



PHYSICAL PLANNING GUIDE

AML/2

AUTOMATED
MIXED-MEDIA
LIBRARY
/2



1 System Description

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1 System Description

The AML/2 is a floor-space efficient, fully automated, robotic storage media archive. It constitutes a high-technology improvement over manual or partially automated tape archive systems.

The open architecture and modular design of the AML/2 allow for

- maximum flexibility in configuration
- integration of a data center's existing tape drives and data formats
- future expansion and adaptation

The AML/2 supports:

- HDS/COMPAREX 7480/6380
- HDS/COMPAREX 7490/6390
- IBM/SNI 3480/3580
- IBM/SNI 3490/3590
- Exabyte 8 mm
- DEC DLT 2000
- STK 4480
- STK 4490
- Reflection (OD)
- Tandem 5180
- Tandem 5190
- Metrum VHS

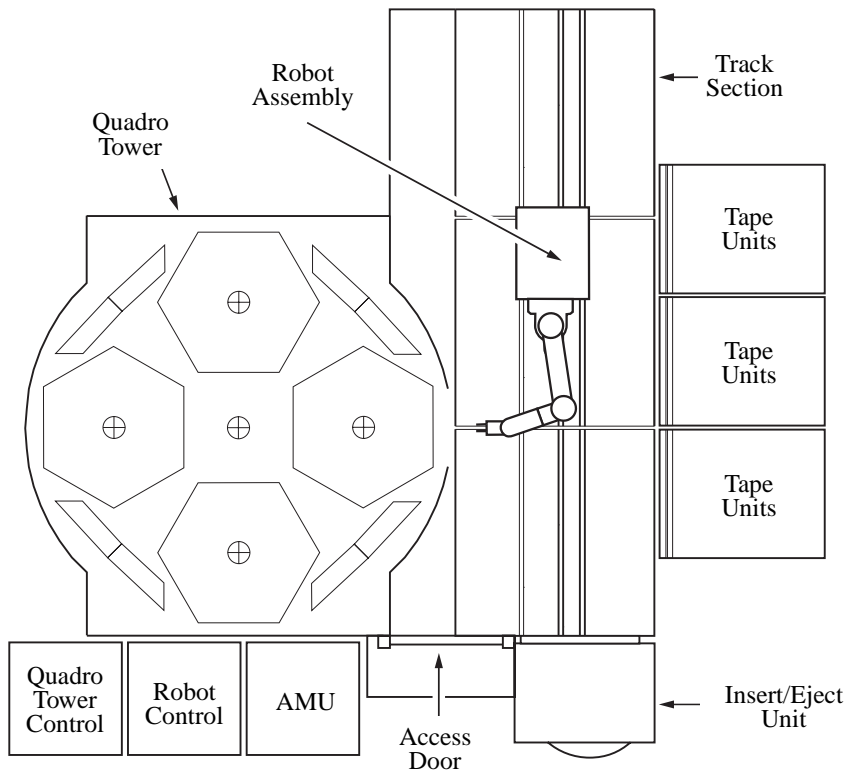


Fig. 1-1: Basic AML/2 Configuration: 1 Quadro Tower, 1 Robot

The AML/2 interfaces with up to 9 host complexes by means of HACC (Host AML Communication Control) software. Each complex may consist of up to 8 hosts.

HACC

- receives media-related MVS messages
- coordinates tasks
- manages and updates the archive catalog (archive database)
- provides recovery from tape errors.

HACC was originally designed to operate in an MVS environment. Meanwhile the following other systems are likewise supported:

- VM/VSE
- further operating systems, such as
 - Tandem
 - Bull

ROBAR: Siemens product integrating the AML system under BS 2000.

1.1 Hardware

1.1.1 AMU (AML Management Unit)

The AMU is the central interface of the unmanned AML/2 system. In normal operation (“AUTO”) the host computer controls the system.

The AMU thus connects the host computer to the

- the robot system
- the insert/eject unit

of the AML/2 system

The AMU’s tasks are

- host communication
 - interprets the incoming host commands
 - checks these commands for executability
- management of the archive catalog
 - saves the logical coordinates of the compartments
 - assigns the media to compartments
 - traces the status of compartments and drives
- conversion of logical coordinates into physical coordinates
- communication with the control units of the robots and storage towers
- operator interface for
 - installation
 - service
 - the operator
- configuration (describes the specific structure of the system)



Information

AMU does not record the data content of the media.

For an archive only one AMU is required.

AMU hardware (→ Installation Guide)

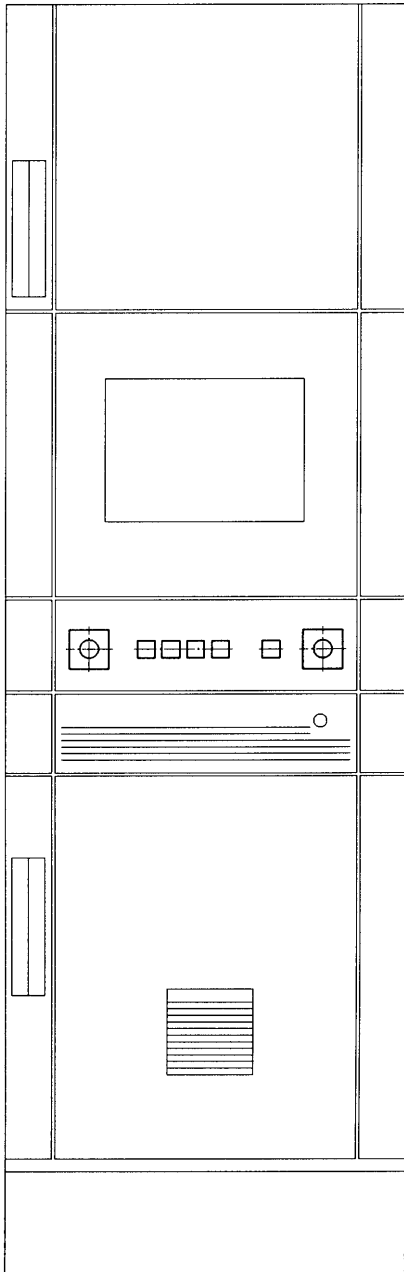


Fig. 1-2: Operating Cabinet (AMU Cabinet)

1.1.2 Archive

The AML/2 is designed to utilize standard one-half inch tape cartridges manufactured by various vendors. It can be configured to handle other media, however, such as

- VHS-Cartridges
- Optical Disks 512
- OD-Reflection
- 8 mm tapes (Exabyte)
- 4 mm tapes (Exabyte)
- DEC/DLT (TK85)
- Optical Disks

Storage strategies (important for planning of the system)

- hierarchical: all media are assigned permanent compartments in the archive
 - advantage: in the operating modes “MANUAL” and “EMERGENCY” individual media are easy to locate
 - disadvantage: the configuration must be altered when media are replaced
- dynamic: the compartment is assigned the medium when it is filed and becomes vacant upon ejection of the medium
 - advantage: replacement of media does not require reconfiguration
 - disadvantage: in the operating mode “EMERGENCY” or when you search for media manually these will be hard to locate

To achieve optimal capacity and physical layout requirements, the AML/2 can be configured with

- Quadro Towers
- linear shelves
- a combination of both

Logical coordinates define the location of each compartment in the archive.

