GENERAL INFORMATION MANUAL

HCC/MVS 3.0

HOST

COMMUNICATION

CONTROL

7th edition

Document number: 600226-A

IMPRINT

7th Edition

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Extensions and changes to this Manual are based on PTF with status ZY00108, due to the fact that software changes were made at the same time.

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7th Edition in February 1997

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1 GENERAL INFORMATION MANUAL for HCC/MVS 3.0

1.1 LITERATURE

Manual	Order number	Reference
General Information Manual	600226-A	G
Installation/Customization Guide	600227-A	G
System Reference Guide	600233-A	G
Operators Guide	600231-A	G
Command Reference	600223-A	G
Conversion Notebook	600224-A	G
Installation/Customization Reference	600228-A	G
Messages and Codes	600230-A	G
ISPF User Guide	600229-A	G
Release Guide	600232-A	G

G This Manual is part of the standard HCC documentation. Further copies of the respective Manual can be obtained from the publisher.

2 RELEASE STATUS

2.1 CURRENT VERSIONS

2.1.1 HCC Version 2/Release 3.1

- HCC intercommunication between complexes using LU 6.2
- AMU [1)]- support (LU 6.2)
- ABBASEND with output
- HCC/ISPF interface
- SMP/E installation
- 4-digit Reply ID (MVS V.4)
- MOUNT Exit
- Dynamic I/O area/eject control
- Protocol improvement (communication)
- Support for 2 robots on one track
    + Insert with target coordinates
    + Dynamic change of robot access
    + Extended allocation influence
- CA1 support Release 5

2.1.2 HCC Version 2/Release 4.0

- Message suppression
- Archive geometry
- Primary / Alternate LU 6.2 for AMU[1]
- SMF recording and Archive mirror recovery
- Message prefix
- 4-digit device numbers
- Generic job name for priority control
- Extended download for coordinates
- Display of CSA (Common Service Area) data
- Display robot statistics
- Tape management systems support
    + CA1 Release 5.1
    + DFSMSrmm
    + CONTROL-T
    + ZARA
- Communication extension to 10 secondary HCCs
- MVS 5.1 support

[1] AMU = Archive Management Unit

2.1.3 HCC Version 3/Release 0.0

- Mixed media support
+ connecting IBM 3995 Model 13x jukeboxes
- Communication extended to 35 secondary HCCs

2.2 SUPPORTED SOFTWARE PRODUCTS

2.2.1 MVS and peripheral environments

- MVS Version 2.2.0 with JES3 Version 2.2.0	Exit **IATUX31** required whereby for Version 2.2.x certain functions such as AMODE 31 are only partially supported.
- MVS Version 2.2.0 with JES3 Version 2.1.5 - MVS Version 2.2.0 with JES3 Version 2.2.1	Exit **IATUX31** required whereby for Version 2.2.x certain functions, such as AMODE 31 are only partially supported.
- MVS Version 5.1.0 with JES3 Version 5.1.1 - MVS Version 5.2.0 with JES3 Version 5.2.1 Setup NONE is recommended in principle for JES3	**no problems known**
- MVS Version 5.1.0 with JES2 Version 5.1.0 - MVS Version 5.2.0 with JES2 - MVS Version 5.2.2 with JES2	**no problems known** **no problems known**
- DFSMS/MVS Version 1.1.0 to Version 1.2.0 - DFSMS/MVS Version 1.3.0 - DFSMS/hsm as from Version 2.3.0 upwards compatible	**not being tested at present**
- DFP as from Version 2.x.x upwards compatible - VTAM as from Version 3.2.0 upwards compatible - SMP/E as from Version 1.5.0 upwards compatible	**APPCCMD** required Data element MCS required for CLIST, messages, panel, table and sample
- TSO as from Version 1.x.x upwards compatible - ISPF as from Version 3.x.x upwards compatible	

It is recommended to use at least CM/2 Syslevel WR06150 with APAR II07033 when using VTAM 4.3. This means that CM/2 1.11 in the original version is sufficient, because this version fulfills the required syslevel, while CM/2 Version 1.1 has a lower syslevel.

2.2.2 External Security

- RACF as from Version 1.6.x upwards compatible	SAF support required
- Top Secret compatible	SAF support required
- ACF2 compatible	SAF support required

2.2.3 Tape Management Systems

- CA1 Version 4 Release 9 and UCC1, respectively special installation criteria as from CA1 PTF 9308, see CA's PIB **GI13563**	
	IECTMS7 and TMS007, respectively, are not supported because CA1 5.1 supports Checkpoint/ Restart Scratch
- CA1 Version 5 Release 1	
- CA1 Version 5 Release 2	**no problems known**
- CA Dynam/TLMS Version 5 Release 0 to Version 5 Release 4 compatible,	
- CONTROL/T Version 1 Release 2.2 compatible	PTF ZY00048 required
- DFSMS/rmm Version 1 Release 0 compatible with restrictions.	
	An exit is being prepared at present.
- EPIC Version 3 Release 1 compatible	
- TAPE2000	**Not supported at present**
- TLMS up to Version 5 Release 4 upwards compatible	
- ZARA Version 1 Release 1 compatible	PTF ZY00038 required

2.3 HCC/MVS INTERNAL RESTRICTIONS

2.3.1 HCC/MVS components

- Connecting up to 9 HCC/MVS Host complexes (Major/Minor complex)
- Connecting a maximum of 7 secondary HCC systems within a complex as from PTF **ZY00044,** up to 10 secondary HCC systems per complex are supported for HCC/MVS 2.4.0

2.3.2 AML/x components

- Connecting a maximum of 2 AML/x systems per primary HCC system
- Connecting a maximum of 2 robots per AML/x system whereby 2 robots on one track are a special version and are no longer actively marketed (supported)
- Support of a total maximum of 99 MVS devices (units) whereby the numbering starting with 01 must be consecutive and in ascending sequence. As from PTF **ZY00052**, a total of 255 MVS devices (units) are supported for HCC/MVS 2.4.0; whereby numbering must only be in ascending sequence.
- Support of **only one** dynamic area within **one** AML/x system

2.3.3 Foreign product components

- Support of a maximum 6-digit pool (volser) names for Scratch selection.

3 SYSTEM OVERVIEW

3.1 INTRODUCTION

Computer centers perform tape processing with widely differing strategies: with or without tape archives, with one or several tape pools, with time-critical or non-critical tape loading, under JES2 or JES3, with various tape management systems etc.

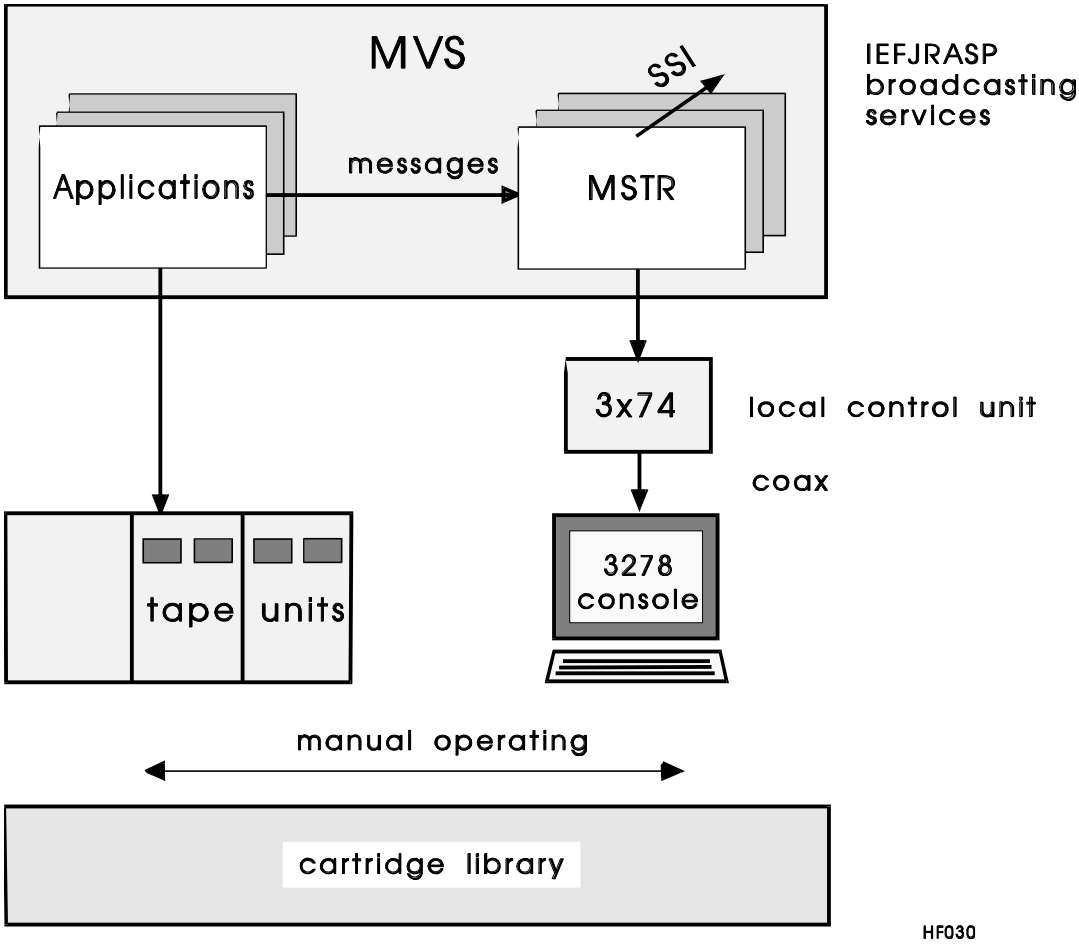


Fig. 1: Manual tape processing

A range of manual activities with varying intensity are normal:

- Repetitive MOUNT/KEEP activities in shift operation
- Cleaning units
- Replying to pending messages (WTOR)
- Daily provision of SCRATCH tapes
- Relocating cartridges to a backup archive
- Initializing cartridges
- Eliminating defective tape material, etc.

The procedural flow in many computer centers has been largely automated with JOB control systems, network monitoring procedures, automatic POWER-ON and IPL procedures, etc.

Operator-free devices such as CPUs, control units and magnetic disks are installed in bunker-type areas, secured and access-controlled.

However, all of these measures suffer from an obvious break in integrity as long as the tape processing, as a significant component within the computer center operation, remains a purely manual procedure.

3.2 INTEGRATING THE AML SYSTEM

The AUTOMATED MEDIA LIBRARY (AML) creates the environment to integrate the magnetic cartridge processing in the automated processing within a computer center. This has the following advantages

- Optimization of the computer center operations
- Extended usage of machine capacities
- Considerable improvement in data security

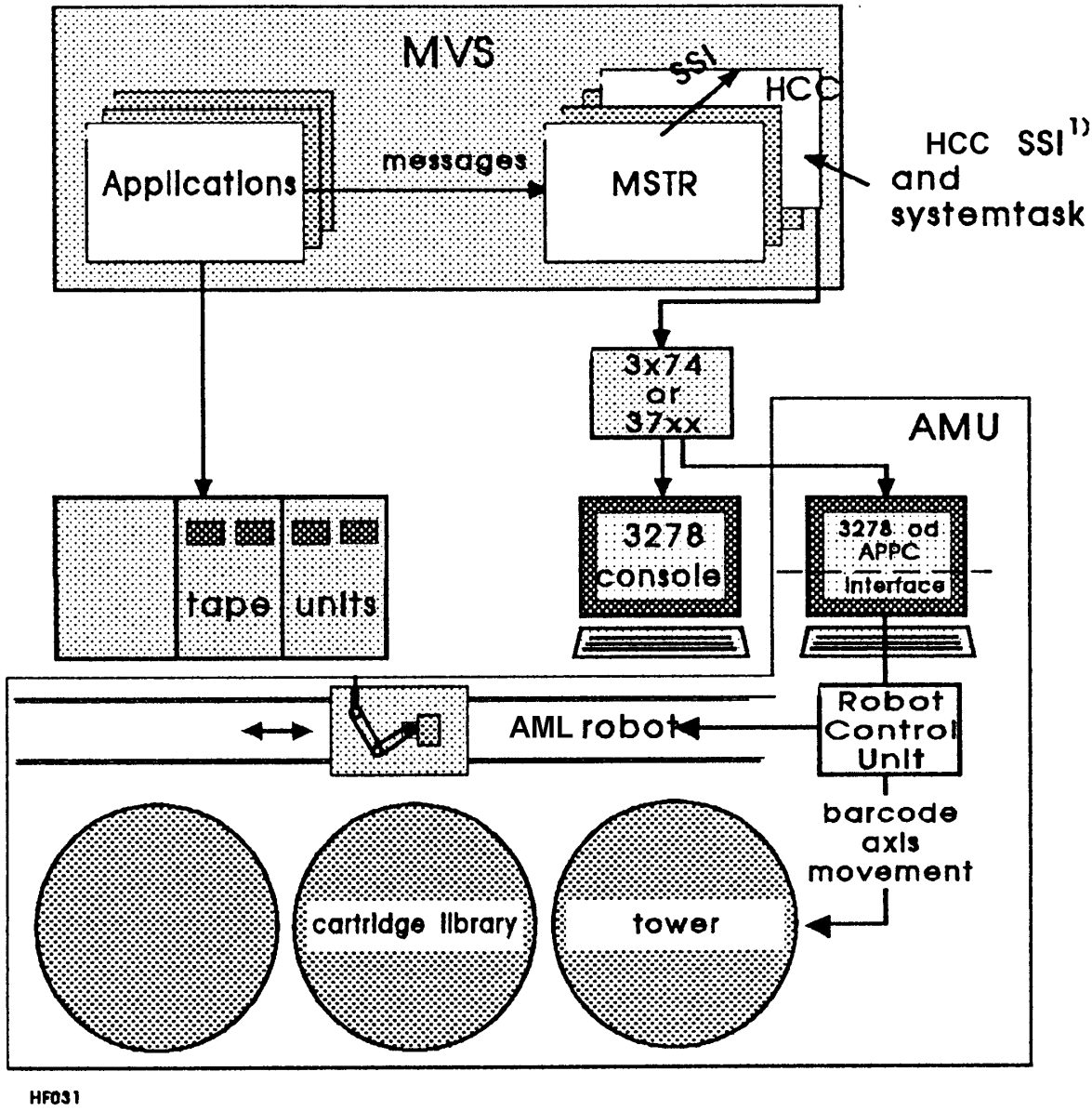


Fig 2. Integrating an AML/2 System

Tape-related MVS messages (Routing code 3,5) are routed to the HCC system task using an MVS standard interface (SSI[1]). HCC controls these messages in a wait queue from where they are routed to

- the AR[2] (ABBA/1) or
- the AMU[3] (AML/2, AML/E and AML/J).

[1] SSI = Subsystem Interface
[2] AR = Archive computer
[3] AMU = Archive Management Unit

Various possibilities are available for the communication:

HOST MVS	ABBA/1 AR[1]	AML/2 - AML/E - AML/J AMU[2]
EXCP	X	X
LU 2	X	X
LU 6.2	---	X

Starting at the HOST, logical terms such as VOLSERs are first converted to logical coordinates, then into physical path increments.

The most significant feature of the implemented HCC software is that all the MVS standards are met.

[1]AR = Archive computer
[2]AMU = Archive Management Unit

3.3 HOST SOFTWARE CONCEPTS

The software component HCC, integrated in the HOST computer, builds the central control for the AML system.

HCC is based on the following functions:

1. The control intelligence of the overall system is located
   - ABBA/1 on the HOST computer side,
   - AML/2 on the HOST computer and AMU side,
   - AML/E on the HOST computer and AMU side,
   - AML/J on the HOST computer and AMU side.

   The robot system only receives commands.

2. Under HCC, the user sees the robot system as a normal unit supported by the operating system.

3. HCC is ready for operation immediately after IPL. The communication with LU 2 / LU 6.2 can first start after VTAM start.

4. HCC does not modify the MVS operating system; no changes are required in the current installation.

5. HCC supports multi-computer systems under JES2 or JES3.

6. HCC only serves the tape units assigned to it whereby, in the normal case, the general MVS allocation is not influenced in any way. The allocation can however be influenced by installing a 'Catalog Verification Exit' (ZHC026DU in IGG026DU) for cataloged files.

7. The HOST-AML communication interface requires, on the hardware side
   - for EXCP, a COAX connection (3270-UCB) to a local non-SNA 3x74 control unit,
   - for VTAM LU 2, a COAX connection to a 3x74 control unit (local or remote),
   - for VTAM LU 6.2 (AML/2/E/J), a physical connection capable of LU 6.2 (for example, 3174 with Token Ring adapter).

8. Communication with HCC is possible through the ABBASEND interface or the MVS-**MODIFY** command.

HCC performs the following tasks, among others, in a computer center:

- Mount/keep of cartridges
- Mount/keep of "unknown" cartridges (foreign-mount)
- Mount/flip/keep of optical disks - operator accessible drive
- Load jukebox / unload jukebox - library input/output station

- Insert/eject of supported media

- Management/selection of scratch tapes
- Management/selection of optical disks with "freespace" for predefined storage groups

- Cleaning cartridge stations
- Management of cleaning cartridges

- Initialization of cartridges
- Initialization of optical disks
    + Maintenance of shelf location
    + Allocation of owner information
    + Allocation to storage groups

- Header check of tapes / header display

- Automatic reaction to replies (cartridges/optical disks)

- Diverse statistics / reports

4 HCC-AML CONFIGURATIONS

4.1 SINGLE AML - SINGLE HOST

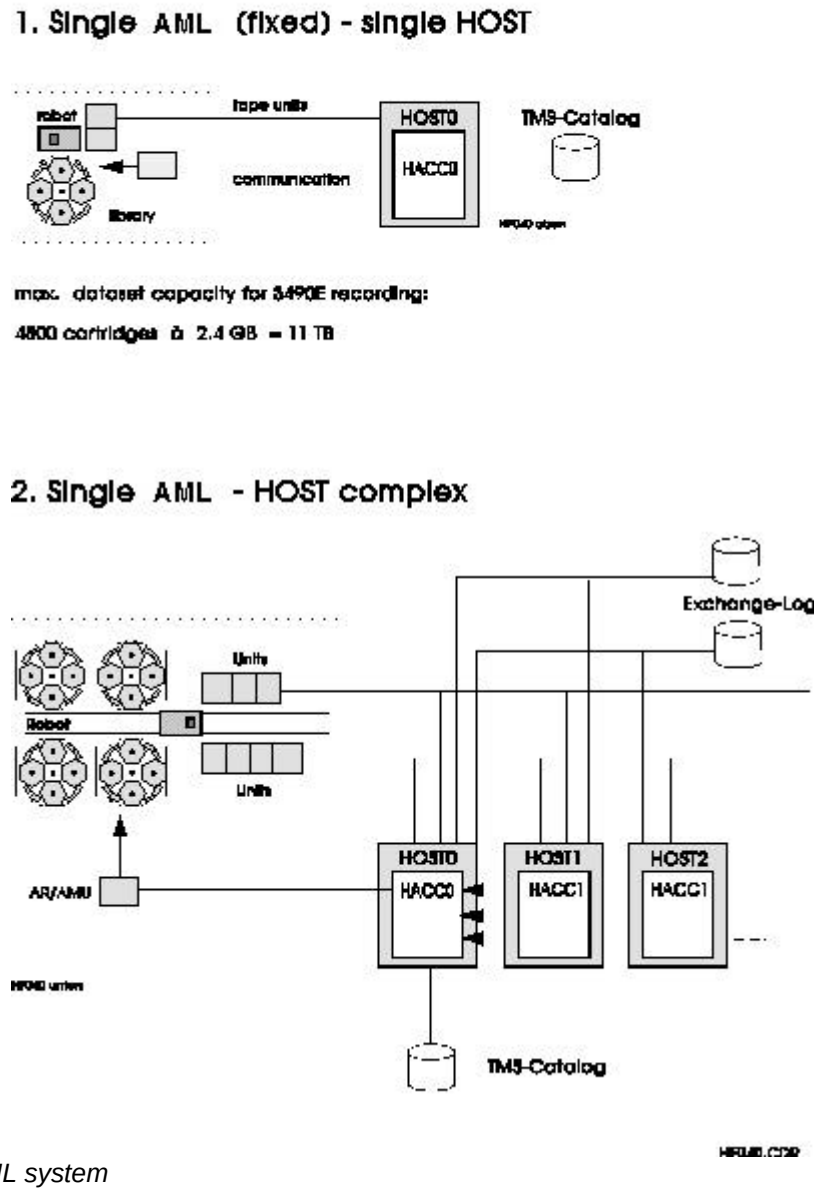


Fig 3. Single AML system

One robot with at least one tape station and a revolving tower.

Description:

- 1 AML system

- 1 robot
- 1 revolving tower
- 1 I/O unit
- n drives (installation-dependent)
- 1 primary HCC
- 1 TMS[1] (optional)

[1]TMS = Tape Management System

4.2 SINGLE AML - HOST COMPLEX

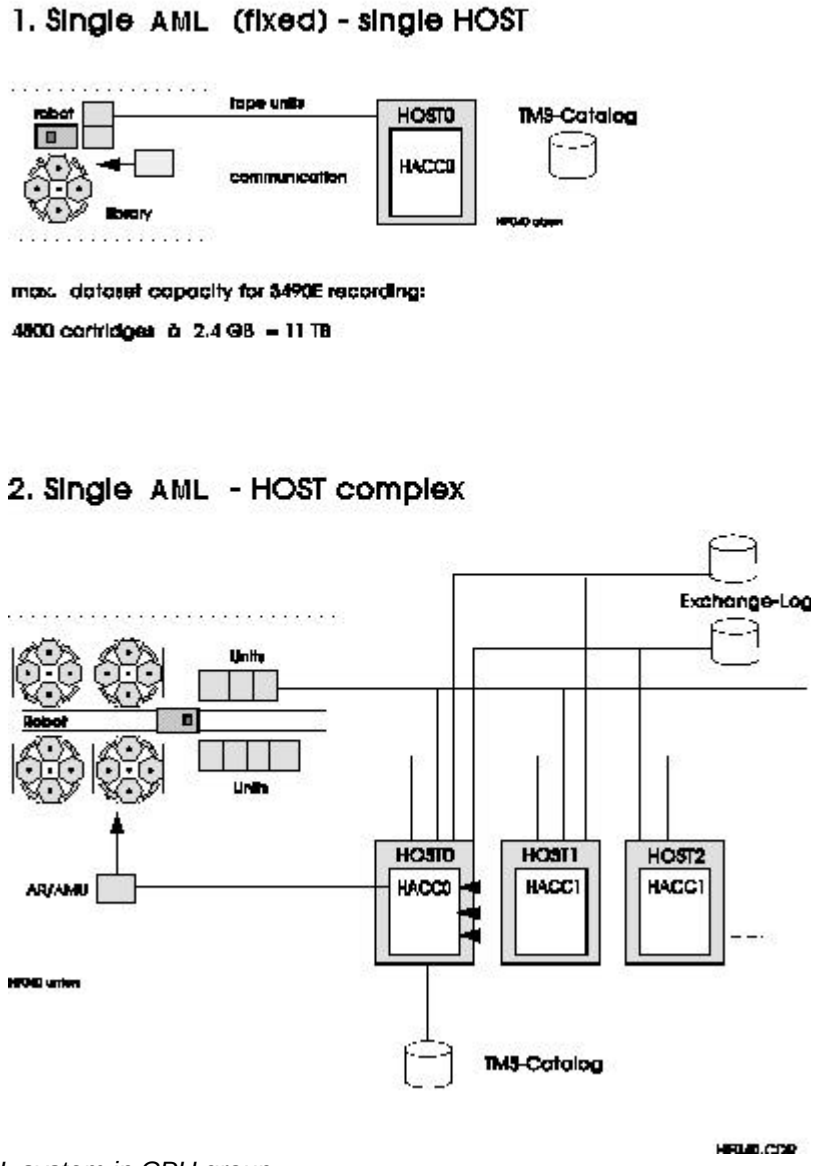


Fig 4. Single AML system in CPU group

Up to 19 host systems can access an AML pool. Shared DASD is used for the data transfer between the systems.

Description:

- 1 AML system
- 1 robot

- n revolving towers
- 1 I/O unit
- n drives
- 1 primary and 1-35 secondary HCCs
- 1 TMS[1] (optional)

[1]TMS = Tape Management System

4.3 DOUBLE AML - HOST COMPLEX

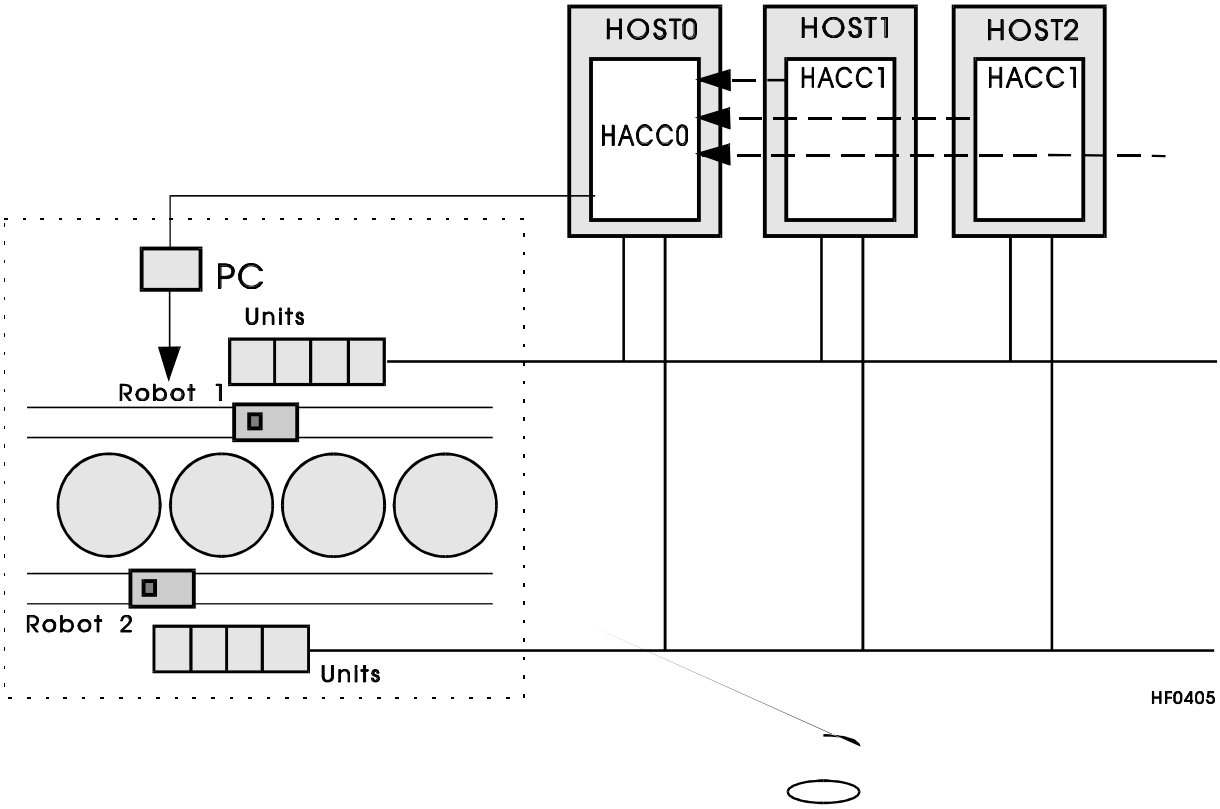


Fig 5. Double AML system in CPU group

Description:

- 1 AML system
- 2 robots
- n revolving towers
- 2 I/O units
- n drives
- 1 primary and 1-35 secondary HCCs
- 1 TMS[1] (optional)

The MVS allocation does not have to be influenced because, the revolving towers can rotate 360 degrees. This means that every robot can access every cartridge.

