



HEWLETT
PACKARD

MICRO 16

**NEW ENTRY LEVEL
A-SERIES COMPUTER**



FIELD TRAINING MANUAL

Internal Use Only

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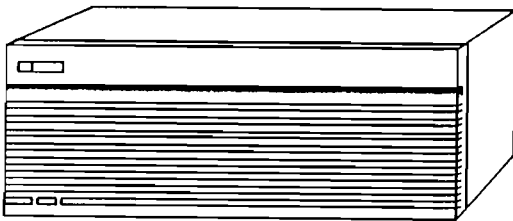


SALES BRIEF

Micro 16 Computer and Micro 16 Plus Bundle

The following sales brief is designed to outline key points contained within this Field Training Manual. READ THIS PAGE IF YOU DON'T HAVE TIME TO READ THE ENTIRE FTM. We do recommend that you thoroughly review the FTM at a later date, though, as not all points are covered in detail here. Keep this page with you as a quick reference.

Description



- * Entry level A-Series computer
- * Priced 20% - 30% lower than Micro 26
- * New package for A600+ CPU
- * Available with 1/2MB or 1MB of memory (expandable)
- * 4 available I/O and memory slots

Benefits

- * Low price
- * Rugged for harsh environments
- * Low support costs

Applications

- * Workcell Control
- * Process Control
- * Data Communication Gateway

Product Limitations

- * Not a "system" product
- * No support of integrated A/D - D/A cards
- * No support of integrated HP-IB Extender
- * Uses uninterruptible power supplies rather than battery backup cards
- * Does not support I/O Extender
- * Maximum memory of 6MB, not 8MB

ORDERING

The Micro 16 can be ordered as a component level product or as a bundle (Micro 16 Plus).

Component Product Ordering

2426E = A600+ CPU with 1/2MB of parity memory and RTE-A execute only
\$5,400 U.S. list
\$5,364 Factory base

2426F = A600+ CPU with 1MB of ECC memory and RTE-A execute only
\$7,400 U.S. list
\$7,364 Factory base

Micro 16 Plus Bundle

2456A = 2426E
+ 12040C 8 channel MUX
+ 12009A HP-IB interface
\$7,015 U.S. list

Opt. 001 = Deletes 2426E (1/2MB memory)
Adds 2426F (1MB ECC memory)
\$2,000 additional

Opt. 002 = Adds ** 9134L 40MB Disc
\$3,550 additional

Opt. 003 = Adds 7945A 55MB Disc
\$5,300 additional

Opt. 004 = Adds 9144A 1/4" Tape backup
\$2,600 additional



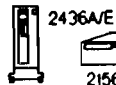














Opt. 015 = Adds 220V for 7945A
\$0 additional

** Note 9134L requires RTE-A 4.0 available April 1, 1986. Also, the 9134L is currently only available as a U.S. version in this bundle.

SALES BRIEF

New Entry Level A-Series Computer

HP 1000 BUILDING BLOCKS

PROCESSORS	A600+ - Double precision floating point firmware - Memory to 8MB-ECC/par - 0.4 MIPS - 50 Kflops	A700 - Microprogrammable - Optional hardware fltg. point - Memory to 8MB - Optional error correcting memory - 0.4 MIPS - 225 Kflops	A900 - Microprogrammable - Hardware floating point - Cache memory - Memory up to 24MB - ECC - 1.3 MIPS - 560 Kflops		
BOARDS	2106BK 				
BOXES	 2426E/F  2436A/E  2156B	 2437A  2137A	 2439A  2139A		
SYSTEMS	 2486A  2196D  2196C	 2487A  2197D  2197C	 2489  2199D  2199C		
SOFTWARE * Same software on all A-Series. * Processor-based pricing.	OPERATING SYSTEMS RTE-A VC+	TOOLS Datapar Graphics/1000-II Symbolic Debug Image/1000 Image/1000-II System Diagnostics Peripheral Diagnostics Microprogramming (A700 + A900) Control/1000	LANGUAGES Basic/1000 Pascal/1000 Fortran 77	DATA COMM DS/1000-IV NS/1000 DSN/X.25 MRJE/1000 RJE/1000-II Advanced Link PMF/1000 (to IBM)	APPLICATIONS PMC/1000 GIS/1000 QDM/1000 PCIF/1000
INTERFACE and ADD-ON CARDS	SERIAL Asynch Serial 8-Channel Multiplexer Multi 8-Chan Mux Programmable Serial Multi PSIF (Modem) PARALLEL Parallel I/F HP-IB I/F	SPECIALS 2Mb PROM w/VCP Loader Event Sense (w/time tagging) Watchdog Timer & Time-of-day Hi-Speed FIFO Buffered Parallel I/O Programmable Parallel (TTL) I/O Programmable Control Store 8-Chan MUX w/Asynch & Sync capability & Modem Control Differential Parallel Bidirectional DATA COMM DS/1000-IV Modem - HP1000 DS/1000-IV Dir Conn - HP1000 Data Link Slave DS/1000-IV Modem - HP3000	ADD-ONS PROM Storage Module Breadboard Extender Priority Jumper Battery Backup Color Video Output A700 Writable Control Store Battery Backup for Micro/1000 A700 PROM Control Store DATA ACQUISITION Hi-Level Analog Input Expansion Multiplexer Analog Output Digital I/O	ADD-ONS A700 H/W Fl. Pt. Proc. Battery Backup for 20 Slot Pack 25KHz Power Module for 20 Slot 25KHz Power Module for 14 Slot Control Store for A900 A-Series Microprocessor System Loop Controller for A-Series HP-IB Extender Integral Modem fbnlibk:so figbidg:so	

