

HP 9000 Series 700i/rt Models 743i, 743rt, and 748i

VMEbus Computer Systems



HP Products, Performance, and Service: The Right Pieces for a Smooth Fit

Customers insist on extensive interoperability, from factory floor to board room. Profit margins seem to shrink by the minute. Time to market is measured in weeks instead of years. In this tough market, using the right pieces is critical for success.

HP ensures a smooth fit with our PA-RISC workstations and real-time systems. These board, box, and system-level products combine superior computing technology and performance,

world-renowned quality, excellent worldwide support, the best price/performance, and a standards-driven approach to both hardware and software systems—to deliver exactly what you need when you need it.

No Missing Pieces

With products and services from HP, you have all the pieces that you need to create the right solution—a solution that works today and into the future. You can take advantage of innovative designs and superior PA-RISC performance without being locked into a proprietary system. You can buy exactly what you need, from an embedded component to a development environment to a complete system. You even have

operating system options: HP-UX, our UNIX-based operating system, and HP-RT, our POSIX-compliant real-time system tuned specifically for PA-RISC.

Put It Together with HP

Standards-based: off-the-shelf simplicity, straight-forward portability, broad range of applications and services, and the ability to grow, expand, and adapt

Extensive, onboard I/O: industry-standard VMEbus and EISA bus, graphics options, and more

Unparalleled flexibility: configure the system exactly the way you want it

HP-RT (real-time) and HP-UX (UNIX based) OS: full-function, industry-standard industrial strength operating systems tuned for PA-RISC

Custom engineering resources: available for special hardware or software solutions for volume OEMs and large projects

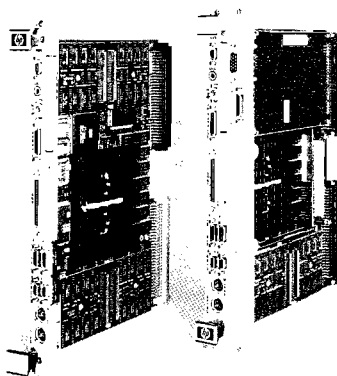
Designed for harsh environments: rack-mountable, modular, direct-access approach for streamlined service, unmatched reliability

HP service and support: today, tomorrow, and for decades to come

Power and Performance

The Model 743 packs incredible performance into one 6U VMEbus slot. It is ideal for embedded applications that demand computing power, performance, and reliability.

The Model 743 provides VME D64 master/slave capability for excellent throughput. The Model 743's onboard ECC DRAM memory corrects 1-bit errors and detects multibit errors, providing better reliability compared to parity memory.



743i/rt 6U VME single board computer showing single slot and double slot options with optional GSC graphics mezzanine card

There's no need to buy a separate I/O board or graphics board for Model 743 computer operations. Standard on-board I/O includes Ethernet, SCSI II, dual RS-232-C, LAN AUI, miniDIN pair, parallel (Centronics) ports, and audio. On-board graphics are optional within the same single VMEbus slot (HP-UX only).

The Model 743's durability, combined with its flexible I/O, make it ideal for embedded applications.

Features	Benefits
HP-UX (Model 743i) or HP-RT (Model 743rt)	• Standards-based operating system tuned specifically for PA-RISC architecture; hardware, software, and support all from one company
64MHz or 100MHz PA-RISC 7100LC processor with built-in high-performance floating point co-processor	• Provides fast and cost-effective native uniprocessor solutions for embedded applications at two performance points
256KB instruction/data cache	• Faster program execution times
Supports industry-standard I/O, including onboard LAN AUI port, parallel (Centronics) port, SCSI II port, dual RS-232-C ports, PS/2, and audio	• Provides all I/O ports on front panel for easy connection
ANSI/IEEE STD 1014-1987compliant and VME64	• High-speed throughput, no need for separate controller board
Expandable ECC RAM	• Buy exactly what you need; ECC RAM provides excellent memory reliability
HP GSC bus	• Supports two HP GSC mezzanine cards
HP quality	• Outstanding reliability
Long product life-cycle commitment	• Designed and implemented for long life-cycle products