[1]TMS = Tape Management System

The advantage of this arrangement is the higher availability should one robot fail but with a decrease in usage of cartridge units on one side.

4.4 AML COMPLEX - HOST COMPLEX

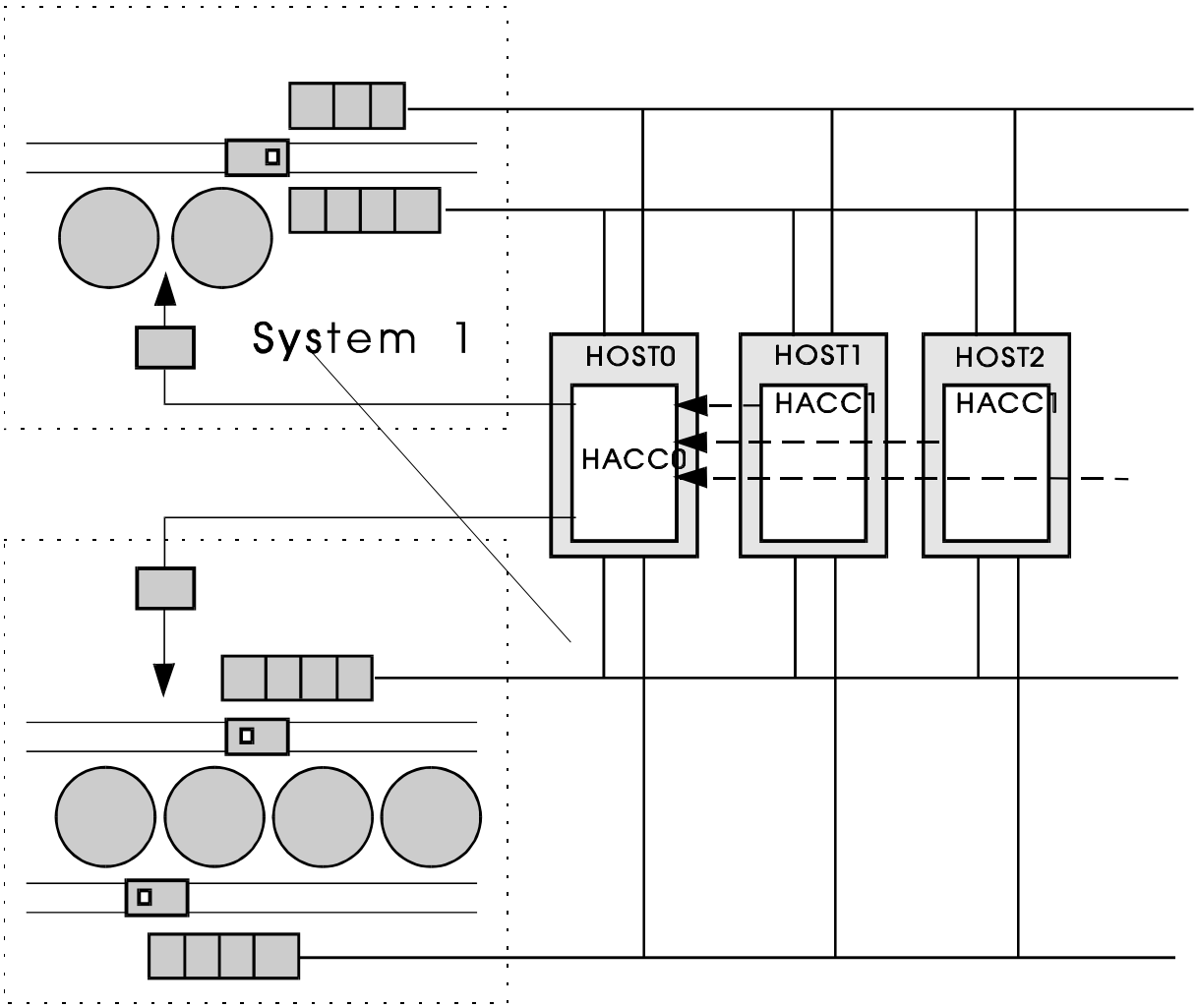


Fig 6. Two AML systems in CPU group

Description:

- 2 AML system
- 2 to 4 robots
- n revolving towers
- 2 to 4 I/O units
- n drives
- 1 primary and 1-35 secondary HCCs
- 1 TMS[1] (optional)

[1]TMS = Tape Management System

Two AML systems provide catastrophe backup in automatic operation.

Backup copies can be created in a different location (K archive) which means ejects are no longer necessary.

4.5 DOUBLE AML - MULTIPLE HOST COMPLEX (LU 6.2)

Description:

- 1 ABBA/1 system
- 2 robots
- n revolving towers
- 2 I/O units
- n drives
- 2 to any number of HOST complexes (communication using LU 6.2)
- 1 MAJOR complex and any number of MINOR complexes
- Per complex, 1 primary HCC and 1-35 secondary HCCs
- 1 TMS per HOST complex (optional)

The host intercommunication runs over LU 6.2.

Multiple HOST complexes are also referred to as clusters.

Each HOST complex has its own independent TMS catalog.

4.6 DOUBLE AML with AMU - SINGLE HOST COMPLEX

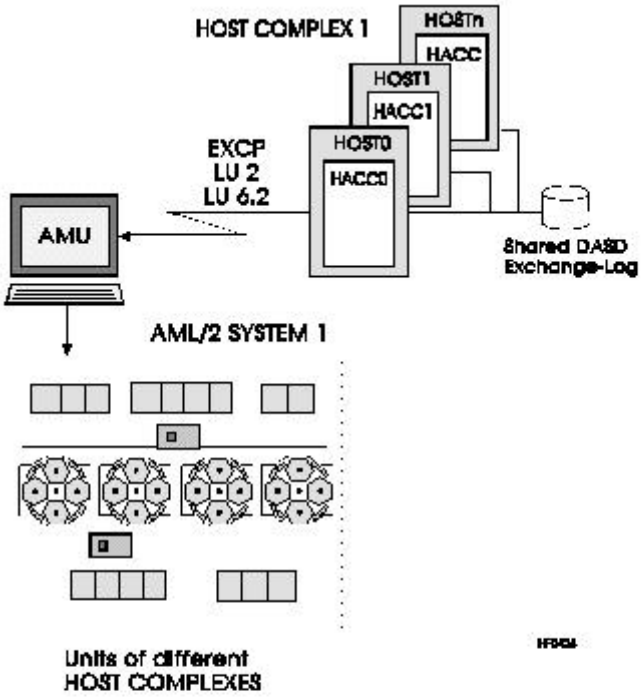


Fig 8. Single host system with access to one AML/2 system using AMU[1]

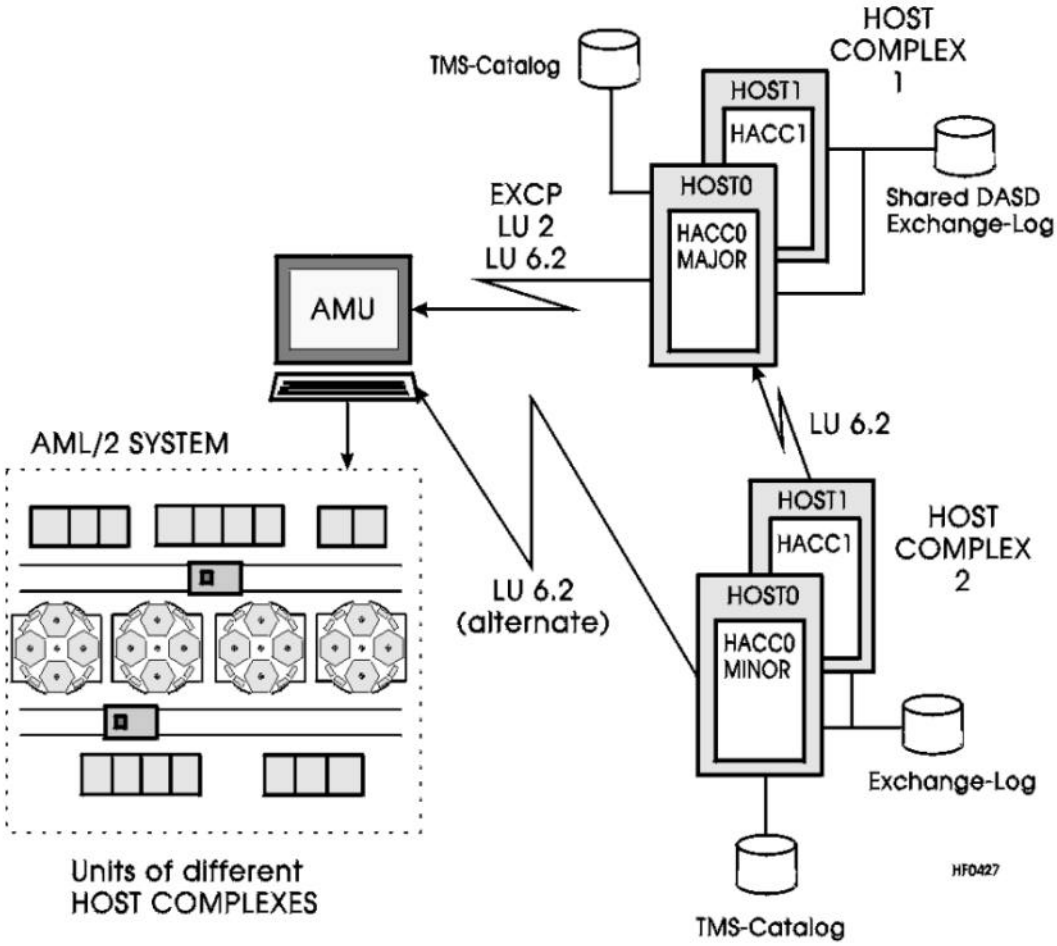
Description:

- 1 AML/2 system
- 2 robots
- n revolving towers
- 2 I/O units
- n drives
- 1 primary and 1-35 secondary HCCs
- 1 TMS[2] (optional)

In this configuration, an AML/2 system is connected to the HOST using an AMU[1].

[1]AMU = Archive Management Unit
[2]TMS = Tape Management System

4.7 DOUBLE AML with AMU - MULTIPLE HOST COMPLEX



HF0427.CDR

Multiple host system with access to one AML/2 system using AMU[1]

[1]AMU = Archive Management Unit

Description:

- 1 AML/2 system
- 2 robots
- n revolving towers
- 2 I/O units
- n drives
- 2 to any number of HOST complexes (communication using LU 6.2)
    - 1 MAJOR complex and any number of MINOR complexes
    - Per complex, 1 primary HCC and 1-10 secondary HCCs
    - 1 TMS per HOST complex (optional)

Multiple HOST complexes are also referred to as clusters.

Each HOST complex has its own independent TMS catalog.

5 ABBA/1 SYSTEM COMPONENTS

The overall ABBA/1 system comprises physical and logical components.

A linear rack, for example, is a physical component and the splitting of this storage into insert, eject or foreign mount areas are logical components.

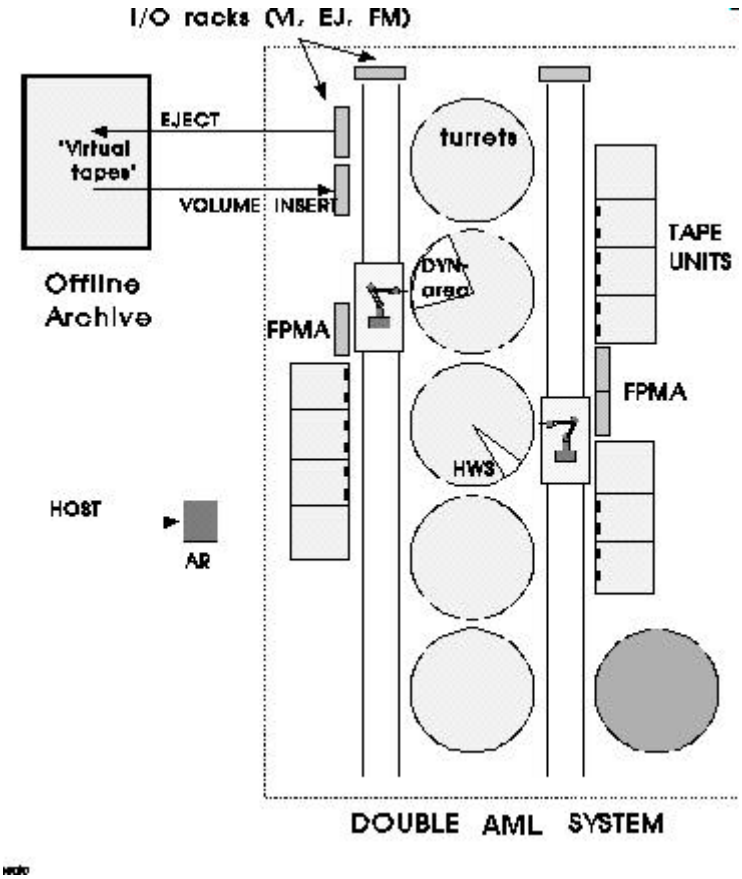


Fig 10. ABBA/1 system components

Explanations:

Abbr.	Designation	Function
VI	Volume insert area	Area for cartridge insert
EJ	Volume eject area	Area for cartridge eject
FM	Foreign mount area	Access area for external cartridges
WB	Problem box (waste box)	Unload position for problem situations
DYN	Dynamic area	ONLINE area of an OFFLINE ARCHIVE
FPMA	Fixed preferred mount/keep area	Area to pre-load scratch cartridges
AR	Archive computer	AML Archive management
HWS	HCC working storage	HCC working area - pass on area

5.1 ABBA/1 COMPONENT DESCRIPTION

5.1.1 REVOLVING TOWERS - ABBA/1

1. SIMPLE TOWER

This type has 16 segments each with 15 rows arranged as a polygon on a disc. Each row in a segment has 10 cartridge positions. The total capacity is 2400 cartridges. The cartridges are stored only in the outer zone of the tower.

2. QUADRO TOWER

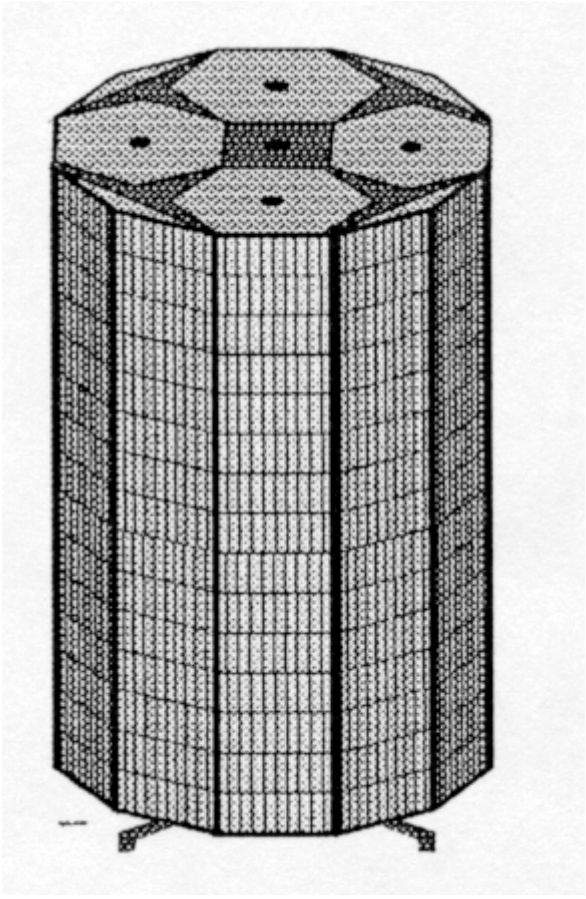


Fig. 11: Quadro tower

This type has 32 segments each with 15 rows arranged as 4 inner towers (each with 6 segments) and 8 outer segments on a disc. This tower accommodates 4800 cartridges.

The Archive computer software synchronizes the robot and the revolving tower.

With a twin-AML system, HCC tries to optimize the tower access depending on the wait queue.

5.1.2 LINEAR STORAGE ABBA/1

Linear storage is a simple rack system parallel to the guide rails of the robot (linear racks).

Each segment in the rack has up to 13 rows and each row in the segment normally has 25 positions.

Linear racks cannot only be used for standard library storage but also for insert/eject zones, foreign mount areas, scratch tape pre-loading units, etc.

5.1.3 CARTRIDGE UNITS - ABBA/1

Each cartridge unit is assigned coordinates. The robot software automatically considers a 90° cartridge turn when executing a **MOUNT**/**KEEP** command to or from the unit.

5.1.4 INSERT AREAS - ABBA/1

This area serves cartridge insert in the ABBA/1 system. Several insert areas can be defined per robot.

Insert areas are usually organized as linear rack units. The individual rows are equipped with a horizontal light barrier for immediate recognition of inserted cartridges.

In these areas, the operator can store cartridges in random sequence.

The insert function has several steps:
1. Position the cartridge.

2. **VI** command (possibly with area specifications).

3. HCC sends search tasks to ABBA/1:
 - Volser is identified in slot
 - Volser and coordinate are sent to HCC

4. Based on the Archive mirror definitions
   HCC sends the insert task to ABBA/1
   - hierarchic: to home position
   - dynamic: in dynamic area

5.1.5 EJECT AREAS - ABBA/1

This area serves cartridge eject from the ABBA/1 system. Several eject areas can be defined.

The **EJ** or **EJDSN** commands trigger an eject.

A message is displayed when an eject area overflows. After removal of the ejected cartridges, the interrupted eject can be resumed by entering the **EJCONT** command.

All insert and eject areas must not overlap.

An area in use is not blocked for further processing.

Organizational measures must ensure that erroneous processing is avoided.

5.1.6 FOREIGN MOUNT AREA - ABBA/1

The foreign mount area serves as a temporary area for processing external cartridges that are not defined in the ABBA/1 archive.

An existing barcode label on the cartridge is ignored.

Each position in the foreign mount area is assigned to a pseudo-volser with the following structure:

***sdnnn**

*	= Special character '*' (indicator to suppress barcode reading)
s	= AML system number
d	= Foreign mount slot number (1-9)
nnn	= Relative position in slot (001-nnn)

The operator inserts an external cartridge in an empty position in this area, then informs HCC about position, volser and so on, with the **FMA** command.

HCC recognizes this volser during a mount request for an external tape and generates a task with the appropriate pseudo-volser.

The Archive computer recognizes the position in the foreign mount area from the volser structure and automatically switches off barcode reading.

Foreign mount areas must **not** overlap insert/eject areas.

5.1.7 PROBLEM BOX - ABBA/1

The problem box (waste box) is a dump position for exceptional situations.

Such situations can arise, for example, during an insert. Cartridges without valid barcode labels are removed from the insert area and moved to the problem box (waste box).

Each robot must be assigned a problem box (W01 here).

5.1.8 CONFIGURATION EXAMPLE ABBA/1

Application:

E01 Eject for sending to the ABC company

E02 Eject to computer center 2

I01 General insert

E03 Eject for OFFLINE ARCHIVE
(dynamic area)

F01 Foreign mount area for external cartridges

W01 Problem box (system 1, robot 1 here)

5.1.9 DYNAMIC AREA - ABBA/1

The dynamic area is a defined subset of cartridge slots (freely selectable) in a tower or rack system. This supports the integration of certain data types that are not normally contained in the active AML library into the automation process with minimal effort.

Computer centers often have data under long-term access protection that is seldom or never used. Cartridges with such inactive data block ABBA/1 library storage space.

The following method can be applied for better storage utilization:

- A manual archive for inactive data is kept external to the ABBA/1 library (OFFLINE ARCHIVE). A dedicated number range is useful in this case. The corresponding data media are marked in the HCC Archive mirror as VIRTUAL VOLSERs.

- Data media can be moved from the OFFLINE ARCHIVE to the dynamic area with the normal insert procedure after the retention period has elapsed (not with direct insert / VI = DIR).

- A virtual cartridge is **always** placed in the next free position in the dynamic area. This position is permanently assigned to the cartridge as home position.

- When data media in the dynamic area are to be used for a scratch request, the selection can be controlled using pool definitions (DSNGR, VOLGR).

- The ABBA/1 archive position is marked as "Free" when a cartridge is moved from the dynamic area to the OFFLINE ARCHIVE.

- It is recommended, for organizational reasons, to specify a dedicated eject slot.

- When an unexpected specific request for a cartridge from the OFFLINE ARCHIVE is made, the data medium must be inserted and an appropriate HCC message is output.

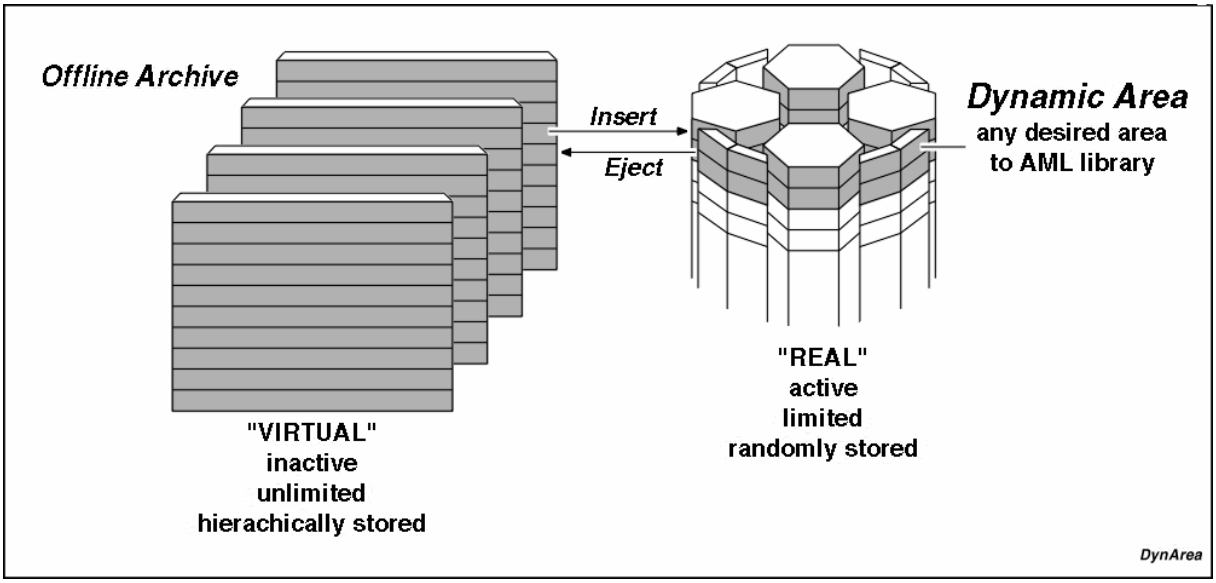


Fig 16. Illustration of an OFFLINE archive in the dynamic area

When all positions are defined as dynamic area in the ABBA/1 archive, the complete archive is then held in random sequence.

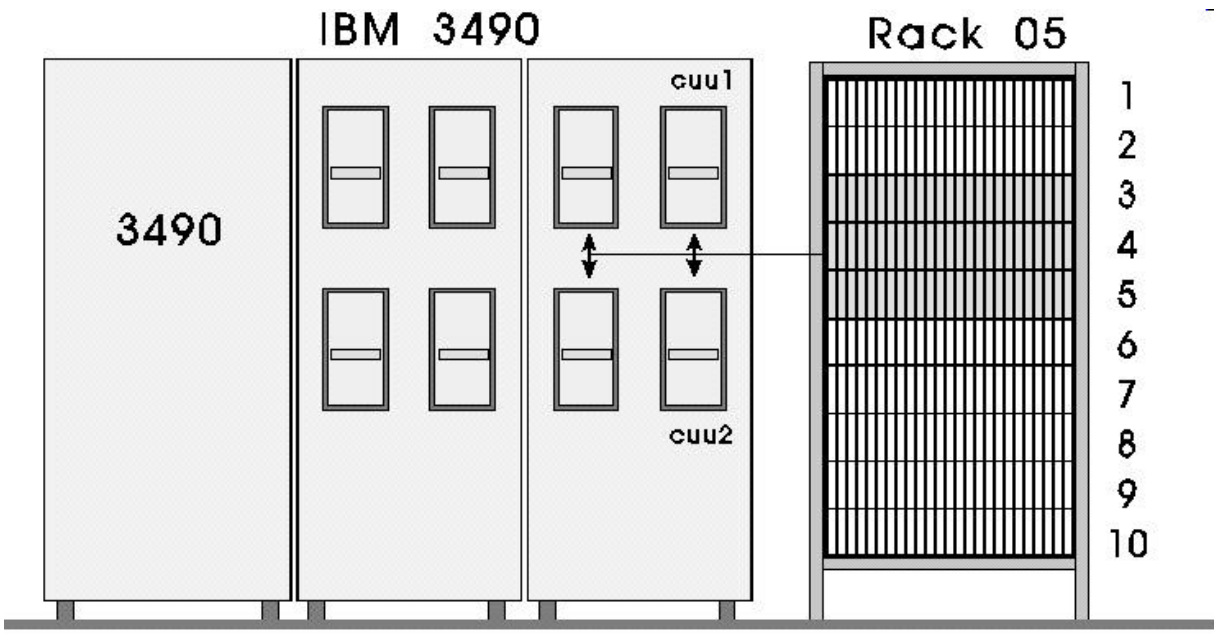
A dynamic area can be spread across several towers/racks.