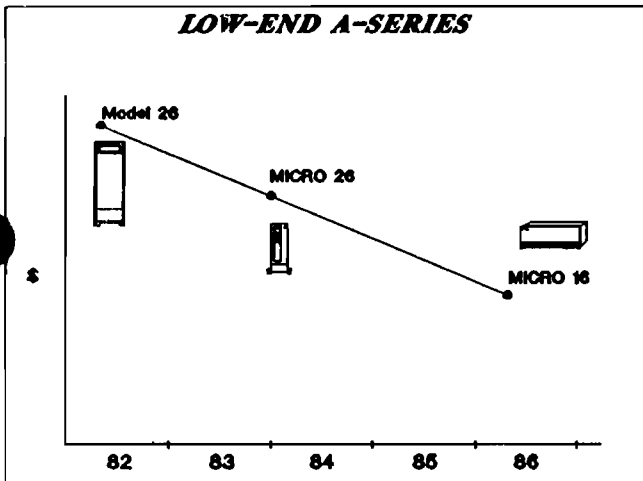
PRODUCT DESCRIPTION

MICRO 16 is the new entry level product for the HP1000

Designed for Low End Applications

The Micro 16 represents a new entry level product for the A-Series family. It is designed for price sensitive applications where fast response to time critical events is required. The Micro 16 is based around a new, smaller and more hardened package, along with the A-Series' most popular CPU, the A600+.

The Micro 16 was developed in response to the many customer requests for a "micro" A-Series computer that could be used for simple control functions and would be priced much less than existing products.

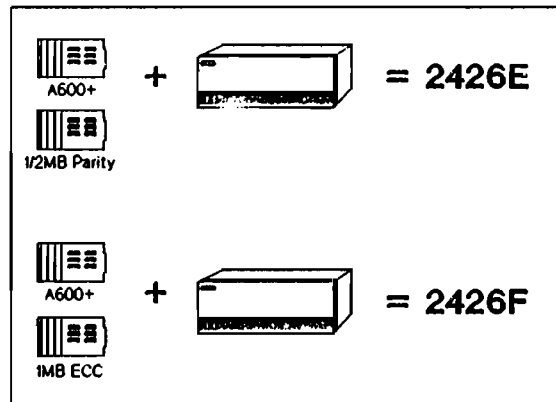


New Low Price

The Micro 16's entry level "box" price is \$5,400, \$1,200 less than any other A-Series box computer. Plus, a bundle of core products (CPU + I/O cards, discs, and tapes) has been created to offer even more attractive pricing and easier ordering for entry level applications. Ordered as a bundled product, the Micro 16 is priced 15-30% less than current A600+ computers.

Component Level Product

The Micro 16 consists of an A600+ two board CPU set in a new six slot package, leaving 4 slots available for interface cards and additional memory array cards. Two base level products are available: one configured with a 512kB parity memory and memory controller as part of the CPU (2426E), and the other configured with a 1MB error correcting memory and memory controller (2426F). See the Ordering Information section for more details on how to configure a solution for your customer and additional pricing.



HP1000SP
Class 1

FEATURES AND BENEFITS

NEW LOW-END A-SERIES COMPUTER



MICRO 16 FEATURES AND BENEFITS

- * Improved Environmental Specs - Operates in harsher locations
- Does not need a "computer" room
- * Smaller Size (325mm wide) - Lower price: racks with all low cost peripherals and cabinets
- * Higher Reliability - Lower support costs
- More "up time"
- * A-Series Compatible Backplane - Uses all existing A-Series I/O cards and memory (except battery backup and 25kHz)

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Improved Environmental Specifications - the Micro 16 package has been designed to be used in harsher environments than many other computers. The comparison below shows how these improvements beat the competition's "rugged" computers.

COMPARISON OF RUGGEDIZATION			
SPECIFICATION	Micro 16	Micro 16 Improvement Over	"Ruggedized" PC
Temperature	0 - 60 degrees C 32 - 140 degrees F	23%	0 - 49 degrees C 32 - 120 degrees F
Humidity	5% - 95%	25%	8% - 80%
Shock	1.5g at 9ms (continuous) 7.0g at 9ms (infrequent)	200%	0.5g at 10ms
AC Input	86 - 140 VAC	135%	104 - 127 VAC

Smaller Size - The Micro 16's form factor (325mm wide x 205mm high x 495mm deep) was designed to be compatible with all of HP's low cost mass storage peripherals allowing new ways to rack a total system. All the new "desk height" cabinets from Direct Marketing Division (DMK) may be used including:

- 92211R - \$550
- 92211L - \$195
- 92211M - \$165

As well as the typical 19" cabinets:

29431G - \$3000

29451-29454 Rosebud cabinets

*Note the 19" rack mount kit will be available June 1, 1986.

See the Ordering Information section for more details on how to rack the Micro 16.

Reliability - The Micro 16's unique cooling system design forces more air over cards in the package keeping the components cooler (hence, the R&D name was "Cooler"). This significantly increases the reliability, because cooler components equate to lower failure rates. This results in lower support costs and greater up time for the customer. We estimate that the Micro 16 is 55% more reliable than any previous A-Series computers (which already have a proven reputation for reliability).