HP Computer Museum
www.hpmuseum.net

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Technical Specifications	Model 743i/64	Model 743i/100
System Processing Unit		
Central processor	PA7100LC	PA7100LC
Clock frequency	64MHz	100MHz
Performance		
SPECint92	66.6	100.1
SPECfp92	96.5	137.0
MFLOPS (DP)	25.3	37.8
MIPS	77.7	121.6
Memory management unit		
Virtual memory address	48 bit	48 bit
Instruction TLB and data TLB	120-page entries unified, 16 variable block entries unified, fully associative	120-page entries unified, 16 variable block entries unified, fully associative
External cache		
Instruction/data cache size	256KB	256KB
Organization	Direct mapped	Direct mapped
Bus width	64 bits	64 bits
Instruction cache bus peak performance	512MB/second	800MB/second
<i>Note: Instruction and data cache are shared. The Models 743i/64 and 743i/100 have a total cache size of 256KB</i>		
Main memory type	ECC single bit correct, double bit detect	ECC single bit correct, double bit detect
Capacity	8-256MB	8-256MB
Main memory bus width	64 data bits w/8 check bits	64 data bits w/8 check bits
Main memory bus peak performance	128MB/sec (64 byte duration)	133MB/sec (64 byte duration)
System DRAM technology	60ns, 4 & 16Mb DRAM	60ns, 4 & 16Mb DRAM
Memory card sizes	8, 16, 32, 64MB	8, 16, 32, 64MB
Graphics Performance		
X11 Vec/sec	1.2M	1.2M
Xmark93	8.1	8.6
PLBsurf	19	23
2D/3D vectors/sec	1.4M	1.6M
triangles/sec	26K	40K
lighted, shaded quadrilateral/sec.	15K	23K

Physical and Environmental

Operating Temperature
-5 to 55° C (ramp rate: 10° C/minute)
Storage Temperature
-40 to 70° C
Humidity, Operating
95% R.H. @ 40° C

Product Safety

Complies with UL 1950; CSA 22.2; IEC 950, 1st edition 1986
System Power
64MHz
7A +5V, .05A +/- 12V typical
100MHz
8A +5V, .05A +/- 12V typical

Physical Configuration

Fits into one or two 6U form factor slots of a VMEbus backplane, depending on configuration
Two slots required for more than 2 RAM cards, or GSC mezzanine card

Dimensions:
160mm x 233mm, single slot or double slot

Other On-board Functions
Internal timer
Watchdog timer
Battery backed-up time-of-day clock

Graphics and Mass Storage

Refer forward to section on Model 748i for Model 743i-supported graphics options, monitors, and mass storage

Built-in I/O (Standard)

LAN

Type
IEEE 802.3/Ethernet
Data rate
10Mb/sec
Connectors
15-pin micro D-sub

Networking Products

NCS, NFS, Berkeley 4.3, TCP/IP, BSD 4.3 Network Services, and ARPA Services

SCSI Interface

Type
SCSI II: single-ended, 8 bit
Data rate
5MB/sec synchronous
1.5MB/sec asynchronous with standard-length cables
Device limit
7 devices
Connector
ALT-1 of SCSI II 50-pin high density

Serial Interface (Two Standard)

Type
EIA RS-232-C, CCITT V.24/V.28
Data rate
460.8Kbps (16550A-compatible UART)
Device limit
1 per interface
Connector
9-pin female micro D-sub*

Parallel Interface (Standard)

Type
Centronics, BUSY handshake
Data rate
300+KB/sec with DMA
200KB/sec sustained
Connector
25-pin female micro D-sub*

VMEbus Interface Specifications

Master

CPU
A16/A24/A32, D8 (EO)/D16/D32, RMW, programmable AM
DMAC
A16/A24/A32, D8 (EO)/D16/D32/D64, BLT, MBLT, programmable AM
(See Note 1)

Slave

Shared memory
A24/A32, D8 (EO)/D16/D32/D64, RMW, BLT, MBLT, UAT
(See Notes 2 & 3)
Responds to non-privileged data, supervisory data, and LOCK AMs
AMs can be individually disabled

