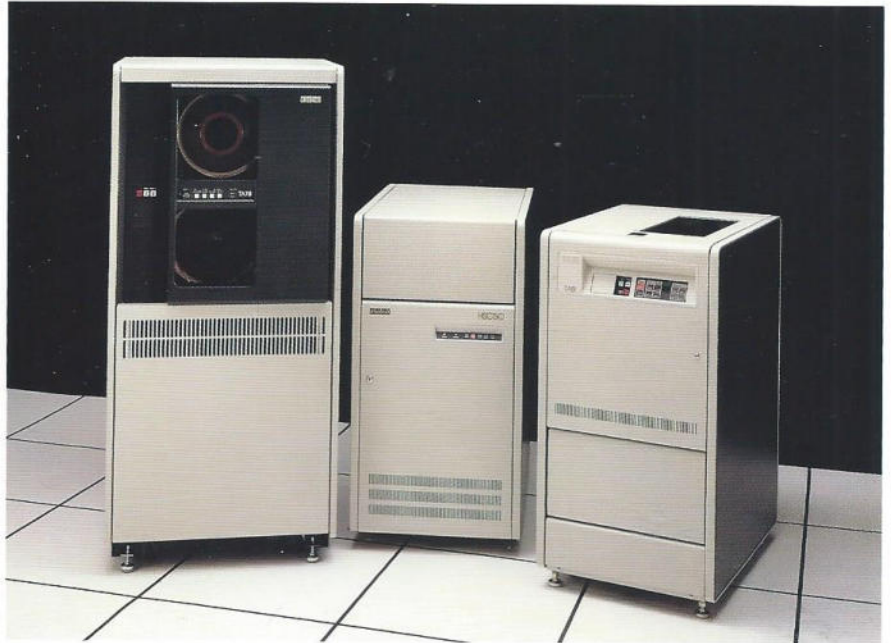## TA78 and TA81 Magnetic Tape Subsystems

A Shared Resource with Enhanced Performance to Complement VAXcluster Systems

digital

Now You Can Have the Best in Tape Subsystems for Your VAXcluster System

Digital's two HSC-based tape subsystems – the TA78 and TA81 – offer significant advantages to VAXcluster System users, and allow you to select the performance you need and a price that fits your budget. The TA78 is the high-performance, top-of-the-line subsystem. The TA81 offers midrange price and performance and extraordinary reliability. Both units offer dual-density recording and outstanding data integrity.

Both subsystems act as shared resources, available to users anywhere in the cluster. Assuming that your cluster is configured with multiple tape drives, this unique accessibility provides redundancy for increased availability and increases the likelihood of your finding a tape drive free when you need it. And you can enjoy these benefits at lower cost than if you tried to provide them on a series of non-clustered systems; one tape subsystem per CPU goes a lot farther in a VAXcluster configuration.

There are performance benefits as well. By attaching your tape subsystems to the HSC50 or HSC70, you can take advantage of the controller's Local Backup Utility, which shortens backup time significantly. VMS Backup operations may also show significantly faster performance. You also gain the benefits of the Digital Storage Architecture (DSA), which moves much of the I/O overhead from the CPUs to the HSC Storage Server. This leaves the CPUs free to perform other tasks and helps increase overall system throughput.

DSA also protects your investment by providing product compatibility, so you can be assured that future expansion will be less costly in both time and dollars.

Highlights for both tape subsystems:

- Allow increased availability and reduce the likelihood of multiple users contending for a limited resource.

- Offer a distinct choice that allows you to select the performance and price that fit your needs and budget.

- Allow high-speed backup to run offline. A local tape utility that runs on the HSC50 or HSC70 Server reduces backup time without affecting cluster performance.

- Are engineered for high reliability.

- Offer outstanding data integrity with read-after-write verification and automatic error detection and correction during operation.

- Are easy to use because they provide automatic tape threading and loading (TA78, TU78) or short manual tape paths (TA81), and conveniently located operator controls.

- Conform to the ANSI standard for Group Code Recording (GCR) (6,250 bits per inch) and for Phase Encoded (PE) recording (1,600 bits per inch) on half-inch nine-track tape.