A-Series Compatible Backplane - the Cooler package is compatible with all A-Series interface cards and add-on cards (except battery backup and 25kHz cards). Also, all customer designed interfaces, using the breadboard interface or programmable serial interface for example, will function *without modification* in this package.

WHERE TO SELL

A Natural for New Applications in Existing Accounts

As with any new product in a family, the biggest potential for sales comes from new business in existing accounts. The Micro 16 offers many opportunities for new business.

Third Parties

The Micro 16, with its lower entry level price, allows third party customers to address new, price-sensitive markets. By subsetting or simply repricing their software, and utilizing the Micro 16's hardware, they can have a solution with all the power of an A-Series at a much lower price.

Our third party accounts often feel competitive pressure before our major accounts do and they have been the biggest supporters of the Micro 16.

(While you're talking to these third parties, ask if they need a development system for a programmer at a remote site OR a development system for one or two programmers. The Micro 16 is perfect for a small, software development station!)

Major Accounts

The Micro 16 offers an opportunity to obtain new business in existing accounts. These customers know the power and flexibility of RTE-A, and will be interested in using a new family member in a new application. Talk to customers using the A-Series for automatic test, and also interest them in using the Micro 16 for data acquisition and control of their manufacturing process. Those using the A-Series in their pilot plants may be interested in using it in their actual process.



WHERE TO SELL

Typical Applications

Process Control

The Micro 16 is an excellent entry level controller for a process control application. Especially suited to a process lab or pilot plant, its low cost, small form factor, compatibility with the higher performance A700s and A900s, and real-time operating system make it an ideal fit to control and modify a pilot process. And don't forget about our third party software for the process industry. See the Solutions for Process Industries brochure (P/N 5954-6754), or the third party catalog for more information.

Customers that are already interested include a pharmaceutical manufacturer on the east coast, a third party with a waste water treatment system in the Midwest, and a chemical company in the east.

Data Communication Gateway

The Micro 16 is an excellent fit for a data communication gateway because of its open system, real-time capabilities, and small size. The Micro 16 today supports 802.3, DS/1000, X.25, MRJE, RJE, and Data Link protocols. If your customer needs a different protocol, there are many third party solutions available, or it can be implemented in custom hardware and/or software.

Remember that manufacturing account where they wanted to integrate their XXXX brand of computer into their CIM hierarchy? Use the Micro 16 as a gateway to allow integration into the manufacturing process.

Workcell Control


















The Micro 16 can be configured as an entry level workcell controller for customers that have simple control needs. The Micro 16 can connect to a variety of devices on the factory floor (over 34 types of HP supported interface and add-on cards) and can collect information from all devices simultaneously using its multi-tasking, real-time operating system. It also has been designed to meet the harsh environments of the manufacturing floor, and allows for growth (can move applications to the A700 or A900 computers).

Pair the Micro 16 with PCIF software for an entry level workcell controller.

WHEN TO SELL

A-Series Family

HP 1000 BUILDING BLOCKS

PROCESSORS	A600+ - Double precision floating point firmware - Memory to BMB-ECC/par - 0.4 MIPS - 50 Kflops	A700 - Microprogrammable - Optional hardware fltg. point - Memory to 8MB - Optional error correcting memory - 0.4 MIPS - 225 Kflops	A900 - Microprogrammable - Hardware floating point - Cache memory - Memory up to 24MB - ECC - 1.3 MIPS - 560 Kflops		
BOARDS	2106BK 				
BOXES	 2426E/F  2436A/E  2156B	 2437A  2137A	 2439A  2139A		
SYSTEMS	 2486A  2196D  2196C	 2487A  2197D  2197C	 2489  2199D  2199C		
SOFTWARE	OPERATING SYSTEMS RTE-A VC+	TOOLS Datapair Graphics/1000-II Symbolic Debug Image/1000 Image/1000-II System Diagnostics Peripheral Diagnostics Microprogramming (A700 + A900) Control/1000	LANGUAGES Basic/1000 Pasca/1000 Fortran 77	DATACOMM DS/1000-IV NS/1000 DSN/X.25 MRJE/1000 RJE/1000-II Advanced Link PMF/1000 (to IBM)	APPLICATIONS PMC/1000 GIS/1000 QDM/1000 PCIF/1000
INTERFACE and ADD-ON CARDS	SERIAL Async Serial 8-Channel Multiplexer Multi 8-Chan Mux Programmable Serial Multi PSIF (Modem)	SPECIALS 2Mb PROM w/VCP Loader Event Sense (w/time tagging) Watchdog Timer & Time-of-day Hi-Speed FIFO Buffered Parallel I/O Programmable Parallel (TTL) I/O Programmable Control Store 8-Chan MUX w/Async & Sync capability & Modem Control Differential Parallel Bdirectional	ADD-ONS PROM Storage Module Breadboard Extender Priority Jumper Battery Backup Color Video Output A700 Writable Control Store Battery Backup for Micro/1000 A700 PROM Control Store	A700 H/W Fl. Pt. Proc. Battery Backup for 20 Slot Pack 25KHz Power Module for 20 Slot 25KHz Power Module for 14 Slot Control Store for A900 A-Series Microprocessor System Loop Controller for A-Series HP-IB Extender Integral Modem	
	PARALLEL Parallel I/F HP-IB I/F	DATAACOMM DS/1000-IV Modem - HP1000 DS/1000-IV Dir Conn - HP1000 Data Link Slave DS/1000-IV Modem - HP3000	DSN.X.25 Network LAN I/F DS/1000-IV Dir Conn - HP3000 Data Link Master	DATA ACQUISITION Hi-Level Analog Input Expansion Multiplexer Analog Output Digital I/O	

The Micro 16 is designed to be an entry level product for the A-Series family. Inputs from a number of low end A-Series customers indicated that they did not require all the functionality that the Micro 26 offered, but did need lower pricing. The following page positions the Micro 16 versus the closest A-Series member, the Micro 26.