Each medium is labelled with a barcode label (barcode) showing the medium number (VOLSER = Volume Serial Number). A scanner on the robot reads the barcode and thereby identifies the medium.

The archive catalog tracks the compartments in the archive, that is, it saves the assignment of volser (media numbers) to logical coordinates.

Quadro Towers

Quadro Towers provide maximum media density while requiring minimum floor space. Depending on ceiling height, each Quadro Tower can store

- 3 840 cartridges 3480 (2.05 m high)
- 4 800 cartridges 3480 (2.43 m high)
- 5 760 cartridges 3480 (2.80 m high)

in just approx. 5 m².

Using double-length tape cartridges, 36-tshelf recording, and data compression, it is possible to store up to 13.8 terabytes of data in a single Quadro Tower (less than 6 square feet of floor space per terabyte of data).

An archive may comprise up to 12 Quadro Towers.

Each Quadro Tower consists of

- 8 segments within the main rotating tower
- and 24 segments arrayed on 4 independently-rotating auxiliary towers.

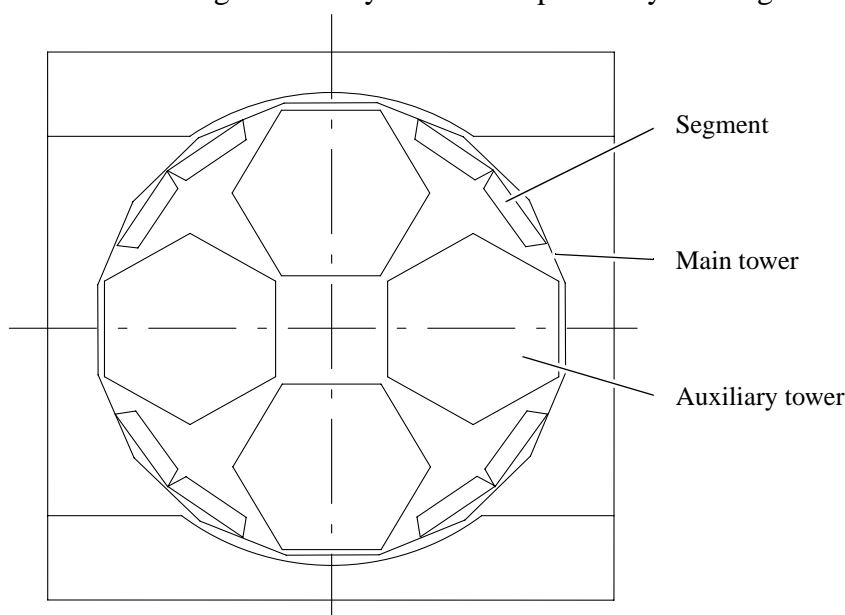


Fig. 1-3: Quadro Tower; Top View

Each segment may be 12, 15, or 18 rows high.

Each row in the segment has 10 compartments (numbers refer to 3480 cartridges).

The average time to present a medium is only 2.5 seconds, with a maximum time of 6 seconds. Quadro Tower performance has been optimized through weight reduction in moving components and the use of composite materials. Computer-directed servo mechanisms control the movement of the main tower and the

auxiliary towers.

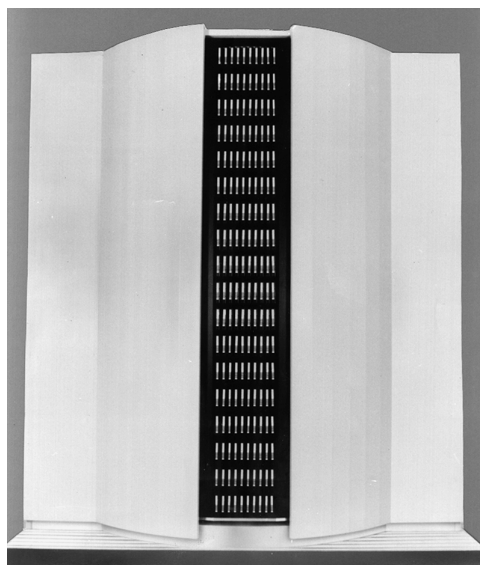


Fig. 1-4: Quadro Tower, Front View

Linear Shelves

Linear shelves are ideally suited for

- long, narrow rooms
- smaller archives.

Linear shelves have 10 compartments per row and are 12, 15 or 18 rows high. The smallest unit thus has only 120 compartments (numbers refer to 3480 cartridges).

AML/2 linear shelf systems are offered in a variety of standard configurations, ranging in capacity from 1 200 to 6 000 compartments. Other configurations are available on request.

1.1.3 Robot System

The robot system provides the physical access to the physical archive and the drives. It executes the commands of the AMU and returns feedback messages.

Functions

- identifying media by scanning (reading) the barcode label
- execution of handling commands
 - moving media into and out of the AML/2 system via the I/O unit
 - storing and retrieving tapes from the archive (as requested by the host system)
 - mounting and dismounting media from drives

The robot system is configured to work with all standard one-half inch tape cartridges and tape drives. This provides for easy integration of existing tape units. A tape archive may be configured to interface with up to 99 tape units.

A single robot can access multiple Quadro Towers or linear shelves. Higher performance is achieved through the use of multiple robots.

- Typical performance (actions) per hour
 - 250 with one robot system
 - 480 with a twin robot system
- Actions are
 - mounting a medium in a drive (mount)
 - returning a medium into the archive (keep)
 - insertion of media (insert)
 - ejection of media (eject)

Components of the robot system include:

- swivelling arm robot (robot system)
- gripper with laser scanner (barcode reader)
- rho 3 robot control
- lifting platform
- lifting column
- carriage
- track sections

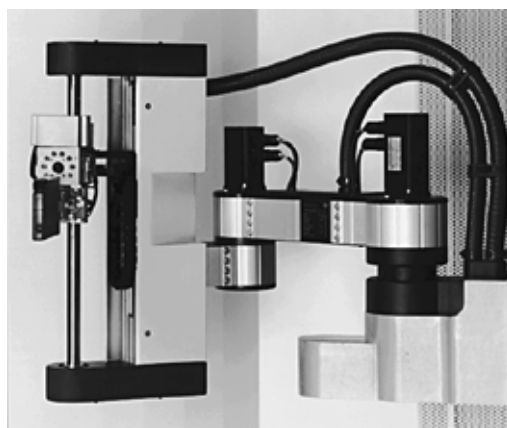


Fig. 1-5: Swivelling Arm Robot

The robot system consists of a four-axis robot equipped with an electro-pneumatic gripper, the lifting column and the carriage.