Arbitration

Programmable request mode ROR, RWD, RWD/fair
Programmable B0-BR3 level for processor and DMAC each
Programmable bus tenure for DMAC

Interrupt Handler

Programmable to be disabled or handle any combination of IRQ1-IRQ7
Runs D32 IACK cycles

Interrupt Generation

Programmable on any single-level IRQ1-IRQ7
Programmable IACK status/ID content and dynamic size

System Controller Functions

Automatic slot 1 detection
Bus error timer programmable from 10 usec to 1.28 msec; can be disabled
Slot 1 arbiter programmable for RR or PRI
Bus arbitration timeout timer of 256 usec
ACK daisy chain driver
Sysreset logic with programmable response and generation

Miscellaneous

Sysfail interrupt and generation

Notes

(1) D8 BLT and D8 MBLT not supported by DMAC. Single D8 transfers for first and last bytes if needed for alignment. DMAC can be programmed to do all non-BLT cycles as well.
(2) RMW does not provide indivisible access to Shared Memory. SW protocol must be followed.
(3) All slaves tolerate but ignore ADO cycles.

*Adapter cable available

VMEbus performance MB/sec				
	D32		MBLT	
	Read	Write	Read	Write
Master*	10	12	38	44
Slave	9	13	33	38

*CPU is master for D32 and DMAC is master for MBLT performance

Human Interface

Keyboard and Mouse Interface

Electrical

IBM PS/2 compatible

Connectors

MiniDIN pair

Data rate

2.5K 11-bit samples/sec

Audio (HP-UX support only)

Type

Integrated 16 bit, up to 44KHz sampling rate (CD quality)

Inputs

Stereo line-in, microphone

Outputs

Stereo headphone

Mono speaker

Connectors

Phone jack (speaker out)

9-pin micro D-sub*

*Custom cable available

Built-in Graphics (Optional)

Features

Type

Integrated, color 8-plane with HP Color Recovery technology (HP-UX only)

Resolutions

640 x 480 x 8, 1024 x 768 x 8, 1280 x 1024 x 8

Windows Systems

X Window Systems, Version 11, Release 5 (X11R5), OSF/Motif 1.2, PEX, PHIGS, Starbase, GKS

Software—HP-UX or HP-RT

HP-UX Technical Specifications

HP-UX 9.05 operating system; complies with IEEE POSIX.1-1988 FIPS 151-1, ANS x3.159-1989, proposed POSIX.2 FIPS (June 1990), System V Interface Definition (SVID) Issue II (base system and all extensions except AS, NS, and shmat [KE_OS]), X/Open Portability Guide Issue III (XPG3), (base component and all optional components except XTI)

HP-UX 9.05 also supports IS 9945/1 and base component and all optional components except XTI

Two user runtime license-to-use included with purchase of 743i

Language Support

HP-PA Assembly, HP C ANSI/C, C++, Fortran/9000, Pascal

HP-RT Technical Specifications

Sub-100µsec deterministic response time

Max. interrupt acknowledgment latency: 5µsec

Max. interrupt response latency:

5-40µsec, depending on ISR type

Max. context switch latency:

50µsec

Max. user semaphore clear with context switch: 30µsec

Complies to IEEE POSIX.1 standard

Follows POSIX.4 draft 9/10 for real-time extensions

Follows POSIX.4a draft 3/4 for process level threads

HP-UX development environment used for designing, compiling, and linking real-time applications and HP-RT kernel