A **KEEP** command for a virtual volser moves the cartridge to its dedicated home position instead of the next empty position in the dynamic area (drive proximity).

5.1.10 FPMA - ABBA/1

The FPMA[1] is positioned in a linear rack (normal case) or in a section of a tower. It is practical to keep this area close to the cartridge drive.

FPMA serves to optimize pure scratch tape processing (mount and keep).



FPMA

Fig. 17: FPMA on xx90 drives

[1]FPMA = Fixed Preferred Mount Area

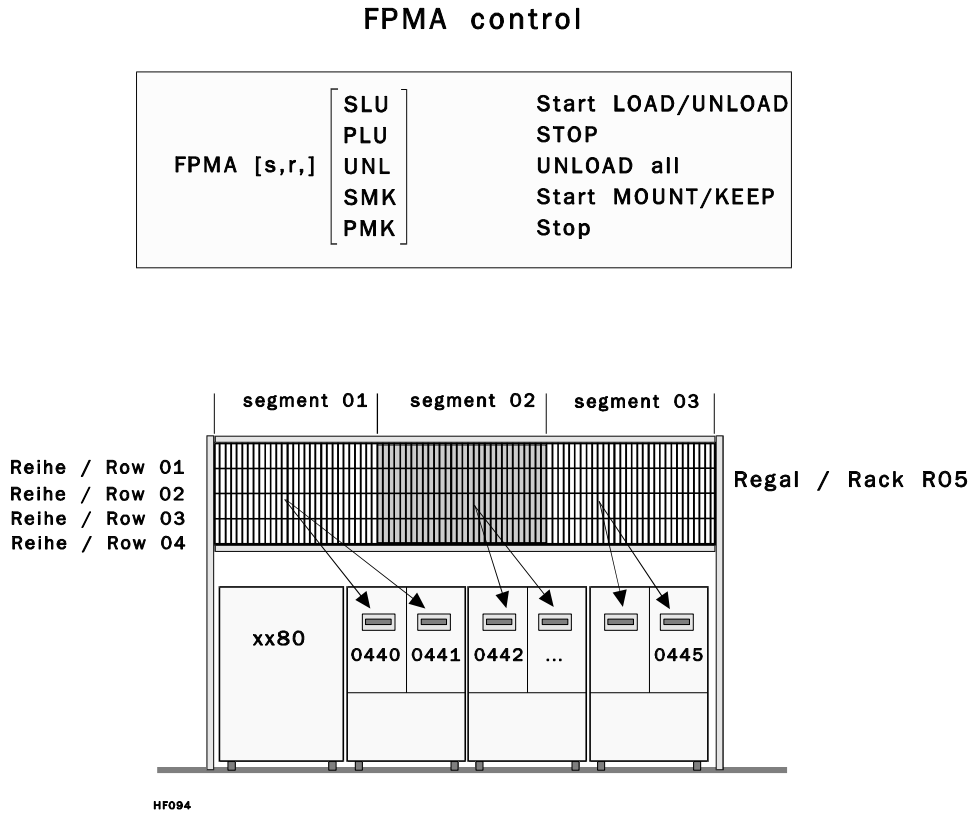


Fig. 18: FPMA on xx80 drives

Each cartridge drive can be assigned to specific areas in the FPMA, overlapping is possible.

Generally, there are intervals during the normal computer center work with low tape processing activity, ABBA/1 can use these intervals to unload or load the FPMA.

5.1.11 HWS - ABBA/1

The HWS[1] serves the robots in a twin-AML system for passing on cartridges.

An ABBA/1 system can have areas which the two robots cannot both access (for example, foreign mount area).

Example: - Cartridge in the foreign mount area of robot 1
- Mount request for drive under robot 2
- Robot 1 uses HWS to transfer the cartridge to robot 2

The HWS must be defined in a revolving tower to which both robots have access.

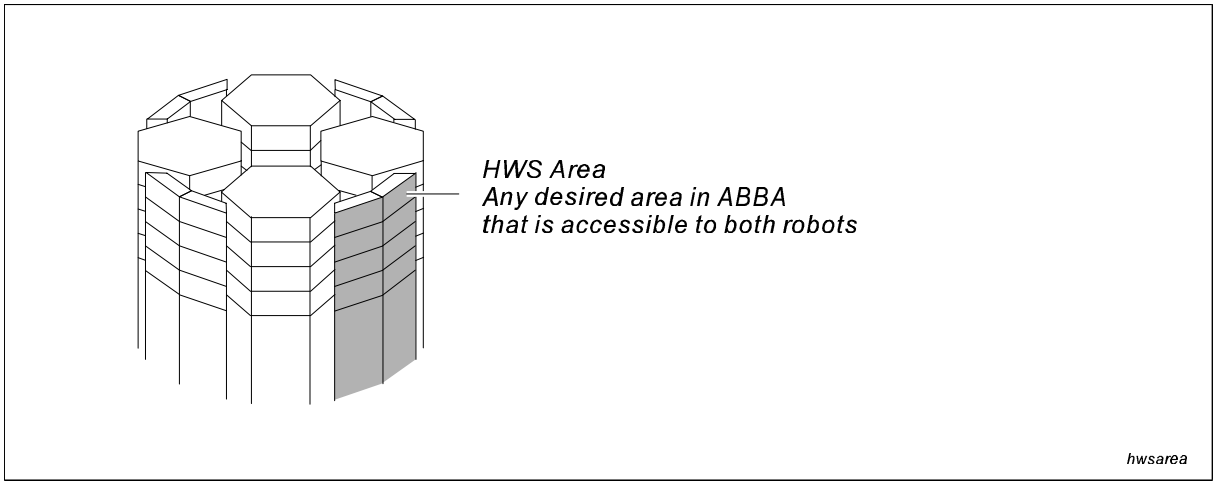


Fig. 19: HCC work storage for ABBA/1

The HCC Archive mirror must be corrected (generated) when the LDEV statements are modified.

Only one working storage area per AML system is possible.

At least as many HWS positions as installed tape units should be defined. However, only as many HWS positions as foreign mount slots are required.

[1]HACC Work Storage

6 AML/2 SYSTEM COMPONENTS

The overall AML/2 system comprises physical and logical components.

An I/O unit, for example, is a physical component and the splitting of this storage into insert, eject or foreign mount areas creates logical components.

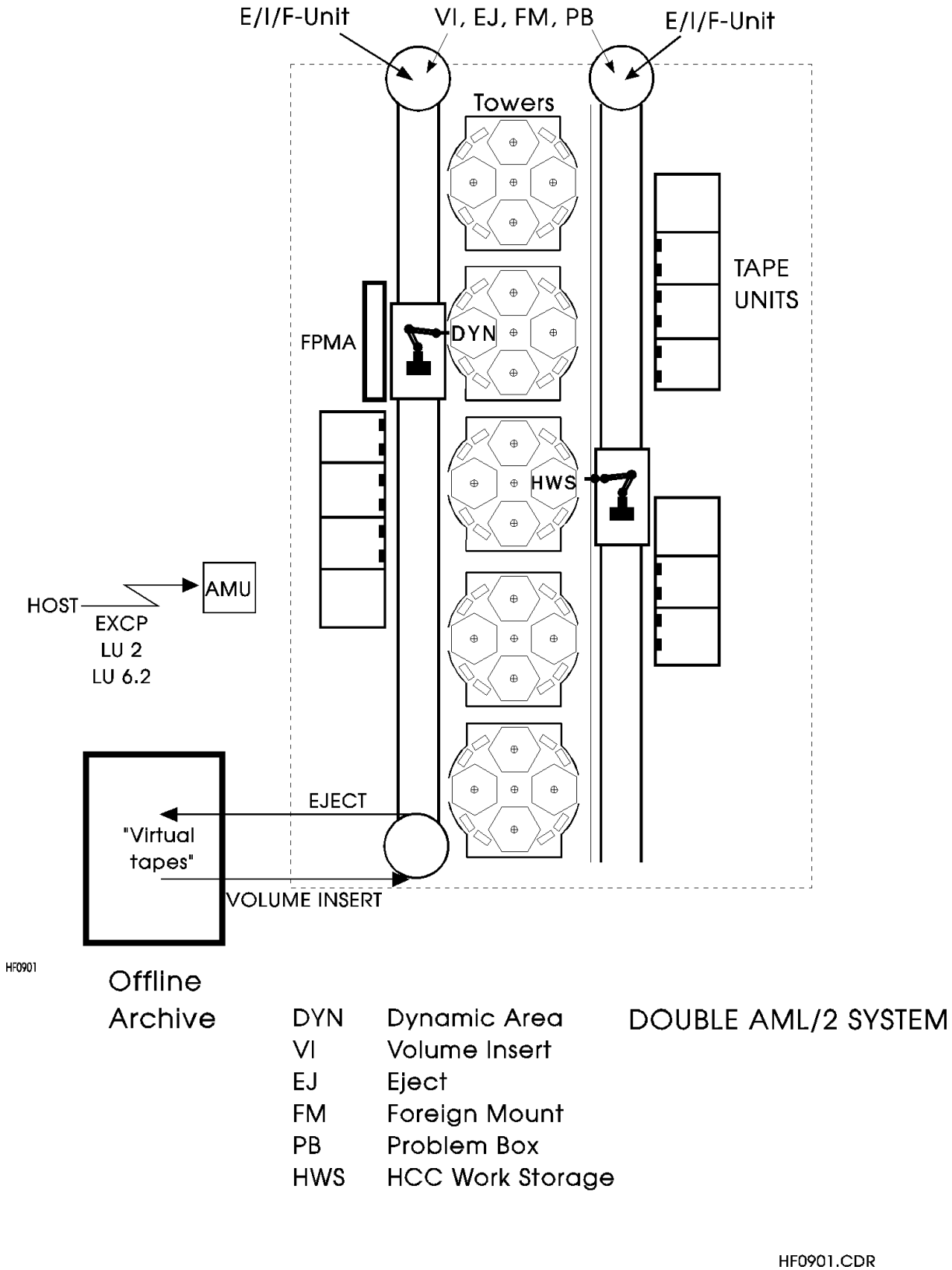


Fig 20. AML/2 system components

Explanations:

Abbr.	Designation	Function
VI	Volume insert area	Area for cartridge insert
EJ	Volume eject area	Area for cartridge eject
FM	Foreign mount area	Access area for external cartridges
CP	Problem box (cartridge pocket)	Unload position for problem situations
FPMA	Fixed preferred mount/keep area	Area to pre-load scratch cartridges
DYN	Dynamic area	ONLINE area of an OFFLINE ARCHIVE
AMU	Archive Management Unit	AML Archive management
HWS	HCC working storage	HCC working area - pass on area

6.1 AML/2 COMPONENT DESCRIPTION

6.1.1 REVOLVING TOWERS - AML/2

QUADRO TOWER for cartridges

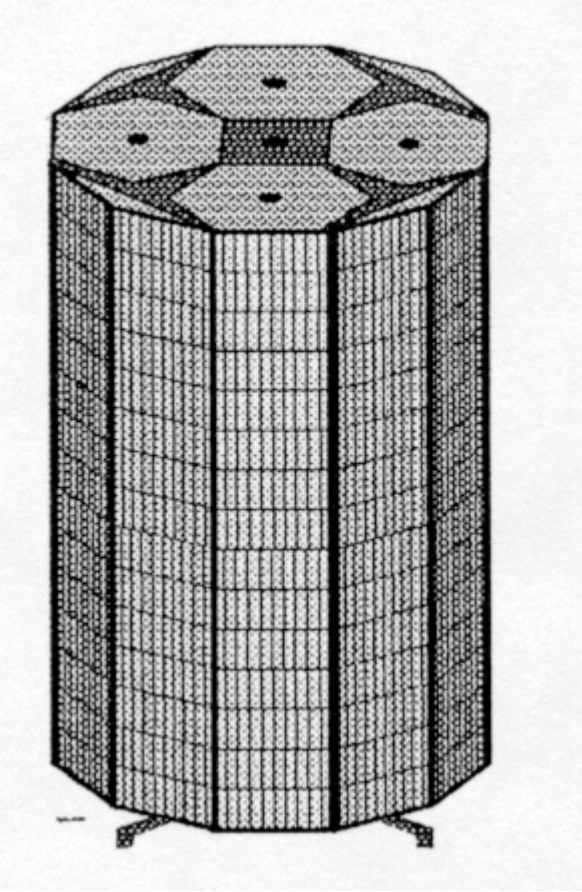


Fig. 21: Quadro tower

This type has 32 segments each with 4 inner towers (with 6 segments each) and 8 outer segments arranged on a disc. Each row in a segment has 10 slots (Fig. 21)

AML/2 quadro towers are available in various heights and for different media:

Capacities of the cartridge versions:

- 12 rows = 3,840 slots
- 15 rows = 4,800 slots
- 18 rows = 5,760 slots

QUADRO TOWER for optical disks

This type has 32 segments each with 4 inner towers (with 6 segments each) and 8 outer segments. Each row in a segment has 11 slots.

Capacity of the optical disk version:

- 13 rows = 4,576 slots

The following is valid for both quadro towers: The AMU software controls synchronization between the robots and tower.

With a twin-AML system, HCC also attempts to optimize the tower accesses depending on the wait queue.

6.1.2 LINEAR STORAGE- AML/2

Linear storage comprises fixed rack systems holding 360 to 540 cartridges. These racks are positioned parallel to the guide rails of the robot (linear racks).

6.1.3 CARTRIDGE UNITS - AML/2

Each drive (cartridge unit) is assigned coordinates. The robot software automatically considers a 90° cartridge turn when executing a **MOUNT**/**KEEP** command to or from the unit.

6.1.4 IBM 3995-13x Jukeboxes - AML/2

The OAD (Operator-Accessible-Drive) and the I/O-S (Input/Output-Station) of the library are assigned coordinates.

The robot software automatically considers a 90° optical disk turn (in both directions) when executing the commands

- Mount
- Keep
- Load Jukebox
- Unload Jukebox.

The optical disk on the OAD is rotated 180° when a **FLIP** command is executed.

6.1.5 INSERT AREAS - AML/2

This area serves cartridge insert in the AML/2 system. Several insert areas can be defined per robot.

Insert areas are usually in I/O units (E/I/F storage[1]).

The required segments are selected for insert or ejects using an OPE[2].

In these areas, the operator can store cartridges in random sequence.

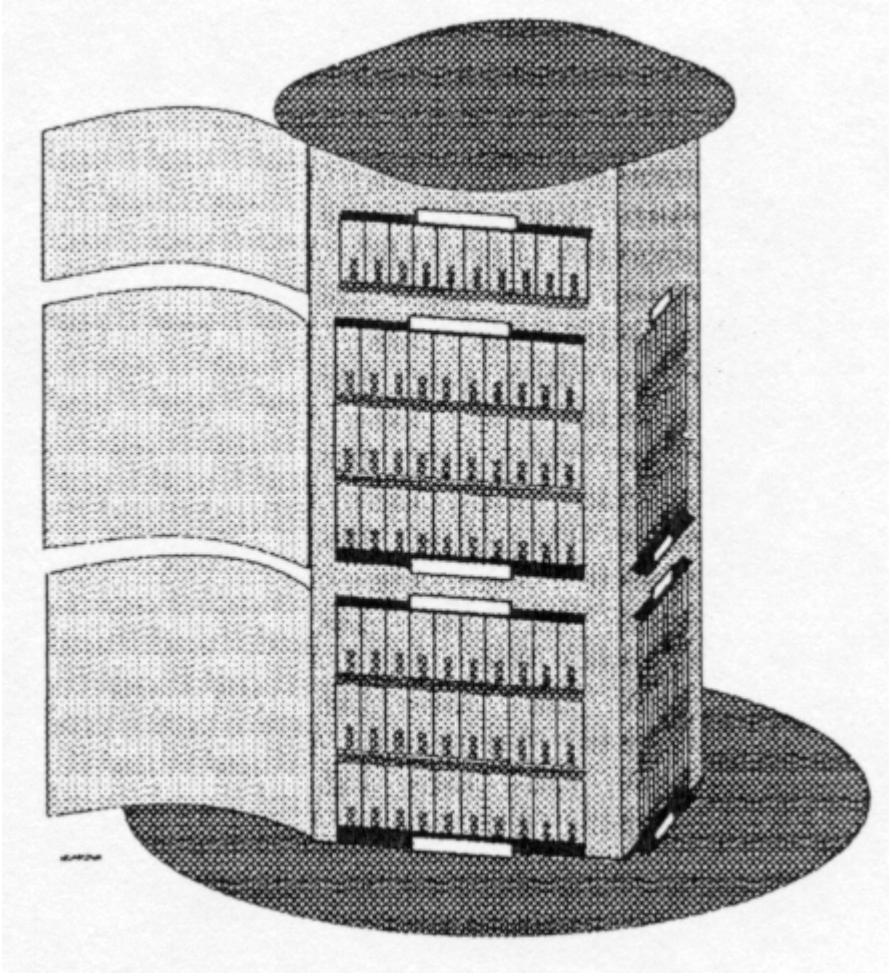


Fig. 22: I/O unit (E/I/F storage[1])

SYS 1/Rob 1	Rows	No	Racks/row	Total racks
Problem box	2	-	9	18
Standard	12	1-12	10	120
Extension	12	13-24	10	120

[1]E/I/F-Storage = Eject/Insert/Foreign-Mount - storage
[2]BDE = Operator element

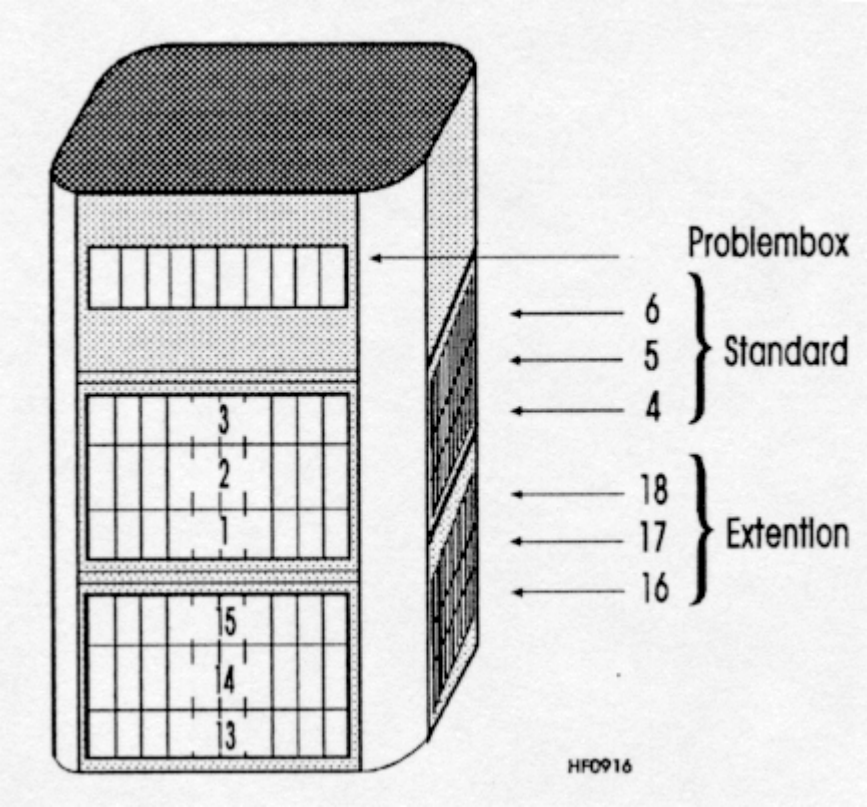


Fig. 23: Insert area for AML/2 in an E/I/F storage

The insert function has several steps:

1. Position the cartridges.

2. **VI** command (possibly with range specifications).

3. HCC sends search tasks to AML/2:
   - Volser is identified in slot
   - Volser and coordinate are sent to HCC

4. Based on the Archive mirror definitions, HCC sends the insert task to AML/2
   - hierarchic: to home position
   - dynamic: in dynamic area

6.1.6 EJECT AREAS - AML/2

This area serves cartridge ejects in the AML/2 system. Several eject areas can be defined. Eject areas are normally in I/O units (E/I/F area).

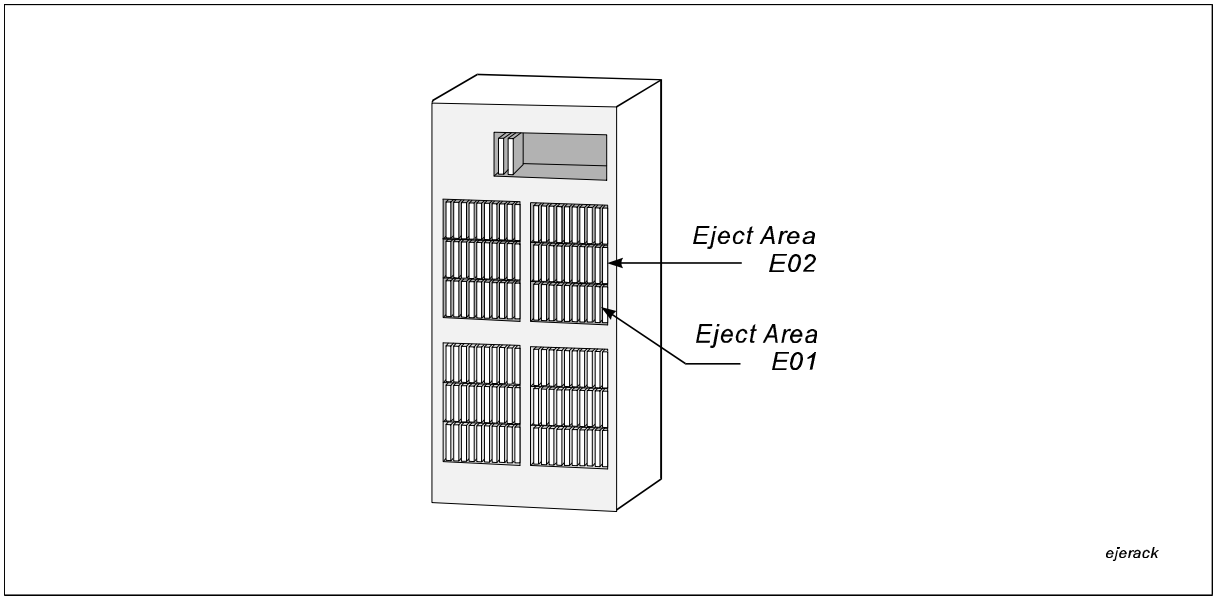


Fig. 24: Eject area for AML/2 in an E/I/F storage

The **EJ** or **EJDSN** commands trigger an eject.

A message is displayed when an eject area overflows. The interrupted eject can be resumed with the **EJCONT** command after removal of the ejected cartridges.

All insert and eject areas can overlap.

An area in use is not blocked for further processing.

Organizational measures must ensure that erroneous processing is avoided.

6.1.7 FOREIGN MOUNT AREA - AML/2

The foreign mount area serves as a temporary area for processing external cartridges that are not defined in the AML/2 archive. The foreign mount area is normally located in an I/O unit (E/I/F area).

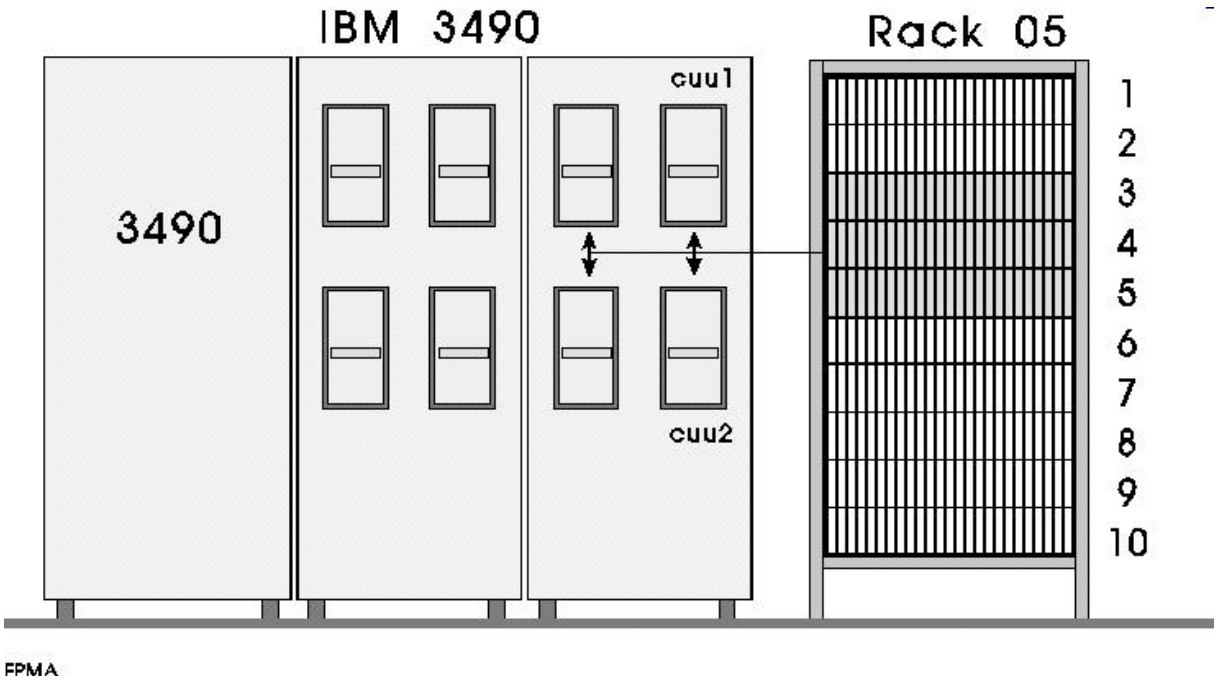


Fig. 25: Foreign mount area for AML/2 in an E/I/F storage

An existing barcode label on the cartridge is ignored.