Rack and pinion drive gearing allow the robot to travel quickly and quietly along modular track sections. The linear speed is nearly 1.5 m/s. The travel range is twelve Quadro Towers.

Fast, exact positioning of the gripper is ensured by

- advanced-design brushless motors
- precision gearing
- a specially developed Z-axis
- a laser scanner

1.1.4 Input/Output Unit (I/O Unit)

Functions of the I/O unit:

- automatic insertion and ejection of media in the AML/2 system
- manual insertion and ejection. The media are put manually into the handling box.
- filing of defective media in a separate problem box

Use of the I/O unit compartments:

- insertion (on HACC/MVS, VolServ overlapping with ejection)
- ejection (on HACC/MVS, VolServ overlapping with insertion)
- foreign mount (compartments for media foreign to the system)

Two types of I/O units are available:

- Type A
- Type B

Type A

Each I/O unit/A has 1 or optionally 2 turning units. If 2 turning units are provided the overall capacity of media doubles.

The turning units operate independently of another. Each turning unit accommodates 4 handling boxes. The turning unit turns the handling boxes from the operator access side to the robot access side.

Each handling box can accommodate

- 30 cassettes (type 3480) or
- 24 Optical Disks or
- 6 D2 small or
- 6 D2 medium or
- 8 VHS cassettes

All handling boxes can be extracted.

The robot takes the media from the handling boxes and files them in the archive or mounts them in drives. Two I/O units can be accessed by each robot. Thus an archive may comprise a maximum of 4 I/O units.

(☞ “I/O Unit/A” Page 1/25)

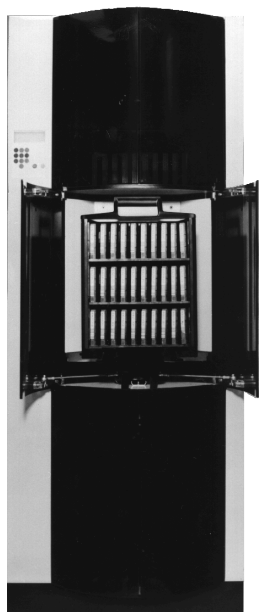


Fig. 1-6: Automated I/O Unit Type A

Type B

This type is the standard I/O unit for AML/2.

It consists of 2 or optionally 4 handling boxes behind a door.

(☞ “I/O Unit/A” Page 1/25)

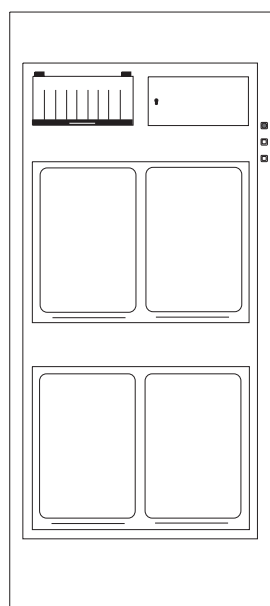


Fig. 1-7: Automated I/O Unit Type B

1.2 Software

1.2.1 HACC (Host AML Communication Control)

HACC is AML's host software, which organizes and manages the AML/2 system. HACC makes automated operation of the archive possible (AML Management Unit) supporting several hosts at the same time.

Without interfering with the performance of host system operations, HACC

- automatically receives media-related MVS messages (routing codes 3 and 5)
- coordinates tasks
- manages and updates the archive's database (archive catalog)
- provides recovery from media errors

Operating in an MVS environment, HACC uses the Standard Subsystem Interface and does not modify the host operating system. JCL changes are not required.

HACC can be tailored, via parameter statements, for many different archive configurations. HACC supports from 360 to 184,320 media in a single robotic domain. It can be configured to accommodate an expanding archive.

MVS media functions are routed from the host computer to HACC by means of the Standard Subsystem Interface. Media functions supported by HACC include:

- mount/keep operations for media (mount/keep)
- volume insertion/ejection (insert/eject)
- administration of drive cleaning
- barcode label initialization and verification
- automatic reply to outstanding WTORS
- operator controlled media swap statistics
- scratch media management

Multiple computers are supported using

- shared Direct Access Storage Devices (DASD) or
- a Token-Ring Local Area Network (LAN)
- either individually or in combination

Up to 9 independent host complexes can be connected. Each remote complex may have as many as 8 computers or system images. Therefore, HACC can support up to 72 computers or system images.

The host system communicates with the AML/2 by means of

- LU 6.2/APPC via Token-Ring adapter
- EXCP/3270 and a local NON-SNA 3274 control unit
- VTAM LU 2 (local or remote).

Minimum software requirements to support HACC are:

- MVS-SP1.3.6 for JES2
- MVS-SP2.2 for JES3
- SMP/E
- Assembler H
- standard utilities