HP-UX hosted cross debuggers for kernel, driver, and application development

SVID/BSD commands and functions provided

Local disk and LAN boot support

Paging control management

Full Networked File System services

ARPA/Berkeley 4.3 networking services

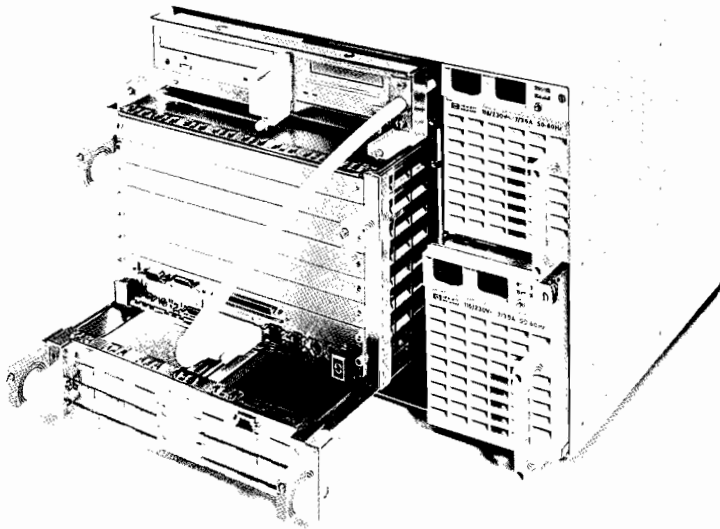
Language Support

HP-PA Assembly, HP C/ANSI C, C++, Fortran

I/O and Networking Support

Onboard I/O drivers for Ethernet, SCSI II, RS-232-C, and Parallel (Centronics)

VMEbus I/O driver development documentation included in developer's kit



**Back of 748i showing
removable modules that
make up system**

Models 748i System Enclosure for 743i

Models 748i/64 and 748i/100 are VMEbus systems that utilize the Model 743i VMEbus single-board computer. You get all the power and performance of this industry-leading technology plus additional flexibility and features especially important for sensory-based data acquisition and display applications.

Whether you're looking for a standalone system, a development environment, or an important component to a larger system, the 748i workstations provide solutions unlike any available before.

Superior Flexibility

The Model 748i workstations have unparalleled flexibility. In addition to a choice of two performance points—64 or 100MHz—you can choose 15 in., 17 in., or 20 in. color graphics monitors. You can have multiple monitor support with an optional HP GSC mezzanine card.

The Model 748i's I/O is flexible, with eight VMEbus expansion slots (two slots used by the Model 743i), four EISA expansion slots, integrated HP-HIL for optional keyboard interface or other HP-HIL devices (the Model 743i is standard miniDIN).

Power in an Industrial Package

We've even made it easier to put the whole system wherever you need it, with three rack mounting configurations plus wall mounting, and direct modular access for streamlined service. Just pull out any module, make any required changes, and tuck back into place—all in less than five minutes. You can even choose where you want your removable media devices, front or back.

And because we know you need to use the Model 748i's power and performance in the real world, it's built to be more durable. The Model 748i is suitable for many harsh environment applications. The 748i's overall size, 310.1mm high by 425.0mm wide by 412.6mm deep (12.22 by 16.75 by 16.24 inches), leaves plenty of room for your other equipment and fits into a standard 19-inch rack—we even include the rack-mounting hardware.

Each Model 748i includes a license for HP-UX, HP's UNIX-based operating system. That in turn provides access to HP's rich, highly integrated development environment, HP SoftBench.

Features	Benefits
System enclosure for Model 743i/64 or Model 743i/100	• The performance to handle the work now and in the future; choose the performance level that's right for you and your applications.
Flexible rack-mount package	• Easy-to-service package that fits in a standard 19 in. rack; rack-mounting hardware included
HP quality	• Outstanding reliability; tested to tough temperature, shock, and vibration levels
Binary compatibility with desktop Series 700 workstations	• Easy application portability and access to over 5000 UNIX applications
Provides both EISA and VMEbus expansion slots	• Unparalleled flexibility in a single, standards-based machine
Industry-standard VMEbus	• 6 available slots to allow access to abundant and diverse VME cards
Industry-standard EISA bus	• 4 expansion slots allow access to broad range of I/O and function cards—the same cards available for use in standard workstations
HP GSC bus	• Supports 2 HP GSC mezzanine cards for added I/O flexibility, including additional graphics and monitors
Modularity	• Fast, easy access to EISA and VMEbus expansion slots, power supply, SPU and mass storage
15 in., 17 in., and 20 in. color graphics	• Choose the monitor that meets your needs—rack mount kits are available for the 15 in. and 17 in. monitors
Extensive standard on-board I/O	• Low-cost and high-performance; quick and easy integration in heterogeneous networks; simple connection of high-speed, low-cost disks and other peripherals; multimedia capability
Front or rear access for removable media	• You can choose what fits your needs: access from the front or back of system
Wide range of mass storage options	• Configure your system with exactly the amount and type of mass storage that your solution requires, up to 4 devices, maximum 8GB disk internal