Each position in the foreign mount area is assigned to a pseudo-volser with the following structure:

***sdnnn**

*	= Special character '*' (indicator to suppress barcode reading)
s	= AML system number
d	= Foreign mount slot number (1-9)
nnn	= Relative position in slot (001-nnn)

In this area the operator inserts an external cartridge in an empty position, then informs HCC about position, volser and so on, with the **FMA** command.

HCC recognizes this volser during a mount request for an external tape and generates a task with the appropriate pseudo-volser.

The AMU[1] recognizes the position in the foreign mount area from the volser structure and automatically switches off barcode reading.

Foreign mount areas must **not** overlap insert/eject areas.

[1] AMU - Archive Management Unit

6.1.8 PROBLEM BOX - AML/2

The problem box or cartridge pocket is a dump position for cartridges in exceptional situations.

Such situations can arise, for example, during insert. Cartridges without valid barcode labels are removed from the insert area and moved to the problem box (cartridge pocket).

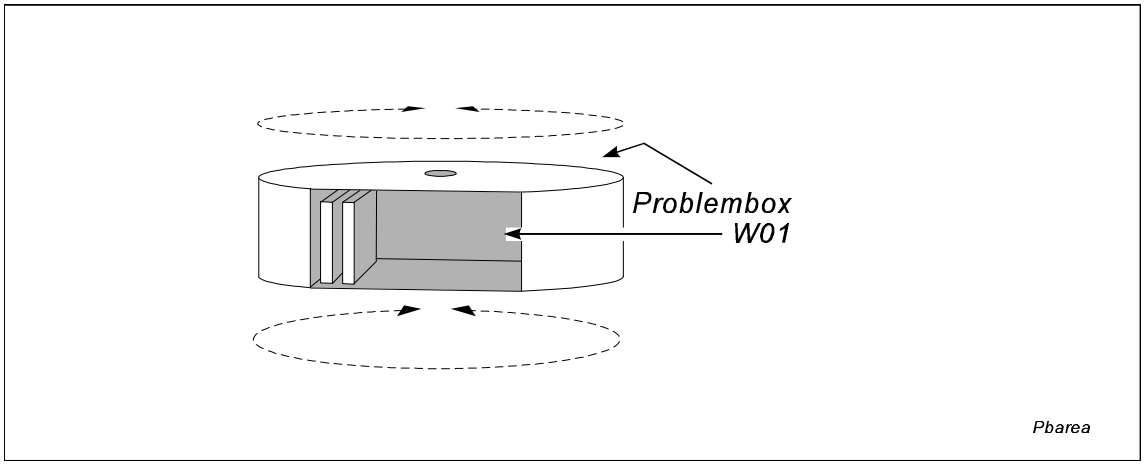


Fig. 26: Problem box (cartridge pocket) AML/2

Each robot must be assigned a problem box (cartridge pocket). The I/O area is used in the case of an overflow.

6.1.9 AML/2 CONFIGURATION EXAMPLE

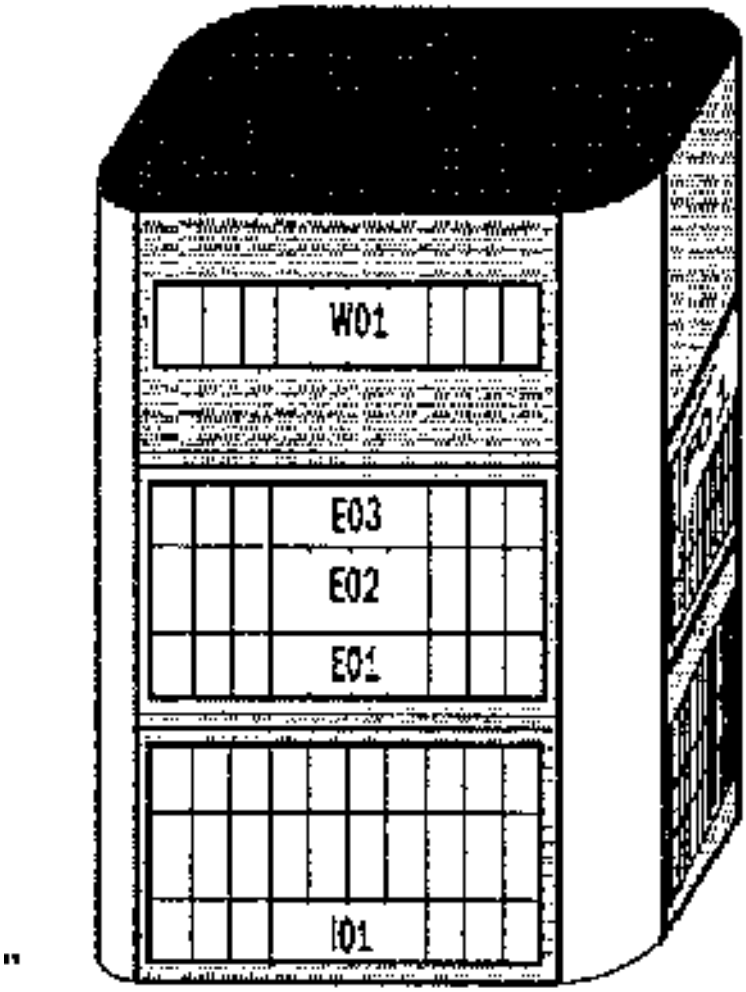


Fig. 27: I/O unit with foreign mount area and problem box

E01	Eject for sending to the ABC company
E02	Eject to computer center 2
E03	Eject for OFFLINE ARCHIVE (dynamic area)
I01	General insert
F01	Foreign mount area for external cartridges
W01	Problem box (system 1, robot 1 here)

6.1.10 DYNAMIC AREA - AML/2

The dynamic area is a defined subset of cartridge slots (freely selectable) in a tower or rack system. This supports the integration of certain data types that are not normally contained in the active AML library into the automation process with minimal effort.

Computer centers often have data under long-term access protection that is very seldom or never used. Cartridges with such inactive data hinder AML/2 library storage space usage.

The following method can be applied for better storage utilization:

- A manual archive for inactive data is kept external to the AML/2 library (OFFLINE ARCHIVE). A dedicated number range is useful in this case. The corresponding data media are marked as VIRTUAL VOLSERs in the HCC Archive mirror.

- Data media can be moved from the OFFLINE ARCHIVE to the dynamic area with the normal insert procedure after the retention period has elapsed (not with direct insert / VI = DIR).

- A virtual cartridge is **always** placed in the next free position in the dynamic area. This position is permanently assigned to the cartridge as home position.

- When data media in the dynamic area are to be used for a scratch request, the selection can be controlled using pool definitions (DSNGR, VOLGR).

- The AML/2 archive position is marked as "Free" when a cartridge is moved from the dynamic area to the OFFLINE ARCHIVE.

- It is recommended, for organizational reasons, to specify a dedicated eject slot.

- When an unexpected specific request for a cartridge from the OFFLINE ARCHIVE is made, the data medium must be inserted and an appropriate HCC message is output.

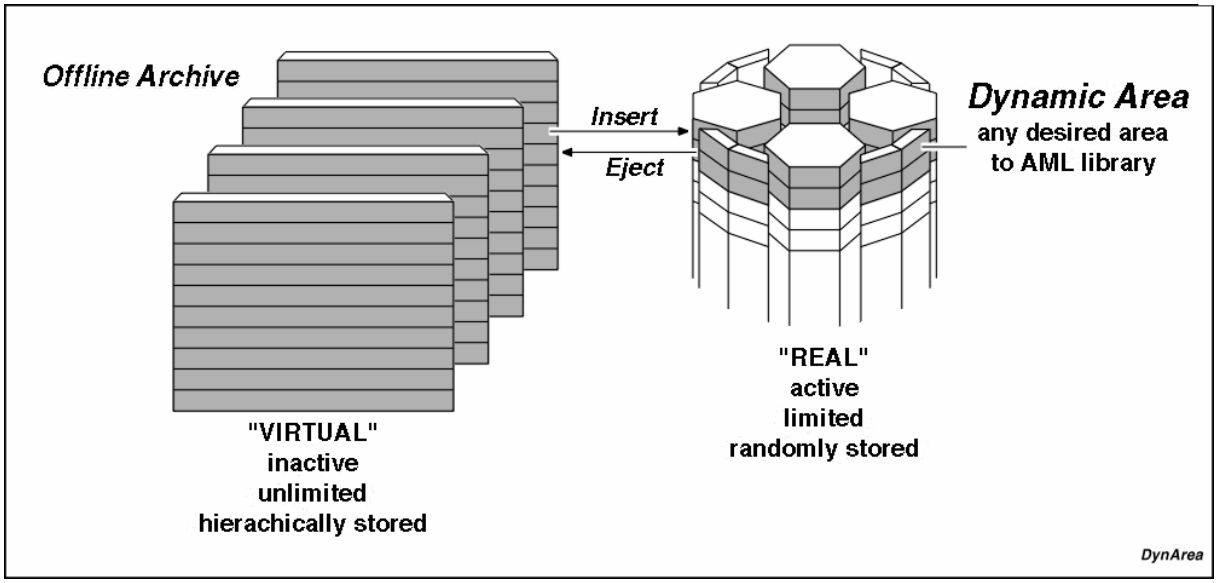


Fig 28. Illustration of an OFFLINE archive in the dynamic area

When all positions are defined as dynamic area in the AML/2 archive, the complete archive is then held in random sequence.

A dynamic area can be spread across several towers/racks.

A **KEEP** command for a virtual volser moves the cartridge to its dedicated home position instead of the next empty position in the dynamic area (drive proximity).

6.1.11 FPMA - AML/2

The FPMA[1] is positioned in a linear rack (normal case) or in a section of a tower. It is practical to keep this area close to the cartridge drive.

FPMA serves to optimize pure scratch tape processing (mount and keep).

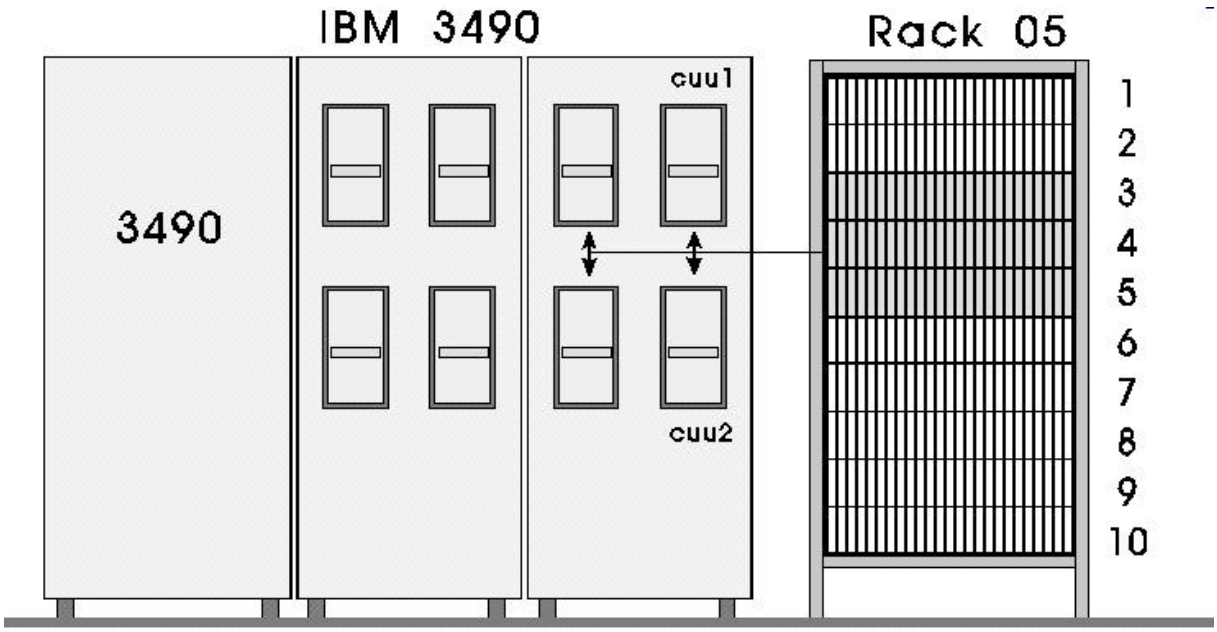
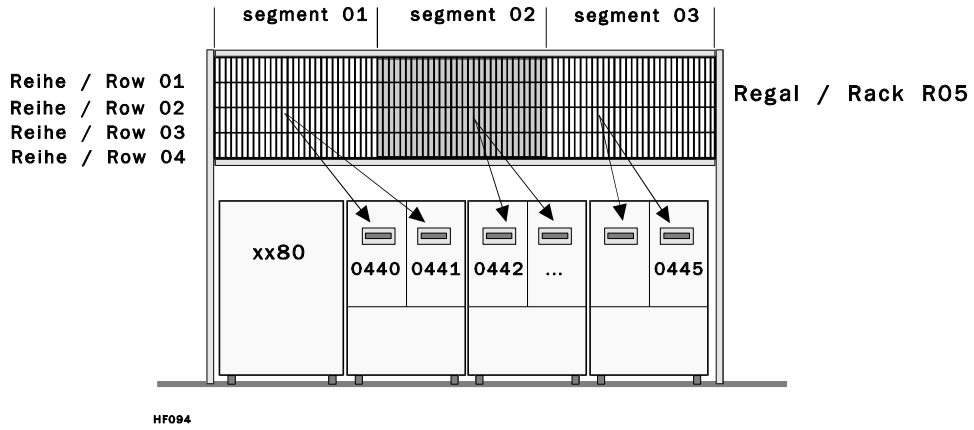


Fig. 29: FPMA on xx90 drives

[1]FPMA = Fixed Preferred Mount Area

FPMA control

FPMA [s,r,]	SLU	Start LOAD/UNLOAD
	PLU	STOP
	UNL	UNLOAD all
	SMK	Start MOUNT/KEEP
	PMK	Stop



HACPARM1 definitions (example)

```
LDEV=R05,05,01-03,01-04,01-25,S=1,FPMA          (phys.coordinates)

FPMADEF=05010101-05030425,S=1,PRIVAT            (subareas & groups)

UNIT=0440,01,1,1,FPMALOC=05010101-05010425 (unit assignments)
UNIT=0441,02,1,1,FPMALOC=05010101-05010425
UNIT=0442,03,1,1,FPMALOC=05020101-05020425
  ...
```

HF094.CDR

Fig. 30: FPMA on xx80 drives

Each cartridge drive can be assigned to specific areas in the FPMA, overlapping is possible.

Generally, during the normal computer center work there are intervals with low tape processing activity and AML/2 can use these intervals to unload or load the FPMA.

6.1.12 HWS - AML/2

The HWS[1] serves the robots in a twin-AML system for passing on cartridges.

An AML/2 system can have areas which the two robots cannot both access (for example, foreign mount area).

Example: - Cartridge in the foreign mount area of robot 1
- Mount request for drive under robot 2
- Robot 1 uses HWS to transfer the cartridge to robot 2

The HWS must be defined in a revolving tower to which both robots have access.

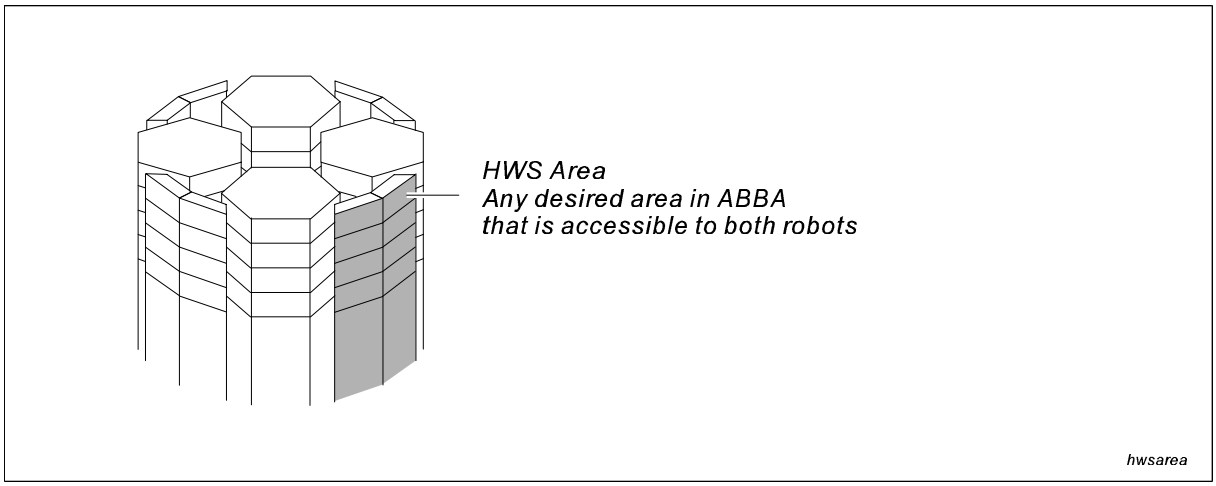


Fig. 31: HCC Work Storage for AML/2

The HCC Archive mirror must be corrected (generated) when the LDEV statements are modified.

Only one working storage area per AML system is possible.

At least as many HWS positions as installed tape units should be defined. However, only as many HWS positions as foreign mount slots are required.

1) HWS = HCC Work Storage

[1]HCC Work Storage

7 AML/E SYSTEM COMPONENTS

The overall AML/E system comprises physical and logical components.

A linear rack, for example, is a physical component and the splitting of this storage into insert, eject or foreign mount areas creates logical components.

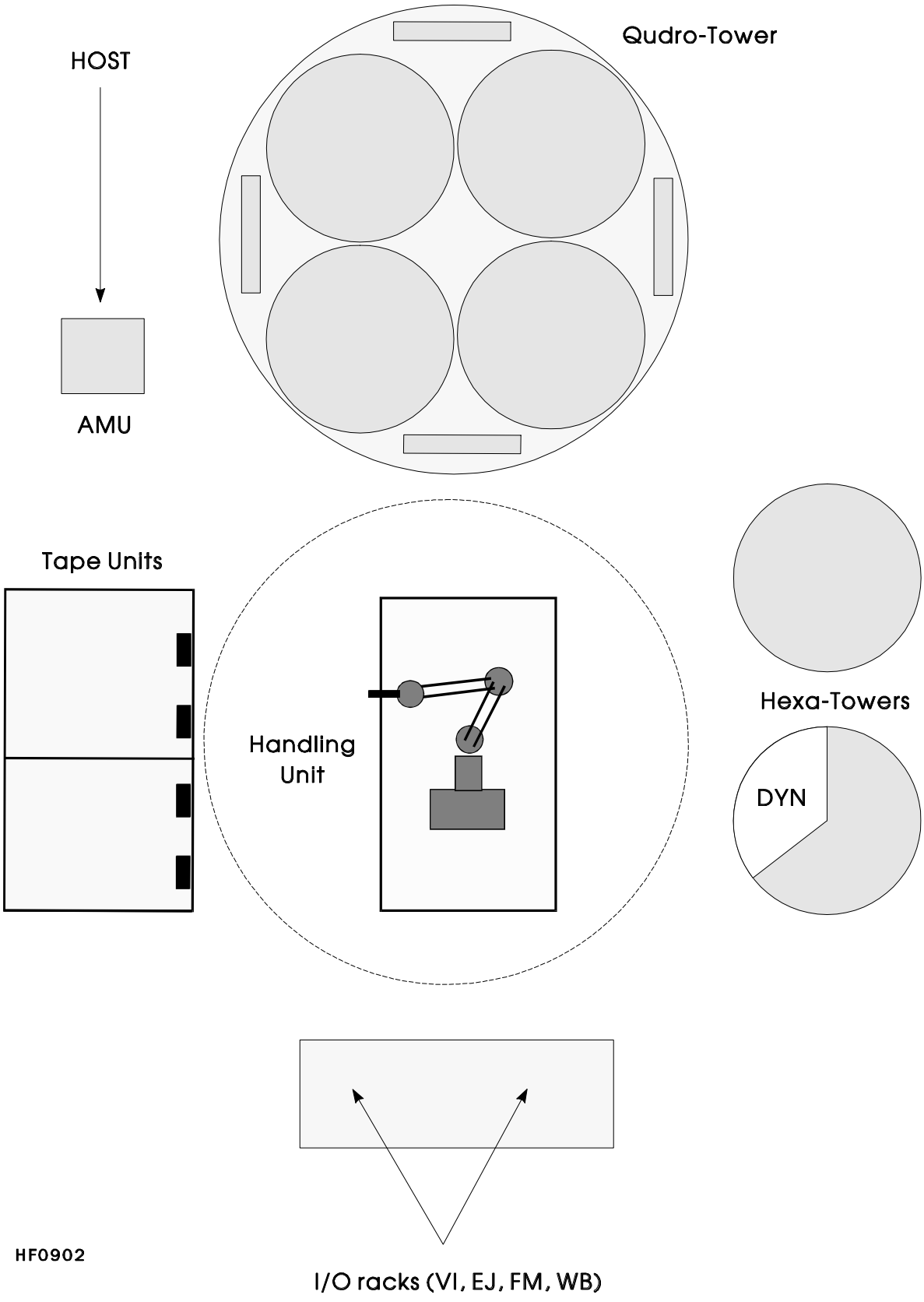


Fig 32. AML/E system components

Explanations:

Abbr.	Designation	Function
VI	Volume insert area	Area for cartridge insert
EJ	Volume eject area	Area for cartridge eject
FM	Foreign mount area	Access area for external cartridges
WB	Problem box (waste box)	Unload position for problem situations
AMU	Archive Management Unit	AML Archive management
DYN	Dynamic area	ONLINE area of an OFFLINE ARCHIVE

7.1 AML/E-COMPONENT DESCRIPTION

7.1.1 REVOLVING TOWERS - AML/E

QUADRO TOWER

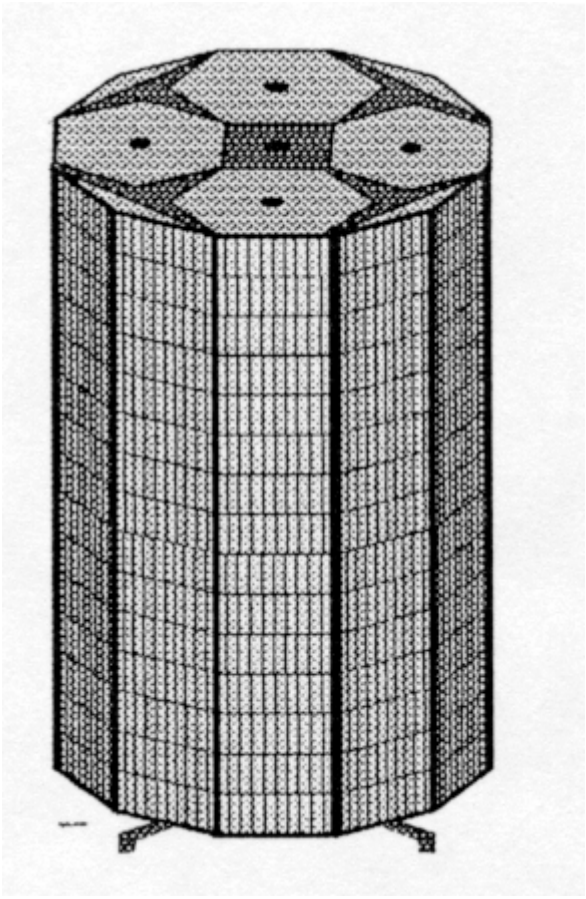


Fig. 33: Quadro tower

This type has 32 segments each with 4 inner towers (with 6 segments each) and 8 outer segments arranged on a disc (Fig. 33).

AML/E quadro towers are available in various heights with

- 12 rows (2.05 m) = 3,840 slots
- 15 rows (2.43 m) = 4,800 slots
- 18 rows (2.80 m) = 5,760 slots

The AMU software synchronizes the robots with the revolving tower

A maximum of two quadro towers can be used per AML/E system.

HEXA TOWER

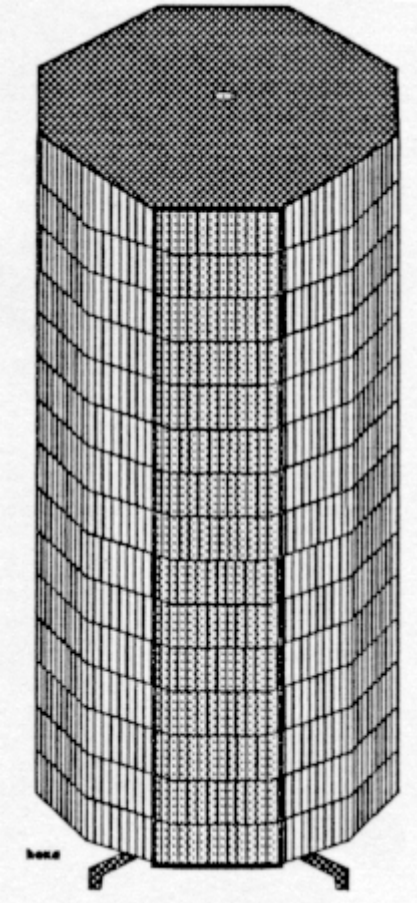


Fig. 34: Hexa tower

This type has 6 segments (refer to Fig. 34).

AML/E hexa towers are available in various heights with

- 12 rows (2.05 m) = max. 720 slots
- 15 rows (2.43 m) = max. 900 slots
- 18 rows (2.80 m) = max. 1080 slots

The robot software synchronizes the robots with the revolving tower.