WHEN TO SELL

Positioning within the A-Series Family

The following chart indicates the differences between the Micro 26 products and the Micro 16 products:

	<u>MICRO 16</u>	<u>MICRO 26</u>
Price		
CPU	\$5,400	\$6,600
Bundle	\$7,015	N/A
Size	205mm x 325mm x 495mm	178mm x 483mm x 648mm
Discs	External	Internal & External
Power Failure Backup	Uninterrupt. Power Supply	Battery Backup Card
Slots	4	12 - 14
Memory Max	6MB	8MB
25kHz Power	No	Yes

WHEN TO SELL

Product Limitations

Items to Watch Out For

Because the Micro 16 was designed as an entry level system, it does not support some of the functionality that other systems do support. The following is a list of items to be aware of:

System - The Micro 16 has been set up as a component and not as a system. The chart below indicates the differences between a component product and a system product.

Feature	Component	System
	Micro 16 2426E	Model 26 2196C
Site Prep	No	Yes
Installation	No	Yes
Max. Discount	39%	29%
Coordinated Delivery	No, except bundles	Yes
Warranty	90 day return to HP	90 day on site

For new customers it is recommended that they purchase a system product to obtain site preparation, on-site installation, and the 90 day on-site warranty. The Micro 16 is designed for customers that are comfortable with the A-Series products and capabilities.

Analog to Digital/Digital to Analog Interfaces - The Micro 16 does not support a 25kHz power card (P/N 12158A/12159A) as this would have significantly increased the price of the Micro 16. Since few customers currently order this card, it was deemed a low priority. Therefore, the Micro 16 does not support the following integrated A/D, D/A and Digital interface cards:

12060B - High Level Analog Input Card
12061A - Expansion Multiplexer Card

12062A - Analog Output Card
12063A - Isolated Digital Input/Output Card

When these functions are required, it is recommended that a customer purchase a data acquisition front-end such as the HP3497 or the HP3852 Data Acquisition and Control Units.

* Note that we are also investigating a solution involving multifunction data acquisition cards.

HP-IB Extender Card - Because the Micro 16 does not support a 25kHz power module it also does not support the 37203L integrated HP-IB extender card without option 001. It is recommended that a customer purchase:

- 1) 37203L with option 001 (fiber optic option which does not require the 25kHz card), or
- 2) the 37203A External HP-IB extender.

Battery Backup - The Micro 16 does not support internal battery back-up cards (P/Ns 12013A, 12154A, 12157A). However, it is compatible with Uninterruptible Power Supplies (UPSs) and System Power Supplies (SPSs) available from UPS and SPS suppliers. Appendix A contains the recommended UPS and SPS specifications. See your local site prep specialist for a supplier that would meet these specifications.

I/O Extender - The Micro 16 is designed for price sensitive applications that do not require many interface and/or memory cards. Therefore, the I/O Extender is not supported as it was deemed too costly for the Micro 16. Customers that are concerned about expanding their system should purchase the 2426F containing 1MB of memory (the higher density memory board frees a slot), or should purchase a Micro 26 with 14 expansion slots.

Memory Expansion - For customers requiring more than 1MB, it is recommended that they purchase the 2426F product, containing 1MB of memory, and add a 12111A or 12111B memory array for 1 1/2 to 2 MB of memory.



ORDERING INFORMATION

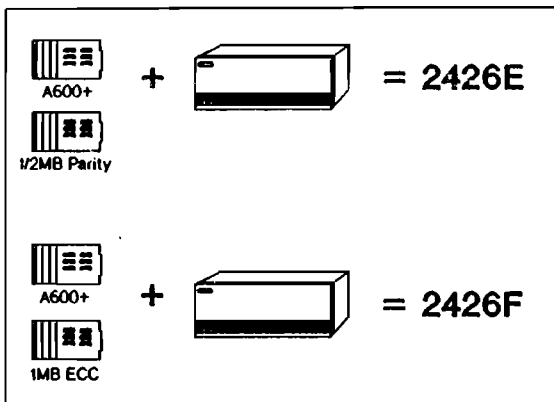
Micro 16's Product Structure

Two Ways to Order

The Micro 16 can be ordered in one of two ways, as a component level product, or as a bundled product. The bundled product (Micro 16 Plus) will usually be the preferred method of ordering as it provides the core products required for most configurations, lower overall pricing, and easier ordering. The component products will be described first as they provide the basis for the bundled product.

Component Level Products

The Micro 16 has two component level products, the 2426E and the 2426F. These products are very similar to the existing 2436E product. The only difference between the "E" and "F" products is in the amount of memory they offer and in the type of memory arrays that can be added.



The 2426E product consists of a 1/2MB parity memory and memory controller, and the A600+ CPU, leaving 4 slots available for I/O cards and additional memory arrays. Only parity arrays can be added to this product. The maximum amount of memory for the 2426E is 3MB, if only one slot is used for an interface card.