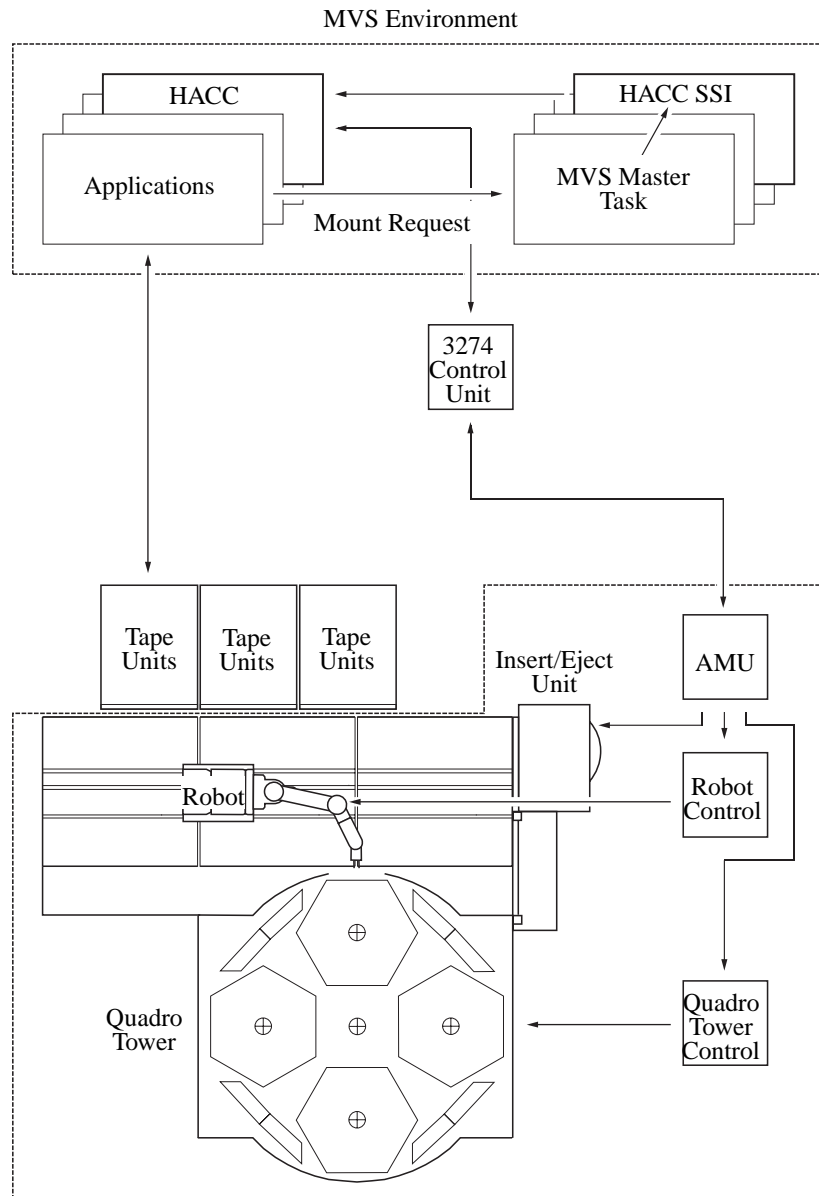


Fig. 1-8: Communication between Host System with HACC and the AML/2

AML/2 requires the following MVS resources:

- approximately 4 to 5 KB total CSA down of the 16 MB line
- virtual main storage of approximately 2.5 MB for 50,000 media
- MVS messages (routing codes 3 and 5) must be available
- TSO is desirable, but not required

1.2.2 ROBAR

ROBAR is the interface between BS2000 and the AML/2 system. It supports an AML/2 system with one or two robots in a multicomputer environment featuring up to 24 BS2000 systems.

ROBAR comprises

- a central element running on a SINIX computer
- a host component for each BS2000 system.

Global coordination for robot operation takes place at SINIX level. Each BS2000 system is of equal status as regards the submission of jobs to the robots. ROBAR performs the host functions for the AML system.

HW (ROBAR-BS2000)

ROBAR-BS2000 is the linkage component within each host. It runs under BS2000. ROBAR-BS2000 transfers the actual mounting and dismounting jobs involved in media handling. Such jobs are submitted by all media-processing programs (e.g. ARCHIVE, MAREN, INIT).

These programs send their requests to ROBAR-BS2000 via the operator interface CONSOLE. The CONSOLE messages relevant to the media are filtered out of the stream of console messages and are passed on to ROBAR-SINIX. Each BS2000 computer has access to the full range of functions offered by the AML/2 system.

For optimum utilization of the robot system, organizational statements for insertion and ejection of media are necessary, in addition to the actual mount requests. ROBAR supplies the required functions in this case.

Employing SDF for these statements permits the user to make use of certain functions, such as the insertion/ejection of media on a computer-specific or user-specific basis.

SINIX PC for Communication with BS2000 (ROBAR-SINIX)

ROBAR-SINIX contains the

- send and receive functions for the BS2000 systems
- message distribution facilities for multicomputer operation.

The connection to the AML/2 computer is set up and monitored here. The main function is the interpretation of messages from the BS2000 and AML/2 systems. From these ROBAR-SINIX produces action calls, which are carried out either by the robot system or by the BS2000 host computer. These are:

- robot actions, such as mounting a medium,
- BS2000 actions, such as responding to a message.

Robot action calls are passed on to the AML/2 computer connected to the SINIX system.

BS2000 action calls are conveyed to the operating system via the CONSOLE interface. ROBAR offers default settings for the message interpreter, which can be modified by the computer center to suit requirements (dynamically during normal operation).

ROBAR maintains information on the

- availability of the media from the point of view of the host
- assignment of the media to the robot-operated or manually-operated archive area.

A special function enables the processing of scratch media using a volume management system other than MAREN.

Start and stop of the AML/ROBAR system is menu-driven. The operator can control the AML/ROBAR system manually as well. Help functions are available to provide support during the installation and modification of the ROBAR message files.

All actions performed by ROBAR are recorded in trace files.

1.2.3 DAS (Distributed AML Server)

What is the DAS?

The Distributed AML Server (DAS) System is a software component which provides control access to an automated archive.

The DAS System is divided in two, local separate, parts:

- the AML Client Interface (DAS Client, ACI)
- the DAS main body (which, in the following, is simply referred to as DAS)

The whole software (ACI and DAS) is called DAS System.

The DAS System enables an unlimited number of clients, using different hardware platforms, to control the AML/2 system. Normally these clients will be using UNIX platforms (either mainframe or workstation). However, any platform that supports ONC RPC (Sun's remote procedure call) could use the DAS.

DAS itself runs on a UNIX host and

- converts the rpc requests into complete protocol units and
- sends them to the AML Management Unit (AMU).

The communication between the AML/2 system and the requesting clients is split into two paths

- the data path
- the control path

The data path is not going through the DAS, but is directly connected with the requesting hosts (DAS does not output control data onto the data path).

The DAS is the head of the control path and all control actions are passed through it. To be able to communicate with DAS each host needs a DAS client software. The DAS Client Interface (ACI) is a C function set packaged in a library.

Any user of the ACI needs to know nothing of the underlying network processing taking place on his behalf. He is only required to provide basic information for the AML/2 operation.

1.2.4 HACC/OS 400

Software Description

A substantial part of the AML system is the HACC/OS 400 Software running under the operating system OS/400.

The AS/400 system is connected to the server via a standard RS232 interface. The software is easily installed in both existing and new AS/400 installations.

The basic HACC/OS 400 design philosophy was

- to maintain the compatibility with the accustomed Tape Management System (TMS) under the operating system OS/400
- to implement “non-attended” large capacity media handling
- to minimize operator intervention

Functions of HACC/OS 400

- control of the communication between
 - the operating system and the AMU (as well as the robots of the archive)
 - the subsystems
- translation of OS/400 Tape Handling Commands for the robot’s individual steps
 - interception of “mount/keep” messages issued by HACC/OS400
 - translation into “mount/keep” commands
 - transfer of commands to the archive’s robots
 - control of the physical “load/unload” processes
- selection of devices
- “operator control” with utility programs

HACC/OS 400 consists of modules for

- installation and configuration
- initialization/termination of the HACC/OS 400 system by the AS/400 operator
- automated media handling
- utility programs
 - media initialization and labeling
 - control file management
 - insertion/ejection of media
- error recovery
- communication with the robot controller (PC with AMU software)

User Interface

Control of the HACC/OS 400 System is via a set of commands in the OS/400 Command Language (CL) style. All commands are fully supported by menus and a complete help system. These commands are divided into three privilege groups: system manager, operator, and user. Each privilege level has its own base menu where the operations available at that level are shown.