A maximum of four hexa towers can be used per AML/E system.

7.1.2 LINEAR STORAGE - AML/E

Linear storage comprises fixed rack systems holding 120 to 180 cartridges. These racks are positioned parallel to the guide rails of the robot (linear racks). A maximum of 6 linear racks can be arranged.

AML/E linear racks are available in various heights with

- 2.05 m = max 120 slots
- 2.43 m = max 150 slots
- 2.80 m = max 180 slots

7.1.3 CARTRDIGE UNITS - AML/E

Each drive (cartridge unit) is assigned coordinates. The robot software automatically considers a 90° cartridge turn when executing a **MOUNT**/**KEEP** command to or from the drive.

7.1.4 INSERT AREAS - AML/E

This area serves cartridge insert in the AML/E system. Several insert areas can be defined per robot.

Insert areas are usually in I/O units (E/I/F racks[1]).

In these areas, the operator can insert cartridges in random sequence.

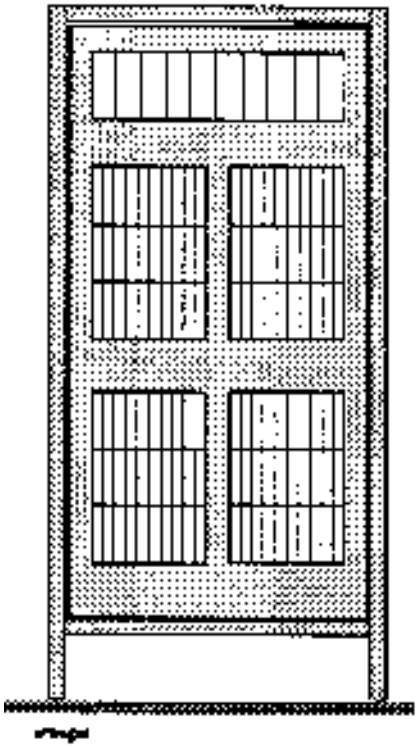


Fig. 35: Insert area for AML/E in an E/I/F rack

The insert function has several steps:

1. Position the cartridges.

2. **VI** command (possibly with area specifications).

3. HCC sends search tasks to AML/E:
   - Volser is identified in slot
   - Volser and coordinate are sent to HCC

4. Based on the Archive mirror definitions, HCC sends the insert task to AML/E

[1]E/I/F-Regal = Eject/Insert/Foreign-Mount - Rack

- hierarchic: to home position
- dynamic: in dynamic area

7.1.5 EJECT AREAS - AML/E

This area serves cartridge eject from the AML/E system. Several eject areas can be defined. Eject areas are normally in I/O units (E/I/F racks).

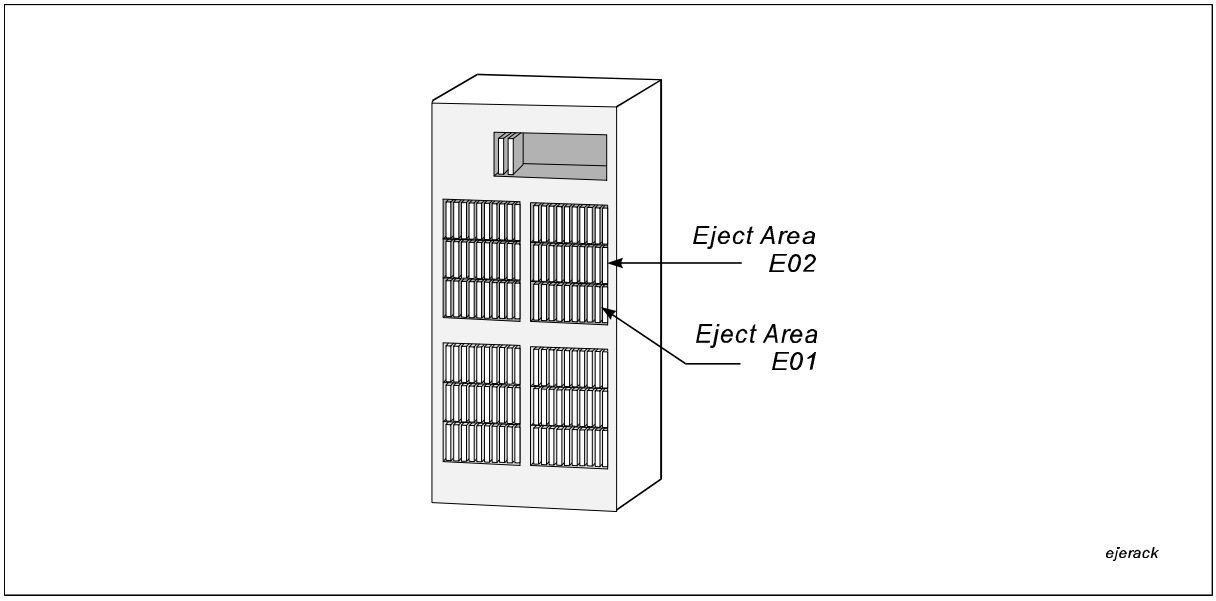


Fig. 36: Eject areas for AML/E in an E/I/F rack

The **EJ** or **EJDSN** command triggers an eject.

A message is displayed when an eject area overflows. The interrupted eject can be resumed with the **EJCONT** command after removal of the ejected cartridges.

All insert and eject areas can overlap.

An area in use is not blocked for further processing.

Organizational measures must ensure that erroneous processing is avoided.

7.1.6 FOREIGN MOUNT AREA - AML/E

The foreign mount area serves as a temporary area for processing external cartridges that are not defined in the AML/E archive. Foreign mount areas are normally in an I/O unit (E/I/F racks).

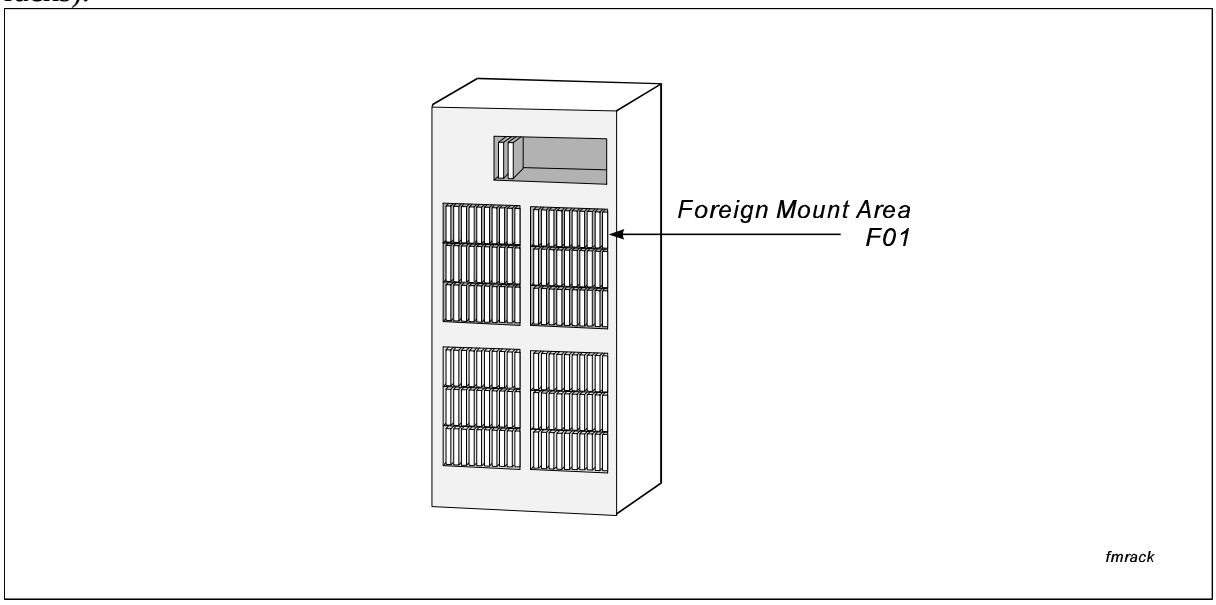


Fig. 37: Foreign mount area for AML/E in an E/I/F rack

An existing barcode label on the cartridge is ignored.

Each position in the foreign mount area is assigned to a pseudo-volser with the following structure:

***sdnnn**

*	= Special character '*' (indicator to suppress barcode reading)
s	= AML system number
d	= Foreign mount slot number (1-9)
nnn	= Relative position in slot (001-nnn)

The operator inserts an external cartridge in an empty position in this area, then informs HCC about position, volser and so on, with the FMA command.

HCC recognizes this volser during a mount request for an external tape and generates a task with the appropriate pseudo-volser.

The AMU[1] recognizes the position in the foreign mount area from the volser structure and automatically switches off barcode reading.

[1] AMU - Archive Management Unit

Foreign mount areas must **not** overlap insert/eject areas.

7.1.7 PROBLEM BOX - AML/E

The problem box (cartridge pocket or waste box) is a dump position for cartridges in exceptional situations.

Such situations can arise, for example, during an insert. Cartridges without valid barcode labels are removed from the insert area and moved to the problem box (cartridge pocket).

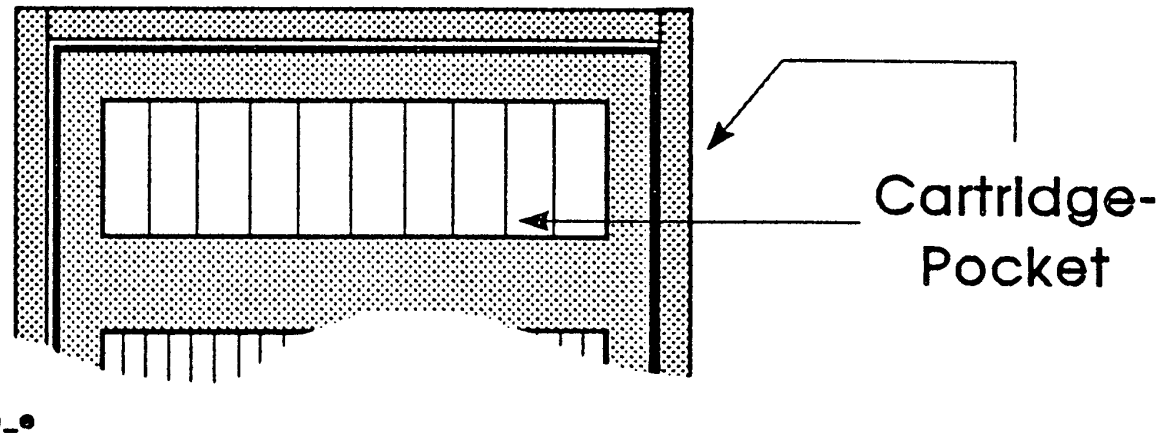


Fig. 38: Problem box for AML/E in an E/I/F rack

Each robot must be assigned a cartridge pocket. The I/O area is used for overflows.

7.1.8 DYNAMIC AREA - AML/E

The dynamic area is a defined subset of cartridge slots (freely selectable) in a tower or rack system. This supports the integration of certain data types that are not normally contained in the active AML library into the automation process with minimal effort.

Computer centers often have data under long-term access protection that it seldom or never used. Cartridges with such inactive data hinder AML/E library storage space.

The following method can be applied for better storage utilization:

- A manual archive for inactive data is kept external to the AML/E library (OFFLINE ARCHIVE). A dedicated number range is useful in this case. The corresponding data media are marked as VIRTUAL VOLSERs in the HCC Archive mirror.

- Data media can be moved from the OFFLINE ARCHIVE to the dynamic area with the normal insert procedure after the retention period has elapsed (not with direct insert / VI = DIR).

- A virtual cartridge is **always** positioned to the next free position in the dynamic area. This position is permanently assigned to the cartridge as home position.

- When data media in the dynamic area are to be used for a scratch request, the selection can be controlled using pool definitions (DSNGR, VOLGR).

- The AML/E archive position is marked as "Free" when a cartridge is moved from the dynamic area to the OFFLINE ARCHIVE.

- It is recommended, for organizational reasons, to specify a dedicated eject slot.

- When an unexpected specific request for a cartridge from the OFFLINE ARCHIVE is made, the data medium must be inserted and an appropriate HCC message is output.

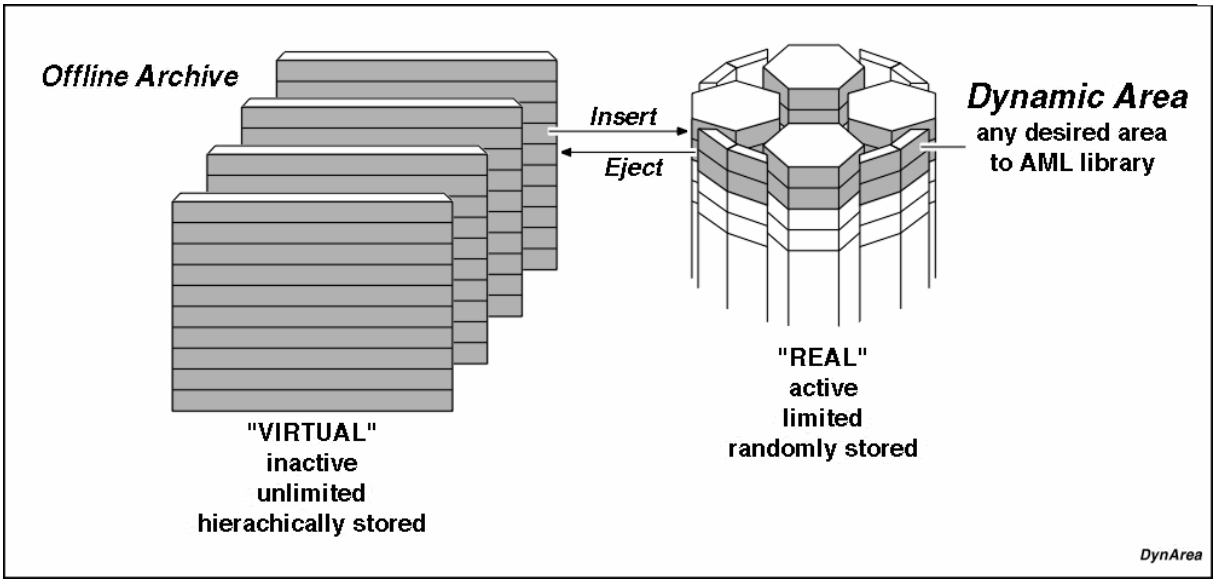


Fig 39.Illustration of an OFFLINE Archive in the dynamic area

When all positions are defined as dynamic area in the AML/E archive, the complete archive is then held in random sequence.

A dynamic area can be spread across several towers/racks.

A **KEEP** command for a virtual volser moves the cartridge to its dedicated home position instead of the next empty position in the dynamic area (drive proximity).

8 AML/J SYSTEM COMPONENTS

The overall AML/J system comprises physical and logical components.

A linear rack, for example, is a physical component and splitting this storage into insert, eject or foreign mount areas creates logical components.

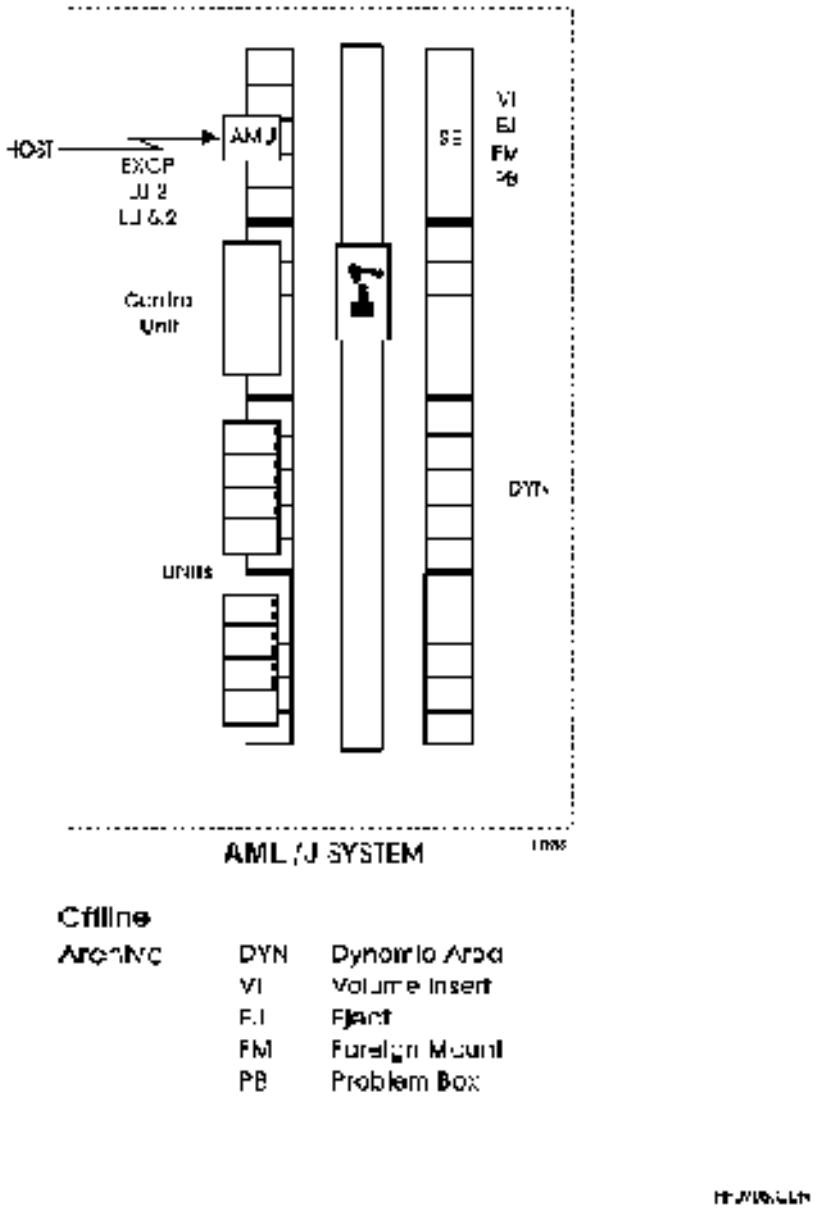


Fig 40. AML/J system components

Explanations:

Abbr.	Designation	Function
VI	Volume insert area	Area for cartridge insert
EJ	Volume eject area	Area for cartridge eject
FM	Foreign mount area	Access area for external cartridges
PB	Problem box (waste box)	Unload position for problem situations
AMU	Archive Management Unit	AML Archive management
DYN	Dynamic area	ONLINE area of an OFFLINE ARCHIVE

The single components of an AML/J system are referred to as storage elements or storage modules. A maximum of 10 storage elements can be serviced by one handling unit.

8.1 AML/J COMPONENT DESCRIPTION

8.1.1 LINEAR STORAGE - AML/J

Linear storage comprises fixed rack systems. 2 racks form a storage element. These racks are positioned parallel to the movement tracks of the robot (linear racks).

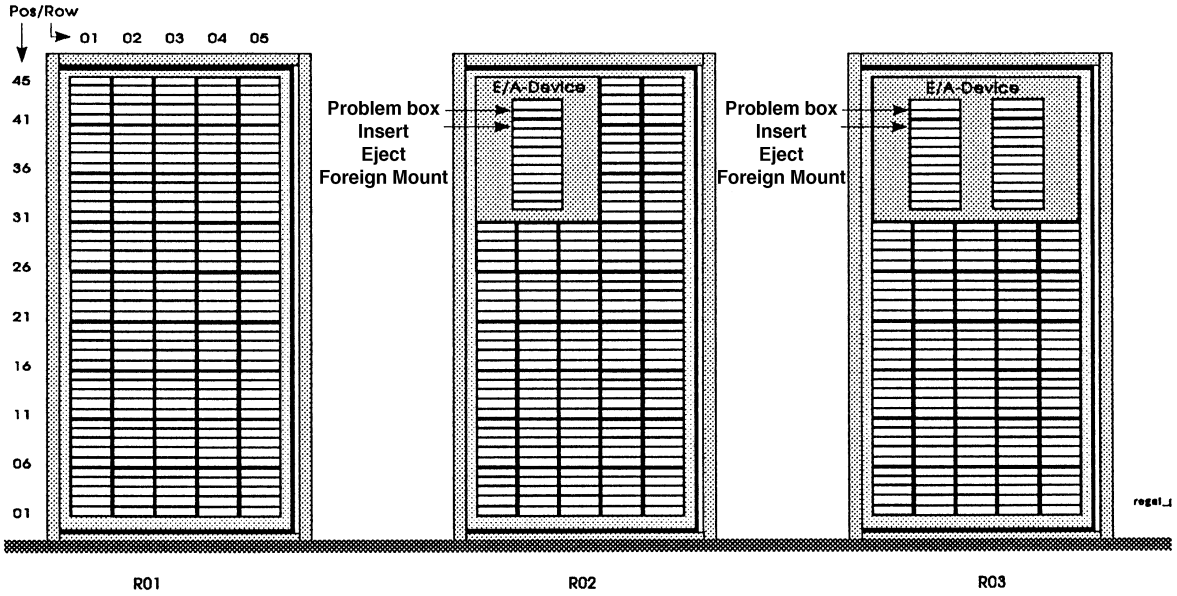


Fig 41. Linear storage of an AML/J system

Linear storage	Medium	I/O devices	Units	Slots/racks
R01	Tapes	none	none	max. 225
R02	Tapes	1	none	max. 180
R03	Tapes	2	none	max. 150

The number of slots for a storage element corresponds to twice the number for a rack.

8.1.2 CARTRIDGE STATIONS - AML/J

Each drive (cartridge unit) is assigned coordinates. The robot software automatically considers a 180° cartridge turn when executing a **MOUNT**/**KEEP** command providing the robot is equipped with a mixed media grabber.

8.1.3 INSERT AREAS - AML/J

This area serves cartridge insert in the AML/J system. Several insert areas can be defined for the robots.

Insert areas are usually in I/O units (E/I/F storage[1]).

The operator can store cartridges in random sequence in these areas.

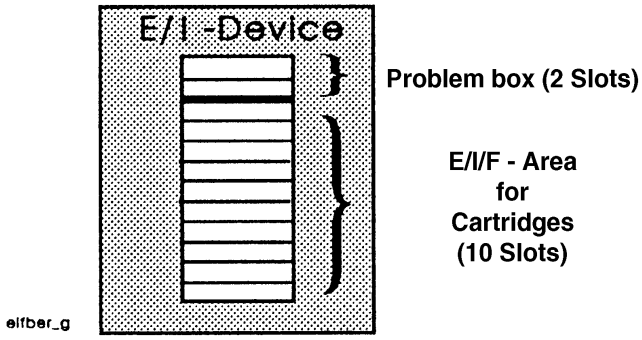


Fig. 42: I/O unit (E/I/F area)

Up to 4 E/I/F areas can be installed in one AML/J system.

[1]E/I/F area = Eject/Insert/Foreign-Mount - area

8.1.4 EJECT AREAS - AML/J

This area serves cartridge eject from the AML/J system. Several eject areas can be defined. Eject areas are normally in I/O units (E/I/F areas).

The **EJ** or **EJDSN** command triggers an eject.

A message is displayed when an eject area overflows. The interrupted eject can be resumed with the **EJCONT** command after removal of the ejected cartridges.

All insert and eject areas can overlap.

An area in use is not blocked for further processing.

Organizational measures must ensure that erroneous processing is avoided.

Up to 4 E/I/F areas can be installed in one AML/J system.

8.1.5 FOREIGN MOUNT AREA - AML/J

The foreign mount area serves as interim area for processing external cartridges that are not defined in the AML/J archive. Foreign mount areas are normally in an I/O unit (E/I/F area).

An existing barcode label on the cartridge is ignored.

Each position in the foreign mount area is assigned to a pseudo-volser with the following structure:

***sdnnn**

*	= Special character '*' (indicator to suppress barcode reading)
s	= AML system number
D	= Foreign mount slot number (1-9)
nnn	= Relative position in slot (001-nnn)

The operator inserts an external cartridge in an empty position in this area, then informs HCC about position, volser and so on with the **FMA** command.

HCC recognizes this volser during a mount request for an external tape and generates a task with the appropriate pseudo-volser.

The AMU[1] recognizes the position in the foreign mount area from the volser structure and automatically switches off barcode reading.

Foreign mount areas must **not** overlap insert/eject areas.

[1] AMU - Archive Management Unit

8.1.6 PROBLEM BOX - AML/J

The problem box (waste box) is a dump position for cartridges in exceptional situations.

Such situations can arise, for example, during an insert. Cartridges without valid barcode labels are removed from the insert area and moved to the problem box.

Fig. 43: Problem box AML/J

The next problem box of a different E/I/F area is used when an overflow occurs. Up to 4 E/I/F areas (with 4 problem boxes) can be installed in one AML/J system.

8.1.7 DYNAMIC AREA - AML/J

The dynamic area is a defined subset of cartridge slots (freely selectable) in a rack system. This supports the integration of certain data types that are not normally contained in the active AML library into the automation process with minimal effort.

Computer centers often have data under long-term access protection that is seldom or never used. Cartridges with such inactive data hinder AML/J library storage space.

The following method can be applied for better storage utilization:

- A manual archive for inactive data is kept external to the AML/J library (OFFLINE ARCHIVE). A dedicated number range is useful in this case. The corresponding data media are marked as VIRTUAL VOLSERs in the HCC Archive mirror.

- Data media can be moved from the OFFLINE ARCHIVE to the dynamic area with the normal insert procedure after the retention period has elapsed (not with direct insert / VI = DIR).

- A virtual cartridge is **always** positioned to the next free position in the dynamic area. This position is permanently assigned to the cartridge as home position.

- When data media in the dynamic area are to be used for a scratch request, the selection can be controlled using pool definitions (DSNGR, VOLGR).

- The AML/J archive position is marked as "Free" when a cartridge is moved from the dynamic area to the OFFLINE ARCHIVE.

- It is recommended, for organizational reasons, to specify a dedicated eject slot.

- When an unexpected specific request for a cartridge from the OFFLINE ARCHIVE is made, the data medium must be inserted and an appropriate HCC message is output.