- Protect your investment; upgrading TU78 to TA78 or TU81 to TA81 tape subsystems can be done at your site in one day or less.
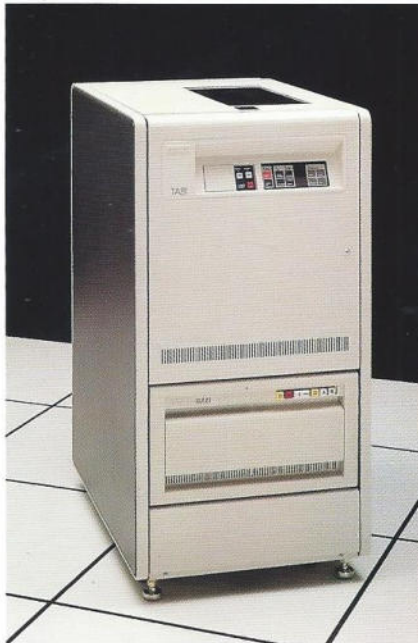
Price-performance Choices to Meet Your Needs

Digital offers two tape subsystems for the HSC Servers — each with its own price-performance characteristics — to provide you with a subsystem that meets your needs. A comparison chart below graphically compares the backup performance of the TA78 and TA81 with their nonclustered counterparts.

Common Attributes and Flexibility

Both TA tape subsystems offer common attributes that allow you flexibility in their use.

- Flexibility in applications — Both subsystems can be used as data interchange, data acquisition, and software load devices. And both are excellent backup devices.

- Flexibility in configuration — The HSC5X-CA interface module has four ports — not just one. This means you need not buy a separate module for each subsystem. And TA78 and TA81 subsystems can be mixed on the same interface module.

- Flexibility in recording format — Both subsystems record and read in either Phase Encoded (PE) or Group Code Recording (GCR) formats (1,600 or 6,250 bits per inch). As dual-density drives, these subsystems can read and write industry-standard tapes for interchange with other tape subsystems — both Digital's and those of other manufacturers. When recording in GCR format, these subsystems have a capacity of 145 Mbytes per reel, using 8-Kbyte records; maximum capacity is 167 Mbytes, using 64-Kbyte records.

These desirable attributes are common to both subsystems. However, there are significant differences in performance and, of course, price. Choose the one that best fits your needs.

The TA78 Tape Subsystem — The High-Performance Choice

The TA78 is the high-performance subsystem and is packaged with its own data formatter and power supply in a single cabinet. The sophisticated start/stop design of the TA78 provides the flexibility to handle a wide variety of applications with

ease; it is well suited for journaling and transaction processing applications and provides maximum performance in backup operation as well. The TA78 is based on the proven design of the TU78 and has been enhanced for increased reliability.

As many as three TU78 slave tape transports can be attached to each TA78 master tape subsystem. These add-on drives are identical to the TU78 slave tape drives now in the field. This protects your investment by allowing you to connect any TU78 slave you now have to the newer TA78 master tape subsystem.

The TA81 Tape Subsystem – The Economical Midrange Choice

The TA81 is Digital's midrange, HSC -based magnetic tape subsystem. Because it is a streaming tape drive, the TA81 is mechanically simpler than the TA78. The TA81, therefore, costs less to own and maintain. Users concerned with high availability may find it especially cost-effective to configure a pair of TA81s rather than one TA78 master and slave. Efficient design allows the TA81, with its for-

TA81

matter, to be packaged in a single waist-high cabinet with room left over for a disk drive in the same cabinet.

With its streaming tape technology, the TA81 is ideal for applications involving sustained input/output such as high-capacity disk backup, data archiving, or recording from high-speed test equipment. It can also use traditional start/stop technology for the slower data transfers associated with journaling, transaction processing, and classical data processing. This low-speed start/stop function is useful for limited activity of this type, but heavy transaction-processing applications are better served by the high-speed TA78 subsystem.

Tape Resource Sharing for Greater Accessibility and Availability

The TA78 and TA81 subsystems provide a fast, shared-access resource for all VAXcluster System users. The ability to share resources is exceptional because the TA78 and TA81 are connected to the HSC50 or HSC70 Server, using DSA interconnects and protocols. The server operates as a specialized, independent node in the cluster, performing many I/O functions and leaving the host CPUs free to perform other tasks.