Monitors	20 in. A4033A	17 in. A4032A	15 in D1196A	11.8 in. Flat Panel/A2882A
Screen refresh rate	75Hz	75Hz	70Hz	75Hz
Video signals	RS-343A	RS-343A	RS-343A	RS-343A
Resolution	1280 x 1024	1280 x 1024	1024 x 768	1024 x 768
<i>Electrical Specifications</i>				
Line voltage:	90-132 VAC	90-132 VAC	88-135 VAC	90-132 VAC
Autoranging:	198-288 VAC	195-264 VAC	193-269 VAC	180-264 VAC
Line frequency	47-63Hz	47-63Hz	47-63Hz	47-63Hz
Maximum current	3.0A/1.8A	2.7A/1.5A	1.5A/1.0A	1.25/0.6A
Power consumption	140 Watts max.	140 Watts max.	75 Watts max.	55 Watts max.
<i>Environmental Characteristics</i>				
Operating temperature	0 to 40° C	0 to 40° C	5 to 40° C	0 to 40° C
Non-operating temperature	-40 to 60° C	-40 to 60° C	-40 to 70° C	-25 to 60° C
Humidity: operating 40° C	10% to 80% R.H.	10% to 80% R.H.	15% to 80% R.H.	15% to 80% R.H.
Max. altitude operating	3658m (12,000 ft.)	3658m (12,000 ft.)	3048m (10,000 ft.)	3048m (10,000 ft.)
Max. altitude non-operating	15,240m (50,000 ft.)	15,240m (50,000 ft.)	10,688m (35,000 ft.)	9,144m (30,000 ft.)
<i>Monitor Physical Characteristics</i>				
Height	474mm (18.7 in.)	414mm (16.3 in.)	366mm (14.4 in.)	378mm (14.9 in.)
Width	474mm (18.7 in.)	406mm (15.98 in.)	354mm (13.9 in.)	330mm (13.0 in.)
Depth	501.5mm (19.7 in.)	450mm (17.71 in.)	400 mm (15.8 in.)	153mm (6.0 in.)
Net weight	30kg (66.1 lbs)	22.0kg (48.4 lbs)	14.0kg (31 lbs)	5.45kg (12 lbs)

Graphics Monitors

Optional HP GSC mezzanine card supports additional graphics monitor
Monitors supported: 15 in., 17 in., or 20 in. color
15 in. and 17 in. are rack mountable
Graphics drivers included

Graphics Specifications

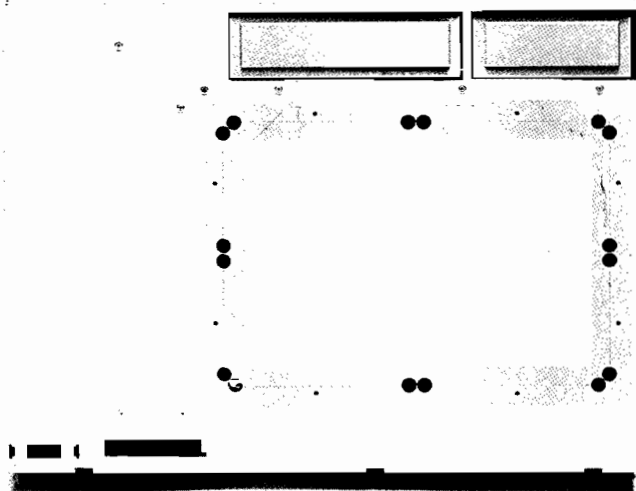
Integrated color, 8-plane with HP Color Recovery technology
Simultaneously displayable colors 256 from a palette of 16.7 million
Graphics planes: 8
Frame buffer: 1536 x 1024
Resolution: 1280 x 1024 or 1024 x 768