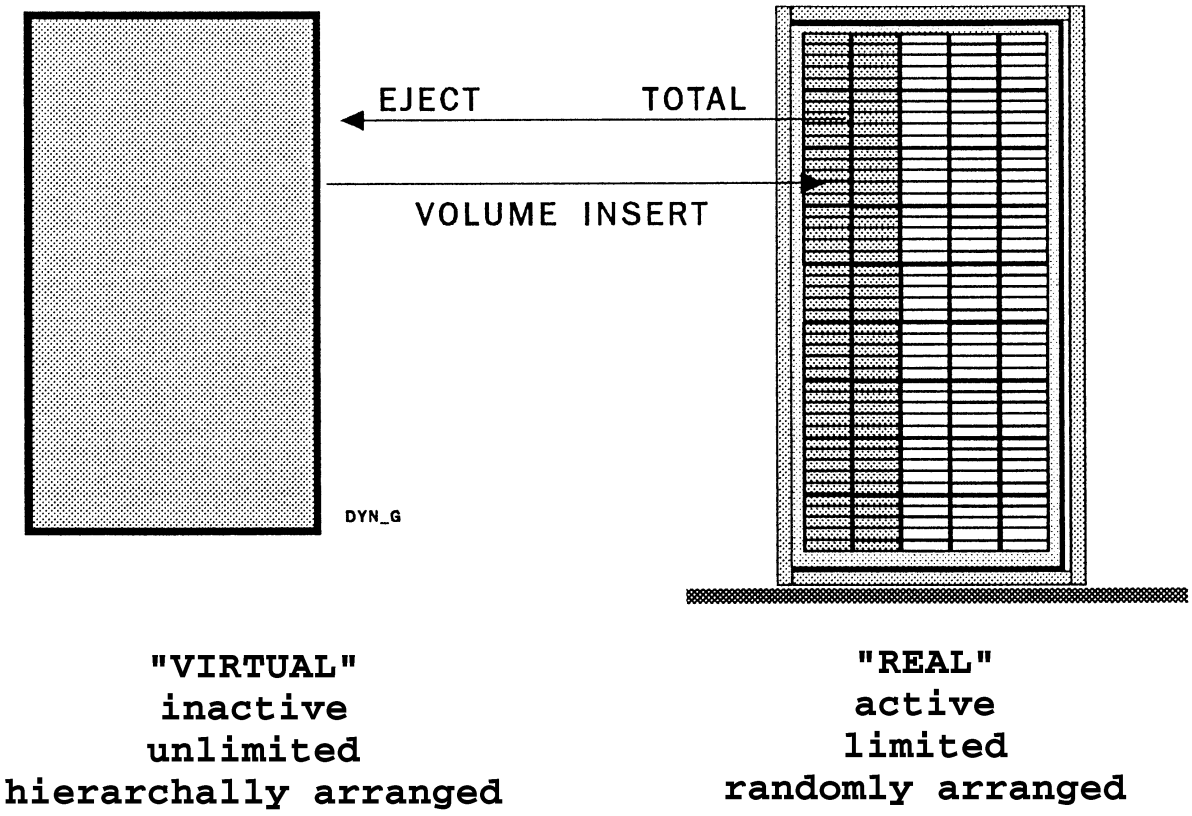


Fig 44. Illustration of an OFFLINE Archive in the dynamic area

When all positions are defined as dynamic area in the AML/J archive, the complete archive is then held in random sequence.

A dynamic area can be spread across several racks.

A **KEEP** command for a virtual volser moves the cartridge to its dedicated home position instead of the next empty position in the dynamic area (drive proximity).

9 AML COORDINATES

All target points within the AML library that can accept cartridges are described by logical coordinates.

The robot software converts these logical coordinates to physical increments (x, y, z axes) relative to a zero point.

9.1 DEFINITION OF COORDINATES

COORDINATE				8-digits
DEVICE	SEGMENT	ROW	POSITION	Each value 2-digits

DEVICE	Number	(00,01-99)
SEGMENT	nth segment in a DEVICE	(00,01-nn)
ROW	nth row in a SEGMENT	(01-nn)
POSITION	nth position in a ROW	(01-nn)

9.2 COORDINATE TYPES

DEVICE TYPE	DEVICE NAME		COORD INATES	
	Name	Range	Lowest value	Highest value
LINEAR RACK-ABBA/1	Rnn	R01-R99	01 01 01 01	99 99 yy xx
LINEAR RACK-AML/2/E/J	Rnn	R01-R99	01 01 01 01	99 01 yy xx
TOWER	Tnn	T01-T99	01 01 01 01	99 99 yy xx
PROBLEMBOX	Wnn	W01-W04	00 00 00 01	00 00 00 02
TAPE UNIT	Dnn	D01-D99	00 00 01 01	00 00 99 01
INSERT AREA	Inn	I01-I99	00 01 yy xx	00 01 yy xx
EJECT AREA	Enn	E01-E99	00 02 yy xx	00 02 yy xx
FREMD MOUNT	Fnn	F01	00 03 yy xx	00 03 yy xx

xx bzw. yy variable values dependent on the relative size of the corresponding unit.

9.3 REDEFINITIONS IN TOWER/RACK

DEVICE TYPE	DEVICE NAME	COORD INATES	
	Range	Lowest value	Highest value
DYNAMIC AREA	T01 - T99	01 01 01 01	99 99 yy xx
	R01 - R99	01 01 01 01	99 99 yy xx
HCC WORK STOR.	T01 - T99	01 01 01 01	99 99 yy xx
FIXED PMA	R01 - R99	01 01 01 01	99 99 yy xx
	T01 - T99	01 01 01 01	99 99 yy xx

Sub-definitions in physical units.

xx and yy variable values dependent on the relative size of the corresponding unit.

9.4 COORDINATE INCREMENTING

Incrementation for coordinate definitions is always VERTICAL. The only exception is the DYNAMIC AREA.

VOLSERs can also be assigned HORIZONTAL.

9.4.1 VERTICAL INCREMENTING ABBA/1

Vertical incrementing has the advantage of being the same ascending sort sequence for coordinates preferred for internal use by HCC.

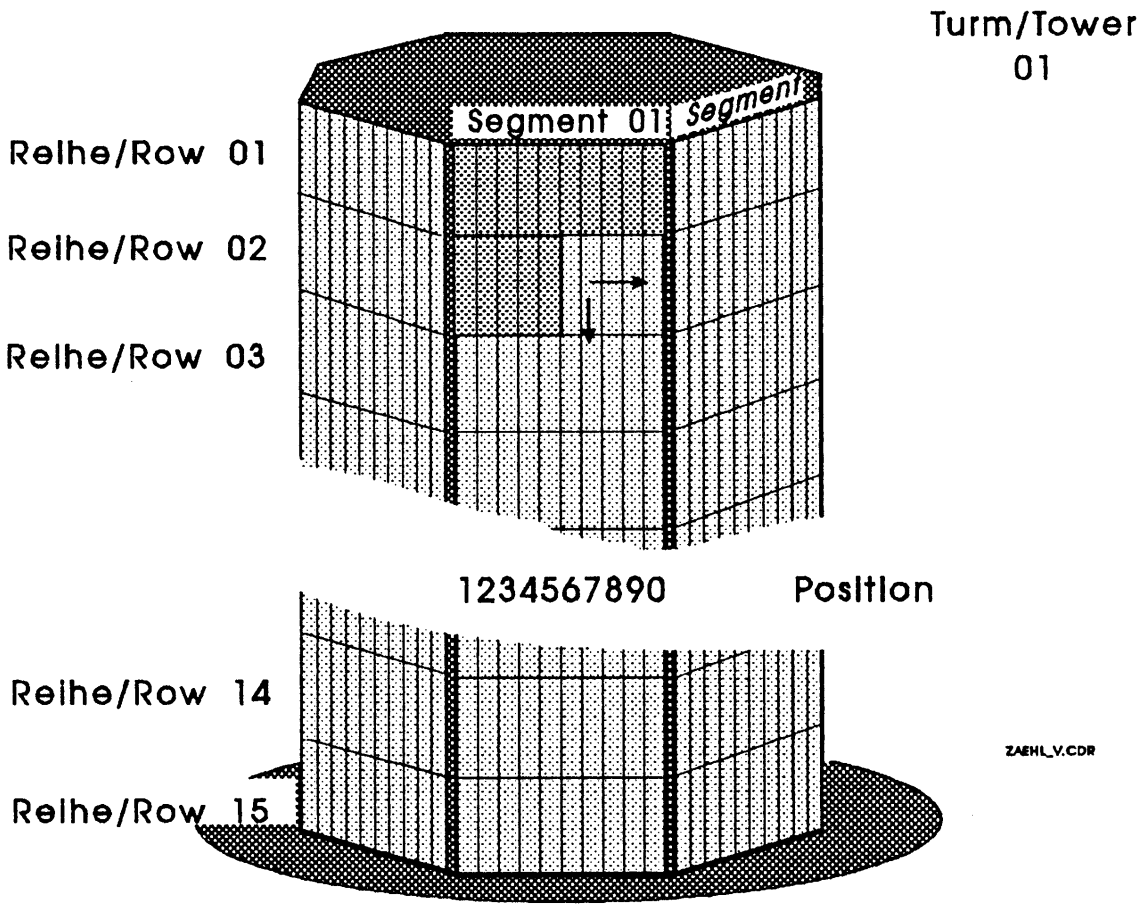


Fig 45. Vertical coordinate incrementing - ABBA/1

Example:

```
LDEV=T01,01,01,32,01,15,01,10,10,S=1,R=1,2
```

Increment: Tower 01 Segm. 01 Row 01 Pos. 01-10 01010101 - 01010110

Tower 01	Segm. 01	Row 02	Pos. 01-10	01010201 - 01010210
		.		
		.		
Tower 01	Segm. 01	Row 15	Pos. 01-10	01011501 - 01011510
Tower 01	Segm. 02	Row 01	Pos. 01-10	01020101 - 01020110
		.		
		.		
Tower 01	Segm. 32	Row 15	Pos. 01-10	01321501 - 01321510

9.4.2 HORIZONTAL INCREMENTING ABBA/1

The DYNAMIC AREA can be defined as being a VERTICAL or HORIZONTAL logical unit. The following example shows a HORIZONTAL arrangement:

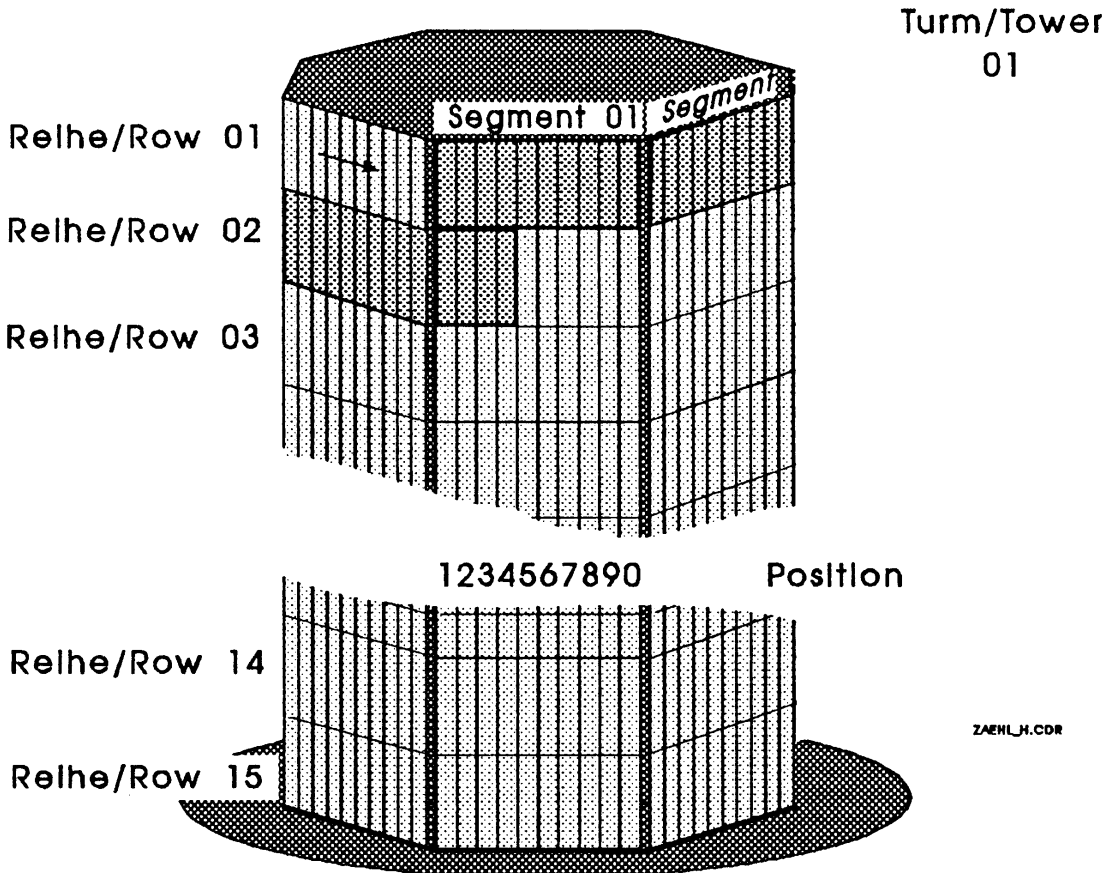


Fig 46. Horizontal coordinate incrementing - ABBA/1

Example:

```
LDEV=T01,01,01,32,01,02,01,10,10,S=1,R=1,2,DYN,HOR
```

Increment:	Tower 01	Segm. 01	Row 01	Pos. 01-10	01010101 - 01010110
	Tower 01	Segm. 02	Row 01	Pos. 01-10	01020101 - 01020110
			.		
			.		
	Tower 01	Segm. 32	Row 01	Pos. 01-10	01320101 - 01320110
	Tower 01	Segm. 01	Row 02	Pos. 01-10	01010201 - 01010210
			.		
			.		
	Tower 01	Segm. 32	Row 02	Pos. 01-10	01320201 - 01320210

***(This example only illustrates the incrementation and may not be a practical example).

9.4.3 VERTICAL INCREMENTING AML/2 and AML/E

Vertical incrementing has the advantage of being the same ascending sort sequence for coordinates preferred for internal use by HCC.

In contrast to ABBA/1, AML/2 counts from the bottom to the top.

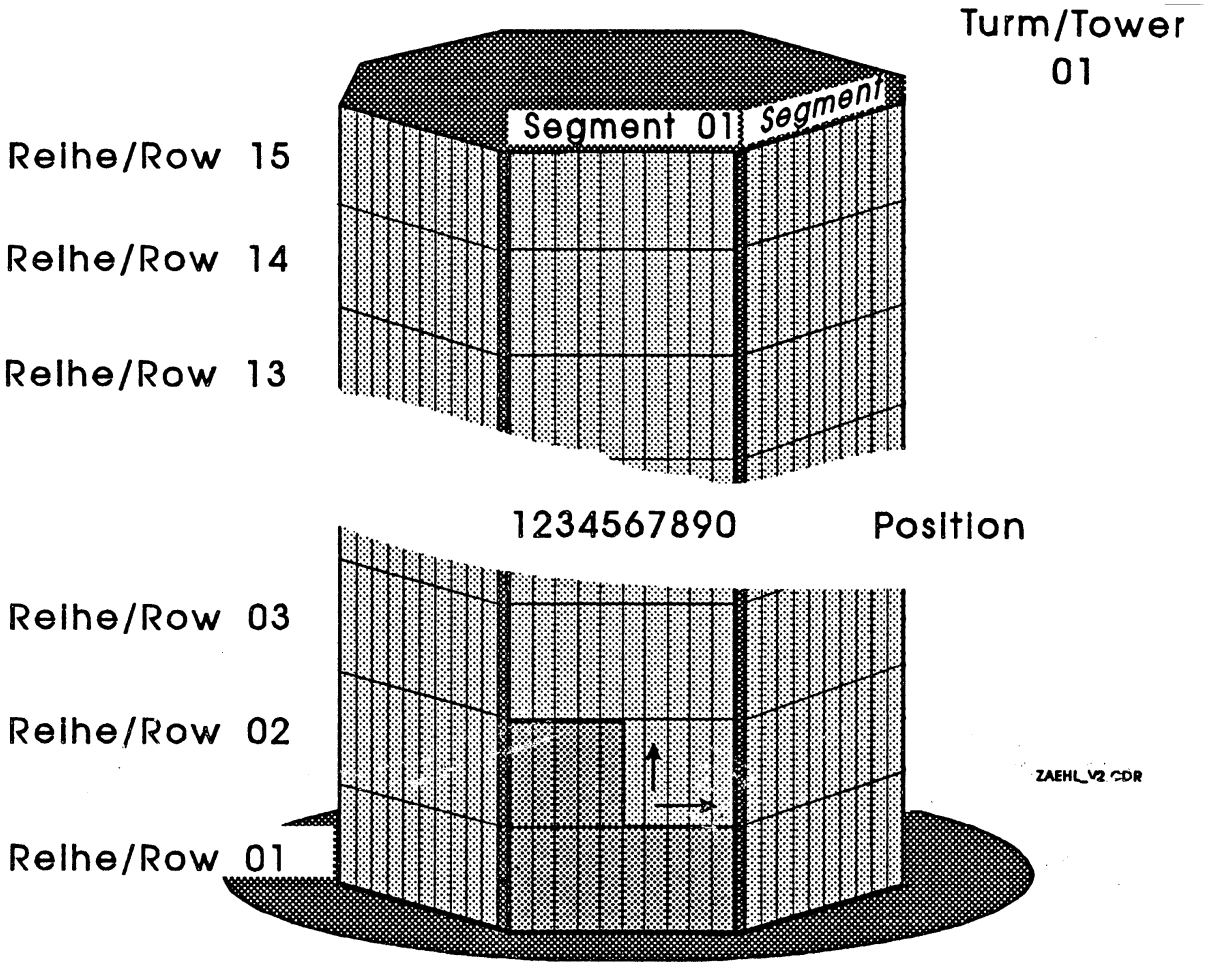


Fig 47. Vertical coordinate incrementing - AML/2 and AML/E

Example for a QUADRO tower (T01) with 15 rows:

```
LDEV=T01,01,01,32,01,15,01,10,10,S=1,R=1,2
```

Increment:	Tower 01	Segm. 01	Row 01	Pos. 01-10	01010101 - 01010110
	Tower 01	Segm. 01	Row 02	Pos. 01-10	01010201 - 01010210
			.		
			.		
	Tower 01	Segm. 01	Row 15	Pos. 01-10	01011501 - 01011510

Tower 01	Segm. 02	Row 01	Pos. 01-10	01020101 - 01020110
		.		
		.		
Tower 01	Segm. 32	Row 15	Pos. 01-10	01321501 - 01321510

9.4.4 HORIZONTAL INCREMENTING AML/2 and AML/E

The DYNAMIC AREA can be defined as being a VERTICAL or HORIZONTAL logical unit. The following example shows a HORIZONTAL arrangement with counting from the bottom to the top:

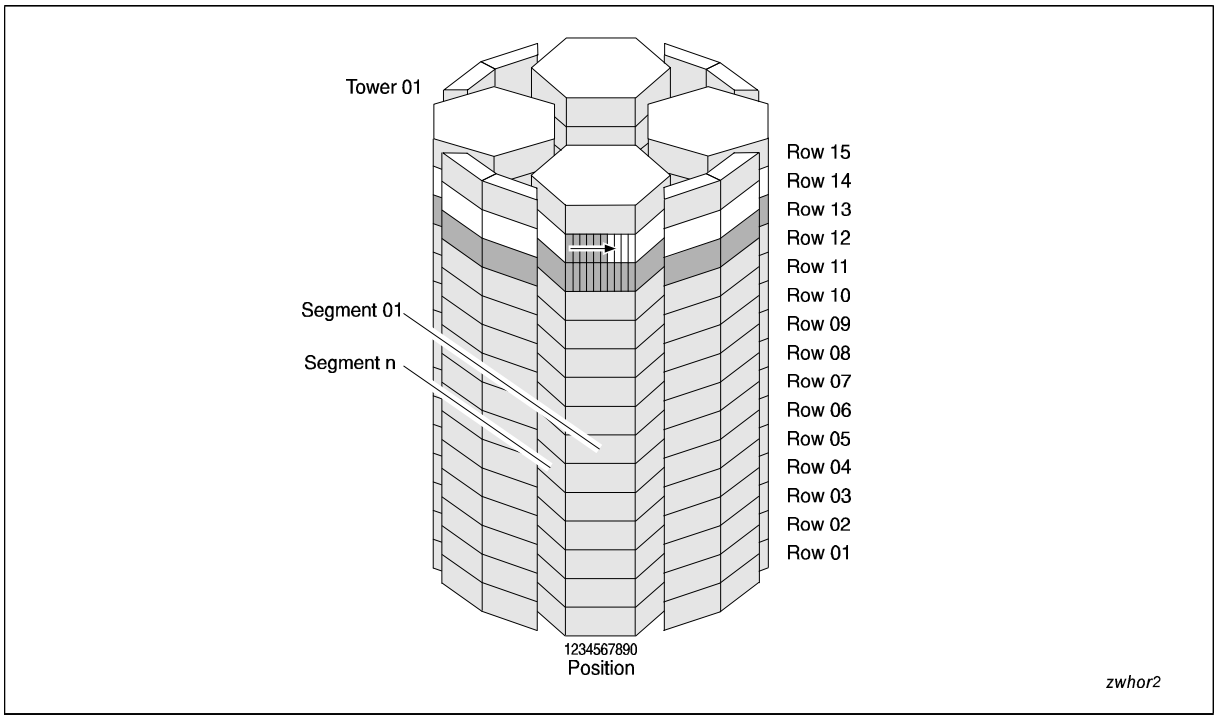


Fig 48. Horizontal coordinate incrementing - AML/2 and AML/E

Example for a QUADRO tower with 15 rows:

```
LDEV=T01,01,01,32,13,14,01,10,10,S=1,R=1,2,DYN,HOR
```

Increment:	Tower 01	Segm. 01	Row 13	Pos. 01-10	01011301 - 01011310
	Tower 01	Segm. 02	Row 13	Pos. 01-10	01021301 - 01021310
			.		
			.		
	Tower 01	Segm. 32	Row 13	Pos. 01-10	01321301 - 01321310
	Tower 01	Segm. 01	Row 14	Pos. 01-10	01011401 - 01011410
			.		
			.		
	Tower 01	Segm. 32	Row 14	Pos. 01-10	01321401 - 01321410

***(This example only illustrates the incrementation and may not be a practical example).

9.4.5 INCREMENTING AML/J

Incrementing in AML/J has the advantage of being the same ascending sort sequence for coordinates preferred for internal use by HCC.

In contrast to ABBA/1, AML/J counts from the bottom to the top.