Resource sharing provides many benefits – but the two most important ones save you time. When multiple tape drives are shared via the HSC50 or HSC70, rather than being local to a single CPU, there is less likelihood of multiple users contending for a single drive, and more likelihood that you can access a drive when you need it. You also save time in the event that a tape drive malfunctions. Rather than waiting for repairs to be completed, you can generally access a functioning drive and complete your application.

For even greater availability and performance, the tape subsystems can be divided between two HSC5X-CA modules instead of all being connected to a single module.

Relative backup performance of clustered and local tape subsystems

(time in minutes)

■ VMS Backup

□ Local Backup (one tape drive)

■ Local Backup (two tape drives)
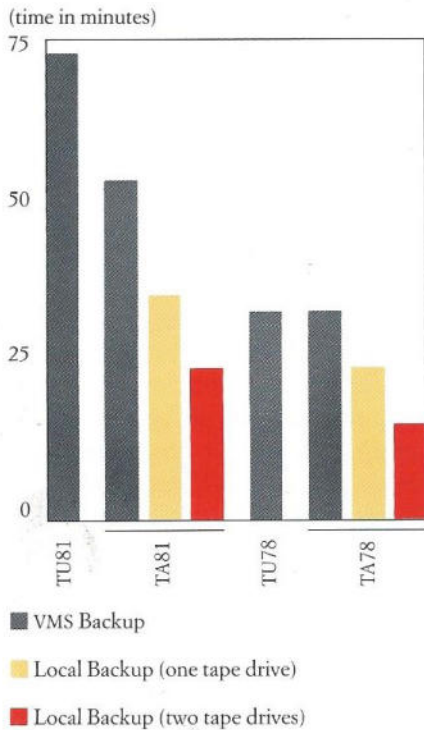
This data represents RA81 backup on a range of VAX systems, using HSC Local Backup or VMS Backup (with VMS switches used to optimize performance). See text for details. TU81s were paired with UDA50-based disks, and TA drives were paired with HSC50-based disks. Performance on your system may vary based on several parameters, but you can use this data as a guideline to relative performance.

Dramatically Increases Local Performance

The HSC Storage Servers support a unique utility that allows them to maximize tape drive performance and to back up or restore a disk at very high speed. Because this Local Backup and Restore utility does not involve the host CPUs, it is possible to perform backup with virtually no effect on the other operations of the cluster. Similarly, the backup operation is not hindered by the timesharing activities of the CPUs. Throughout the Local Backup operation, your data is protected by the outstanding data integrity features of the GCR tape formatter, as described in the next section of this brochure.

The TA78 and TA81 tape subsystems also support all standard VMS tape utilities but these programs are run under host CPU control. When host-based tape utilities are run, the CPUs use the HSC Server as an intelligent controller. A combination of factors can help you achieve significantly faster performance with the TA drives than with their TU counterparts. Several VMS switches can also be used to optimize the performance of VMS Backup without compromising data integrity, when operating at 6250 bpi

density (GCR mode). The settings used to generate the performance graph included Buffer = 5/NOCRC/ Block Size = 16 Kbytes.

In Local Backup, a physical copy of a disk is written to tape. The copy is a block-for-block transfer with no data compaction or file reorganization. Local Backup and Restore runs on the HSC Server, with no involvement of the host CPUs, and can access any disk and tape drives on the same HSC Server. The utility program is extremely fast and can back up an RA81 disk in 15 to 20 minutes using a TA78 tape subsystem. The chart depicting backup performance shows the impact of the Local Backup utility.

For optimum performance, two tape drives can be used. This arrangement allows the HSC Server to run backup continuously—writing to one tape drive while rewinding the other—so that no operating time is lost for rewind or reel changing.

During the local backup operation, the disk and tape drives involved in the data transfer are under HSC control and are unavailable to the host CPU. However, any other disk and tape drives on that HSC are unaffected and are fully available to the CPU. Therefore, most of the cluster's operation can continue while backup is taking place. If the disk being backed up is a member of a shadow set, then full cluster operation can continue, using the other member of the shadow set. The Local Restore utility reverses the the entire operation, copying data block-by-block from the tape subsystem to a disk subsystem.