1.2.5 Operating System

- Multitasking Operating System OS/2 English
- Database Manager DB 2/2 Version 1.0 (IBM) English
- Communication Manager CM/2 Version 1.1 (IBM) English
- Distributed Access Console Facility (DCAF)

1.2.6 AMU (AML Management Unit) Software

Operating in the OS/2 environment, AMU software consists of seven stand-alone processes (programs) running in parallel (multitasking). Each of the seven processes serves peculiar purposes.

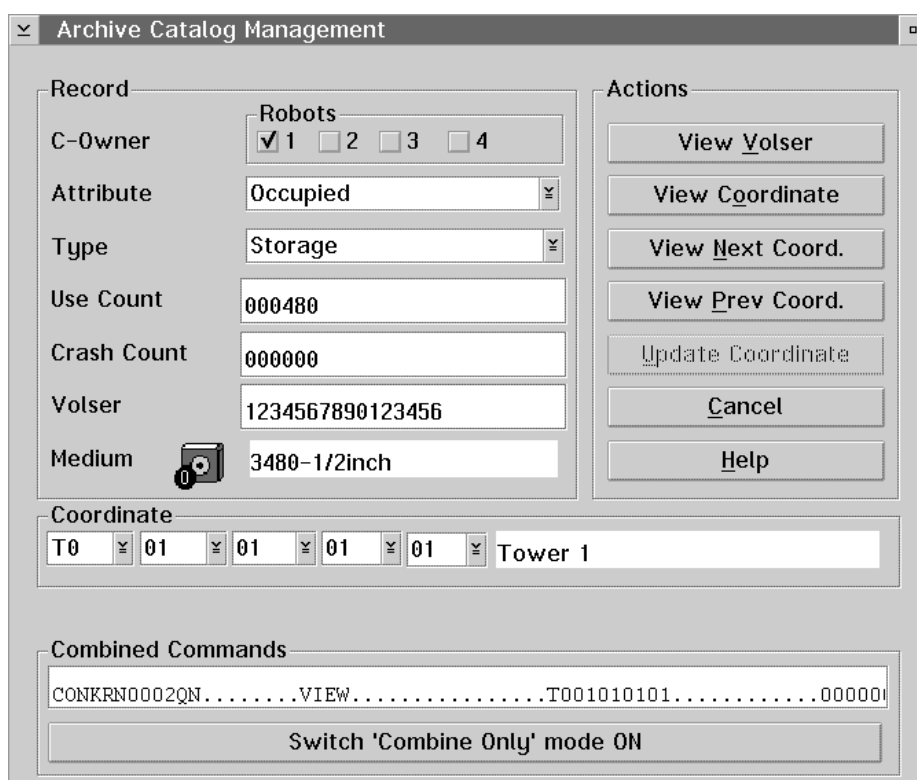


Fig. 1-9: Example of AMU Software's Graphical User Interface

- **HOC (HOst Communication)**
Communication with
 - host computers
 - the controls of the robot and the storage towers
 - I/O unit A
- **ARC (ARChive)** management of the archive catalog using an SQL database
- **KRN (KeRNel)** central logic, converts host commands into control commands
- **CON (AML Operator CONsole)** operator console (user interface)
- **ART (AleRTer)** writes logs and traces
- **RFM (Rho File Manager)** transfers files (control software) between the AMU and the rho control (only used for service after the communication with the host computer has been stopped)
- **ARCBACK (ARChive-BACKup)** saving, protocolling (journaling) and restoring the archive catalog (secondary process making an ASCII backup of the database daily)



Information

AMU does not record the data content of the media.

In normal (“AUTO”) operating mode, the host computer directs the AML/2 system. Commands are only input manually at the AMU console when specific intervention is required, e. g. operation of Quadro Towers in “MANUAL” mode.

1.2.7 System Data Flow

Major system control components include:

- host software/hardware
- AMU (AML Management Unit)
- controls of
 - robots
 - Quadro towers
 - I/O unit

The basic operational philosophy of the AML/2 system is that the host is always the “master.” During normal processing, all commands originate with the host system.

When the host software determines that an archive action is necessary,

- it creates the appropriate command string
- and sends it to the AMU

The AMU

- receives the command
- checks the command for validity
- interprets the host command
- issues appropriate commands to control units of
 - robots
 - Quadro towers
 - I/O units

The robot, Quadro tower, and I/O unit controllers

- check the AMU commands for validity
- carry out the requested actions and
- after completing the actions report their status back to the AMU

When all controllers have reported, the AMU reports an overall result back to the host system.

1.3 Specifications

1.3.1 Archive Configuration

| | |
|-------------------------------|---|
| Host complexes (HACC) | A maximum of 9 host complexes (main hosts), with 8 hosts (sub-hosts) each, can communicate with 2 AMUs |
| HACC Software | One per each host in a complex |
| AMU (Archive Management Unit) | One per archive, parallel connection to 3 different hosts is possible. |
| Quadro Towers | Maximum of 12 per archive |
| Robot Systems | Maximum of 2 per archive |
| Track Sections | 1.2 m sections, combined to overall length required by archive. Max. overall length: 24 m with 12 Quadro towers |
| Drives | Maximum of 99 per archive |
| I/O Units | Maximum of 4 per archive (2 per robot) |
| Necessary Ceiling Height | <ul style="list-style-type: none">• 12 rows with 3480 cartridges = 2.05 m (small)• 15 rows with 3480 cartridges = 2.43 m (medium)• 18 rows with 3480 cartridges = 2.80 m (high) |