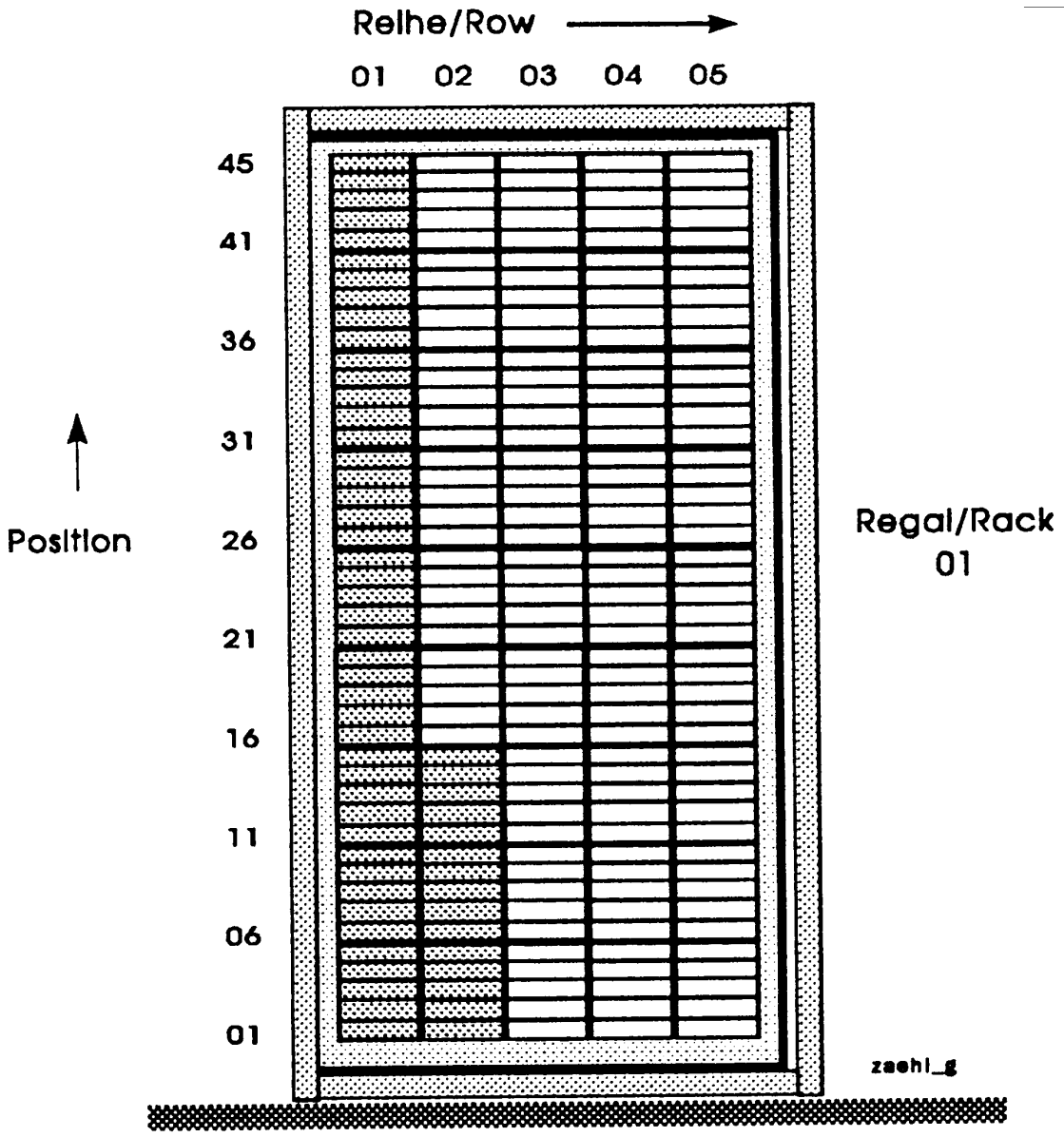


Fig 49. Coordinate incrementing - AML/J

Example for linear storage (R01) with 225 slots:

```
LDEV=R01,01,01,01,01,05,01,45,45,S=1,R=1
```

Increment:	Rack 01	Segm. 01	Row 01	Pos. 01-45	01010101 - 01010145
	Rack 01	Segm. 01	Row 02	Pos. 01-45	01010201 - 01010245
			.		
			.		
	Rack 01	Segm. 01	Row 05	Pos. 01-45	01011501 - 01011545

9.4.6 COORDINATE INCREMENTING IN I/O AREA - AML/2

Every robot in an AML/2 system has one I/O area available. This area has either 120 or 240 slots:

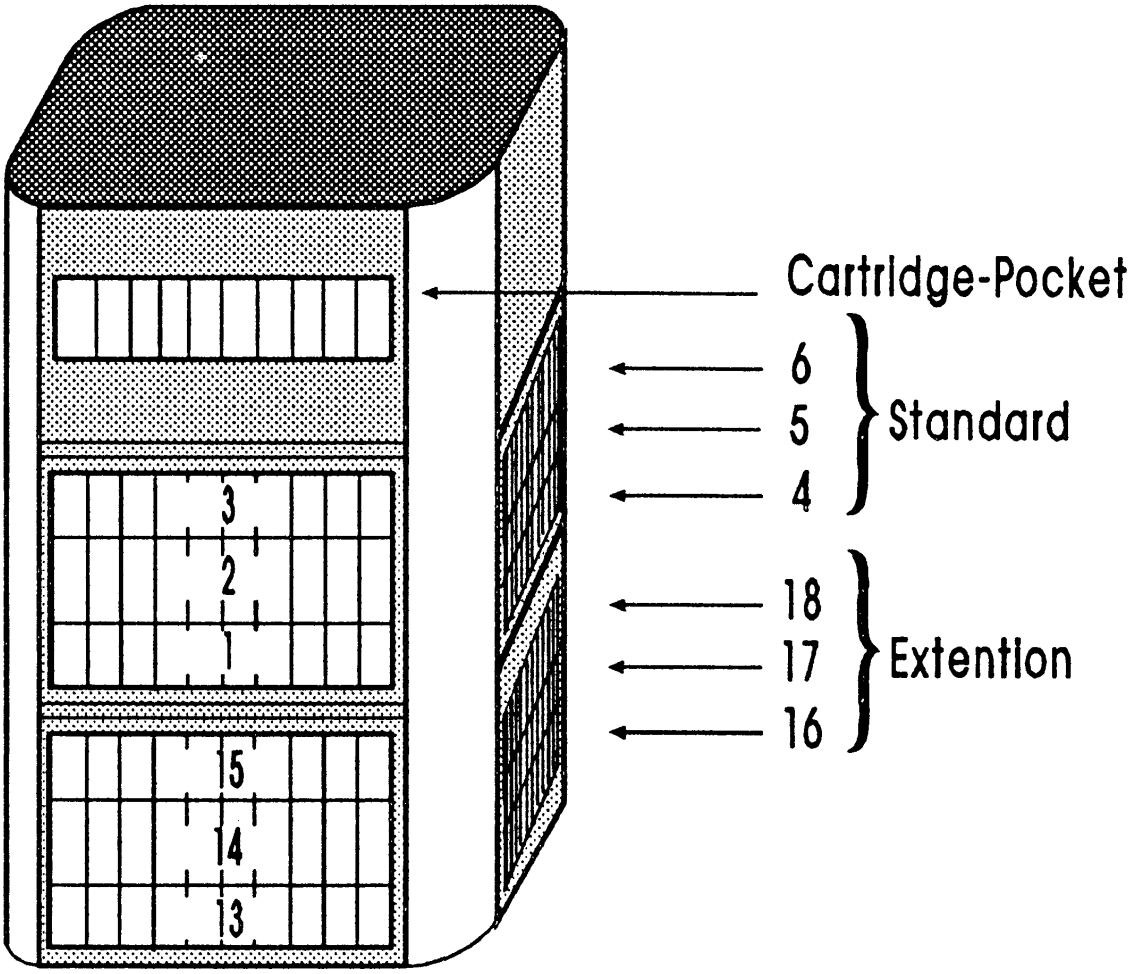


Fig. 50: I/O area - AML/2

120 slots = 4 segments each with 3 rows and 10 slots (standard)
240 slots = 8 segments each with 3 rows and 10 slots (standard plus extension)

Increment:

Segment 1	= rows 1 - 3	from bottom to top	(standard)
Segment 2	= rows 4 - 6	from bottom to top	(standard)
Segment 3	= rows 7 - 9	from bottom to top	(standard)
Segment 4	= rows 10 – 12	from bottom to top	(standard)
Segment 5	= rows 13 - 15	from bottom to top	(extension)
Segment 6	= rows 16 - 18	from bottom to top	(extension)

Segment 7	= rows 19 – 21	from bottom to top	(extension)
Segment 8	= rows 22 – 24	from bottom to top	(extension)

Input and output areas can overlap. The foreign mount area must not overlap any input/output areas.

Example for an I/O unit (E/I/F storage):

`LDEV=I01,00,01,01,01,01,01,01,10,S=1,R=1`	VI	1 slot
`LDEV=I10,00,01,01,01,01,01,03,10,S=1,R=1`	VI	3 slots
`LDEV=I11,00,01,01,01,01,01,05,10,S=1,R=1`	VI	5 slots
`LDEV=I12,00,01,01,01,01,01,10,10,S=1,R=1`	VI	1 row = 10 slots
`LDEV=I13,00,01,01,01,03,01,10,10,S=1,R=1`	VI	1 segment = 30 slots
`LDEV=I14,00,01,01,01,06,01,10,10,S=1,R=1`	VI	2 segments = 60 slots
`LDEV=I15,00,01,01,01,09,01,10,10,S=1,R=1`	VI	3 segments = 90 slots
`LDEV=I16,00,01,01,01,12,01,10,10,S=1,R=1`	VI	4 segments = 120 slots
`LDEV=I19,00,01,01,01,24,01,10,10,S=1,R=1`	VI	8 segments = 240 slots
`LDEV=E01,00,02,02,13,23,01,10,10,S=1,R=1`	EJ	3 segments + 2 rows
`LDEV=F01,00,03,03,24,24,01,10,10,S=1,R=1`	FM	10 slots foreign mount

Explanation of LDEV parameter:

`LDEV=xxx,xx,xx,xx,yy,yy,zz,zz,aa,S=s,R=r`

`xxx,xx,xx,xx,`	`Ixx,00,01,01,`	= Insertion slot
	`Exx,00,02,02,`	= Ejection slot
	`Fxx,00,03,03,`	= Foreign mount slot
`yy,yy,`		= Rows (from - to)
`zz,zz,`		= Slots (from - to)
`aa,`		= Number of slots in a row
`s`		= System ID
`r`		= Robot ID

Further information concerning the LDEV parameter can be found in the Installation/Customization for HCC 3.0 Manual.

9.4.7 COORDINATE INCREMENTING IN I/O AREA - AML/E

Every robot in an AML/E system has one I/O available. This area has 120 slots:

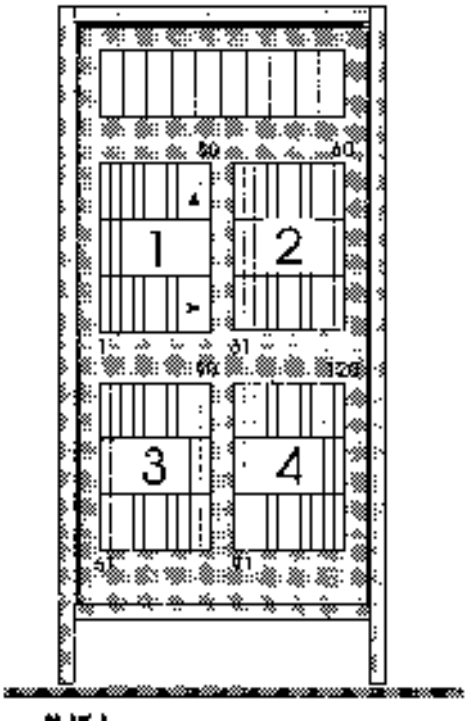


Fig. 51: I/O area - AML/E

120 slots = 4 segments each with 3 rows and 10 slots

Increment:

Segment 1	= row 1 - 3	slot 1 - 30	from bottom to top
Segment 2	= row 4 - 6	slot 31 - 60	from bottom to top
Segment 3	= row 7 - 9	slot 61 - 90	from bottom to top
Segment 4	= row 10 - 12	slot 91 - 120	from bottom to top

Input and output areas can overlap. The foreign mount area must not overlap any input/output areas.

9.4.8 COORDINATE INCREMENTING IN I/O AREA - AML/J

Every robot in an AML/J system has one to four I/O areas available. Each area has 10 slots:

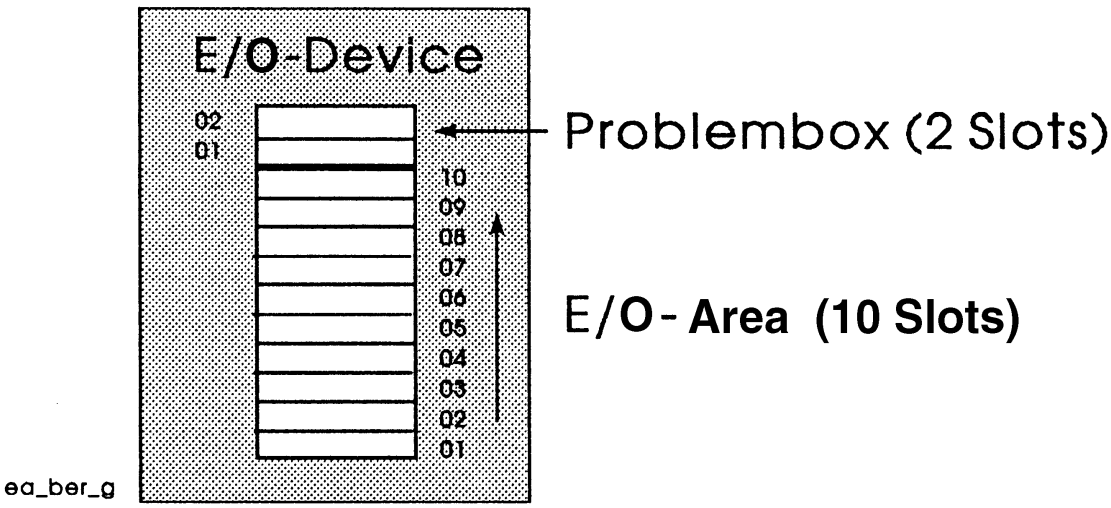


Fig. 52: I/O area - AML/J

Increment:

Segment 01	row 01	slots 01 - 10	from bottom to top

Input and output areas can overlap. The foreign mount area must not overlap any input/output areas.

10 HCC COMPONENTS

10.1 HCC COMPONENTS OVERVIEW

HCC comprises the following components:

Programs:

- Main tasks, subtasks, subroutines
- Subsystem function module
- Archive administration (HAA command)
- Command service interface (ABBASEND)
- Exits (optional)

Files:

- Archive[1]	1 cyl per 5000 cartridges
- Unit recovery and statistic log[1]	1 track
- CPU-CPU transfer log[2]	1 cyl
- Message log 1-4[2]	As required
- Load library[1]	5 cyls (object code)
- Installation files[3]	5 cyls (object code)
	(1 cyl 3380 = 0.6 MB)

HCC requires the following MVS operating system resources:

- Overall CSA requirements 4-5 KB below the 16 MB level
- Calculated size over 16 MB from MAXTSO parameter
- Virtual memory: approx. 2.5 MB for 50,000 cartridges
- Negligible I/O activity according to the MOUNT/KEEP rate
- All MVS messages with routing code 3,5 must be available
- TSO environment
- ISPF environment[2]

Requirements during installation and for maintenance:

- ASSEMBLER-H (IEV90)
- SMP/E[1]

Standard utilities:

- SORT/MERGE
- IDCAMS
- IEBCOPY

[1] required [2] optional [3] required for installation

10.2 CONFIGURATION OVERVIEW

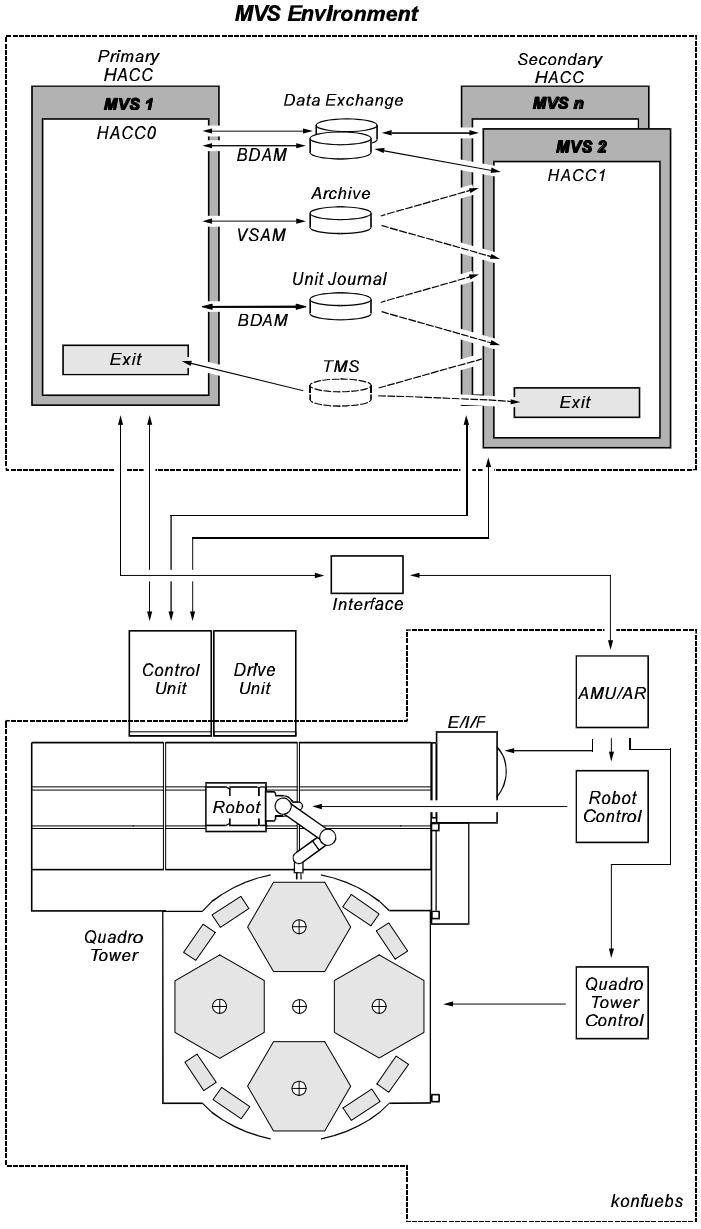


Fig 53. AML control in CPU group

One HCC is active on each MVS involved but only one HCC, the primary HCC (HACC0), assumes control of the AML system.

The primary HCC can be started on any MVS system. It is recommended to select an MVS with high mount activity.

A secondary Started task (HACC1 - HACCn) runs on each of the other MVS systems. The MVS systems must be connected to the HCC with SHARED-DASD.

HCC does not initiate any RESERVE/DEQs to a disk; a required ENQ is issued logically.

The main tasks comprises functional levels of subtasks and subroutines and run event-controlled (WAIT-POST principle).

A central part of the HCC main task coordinates the events arriving asynchronous (MULTIPLE WAIT ECBLIST).

Asynchronous events are, for example:

- Data transfer from subsystem exit (MVS messages)
- Data transfer from ABBASEND (cross memory services)
- Operator communication (Modify command)
- Conversation communication with the AML system
- I/O-complete from Archive mirror and Recovery log
- Data transfer for secondary systems
- Support functions such as label checking or initialization
- Determination of cartridges available etc.

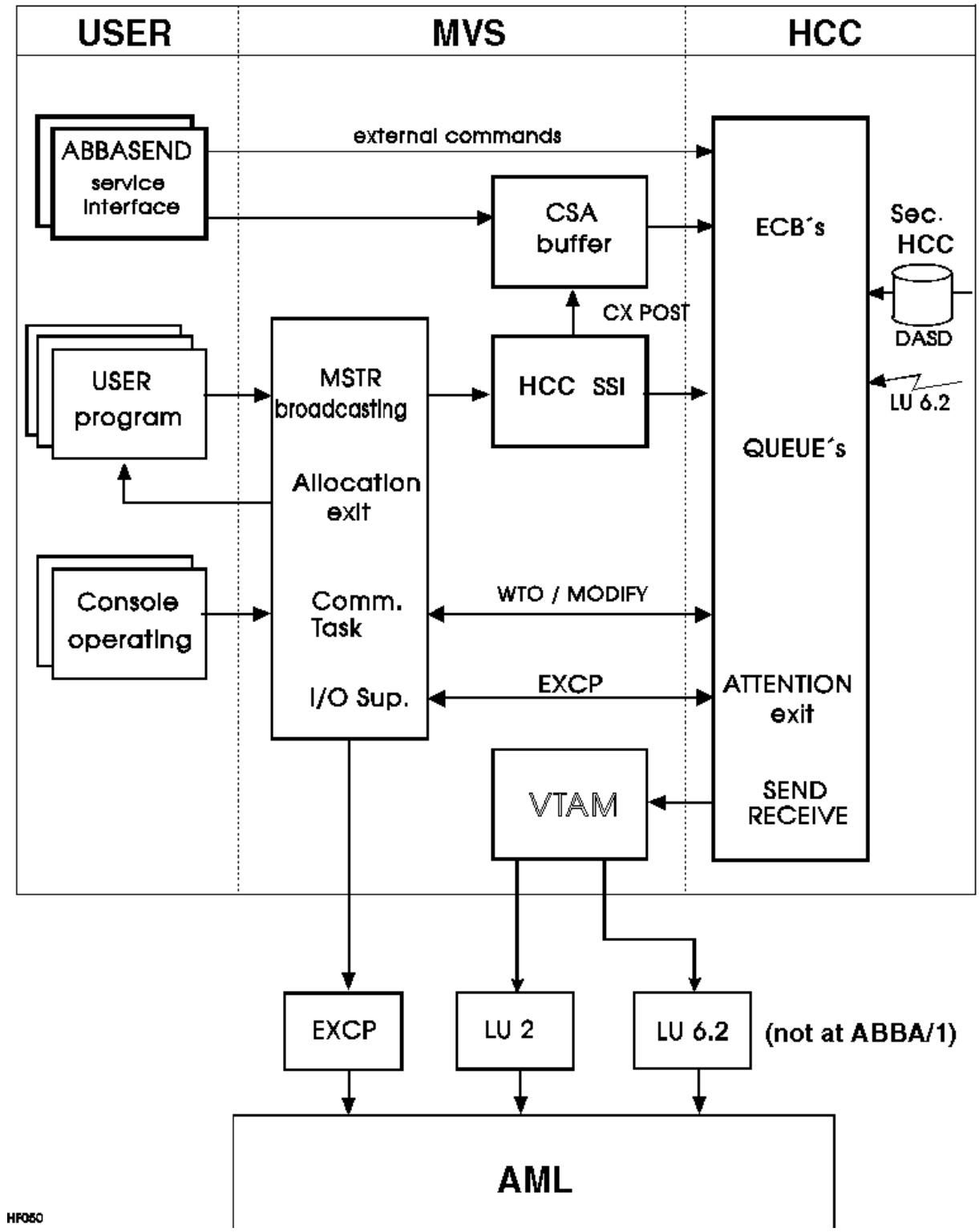


Fig 54. HCC operation flow

1 not for ABBA/1

10.3 MVS-HCC INTERFACE

A significant HCC task is to extract all tape-related messages from the operating system environment.

The SUBSYSTEM INTERFACE is a suitable interface for this function. This interface is described in the IBM literature SC28-1502 MVS/ESA / SUBSYSTEM INTERFACE.

The COMMON REQUEST ROUTER of the IEFJRASP master subsystem is used on all active secondary subsystems. A copy of every WQE, amongst others, is sent to the subsystem using the IEFSSREQ services. REPLY-IDs are also present for WTORs, messages can be suppressed.

The implementation of this broadcasting function must be entered during installation as a subsystem definition in IEFSSNxx in the SYS1.PARMLIB. The MSTR subsystem then assigns the defined subsystem its own SSCVT during IPL.

The SSCVT has two full words SSCTSUSE and SSCTSUS2 for free use by the defined subsystem. HCC uses these words as anchor-points within the operating system during internal communication (pointer to internal control blocks, retrieval using CVTJESCT).

The subsystem interface eliminates the necessity for further exits or modifications to MVS in order to extract operation messages.

The subsystem becomes active when the SSCTSSVT pointer is set. The IEFSSREQ module pointer set in the SSI function matrix is branched to. This pointer points to the HCC SUBSYSTEM FUNCTION MODULE ZHC01200 (SFM in short).

The SSVT is created during the initial start of the HCC system task or by an initialization routine (ZHC20200). The SFM can be refreshed during start of the HCC system task when the SMF code has been modified (PARM: SSI=Y).

The following system-technical requirements are satisfied:

1. The SUBSYSTEM FUNCTION MODULE can be addressed from every MVS address area (CSA location).

2. IEFSSREQ automatically controls AMODE 24/31.

3. Should the HCC system task abort, an ESTAE routine terminates the SFM communication with HCC but the SMF still remains active for MVS message extraction.

4. To ensure recovery integrity for HCC, no tape-relevant messages may be lost and this is why the SFM has a recovery queue for tape units. Pending requests can then be recovered after the HCC system task has been restarted irrespective of the fact that manual operation is possible in the meantime.

5. SFM is located below the 16 MB level, for compatibility reasons, with MVS/370 and is designed to minimize CSA main memory requirements. The allocated CSA area comprises:

   - HACCVT
   - SSI function matrix
   - SUBSYSTEM-FUNCTION-MODULE
   - Message buffer
   - Recovery area

   and needs about 4 KB memory (depending on the number of tape units installed).

   These areas are allocated as contiguous memory to avoid CSA memory fragmentation (SP 228).

6. The SFM has no application logic, it only filters out the relevant messages with routing codes 3 and 5 (tape pool and tape library) from all the WTO/WTOR messages.

7. The WTO/WTOR messages extracted by SFM are passed to HCC from a queue using Cross-Memory-POST.

8. The MVS messages are not passed directly to the HCC main task but to a subtask running in the HCC address area with the highest dispatching priority. This is achieved by setting the main task back against the subtask with the CHAP macro after the initialization. This subtask then performs only main memory operations and is not hindered by the HCC I/O operations (permanent enabled). The subtask also takes over the HCC address area buffering for MVS messages.

10.4 HCC-AML INTERFACE

10.4.1 VTAM - LU 6.2 - COMMUNICATION (AML/2/E/J)

The communication with the AMU[1] is normally serviced by a LU 6.2 interface.

The HACNET statement is used to select this communication method.

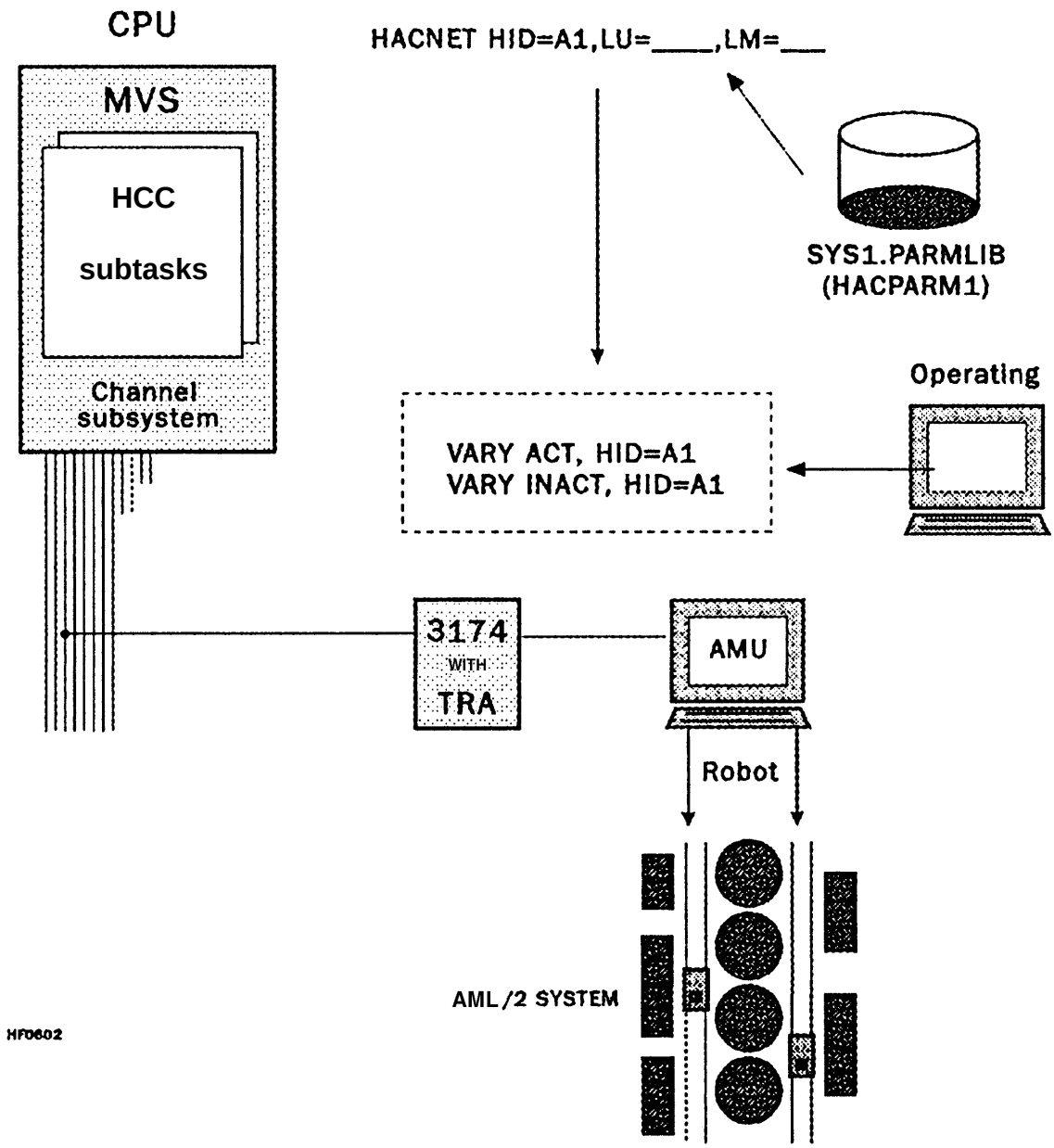


Fig 55 HCC-AML-AMU interface with LU 6.2 (AML/2 here)

[1]AMU = Archive Management Unit
TRA = Token Ring Adapter

10.4.2 VTAM - LU 2 COMMUNICATION (ABBA/1/AML/2/E/J)

HCC can communicate with the AML systems using VTAM LU 2. A separate VTAM application is then executed under HCC.