Mass Storage

High-performance, single-ended internal and external disk subsystems using industry-standard SCSI II interface; capable of supporting up to 5MB/sec synchronous data rate throughput
Front-to-back reversible mount so removable media can be accessed through connector or non-connector face of package
Total of four disk bays:
One 5.25-in. half-height removable media bay (convertible to 3.25-in. half-height removable or fixed media bay)
One 3.25-in. half-height removable or fixed media bay
Two 3.25-in. half-height fixed disk bay
Daisy chaining SCSI connectors provided

Mass Storage Environmental Specifications

Temperature operating 5 to 40° C
Temperature non-operating -40 to 70° C
Humidity: non-condensing, operating 15% to 80% R.H. max.
Operating max. wet bulb temp 37° C
Non-operating, 15% to 90% R.H. max.
Non-operating max. wet bulb temp 68° C
Altitude: operating, 3050m (10,000 ft.)
Altitude: non-operating, 12,200m (40,000 ft.)
Vibration: operating, . 2G, 0-peak Gs, 5-500Hz, swept sine
Shock: operating, 5G, peak, 11ms 1/2 sine



Front of 748i with plastic cover removed showing knockout panel for P2 access

Disk Model (formatted capacity)	525MB	1.0GB	2GB
Controller type	SCSI II SE	SCSI II SE	SCSI II SE
Disk size	3.5 in.	3.5 in.	3.5 in.
Average seek time	14.5 msec	13.5 msec	12.6 msec
Data transfer rate	1.5MB/sec	2.2MB/sec	4.6MB/sec

Removable Media Device Options

600MB CD-ROM
1.4MB 3.5" floppy disk drive
DDS tape drives
Number of internal devices
4 (maximum two removable media devices)
Internal disk capacity 8GB
Maximum external disk capacity 294GB
(using four add-on fast differential SCSI II EISA upgrade kits)

Technical Specifications

System Processing Unit

Utilizes Model 743i as SPU. Refer back to the section on the 743i for processor specifications.

Standard I/O Specifications

Expansion Slots

4 EISA expansion slots
Bus performance: ideal slave transfer rate (mb/s), read 25, write 25
8 VMEbus expansion slots
(2 used by the Model 743i SPU)

*One HP-HIL Interface**

Type: HP serial desktop bus
Device limit: 7 devices (note: some devices count as more than one device—e.g., 9-knob box = 3 devices)

Connector: AMP SMD; 4-pin shielded connector, 1 connector pin out provides 1 Amp of +12V to the loop

*(May not be used if PS/2 keyboard or mouse inputs are used)

DMA Controllers

EISA ISP DMA
7 channels
32-bit address
Transfers programmable for byte,
16-bit and word EISA refresh
address generation

Service/Diagnostic Support Hardware

User visible power indication
System function indicator

Rack-mount Package

Front/back/center column/wall
rack-mount options
Front or back power control
access
Modular serviceability through
connector end of box
7 rack units high
Knock out panel for easy P2 access
Dual power supply

Physical and Environmental for 748i

System Unit Power (2 installed)

Current
RMS 12A max. @ 90-132V
Peak 20A max. @ 90-132V
RMS 6A max. @ 180-250V
Peak 12A max. @ 180-250V
Line select
Auto ranging
90-132V
180-250V
Line frequency: 50-60Hz
Power
1080 max. Watts
3672 max. BTU/hour
928 max. Kcal/hour

Physical Dimensions

Height 3120.1mm (12.22 in.)
Width 425.0mm (16.75 in.)
Depth 412.6mm (16.24 in.)
Net weight 29kg (60 lbs)

Product Safety

UL 1950; CSA 22.2; IEC 950,
1st edition 1986; TUV EN60950

Laser Safety

IEC 825; 21 CFR Chapter 1
subchapter J (USA)