The 2426F product consists of a 1MB error correcting memory and memory controller, and the A600+ CPU, again leaving 4 slots available for I/O cards and additional memory arrays. The "F" product can use both parity *and* ECC memory arrays. The maximum memory for the "F" product is 6MB, if only one slot is used for an interface card.

Both the 2426E and F contain an execute only version of the RTE-A operating system.

MICRO 16 PRODUCTS		
	2426E	2426F
Standard Memory	1/2MB Parity	1MB ECC
Available Slots	4	4
Memory Arrays	Parity Only t2103C t2103D	Parity & ECC t2103C t2103D t2111A t2111B t2111C
Max Memory (with I/O card)	3MB	6MB

These products can be ordered as line items or as part of the bundled systems.

ORDERING INFORMATION

Micro 16 Plus Bundle

Bundled Products

A bundle is a grouping of products that are orderable under one product number. This upper level product number also can have options to make the bundle more flexible.

What is SUN?

SUN, or the System Unbundler, is a subsystem that is incorporated into OMS, the field Order Management System. It gives OMS the capability to automatically explode a bundled product entered by the order coordinator into the list of products specified for the bundle. This subsystem is used in the Micro 16 Plus bundle. SUN allows for special pricing to meet target markets, and easier ordering.

Bundled Product Structure

Ordering the bundled product offers additional price benefits over ordering component products. Most hardware configurations will be priced 15% less when ordering via the bundle. Below is a table showing the order structure of the bundle:

MICRO 16 PLUS BUNDLE
P/N 2456A
**** HP CONFIDENTIAL ****
**** DO NOT COPY THIS PAGE ****

	U.S. LIST
2456A Consists of:	
2426E - A600+ CPU, 1/2MB memory, RTE-A right-to-execute	\$7,015
12040C - 8 channel MUX	
12009A - HP-IB interface	
Option 001	2,000
Replaces 2426E 1/2MB CPU with:	
2426F - A600+ CPU, 1MB ECC memory, RTE-A right-to-execute	
Option 002 (excludes Option 003)	
Adds:	3,550
9134L - 40MB Disc	
Option 003 (excludes Option 002)	
Adds:	5,300
7945A - 55MB Disc	
Option 004	
Adds:	2,600
9144A - 1/4" Tape Backup	
Option 015	
Adds:	0
220 volts for the 7945A	

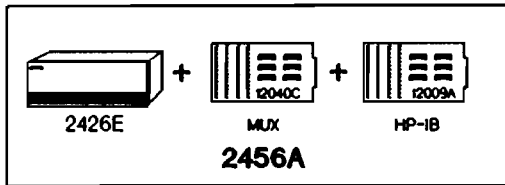
ORDERING INFORMATION

Configuration Examples

The following are some examples of how to configure Micro 16 solutions for your customers. The configurations go from a base level bundle to a high-end configuration.

Base Level Bundle

The 2456A base level bundle offers a 29% price decrease under a current Micro 26 with MUX and HP-IB interfaces.



Mobile Units

By adding the 7907A fixed and removable disc, a terminal, and printer, the Micro 16 PLUS bundle allows customers to operate the computer in environments where shock is a problem. Often, customers need a rugged computer that can be driven around in a truck or van to gather data on location.

Add:	
7907A 41MB Fixed/Remove disc	12,500
2392A Terminal	<u>1,375</u>
Total	\$20,890
	U.S. list

Memory Based System

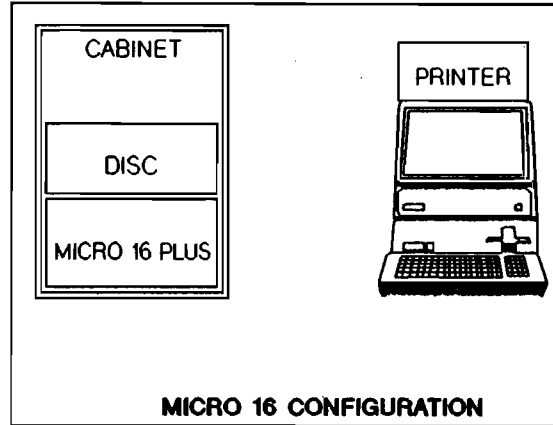
By adding additional memory, a DS interface to download programs, and a terminal, the Micro 16 Plus bundle is an excellent memory-based system. With the Micro 16's excellent reliability and environmental specifications, eliminating the mass storage allows the system to operate in much harsher environments.

Add:	
Option 001 (2456A) add'l mem.	\$2,000
12044A DS/1000 interface	<u>2,550</u>
2392A Terminal	<u>1,375</u>
Total	\$12,940
	U.S. list

ORDERING INFORMATION

Configuration Examples

Low End Configuration



This configuration represents the lowest end, disc based system, perfect for many applications.

P/N	DESCRIPTION	U.S. LIST	PREVIOUS LIST (2436E)
2456A	Contains: 2426E CPU, 12040C MUX, 12009A HP-IB	\$7,015	\$12,030
9133H	20MB Disc/microfloppy	2,740	(included above)
92211M	325mm Cabinet	165	200 (floor mount)
2392A	Terminal	1,375	1,375
2225D	Thinkjet printer	495	495
Total		<u>\$11,790</u>	<u>\$13,900</u>

15% decrease

Application

* Automatic Test	
Add: 12009A HP-IB I/F	\$1,100
92077A O.S.	1,000
	<u>\$13,890</u>
* Program Development	
Add: 92077A O.S.	1,000
	<u>\$12,790</u>

ORDERING INFORMATION

Racking

Computer Mounting

The following paragraphs give mounting information for the HP 2426E/F.