1.3.2 Quadro Tower

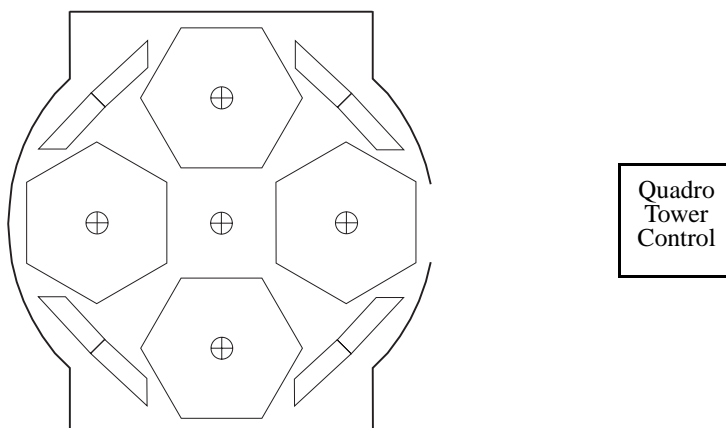


Fig. 1-10: Quadro Tower, Quadro Tower Control

| Size (rows) | small | medium | high |
|-----------------------------|-----------------------|-----------------------|-----------------------|
| Capacity 3480 cartridges | 3 840 | 4 800 | 5 760 |
| Height | 1.87 m | 2.25 m | 2.62 m |
| Weight Empty | 2 540 kg | 2 600 kg | 2 660 kg |
| Weight Full | 3 500 kg | 3 800 kg | 4 100 kg |
| Floor Load Full | 550 kg/m ² | 550 kg/m ² | 550 kg/m ² |

| | |
|-------------------------|---|
| Space Required | 2.24 m by 2.24 m (5.02 m ²) |
| Power Requirements | 50 Hz, 400 V AC, 3-phase |
| Total Power Consumption | 0.5 kVA |
| Manual Operation | Yes, when host or power fail |

Specifications

Capacity Mixed Media

| Size | 3480 Com- part- ments | OD- Reflection | | OD 512 | | VHS | 8 mm Tape | TK | D2 small/ medium |
|--------|--------------------------------|--|-------|--------|-------|-------|-----------------|-------|------------------------|
| | | OD | 3480 | OD | 3480 | | | | |
| small | 3 840 | 2 304 | 960 | 2 112 | 960 | 1 792 | 4 800 | 2 816 | 1 344 |
| medium | 4 800 | 3 168 | 1 200 | 2 904 | 1 200 | 2 048 | 6 080 | 3 584 | 1 728 |
| high | 5 760 | 3 744 | 1 440 | 3 432 | 1 440 | 2 560 | 7 360 | 4 096 | 2 112 |
| | | only 24 segments with OD possible and 8 segments with 3480 cassettes | | | | | | | |

Number of media per segment

| Size | 3480 Com- part- ments | OD- Reflec- tion | OD 512 | VHS | 8 mm tape | TK | D2 small/ medium |
|--------|--------------------------------|------------------------|--------|-----|--------------|-----|------------------------|
| small | 120 | 96 | 88 | 56 | 150 | 88 | 42 |
| medium | 150 | 132 | 121 | 64 | 190 | 112 | 54 |
| high | 180 | 156 | 143 | 80 | 230 | 128 | 66 |

1.3.3 Robot System



Fig. 1-11: Robot, Robot Control

| | |
|--------------------------------|---|
| Robot Model | Robot system |
| Axes | 4, plus horizontal and vertical |
| Number of Grippers | 1 pneumatic |
| Barcode Reading System | Barcode scanner |
| Scan Capabilities | <ul style="list-style-type: none"> • Code 39 in any direction • STK Code • Code 128 • CODABAR • Interleaved 2OF5 • UPC • EAN • Points |
| Power Requirements | 50 Hz, 400 V AC, 3-phase |
| Max. Length of Horizontal Axis | 29.5 m |
| Linear Speed | 1.5 m/s |
| Linear Travel Range | 12 towers |

Specifications

1.3.4 I/O Unit/A

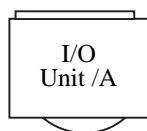


Fig. 1-12: I/O Unit/A

| | |
|--|---|
| Capacity | Single turning unit: 4 handling boxes Double turning unit: 8 handling boxes |
| Handling Box | 4 handling boxes per turning unit Each handling box (Mixed Media) has space for <ul style="list-style-type: none">• 30 cassette tapes (type 3480) or• 24 OD Reflection or• 22 OD 512 or• 8 VHS or• 30 tapes 8 mm or• 16 TK or• 6 D2 medium or• 6 D2 small |
| Power Requirements | 50 Hz, 230 V AC |
| Simultaneous Insert/ Eject Activity | Yes, depending on host software |

1.3.5 I/O Unit/B



Fig. 1-13: I/O Unit/B

| | |
|--|--|
| Capacity | Standard: 2 handling boxes High capacity unit: 4 handling boxes |
| Handling Box | 4 handling boxes per turning unit Each handling box for Mixed Media has space for <ul style="list-style-type: none"> • 30 cassette tapes (type 3480) or • 24 OD Reflection or • 22 OD 512 or • 8 VHS or • 30 tapes 8 mm or • 16 TK or • 6 D2 medium or • 6 D2 small |
| Power Requirements | 50 Hz, 230 V AC |
| Simultaneous Insert/ Eject Activity | Yes, depending on host software |

Specifications

1.3.6 AMU (Archive Management Unit)

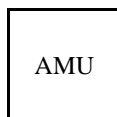


Fig. 1-14: AMU Cabinet

| | |
|---|--|
| CPU | IBM PS/2 Desktop (80486 processor) |
| Disk Capacity | min. 200 MB hard disk 1.44 MB floppy disk drive |
| Memory | 16 MB RAM |
| Graphics Adapter | XGA |
| Monitor | 14" IBM color (0.28 mm dot pitch, 1 024 x 768 pixel resolution in XGA-2 mode) |
| Input | IBM PS/2 101-key Enhanced Keyboard (English, American, German, French) IBM PS/2 Mouse |
| Possible Host Communication Adapter | <ul style="list-style-type: none">• IBM Token Ring 16/4 Adapter• IBM 3270 Emulation Card• SDLC-Adapter• X.25 Coprocessor (Datex-P)• RS232C• 3COM Ethernet Adapter |
| Communication to Controller Ggeneral via RS232C | <ul style="list-style-type: none">• IBM Realtime Interface Coprozessor (RIC) 8xRS232C• IBM Dual Async Adapter 2xRS232C |
| Operating System | IBM OS/2 v.2.1 with Extended Services |
| Power Requirements | 50 Hz, 230 V AC |
| Total Power Consumption | 0.2 kVA |

1.3.7 HACC (AML Communication Control /MVS)

| | |
|--------------------------------------|---|
| Components | <ul style="list-style-type: none"> • Main task • Archive administration modules • Subsystem function modules • Allocation control exit (optional) |
| Minimum Software Required | <ul style="list-style-type: none"> • MVS-SP1.3.6 for JES2 • MVS-SP2.2 for JES3 • SMP/E • Assembler H • Standard utilities |
| Requires the Following MVS Resources | <ul style="list-style-type: none"> • Total CSA requirement approximately 4 to 5 KB • Virtual main storage requirement of approximately 2.5 MB for 50,000 media • Insignificant I/O activity (related to mount/keep operations) • MVS messages (routing codes 3 and 5) must be available • TSO is desirable, but not required |
| Files | <ul style="list-style-type: none"> • Basic archive storing 5 760 cartridges — 1 cyl (1 cyl 3 380 = 0.6 MB) • Unit recovery and statistics log — 1 cyl • CPU-CPU transfer log — 1 cyl • Message log (optional) — 5 cys • Installation data sets (optional) — 5 cys • Load archive — 6 cys |
| HACC Communication | <ul style="list-style-type: none"> • LU 6.2/APPC via Token-Ring adapter • EXCP/3270 via a local NON-SNA 3274 control unit • VTAM LU 2 (local or remote) |

1.3.8 Barcode Labels for 3480 Cartridges

Accurate and reproducible barcode reading by the barcode scanner is only possible, if the barcode meets the requirements outlined below.