Acoustics

Tested to ISO 7779; declaration
according to ISO 9296

Ergonomics

ZH1-618

Electro-magnetic

Compatibility (EMC)

(FCC, VCCI, and European
CE marks)

Radiated and conducted
emissions: FCC Class A, 47
CFR Parts 2 & 15; VCCI Class 1;
ITE-EN55022/CISPR22 Class A;
ISM-EN55011/CISPR11 Class A
CISPR22/11; CISPR22/11 Class B
systems available too

Magnetic emissions: 49 CFR, IATA
Dangerous Goods Regulations,
30 ed—< 2 milligauss at 2.1m

Radiated immunity:
ITE/ISM-EN55024-3—3V/m
(IEC 801-3 level 2); systems
meeting 10V/m available, also
(IEC 801-3 level 3)

ESD immunity:

ITE-prEN55024-2—
3/8KV CD/AD; •
ISM-prEN50082-2—
4/8KV CD/AD;
IEC-801-2 level 3—
6/8KV CD/AD;
15KV AD (op.), 25KV AD
(survival)

Magnetic immunity: 317 A/m
(4 Gauss), exceeds
IEC 801-8 level 5—100 A/m
Line transient immunity:
Conducted fields: IEC 801-6 level
2—3V rms; level x—30V rms
Fast transients:
ITE/ISM-prEN55024-4,
IEC 801-4 levels 3—2KV mains,
1KV ports
Surge transients: IEC 801-5 level
3—1KV DM, 2KV CM; 3KV pk.
ring wave DM/CM

**Environmental Ruggedness
without Mass Storage**

(compliant to IEC 654-1 Class C1
levels, or better)

Temperature, operating
-5 to 55° C (ramp rate: 10° C/
minute)

Temperature, storage
-40 to 70° C

Humidity, operating
95% R.H. @ 40° C

Altitude, operating
4,600m (15,000 ft.)

Altitude, storage
15,300m (30,000 ft.)

Mechanical vibration
(compliant to IEC 654-3
Class VH3 levels, or better)
Operating (random vib.)—
0.002 g²/Hz from 5-350Hz, rolloff
@ 6dB/Octave to 500Hz
Survival (random vib.)—
0.02 g²/Hz from 5-100Hz, rolloff
@ 6dB/Octave to 137Hz,
0.0107 g²/Hz from 137-350Hz,
rolloff @ 6 dB/Octave to 500Hz
Survival (swept sine vib.)—10m/s²
(1 G0-pk.) from 5 to 500Hz,
sweeping at 1 Octave/min.,
dwell 10 minutes at 4 lowest
frequencies; 20m/s² (2 G0-pk.)
from 10-150Hz, 10 sweeps at
1 Octave/min.

Mechanical Shock
(compliant to IEC 654-3 and
IEC-68-2 methods)
Operating, end-use handling shock
150 cm/s (60 in./s²) using <3 ms
1/2 sine wave (~1230 m/s² faired
acceleration)
Survival, transportation shock
(unpackaged)
295 m/s² minimum (> 30G) using
605 cm/s (238 in./sec) trapazoidal
wave
Survival, packaged shock
Drop height 61 cm (24 in.)

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Czech Republic:

Tel: +42/2/4717321

Denmark:

Tel: +45/45/99/1000

Finland:

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France:

Tel: +33/1/69918000

Germany:

Tel: +49/6172/16-0

Greece:

Tel: +30/1/6896411

Hungary:

Tel: +36/1/2527300

Iceland:

Tel: +354/1/671000

Ireland:

Tel: +353/1/2844633

Italy:

Tel: +39/2/92/121

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Tel: +31/20/5476911

Norway:

Tel: +47/67/15/97/00

Poland:

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Portugal:

Tel: +351/1/3017330

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Sweden:

Tel: +46/8/750/2000

Switzerland:

Tel: +41/57/312111

Turkey:

Tel: +90/1/224/5925

United Kingdom:

Tel: +44/344/360000

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Tel: +41/22/780/8111

Middle East and Africa Operations:

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