Backup Performance Highlights

- Optimized switch settings provide up to 100% performance improvement when operating in GCR mode (6250 bpi).
- The TA78 provides approximately twice the performance of the TA81.
- TA81 tape subsystems perform up to 50% faster than TU81s.

Outstanding Data Integrity

Constant data checking and error correction in both recording modes ensure outstanding data integrity. Both the TA78 and TA81 perform read-after-write verification to ensure each bit written is verified immediately after it is recorded. Vertical parity is checked, character-by-character, at both densities when reading and writing. Data integrity on both the TA78 and TA81 is further ensured by recording Error Correcting Code (ECC) and Cyclic Redundancy Check (CRC) characters on the tape when in GCR mode. The tape subsystems use this extra information to make single- and double-track error correction without CPU intervention.

Unrecoverable errors rarely occur; if one should occur, however, the tape subsystem alerts the HSC Server. To facilitate rapid repair, diagnostic software in both the tape subsystem and the HSC Server can be used to locate the problem. Diagnostics are run offline without any CPU involvement and have minimal impact on the cluster's operation.

Easy to Use and Maintain

For ease-of-use, the TA78 features automatic loading, and the TA81 has a 13-inch tape path for fast manual loading. (This is the shortest tape path of any of the industry's ANSI-compatible tape products.) All operator controls are conveniently located on the front panel. The controls on the TA81 are touch-type membrane switches.

Both models are designed for simplified maintenance and ease of service. Both the TA78 and the TA81 have built-in diagnostic software and allow rapid access to all field-replaceable modules. The TA81 needs no adjustment or preventive maintenance except for routine, customer-performed head-cleaning. Both subsystems have a dia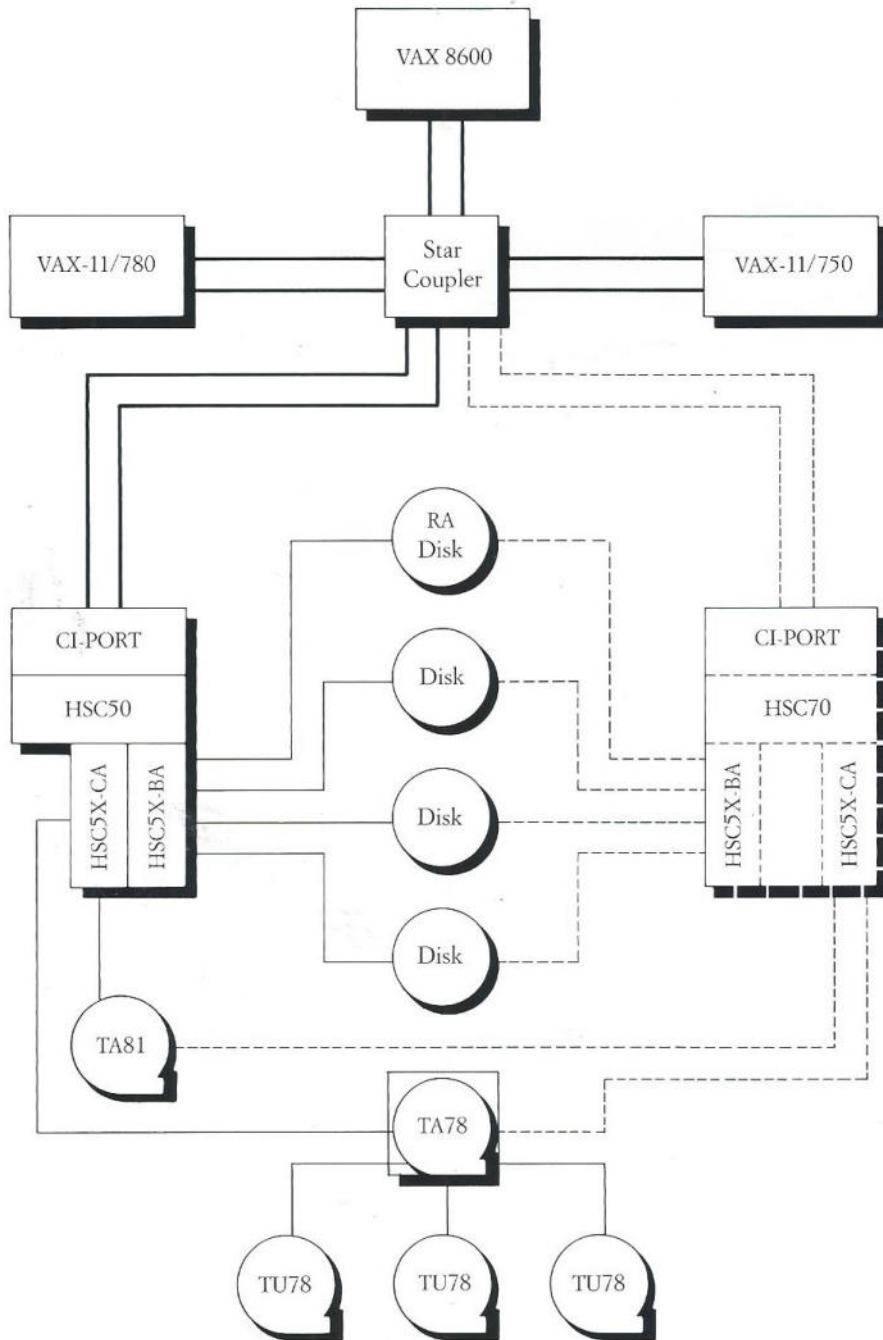gnostic port that allows a hand-held terminal or any ASCII terminal with a serial line interface to be connected to it. With the terminal, a field service engineer can monitor the subsystem's status, exercise the subsystem, and analyze fault conditions.