The HCC-AML interface can be realized within the VTAM possibilities, local or remote, using the network components installed.

The COMDEF statement is used to select this communication method.

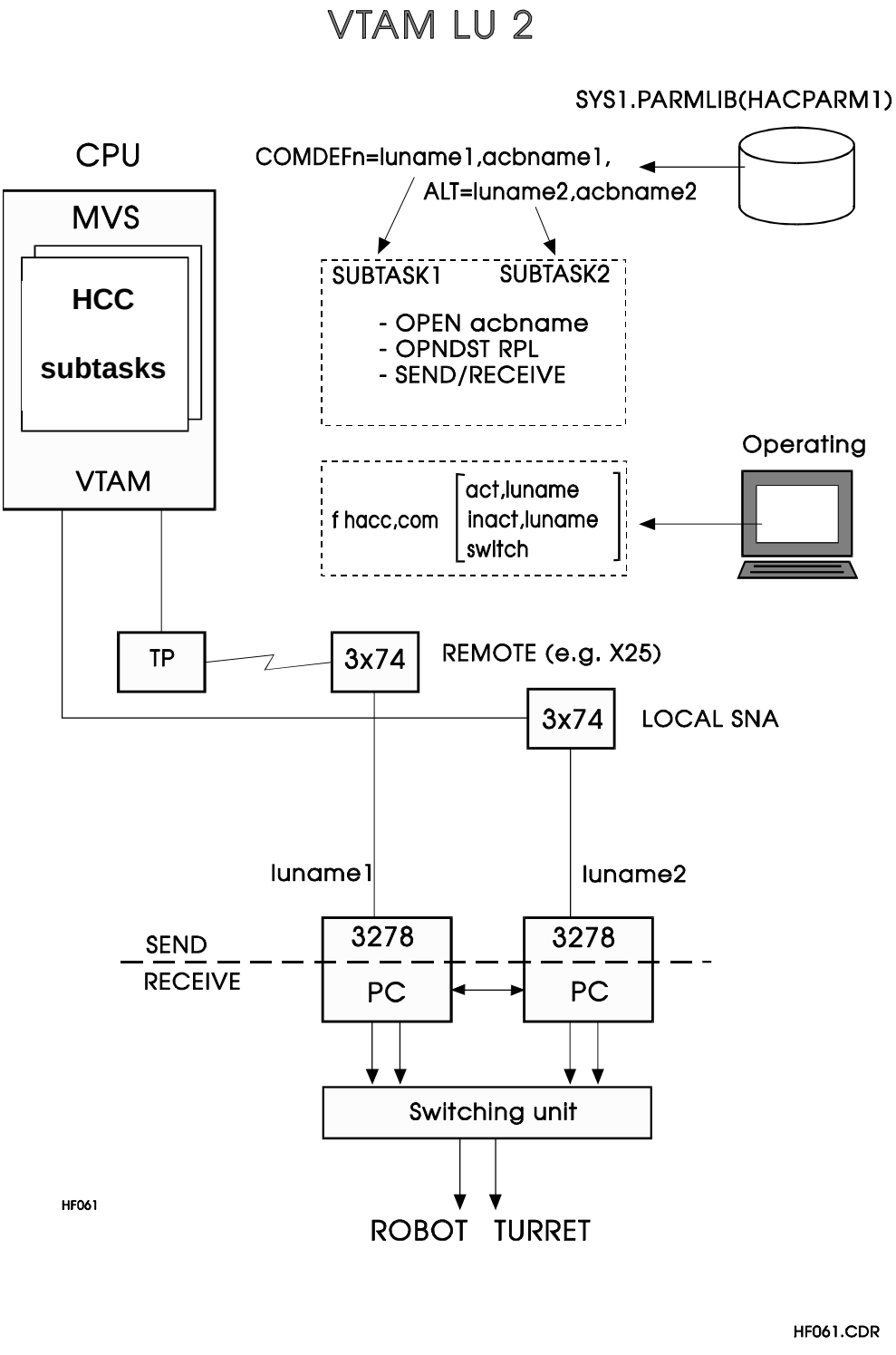


Fig. 56. HCC-AML interface with VTAM LU 2

HCC can receive parallel on both paths when a secondary communication path has been established but only normally sends over the primary path.

10.4.3 EXCP COMMUNICATION (ABBA/1/AML/2/E/J)

HCC can use its own interface method on an EXCP basis to communicate with the AML system.

EXCP (execute channel program) is a basic MVS operating system function and can be used on all units that can be connected. A local non-SNA 3x74 compatible control unit as console is always required as part of the IPL-capable basic components of an MVS system (up to and including MVS 4.1). HCC then runs the communication with AML on this minimum equipment level.

The COMDEF statement is used to select this communication method.

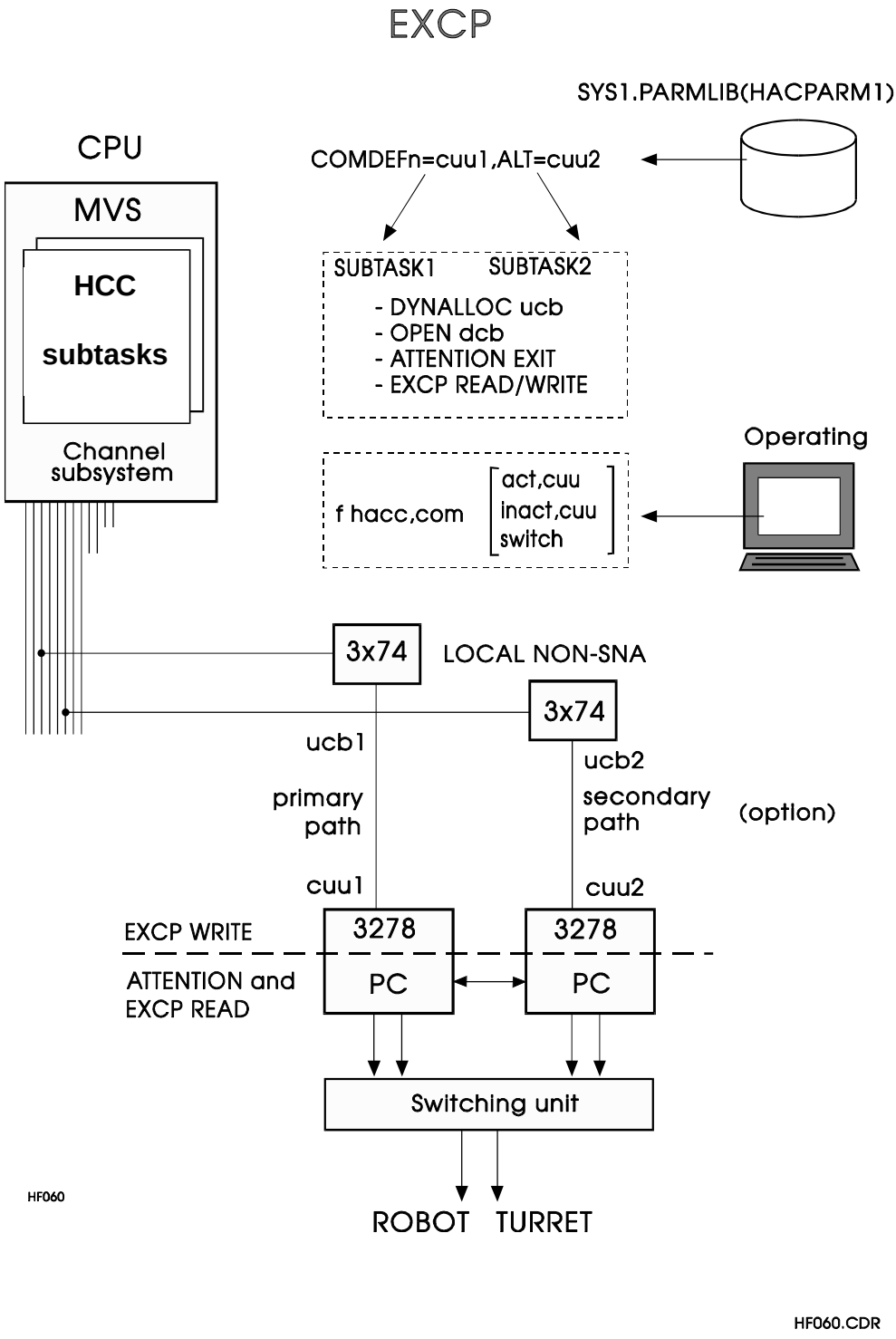


Fig 57. HCC-AML interface with EXCP

HCC supports two independent 3x74 communication paths for each AML system, practically as two separate control units.

10.5 HCC-HCC INTERFACE

10.5.1 VTAM - LU 6.2 HOST COMPLEXES

Within a HOST complex, a primary HCC system (HACC0) is connected to a maximum of 35 secondary HCC systems (HACC1 to HACC9, HACCA to HACCZ) on the basis of a shared DASD 'Exchange Log'. One subscriber acts as the PRIMARY HOST and a maximum of 35 other subscribers as SECONDARY.

Up to a maximum of 35 HOST complexes (H1 - H9, HA - HZ) can be connected to each other using LU 6.2. These specifications refer to HCC 2.4.0 and HCC 3.0. Various AMU versions can deviate from these specifications. H1 - H9 are supported by all current releases.

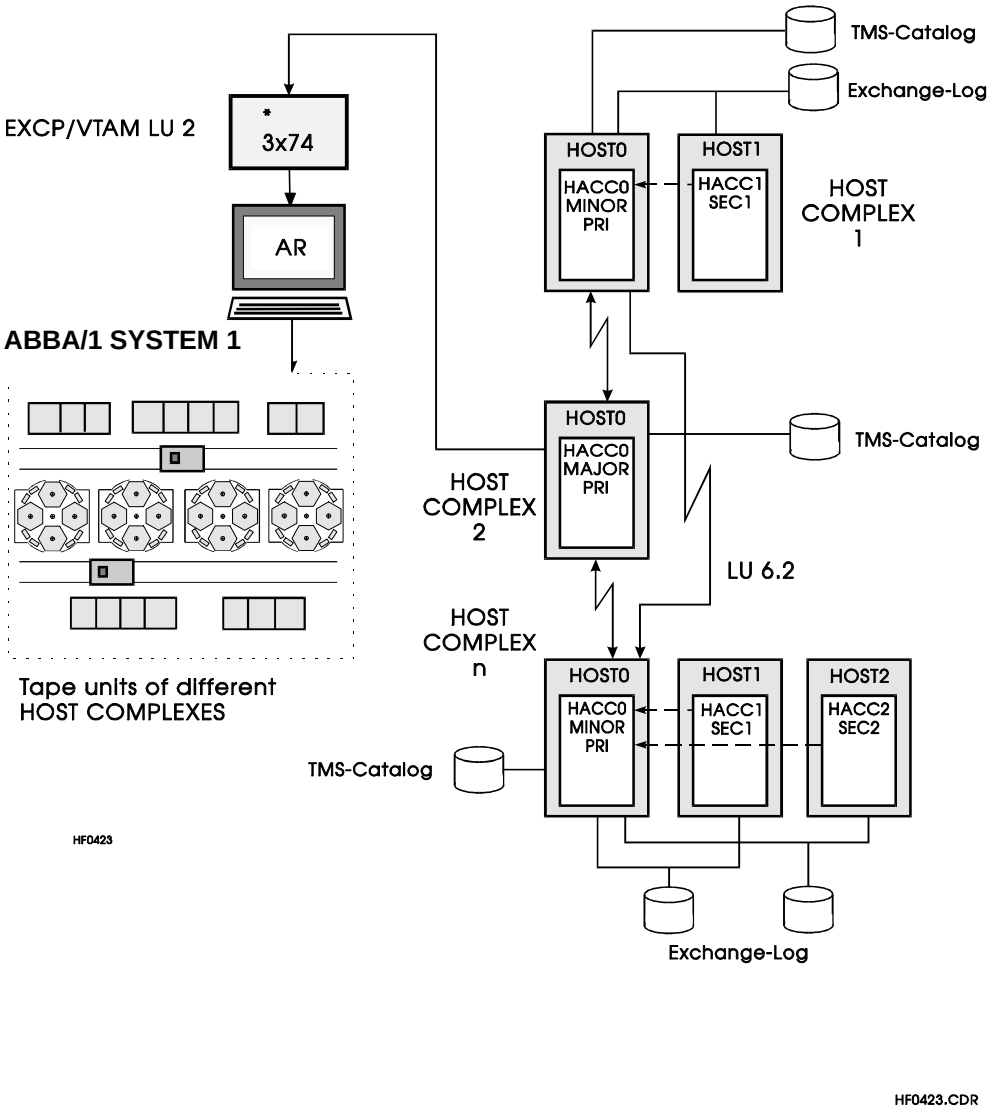


Fig 58. HCC-AML interface with EXCP and LU 6.2 HOST intercommunication

Each complex made up of one HACC0 and up to 18 HACCn systems is independent with regard to organization and recovery. There is an additional attribute within a multi-host

complex: MAJOR or MINOR. This attribute only applies to the respective primary HCC system.

Every HOST complex can be a MAJOR or a MINOR system but, at the same time, only one MAJOR system may exist.

*) This communication runs over LU 6.2 for AMU and AML/2

The MAJOR HACC0 system is the only system that may send tasks directly to AML, the MINOR HACC0 systems send their tasks for AML indirectly over the MAJOR HACC0 system[1]. This means that the control and optimization of the AML system runs over one central wait queue and prevents the other HCC systems having uncontrolled effect on the AML system.

Each HOST complex has its own independent TMS catalog.

[1]This communication runs over LU 6.2 for AMU and ABBA/2

10.5.2 LU 6.2 COMMUNICATION EXAMPLE

The following example illustrates the communication for a MOUNT task for the HOST complex H2.

The systems are started as follows:

Complex 1: `S HACC.A,HID=H1,MID=M1,A1ID=A1,M1=H2`
Complex 2: `S HACC.A,HID=H2,MID=M1,A1ID=A1,M1=H2`
Complex 3: `S HACC.A,HID=H3,MID=M1,A1ID=A1,M1=H2`

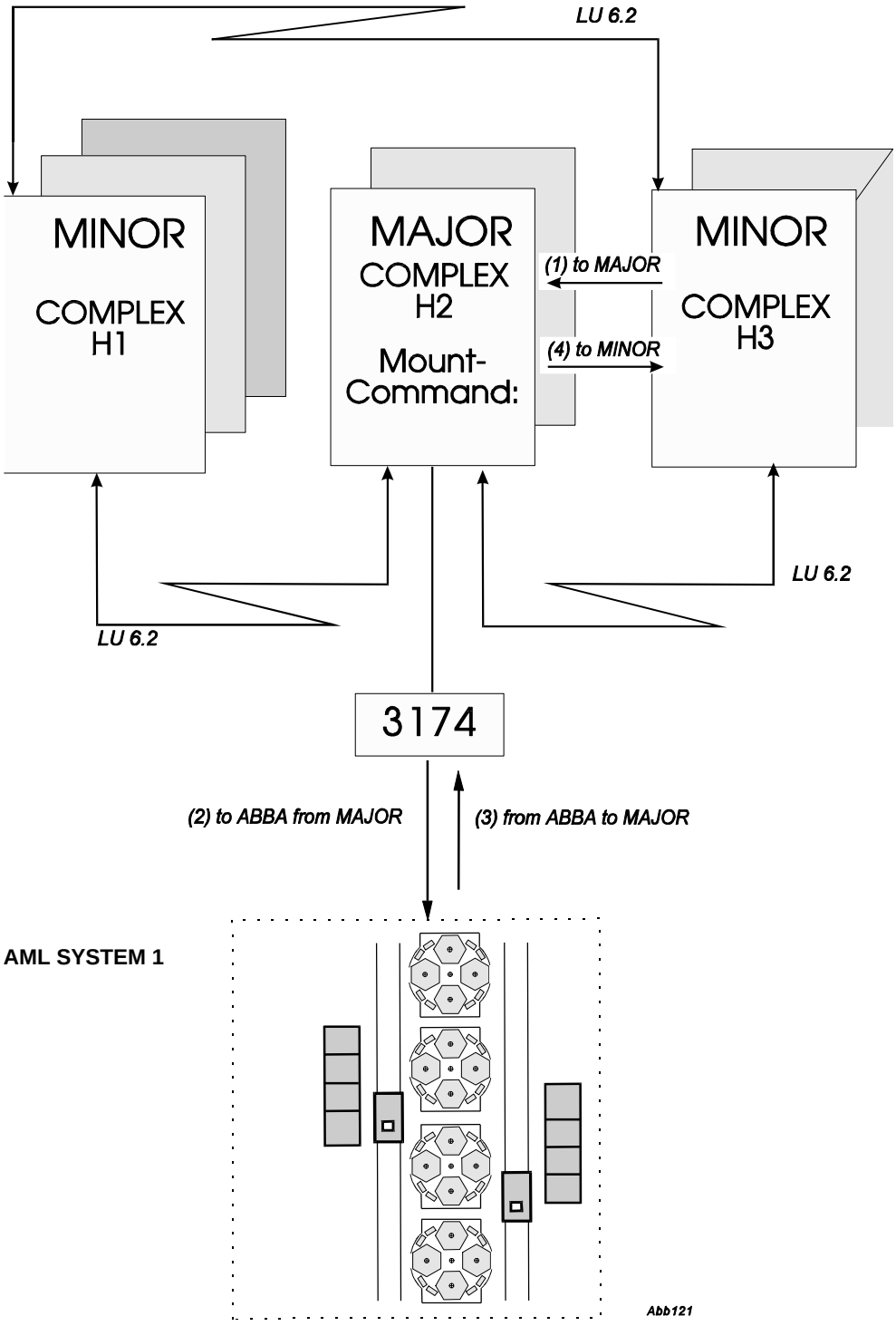


Fig 59. Message sequence during LU 6.2 intercommunication

Send sequence:

	<rrsstaa	sqnr	comm	a	retc	s	r	ddd	volser	..	Hx	sqnr>	
1. Mount command from H3:	<M1H3A00	0123	MO			1	2	D07	004711	..	H3	0123>	Inter-Host
2. Passed on by M1:	<A1M1A00	3002	MO			1	2	D07	004711	..	H3	0123>	Host-AML
3. Reply from A1:	<M1A1A00	3002	MO	P		1	2	D07	004711	..	H3	0123>	AML-Host
4. Back from M1 to H3:	<H3H2A00	0123	MO	P		1	2	D07	004711	..	H3	0123>	Inter-Host

rrsstaa = Header (rr = receiver ss = sender)
sqnr = Wait queue number (0123: in MINOR 3002: in MAJOR)
Hx = Sender

11 MVS ALLOCATION INFLUENCE

It is often necessary to influence the MVS allocation. It is then necessary for supporting more than one tape pool with the same unit type (UCBTYP). For example, two completely separate AML systems (refer to the Figure below) or one AML system are operated with a manual cartridge pool run parallel (migration phase).

The MVS allocation is normally influenced with the UNIT parameter in Job Control or by dynamic allocation. The file disposition must be considered. A UNIT or UNITTYP specification is necessary for files to be created, for example,

```
//TAPEOUT   DD   DSN=dsname,DISP=(NEW,CATLG),UNIT=POOL2,...
```

whereas the UNITTYP for existing files is automatically substituted from the system catalog:

```
//TAPEIN    DD   DSN=dsname,DISP=OLD
```

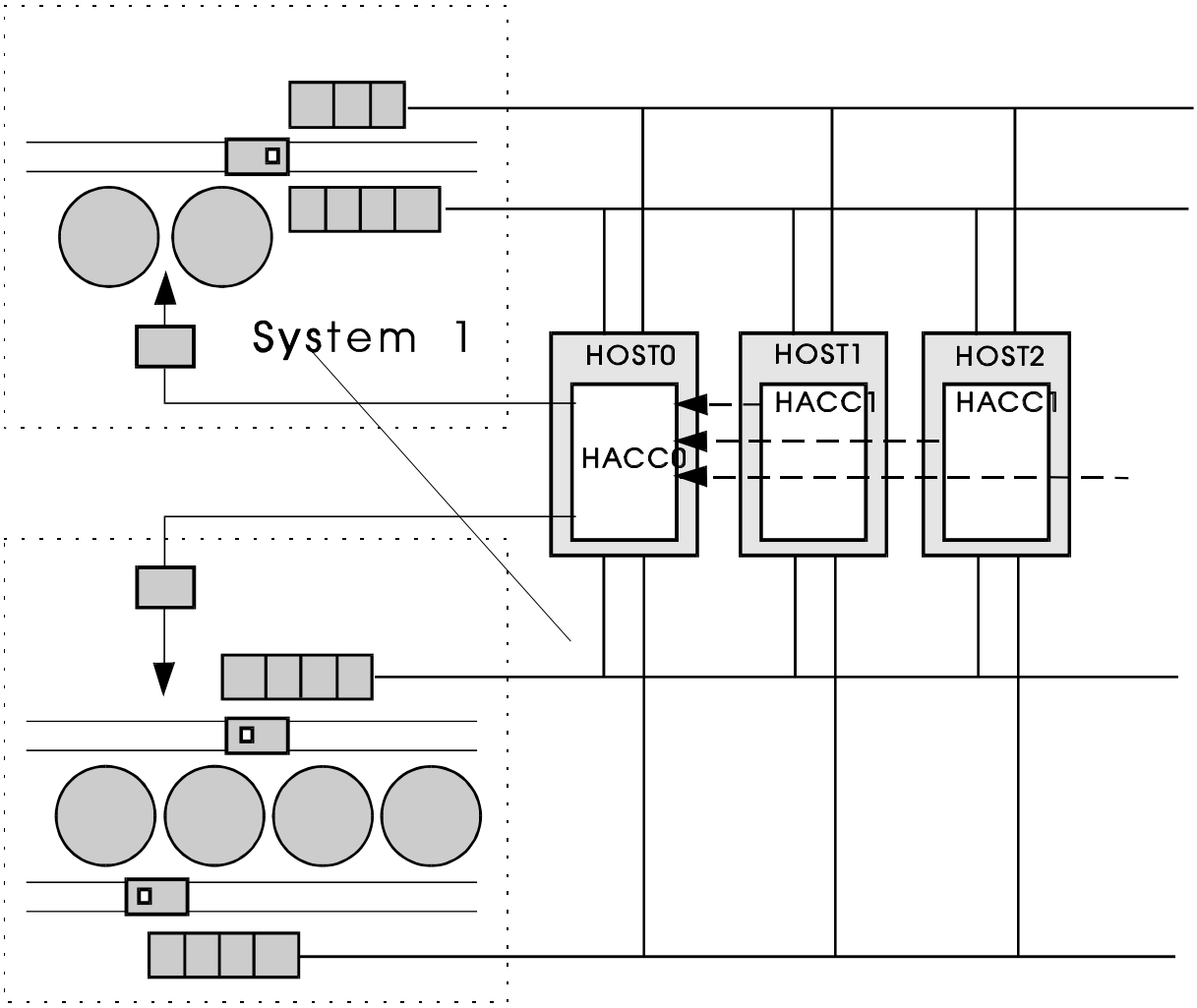


Fig 60. Two separate tape pools

The following problem then arises: the information in the system catalog is restricted to the general UNITTYP (UCBTYP) and the ESOTERIC NAME in the UNIT parameter of the JCL is not retained when the file is created which means that the pool specification where the cartridge was created is lost.

The lost location information (for example, POOL1 or POOL2) must be supplied to MVS when such a cartridge is requested later, for example in the form

```
//TAPEIN   DD  DSN=dsname,DISP=OLD,UNIT=POOL2
```

This specification leads to a JCL error because UNIT parameters must be specified for an "OLD" file. When the pool is not specified, MVS performs the allocation according to its own rules. This means that cartridges from POOL1 (Building 1) could be requested from POOL2 (Building 2) and vice versa.

In earlier MVS versions (before SU 60), the ESOTERIC NAME was stored direct as UCB-LOOKUP VALUES instead of the UCBTYP (for example, for 3480 UCBTYP=X'78008080'). The location information was thus retained in the catalog. The disadvantage was that all affected files had to be re-cataloged when appended with ESOTERIC NAMEs because this modified the LOOKUP VALUE.

This location problem is solved automatically when differing unit types are installed in POOL1 and POOL2, for example, standard 3480 units in POOL1 (UCBTYP=X'78008080') and 3480 units with compaction feature in POOL2 (UCBTYP=X'78048080' data conversion bit).

The following method has been implemented under HCC for multiple tape pools:

The lost location information is reconstructed in the CATALOG INSTALLATION EXIT IGG026DU using a table (HACEDT) that contains the location of the VOLSERs.

Further information can be found in the Installation/Customization for HCC 3.00 Manual and in the System Reference Guide.

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