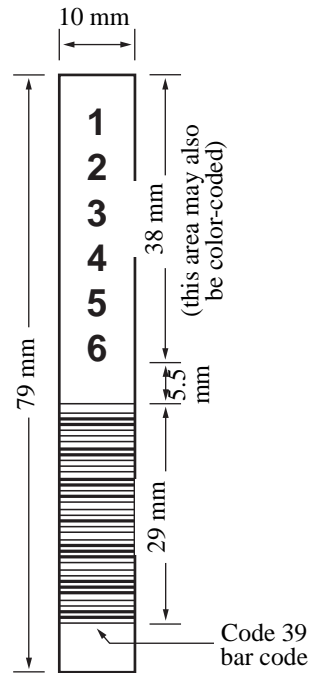


Fig. 1-15: Code 39

ANSI MH10.8M-1983 Standard

- Number of digits: 6
- Background reflection: at least 25 %
- Print contrast: at least 75 %
- Ratio: at least 2.2
- Module: 250 μm
- Print tolerance: $\pm 57 \mu\text{m}$

Additional Requirements

- Length of the rest zones (☞ drawing above): 5.25 mm ± 0.25 mm.
- No black marks may be present in the intermediate spaces or rest zones.
- No white areas may be present on the bars.
- Bars should read in a uniform direction. (Non-uniform reading directions are feasible in principle, but have a detrimental effect on performance).
- Each label should be applied in the upper right corner of the tape cartridge recess (when oriented vertically).

Quality Testing: Compliance with the above specifications may be checked and documented with the “Ergilaser 3000 High Density” barcode measuring device (manufactured by Laetus Company).

We recommend the following barcodes

- Code 39
- STK Code
- Code 128
- CODABAR
- Interleaved 2OF5
- UPC
- EAN

1.3.9 Fire Extinguishing Equipment



Note

ADIC/GRAU Storage Systems is not responsible for the installation of the fire extinguishing equipment.

The customer must order it from a specialized company.

ADIC/GRAU Storage Systems supplies only suitable slots for detection of smoke and holes for installation of components of a fire extinguishing system (→ following drawing).

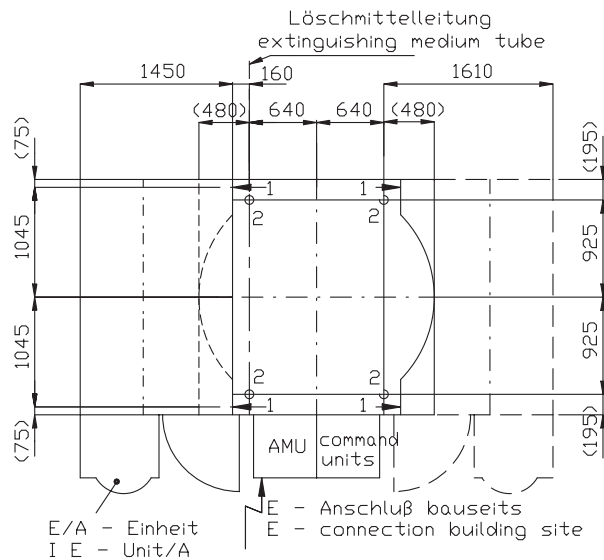
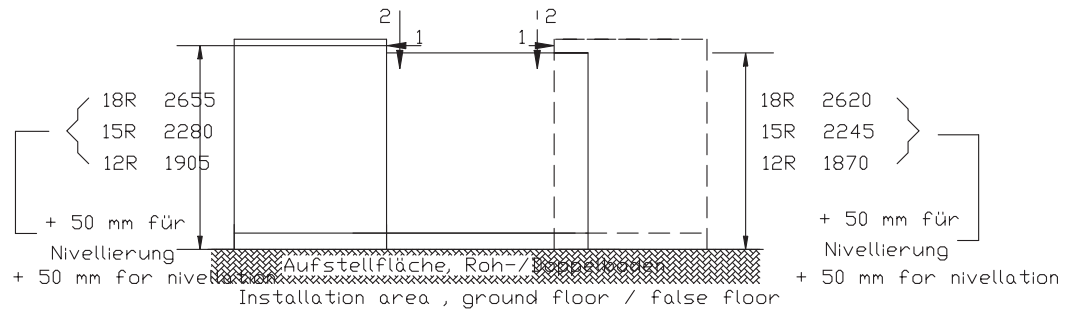


Fig. 1-16: Sketch of Fire Extinguishing Equipment

1.4 System Requirements

Power Requirements

| | |
|--------------|---|
| Frequency | 50 Hz (± 1 Hz) |
| Voltage (AC) | 230 V AC ± 10 % 1 phase +N +PE (AMU) 400 V AC ± 10 % 3 phase +N +PE |
| Fusing | for system with 1 robot and ≤ 3 QT 400 V at 16 A MT for system > 3 QT 400 V at 25 A MT 230 V at 16 A for AMU (In case of electrical shutdown due to room temperature overload only the 400 V connection must be switched off. The AMU (OS/2 PC \Rightarrow 230 V connection) should be shutdown by a special shutdown procedure). optional 230 V at 16 A for Backup AMU |

1.4.1 Power Consumption and Heat Emission of the System

The following values are mean values assuming permanent use of all components of the AML-System under realistic operating conditions.

| | |
|-------------------------|--|
| Total Power Consumption | <ul style="list-style-type: none"> • 1 robot and ≤ 3 QT: 1.2 kVA • 1 robot and > 3 QT: 1.6 kVA • 2 robots and ≤ 3 QT: 1.7 kVA • 2 robots and > 3 QT: 2.2 kVA |
| Heat | single-AML: max. 2.5 kW twin-AML: max. 5.0 kW |

1.4.2 Floor Requirements

The system can be installed either on the ground floor or on a subfloor.

The maximum height differences of ground floor/subfloor must not exceed ± 7 mm anywhere in the installation area.

The floor must

- be dust-free
- be physically, chemically, and acoustically appropriate
- have a minimum load-bearing capacity of 550 kg/m^2

1.4.3 Electrical Connections

Power

Power is connected to the AML-System through the AMU rack. The customer is responsible for the supply of power to the point of connection (240 V/400 V).