The TA78 and TA81 are designed for high reliability by eliminating troublesome and short-lived mechanical components and replacing them with solid-state components. Both subsystems are designed to reduce mechanical wear and to help protect the tape from damage and excessive wear. At powerup, the tape subsystems run self-test diagnostics and report any detected problem so that it can be corrected before the drive is needed. The TA78 also runs these tests when no tape is mounted.

Upgrade Kits Protect Your Investment

TA78 and TA81 upgrade kits protect your storage system investments. You can buy a stand-alone VAX System now, upgrade to a VAXcluster System later, and yet retain and use the original tape subsystem peripherals. All that needs to be done is install upgrade kits to your TU78 master, TU81-Plus or TU81 subsystems. The kits let you convert from TU to TA configuration quickly and easily. The kits contain all that is needed to upgrade the subsystems.* It takes about one working day (or less) to install a kit.

*If your present system configuration has no HSC-based tape subsystems but does have an HSC50 or HSC70 Server, you will need the HSC5X-CA tape interface module for your first TA subsystem.

VAX 8600

VAX-11/780

Star
Coupler

VAX-11/750

RA
Disk

Disk

Disk

Disk

CI-PORT

HSC50

HSC5X-CA

HSC5X-BA

CI-PORT

HSC70

HSC5X-BA

HSC5X-CA

TA81

TA78

TU78

TU78

TU78

One possible VAXcluster Storage Subsystem

Configuration Parameters

Both the tape units and the HSC Servers offer significant flexibility in configuring your mass storage subsystem. This allows you to tailor your system for cost-effectiveness and efficient performance.

Masters and Slaves – A TA78 master tape subsystem contains one TS78 formatter and one TU78 tape transport, packaged in a single cabinet. A maximum of three additional TU78 slave transports can be attached to each TA78 master, connecting to the formatter in a radial fashion. In contrast, TA81 subsystems each contain a formatter, and no slave transports are available.

Dual Porting – Both systems include two ports and are supplied with two cables for connection to HSC50 or HSC70 Servers. Dual ports are provided to facilitate rapid reconfiguration should an HSC malfunction. However, only one port should be enabled at any one time. The two ports are *not* intended for functions such as simultaneous access through multiple HSCs or for automatic failover.

HSC Servers – HSC50 Servers support as many as six I/O channel modules, each of which contains four ports. An HSC70 supports eight of those channels. A disk module can connect to four disk drives (one drive

per port), while a tape module can connect to four tape units – either TA78 masters or TA81 subsystems. Disk drives and tape transports can be mixed on a mass storage system (HSC50 or HSC70) but not on one channel module.