Table Mounting

The computer may be used as a freestanding instrument in a land-based environment. The only consideration is that adequate space be allowed front and rear to ensure 1) full intake and exhaust of ventilating air and 2) servicing the computer as below:

Operating Clearance: 152.4 mm (6 inches)
Service Clearance: 762.0 mm (30 inches)

Rack Mounting

The 2426E/F Computer can be mounted in the following racking products (see the table on the next page):

HP 92211M) See Computer
HP 92211L) Users Catalog
HP 92211R) for more information.
HP 29431X]
HP 2945x] 19" EIA cabinets

In the HP 92211M/L/R, the computer should always be positioned as the lowest component to keep the center of gravity as low as possible and/or to make more frequently used peripherals more accessible. Racking installation procedures are provided with the cabinets.

Mounting the HP 2426E/F Computer in the HP 29431/2945x is performed by using a rack adaptor that will be available on the June 1, 1986 Corporate Price List. Racking instructions will be provided with the rack adaptor product.

See the racking table on the next page for further information.

HP Computer Museum
www.hpmuseum.net

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ORDERING INFORMATION

Racking

Cabinets Available for Rack Mounting the HP 2426E/F Computer

Product	Vertical Rack Space (mm)	Height (mm)	Width (mm)	Depth (mm)	Available Power Distribution Unit
HP 92211M	341	435	425	425	HP 92199B (U.S.)
HP 92211L	523	620	425	525	"
HP 92211R	575	720	375	711	"
HP 29431G	1430	1600	625	810	with cabinet
HP 29450	557	720	600	800	07914-60014 (need special rear door: 07914-60043)
HP 29451	837	1000	600	800	"
HP 29452	1074	1237	600	800	"
HP 29453	1437	1600	600	800	"
HP 29454	1837	2000	600	800	"

COMPETITIVE ANALYSIS

DEC

DEC Micro PDP-11/23

The Micro PDP-11/23 is the entry-level system product in DEC's Micro PDP line. Based on DEC's F-11 processor, the 11/23 is the same as the original Micro PDP-11/23, which was introduced in 1982. The idea at the time was to provide an answer for customers who needed good performance at less cost than a full-fledged PDP system. Today the 11/23 has been more or less obsoleted by the 11/73, which offers a considerable performance advantage at a slightly higher cost. Any customer who is considering the 11/23 would be an excellent candidate for the Micro 16. The table below illustrates that the Micro 16 is much more powerful for almost the same price.

DEC Micro PDP-11/73

At its introduction in 1984, the PDP 11/73 was presented as the high-end Q-Bus based PDP system. It is built around the 15 MHz version of its "PDP on a chip" processor, the J-11. It offered DEC users three times 11/23 performance in the same box for about a 10% premium.

The 11/73 is higher priced than the Micro 16, but its higher performance (around 0.7 MIPs) may keep it in the running with some performance-sensitive customers. If their applications are I/O intensive, the Micro 16's I/O bandwidth -- nearly twice that of the 11/73 -- will help to overcome any objections the customer may have regarding performance.

DEC Micro PDP-11/83

The 11/83 has been DEC's new top of the line Q-Bus system since its introduction in the fall of 1985. It is based on the 18 MHz J-11 processor, and offers approximately twice the performance of the 11/73 along with greater storage capacity.

The 11/83 probably won't be competing directly with the Micro 16. With its performance rating of 1.2 MIPs and its 14 I/O slots it is no match for the Micro 16 in terms of compactness and low cost (complete systems start in the \$30,000 range). The new Micro 29 Plus bundles (see the Micro 29 Plus Field Training Manual) would be more appropriate to sell against an 11/83.

SYSTEM COMPARISON: HP vs. DEC

	MICRO 16	11/23	11/73	11/83	MICROVAX II
Year Introduced	1986	1982	1984	1985	1985
CPU	A600+	F-11	J-11 (15 MHz)	J-11 (18 MHz)	32-bit VAX
Performance (MIPs)	0.4	0.3	0.5-0.8	1.2	0.9
Maximum Memory (MB)	6	4	4	4	16
I/O Bandwidth (MB/sec)	4.3	1.7	2.5	N/A	2.7
Price (low-end system)	\$ 11,130	\$ 10,975	\$ 14,085	approx. \$30K	\$ 24,490

N/A - Not available

DEC MicroVAX II

The MicroVAX II is not really comparable to the Micro 16 as a low-cost, entry level system; it is more of a competitor against the Micro 29. Nevertheless, some customers will consider it because of the large amount of media attention it has received. The publicity has emphasized its 32-bit architecture and its low cost.

A comparison of the low end MicroVAX II bundle against a comparable Micro 16 system illustrates the price differential.

	MICRO 16 Plus (2456A) (Mid-range System)	MicroVAX II
CPU	\$ 7015	*
MUX	*	*
Disk controller	*	*
Memory (2MB)	\$ 5500 (1MB) opt. 001 + 1MB	*
LAN card	\$ 3100	*
Disk/floppy	\$ 3550 (40MB)	* (31MB)
Terminal	\$ 1375	*
OS license	*	*
	<hr/> \$ 20540	<hr/> \$ 24490

* - included in bundle

There are a few differences between these two configurations which should be noted. First, the OS license included with the MicroVAX II supports only 1-2 users, whereas RTE-A licenses aren't limited as to the number of users (the Micro 16 supports 4-8). Also, the disk quoted for the MicroVAX has 31MB capacity compared to 40MB in the Micro 16 bundle.

