contact the nearest Digital sales or service office for information on availability.

Installation Service

The purchase of installation as a separate service is appropriate in those instances in which there is no need to purchase a Startup Package or there is a need to have add-on dependent products installed. Installation Service ensures that customers have received all of the proper distribution materials and ensures that the system generation process for the operating system and/or dependent software products is completed.

End User Advisory Services

This application support is system level targeted for end users. Levels of service available are Startup Package I, telephone advisory and update service, and stand-alone update service. Applicable software products are A-to-Z and MDAS.

Development Service Large Systems Marketing

This service is targeted to the OEM and small-business customer developing application around A-to-Z or DECtap. DECsupport, Basic, and Self-Maintenance Startup Packages are available.

Further detailed information on specific Software Product Services is available from your local SPS Business Account Specialist (BAS). The U.S. SPS Sales Hotline, DTN 292-2300, is available to answer internal sales questions.

DECstart Services

All DECstart Services may be purchased a la carte as well as in a Startup Package. In particular, there is an option to upgrade the DECstart component in Startup Package Level II to a DECstart Plus Service if desired.

Customer Training Programs

Digital's Educational Services organization offers a wide range of high-quality instructional programs and courses, enabling customers to make the most effective use of their training dollars before, while, and after their systems are installed. Comprehensive educational curricula are available in a selection of course formats: seminars, instructor-led training, audiovisual courses, onsite training, self-paced instructions (SPIs), and computer-based instruction (CBIs). Customers may select the format, program, or delivery mechanism that best matches their training needs.

Technical and Management Seminars

Technical and Management Seminars are designed for data processing professionals and managers as well as for nontechnical personnel. Seminars, enabling students to understand data processing and to focus on the newest technologies, can be delivered at the customer's site, at a local Digital Training Center, or in a hotel conference facility.

Instructor-led Courses

Instructor-led courses provide classroom lectures combined with hands-on experience in system or application software at one of Digital's Training Centers or onsite at the customer's facility. Students benefit from the expertise and personal attention of an expert instructor as well as from classroom interaction with other course participants.

Self-paced Instruction

Self-paced instruction offers self-contained modular instructional units, exercises, and texts, enabling students to select specific topics necessary for their job requirements. SPI course content is often comparable to the content of Digital's Instructor-led Courses; with SPI, however, customers can learn at their own site, at their own pace. Digital offers SPI instruction and computer-based instruction.

Computer-based Instruction

Computer-based instruction is a series of "packaged courses" that allows training to be presented online, combining study from text or workbook and interactive dialog with the student's computer. Students can learn at their own pace, scheduling CBI instruction around their work needs, and can conveniently access these courses, which are provided on magnetic tape or on diskette.

Interactive Video Information System (IVIS)

Interactive Video Information System (IVIS) is a powerful, integrated hardware and software training tool. Digital's IVIS combines the computing power of the Professional 300 Series computer with high-resolution video, dual-channel audio, sophisticated graphics, and text resulting in a versatile, dynamic learning workstation.

Digital Press

Digital Press, the publishing entity of Digital's Educational Services group, produces practical, timely books for today's computer community. The Press serves the computer professional and academic and business communities with publications on computer related subjects that appeal to the general interests or the specific needs of these communities.

Written by leading authorities and practitioners in the computer field, Digital Press books provide accurate, up-to-the-minute information on computer technology. They address the real-world interests of computer professionals including managers, programmers, system designers, and business users, and they meet the academic needs of students as well as instructors. No matter what their computer interests are, readers find Digital Press's books useful and stimulating.

Information on ordering through Digital Press can be obtained by calling 1-800-343-8321.

Onsite Training

Seminars and instructor-led courses can be delivered at customer sites, particularly for customers with large-scale and multiuser training needs. Onsite instruction provides the added benefit of allowing users to learn one subject or more, together with their colleagues, on their own systems(s).

Adaptive Learning Solutions

Adaptive learning solutions provides custom training programs in a number of subject areas. Designed to increase productivity and to reduce human resource development costs, these programs usually include Digital's Interactive Video Information System (IVIS) or Digital's Computer-Based Instruction (CBI). Experts also consult with customers to determine their training or information needs and to help them create and maintain their own courseware, inhouse.