If you already have an HSC Server but do not yet have clustered tape units, you will need to order an HSC5X-CA tape channel module with your first TA81 or TA78 tape subsystem. Although each module can support four tape units, you may prefer to add additional modules as your tape farm grows, in order to maximize throughput and increase availability. TA78s and TA81s can be attached to the same HSC5X-CA module.

If you'd like to learn more about these products or other Digital products, call your nearest Digital Sales Office or ask your Digital Sales Representative.

Specifications

	TA78 Subsystem	TA81 Subsystem
Performance		
Read/write speeds		
Start/stop mode	125 ips	25 ips
Streaming	Not Applicable	25 & 75 ips
Maximum Data Transfer Rate	781 Kbytes/s	468 Kbytes/s
Rewind Speed (average)	440 ips	192 ips
Rewind Time (2,400-ft tape)	65 s	150 s
Data Organization		
ANSI Standards		
PE to Std X3.39-1973	Yes	Yes
GCR to Std X3.54-1976	Yes	Yes
Number of Tracks	9	9
Recording Density in PE mode	1,600 bpi	1,600 bpi
Recording Density in GCR mode	6,250 bpi	6,250 bpi
Capacity		
in PE mode (2 Kbyte blocks)	40 Mbytes	40 Mbytes
in GCR mode (8 Kbyte blocks)	145 Mbytes	145 Mbytes
in GCR mode (64 Kbyte blocks)	167 Mbytes	167 Mbytes
Record Length	Variable up to 64 Kbyte maximum	Variable up to 64 Kbyte maximum
Recording Medium (ANSI Standard)	0.5-in magtape	0.5-in magtape
Reel Diameters	17.8 cm (7 in)	17.8 cm (7 in)
	21.6 cm (8.5 in)	21.6 cm (8.5 in)
	26.7 cm (10.5 in)	26.7 cm (10.5 in)
Tape Cartridge	IBM Easyload[1]	Not Applicable
Operating Environment		
Temperature Range	15°C to 33°C	15°C to 33°C
	59°F to 90°F	59°F to 90°F
Relative Humidity	20 to 80%	20 to 80%
Maximum Wet Bulb Temperature	25°C (77°F)	25°C (77°F)
Maximum Altitude	2,400 m (8,000 ft)[2]	3,000 m (10,000 ft)
Maximum Acoustic Noise	70 dBa	51 dBa

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Specifications continued

	TA78 Subsystem	TA81 Subsystem
Power Requirements		
Voltage at 60 Hz	240 Vac	120 Vac
Voltage at 50 Hz	240 Vac	240 Vac
Phase	Single	Single
Maximum Power Consumption	3.7 kVA	0.5 kVA
Heat Dissipation	6.7 KBtu/h	1.03 KBtu/h
Power Plug at 60 Hz	NEMA 6-15R	NEMA 5-30
Power Plug at 50 Hz	NEMA 6-15R	Schuko/CEE 7-7
Maximum Cable Length (HSC to TA drive)	30.5 m (100 ft)	30.5 m (100 ft)
Physical Characteristics		
Height	154 cm (60.5 in)	106 cm (41.6 in)
Width	70 cm (27.5 in)	54 cm (21.3 in)
Depth	76 cm (30.0 in)	76 cm (30.0 in)
Weight	286 kg (630 lb)	106 kg (235 lb)
Configuration Parameters		
Drives per Formatter	4	1
Formatters per HSC5X-CA	4	4
Drives per HSC[3]	[4]	[4]
Dual porting to two HSC50 Servers	Possible with caution. Contact your Field Service Representative	

[1]*IBM and Easyload are trademarks of International Business Machines Corporation.*
[2]*At altitudes above 610 meters (2,000 feet), the TA78 subsystem must have a high-altitude kit installed. Contact your local field service office to arrange for installation.*
[3]*Specifications for the HSC Servers can be found in the information sheet for those devices.*
[4]*An HSC Server supports at least eight tape subsystems in any combination of masters and slaves, whether attached to one or more HSC5X-CA modules. The number of tape subsystems supported will increase as VAXcluster capabilities evolve. Consult your Sales Representative to be sure you have a VAXcluster and VMS Operating System release that supports this subsystem or if you need more information on configuration requirements.*