These configurations help to illustrate the differences between the product structures of the Micro 16 and the MicroVAX II. The MicroVAX II system quoted in the table is the lowest-end bundle available. Other bundles include disks ranging from 71-405MB, tape drives, up to 5MB memory, and a MUX with up to 16 channels. On the other hand, the Micro 16 configuration quoted is a mid-range system. A low end system (512kB, MUX, 20MB disk/floppy, terminal) is priced at around \$11,130. The Micro 16 is designed to provide configuration flexibility and low cost; it is more focused toward the low end than the MicroVAX II.

The Micro 16 also has some performance advantages. Unlike VMS, RTE-A is optimized for real-time processing. In addition, I/O performance on the Micro 16 is almost 60% better than on the MicroVAX II (specifications for read operations are 4.3 MB/second and 2.7 MB/second, respectively).

For a more complete analysis of the MicroVAX II, see the Micro 29 Plus Field Training Manual.

COMPETITIVE ANALYSIS

IBM

IBM's product introductions over the last year illustrate its commitment to the technical marketplace. In 1985, IBM introduced three new products in its Industrial Computers line: two ruggedized PC/ATs and a ruggedized PC/XT. And in January of this year IBM released its first RISC machine, the PC/RT. IBM is just getting started in this market; their activities in the coming months will tell us more about their direction.

IBM PC/AT

The IBM PC/AT will be a major competitor for the Micro 16. PCs are becoming increasingly popular for factory floor use, particularly in simple dedicated applications in which real-time scheduling is less of an issue. In 1985, IBM introduced two ruggedized versions of the PC/AT for the factory floor. The two systems are identical except for the enclosures: the 7531 comes in a floor-standing cabinet, while the 7532 is rack-mountable.

PRICING COMPARISON MICRO 16 Plus vs. IBM 7531 (PC/AT)

	MICRO 16 PLUS	IBM 7531
CPU	\$ 7015	\$ 6145
Serial ports	*	\$ 430
Disk controller	*	*
Disk (20 MB)	\$ 2740	\$ 1695
Microfloppy drive	**	*
Terminal / monitor	\$ 1375	\$ 525
	\$ 11,130	\$ 8795
* - included in bundle	** - included with 20MB disk	

The 7531 is available for about 25% less than a Micro 16 for a single purchase (\$8795 to the Micro 16's \$11,130 for a CPU, 512kB, 20MB disk/floppy, and terminal). With maximum volume discounts, the premium falls to around 10% (\$6156 for the 7531; \$6789 for the Micro 16).

SYSTEM COMPARISON: HP vs. IBM

	Micro 16	7531 (PC/AT)	PC/RT
Year Introduced	1986	1985	1986
CPU	A600+	Intel 80286	32-bit RISC
Performance (MIPs)	0.4	0.6	1.5 - 2.5
Maximum Memory (MB)	6	3*	4
I/O Bandwidth (MB/sec)	4.3	N/A	N/A
Mid-range System Price (1MB, 40MB disk, floppy, terminal)	\$ 14,610	\$ 12,265	\$ 16,330

N/A - Data not available

icompat/tpbn

* accessible only by Xenix
(MS-DOS only supports 640KB)

The Micro 16 offers some significant advantages in return. Unlike the PC/AT, it was designed specifically for real-time applications, with its hardware and operating system optimized to provide low, predictable response times. The PC/AT's operating system, MS-DOS, was not designed for real-time processing. It is inherently single-tasking -- IBM has had to rely on third parties to provide multi-tasking capability -- and its scheduling is not priority-based to provide better real-time control.

Customers whose applications are subject to extreme environmental conditions will also appreciate the Micro 16's ruggedness. As the following comparison illustrates, the Micro 16 handles harsh conditions better than IBM's ruggedized PC/AT. The Micro 16 was designed to provide higher reliability than ever before -- estimated mean-time-between-failures is 9.6 years.

RUGGEDIZATION: Micro 16 vs. IBM

	Micro 16	IBM 7531 (Ruggedized PC/AT)
Temperature	32 F - 140 F 0 C - 60 C	32 F - 120 F
Humidity	5% - 95%	8% - 80%
Shock		
Continuous	1.5g at 9ms	0.5g at 10ms
Infrequent	7.0g at 9ms	N/A
AC Input	86 - 140 Vac	104 - 127 Vac

N/A - Not available

Another Micro 16 advantage is its compatibility with a complete family of real-time computers. Customers who need additional performance can easily move their applications to higher level A-Series machines. The upgrade path for a PC/AT is much less clear. The new PC/RT runs a different operating system; users have to buy a PC/AT coprocessor to run PC/AT applications.

There are some customers for whom a PC will be the best solution. They may be first time users who need a very friendly system, users who want to have available the PC's wide array of software solutions, or users who want very low cost solutions for simple, dedicated control applications. In these cases, HP's Vectra PC is the best machine to sell -- for the same price as the IBM PC, customers get 30% better performance in a 30% smaller package.