VMS courses are offered worldwide (except for seminars, which are currently offered in the U.S. only). Customers investing in VAX/VMS Version 4.0 can benefit from a variety of new VMS courses, each aimed at specific audiences from first-time users of VMS to advanced Version 3 users who are upgrading to Version 4. Existing customers already familiar with VMS Version 3 may purchase training that concentrates only on the new features of Version 4 and how to upgrade to the new version quickly and efficiently.

Further information on the complete VMS Version 4.0 curriculum can be obtained from your local Digital Sales Representative, or from your local Digital Training Center. For information on seminars and instructor-led courses, call your local Educational Services registrar in Bedford, MA at (617) 276-4949. To order CBI or SPI courses, call 1-800-343-8321 (outside the state of Massachusetts) or 1-800-462-8006 (within Massachusetts). For information about CBI or SPI courses, write to:
Digital's Training and Information Products Group
12A Esquire Road
North Billerica, MA 01862

VAX/VMS and ULTRIX-32 Software Training Lecture/Lab and Seminar Training

Comprehensive training schedules are available in our quarterly publication *DIGEST: Digital Educational Services Today*. To register for seminars registrar at (617) 276-4949. For further information, write to:
Seminar Programs
Educational Services
Digital Equipment Corporation
12 Crosby Drive BOW/E58
Bedford, MA 01730

Leasing Services

As part of Digital's total solution, the U.S. Customer Finance organization provides financing and leasing alternatives for customers who choose not to purchase Digital's products on a cash basis. Whether our customer is responding to budgetary limitation or prefers to preserve cash and bank lines for other purposes, Customer Finance can facilitate the acquisition of Digital's products.

Programs

- Master Lease—A convenient arrangement that supports the delivery of equipment over an extended period of time. Each delivery (Lease Schedule) can be tailored to the Lessee's specific needs, e.g., fair market value option or prenegotiated option.
- DEClease™ —A simple-to-use lease contract that will support single delivery leasing needs. Step-by-step instructions are provided for both Digital's personnel and customers.

Plans

- Tax-oriented Leases—Leases that use tax benefits and residual values in their pricing mechanics. Terms range from 2 to 5 years. The Title remains with the Lessor and the equipment can be purchased from the Lessor at its fair market value at the end of the term. This plan is extremely price sensitive.
- Lease with Option to Purchase—Leases that normally include a prenegotiated purchase-option. Tax benefits often flow to the Lessee. Terms range from 2 to 5 years. The Title remains with the Lessor until the purchase option is exercised.

Customers Supported

- State and Municipal Subdivisions
- Commercial (for profit businesses)
- Nonprofit (Hospitals, Associations, Private Educational Institutions)
- Federal Government
- Prime Contractors

Field Support

Customer Finance Managers are conveniently located throughout the country. They work with customers and Digital account managers in developing financial strategies which best meet customer needs. For more information, please contact your Customer Finance Manager or call 1-800-322-3239 (within Massachusetts).

Digital's Electronic Store

The Electronic Store is a free online computer service that helps customers evaluate, select, and purchase products online. The Store offers quick, easy shopping for Digital products such as VAXstations, personal computers, microcomputers, software, tapes, disks, terminals, printers, environmental products, accessories, and supplies. The Store is a simple menu-driven system requiring no expertise or training.

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Literature/Expansion Products Reference Guide

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The *Large Systems Marketing's Software Referral Catalog* is updated and printed yearly, with the LCG Applications Update printed periodically between editions of the complete catalog. The catalog currently contains over 400 software product descriptions. Many of the packages listed in the *Large Systems Marketing's Software Referral Catalog* have versions that run in the VAX family of computers, either under the VMS or UNIX™ operating systems, and future editions will include additional VAX software.

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Marlborough, MA 01752

Literature/MicroPDP-11 Manuals

MicroPDP-11 User Manuals

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To order these documents, write:

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Realtime Systems and Options Catalog
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1988 January – March

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