IBM PC/RT

IBM's real-time PC -- the PC/RT -- was introduced in January, 1986. It contains a new IBM-designed 32-bit processor based on a RISC architecture. Running at 2 MIPs, it is in a different league from the Micro 16 with respect to raw performance. It is also priced somewhat higher, but it will still provide serious competition for the Micro 16.

The PC/RT runs its own UNIX (called AIX) and is positioned primarily as an engineering workstation. It also has a real-time resource manager, VRM, which must be accessed with driver calls through AIX. This architecture has two weaknesses with respect to real-time programming. First, programmers must learn two environments in order to make optimal use of the machine's real-time capabilities: AIX and VRM. In addition, the machine has to rely on AIX for process scheduling. It's unclear exactly what IBM added to UNIX to get AIX, but the scheduling in standard UNIX is not optimized for real-time processing.

The PC/RT's pricing and product structure position it more in the engineering lab than on the factory floor. The lowest-end configuration mentioned in IBM's product announcement included 1MB of memory, a 40MB disk, and a 1.2MB floppy disk drive; the price quoted was \$11,700. The Micro 16's structure is much more flexible; customers can buy anything from the CPU in a box to a full-blown system.

COMPETITIVE ANALYSIS

IBM (continued)

Finally, the Micro 16 offers compatibility with a family. The PC/RT is a unique product running a unique operating system (customers have to purchase a PC/AT coprocessor card at \$995 to run PC/AT applications). On the other hand, the Micro 16 is part of a proven family of real-time computers.

COMPETITIVE ANALYSIS

Sales Strategy Summary

if competition is...

and customer's major concern is...

	Price	Performance
DEC Micro PDP-11/23	<ul style="list-style-type: none">- sell Micro 16 on better price/performance; volume discounts	<ul style="list-style-type: none">- sell Micro 16 on higher performance
DEC Micro PDP-11/73	<ul style="list-style-type: none">- sell Micro 16 on lower price, more configuration flexibility at low-end	<ul style="list-style-type: none">- sell Micro 16 on better I/O performance- sell Micro 16 on optimized real-time OS
DEC Micro PDP-11/83	<ul style="list-style-type: none">- sell Micro 16 on much lower price, low-end focus	<ul style="list-style-type: none">- sell Micro 16 on better I/O performance- sell Micro 16 on optimized real-time OS- sell Micro 29
DEC MicroVAX II	<ul style="list-style-type: none">- sell Micro 16 on lower price, more configuration flexibility, low-end focus	<ul style="list-style-type: none">- sell Micro 16 on better I/O performance- sell Micro 16 on optimized real-time OS- sell Micro 29
IBM PC/AT	<ul style="list-style-type: none">- look for customers who qualify for maximum volume discounts: HP's are better than IBM's, so they bring prices more in line- sell Vectra	<ul style="list-style-type: none">- sell Micro 16 on real-time focus, optimized OS- sell Micro 16 on ruggedness, reliability
IBM PC/RT	<ul style="list-style-type: none">- sell Micro 16 on lower price, low-end focus	<ul style="list-style-type: none">- sell Micro 16 on factory floor focus, proven real-time performance through a single real-time environment- sell Micro 16 on ruggedness, reliability

APPENDIX A

Uninterruptable and Standby Power Source Specifications

The 2426E/F can be protected against AC power failures when used in conjunction with an uninterruptible power supply (UPS) or a standby power source (SPS). The following input AC power requirements should be considered when selecting an appropriate UPS or SPS for the 2426E/F. See your local site prep specialist for help choosing a UPS or SPS vendor for the 2426E/F. Note that these requirements are to maintain continuous operation of the 2426E/F computer so that AC power failures are not detected by the computer. The customer should also consider backing up AC power to system discs, terminals and other devices which may require uninterrupted AC power.

2426E/F AC OPERATING RANGE*

The 2426E/F is capable of operating continuously over the following ranges. The UPS or SPS output must provide AC voltage and current which fall within these limits imposed by the 2426E/F.

Line Voltage: Range 1	86 - 140 VAC rms	120 VAC nominal
Range 2	172 - 276 VAC rms	220/240 VAC nominal

Line Frequency 47.5 - 66 Hz

Power Factor 0.75 minimum, current lagging the voltage

Total Harmonic Distortion 10% maximum

2426E/F Carry-over Time 15.0 milliseconds, maximum capability of 2426E/F without disturbance of continuous operation. This carry-over time is greater than a half cycle at 47.5 Hz (10.5 mseconds).

2426E/F Inrush Current (cold power-up):

Range 1	20.0 Amps rms, maximum
Range 2	40.0 Amps rms, maximum

* Most UPS & SPS units are enabled when the AC line voltage drops below 15% of nominal 120 VAC rms, i.e. below 102 VAC. However, the 2426E/F will operate continuously down to 86 VAC rms. This capability of the 2426E/F should be taken into consideration when selecting an appropriate UPS or SPS configuration.

AC VOLT-AMPS CONSUMPTION (VA)

Maximum VA rating is based on the worst case 2426E/F load configuration (160 watts DC output loading) at 55 degrees C ambient temperature.

Range 1 (120 VAC nominal)	300 VA maximum
Range 2 (240 VAC nominal)	300 VA maximum

ENVIRONMENTAL PERFORMANCE OF 2426E/F

Temperature

Operating	0 to +60 degree C
Non operating	-40 to +75 degree C

Relative Humidity 5% to 95%, non-condensing

Micro 16 FTM -22



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