Note

An undetermined shutdown of the AMU (AML Management Unit) can cause severe problems during restart of the system (i. e. if open files had not been closed correctly, data sets in the database may be missing, etc.).

Communication of Host and AML

(☞ plan of possibilities of Host-AML communication)

Connection via LU 6.2

The customer provides the physical **Token Ring** connection to the AMU-rack.
Connection via 9-pin sub-D plug.

Connection via EXCP/LU2

The customer provides a **coax cable** to the AMU-rack.

For either the EXCP or the LU2 Connection

ADIC/GRAU Storage Systems must know the EC-Level (Release of the Micro-code) of the control unit. This information should be part of the control unit.

Miscellaneous Connections

There should also be a TSO Console for operation of the AML-System as near as possible to the system installed.

A phone with the ability to reach ADIC/GRAU Storage Systems headquarters in Germany must also be available.

There must also be a possibility to connect a modem to the telephone system (in Germany a so called TAE 6N plug is used).

1.4.4 Climatic Requirements

| | |
|---------------------------|-------------|
| Temperature (min./max) | 10 °C/32 °C |
| Humidity (min./max.) | 15 %/80 % |
| Altitude | no limits |

2 Site Data

2.1 General

Customer Name:

Mailing Address:
.....
.....

Sales Contact:

Telephone:
Telefax:

Shipping Address:
.....
.....

Installation Contact:

Telephone:
Telefax:

Process and Timing for Hardware/Software Change Control:
.....
.....
.....

Target Installation Starting Date:

Target "Ready for Use" Date:

ADIC/GRAU Storage Systems Representative:.....

ADIC/GRAU Storage Systems Account Manager:

2.2 Physical Environment

- Room Dimensions:
- Ceiling Height:
- Ceiling Projections:
- Floor Type: subfloor yes < > no < >
- Floor Load Capacity:
- Subfloor Load Capacity:
- Fire Extinguishing Equipment:
- Distance between Subfloor and Floor:
- Size of a Part of Subfloor plate:

2.2.1 Layout



Information

The room layout drawn by the customer is the basis for all activity outlined in the customer order.

Please, include the following in the layout

- **Planned extensions of the system as optional.**
- **Obstacles to wiring, such as obstructions under floor and cable ducts.**

Fig. 2-1: Customer's Room Layout (Sketch)

2.3.2 Media Storage

Quadro towers

3 840 Cartridges 3480 (12 rows, 2.05 m):

4 800 Cartridges 3480 (15 rows, 2.43 m):

5 760 Cartridges 3480 (18 rows, 2.80 m):

Linear shelves

Need storage for media

Length Restrictions:

Height Restrictions:

Number of positions in the archive reserved for dynamic use

.....

2.3.3 Physical Definition of the I/O Unit

Number of units (max. 2 units per robot)

.....

Type of units and media

Capacity of 1 handling box

| Number | Media Type |
|--------|-----------------|
| 30 | 3480 cartridges |
| 24 | OD-Reflection |
| 22 | OD 512 |
| 8 | VHS |
| 30 | Exabyte 8 mm |
| 16 | TK |

| Unit | A | | | | | | | | | | B | | | |
|------|------------------|--|--|--|------------------|--|--|--|--|--|------------------|--|------------------|--|
| | 4 handling boxes | | | | 8 handling boxes | | | | | | 2 handling boxes | | 4 handling boxes | |
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |

Hardware Configuration

2.3.4 Media Movement

Robot(s):

Track Length(s):

2.3.5 System Controls

AMU Cabinet (1 required per system):

Tower Control Cabinet (1 required for every 3 towers):

Robot Control Cabinet (1 required per robot):

2.3.6 Cabling

System running on uninterruptible power supply (USP)?

yes < > no < >

AMU to host connection type (cable supplied by customer):

.....

.....

AMU to Quatro Tower control (length):

AMU to robot control 1 (length):

AMU to robot control 2 (length):

Robot control to Quatro Tower control (length):

Quatro Tower control to machine edge* (length):

Robot control to machine edge* (length):

Cabling Restrictions (show any under-floor obstructions or cableways on "Customer's Room Layout" sketch):

.....

.....

.....

.....

.....

.....

AC Power Cable Code Restrictions:

.....

.....

.....

.....

.....

* "machine edge" is defined as the end of the robot track section that butts up to the I/O unit.

2.4 Software Configuration

2.4.1 Host Software HACC/MVS

Is a number of positions in the tower reserved for dynamic use?

yes < > no < >

If yes: number of positions

Reservation of the I/O unit:

Number of positions to be used x 30 = positions

Insert area positions

Output area positions

Foreign mount area..... positions

I/O areas can be defined dynamic, i. e. overlapping. This means, that the customer should separate inserts and outputs in his organization.

The definition of positions as foreign mount area reduces the number of positions available for insert/output.

2.4.2 Operating System Interface

Please note all operating system interfaces of the systems with AML connection.

SMF I.D.:

Host type:

Operating System:

PTF Level:

JES:

Media Management System:

| Interface | Address |
|------------------|----------------|
| EXCP | |
| VTAM | |
| LAN | |

Other Software (i.e., MIM, STAM, etc.):

.....

2.4.3 Network-Settings for Token Ring Connention

The parameters listed below are obligatory for the configuration f the OS/2 Communications Manager.

Please acquire the following parameters from the person responsible for the network:

Network Name: (often beginning with “DE” + company name)
(NETID)

Local TKR Address: (AMU)
(MAC address)

Remote TKR Address: (3174, 3745)
(MAC address)

TKR Transmission speed: 4-MBit < > 16-MBit < >

The TKR transfer speed must be set in the setup of the AMU PC.

If our suggestions for VTAM settings or HACPARM are not adhered to other pre-defined settings in the OS/2 Communication Manager must be checked with the Cross-Reference.

2.4.4 Cross-Reference

The following is a description of the interactions of

- AMU configuration
- OS/2 Communication Manager (CM)
- VTAM and
- HACPARM

Software Configuration

The entries on each row of the table (line) are interconnected and must agree.

| CM | VTAM | HACPARM | AMU-Config. | Default |
|-----------|--------------------------------|---------------------------|------------------------------|--|
| A | 1. Locaddr LU 2 | --- | --- | 02 |
| B | 2. Locaddr LU 2 | --- | --- | 03 |
| C | PU-Name | --- | --- | OBISAMUP |
| D | ACB-Name | HACNET (LU-Statement) | --- | OBISACB |
| E | LU 6.2-Name (receive) | HACNET (LU-Statement) | --- | OBISAMUR |
| F | LU 6.2-Name (send) | HACNET (LU2-Statement) | --- | OBISAMUS |
| G | 1. Locaddr LU 6.2 (receive) | --- | --- | 05 |
| H | 2. Locaddr LU 6.2 (send) | --- | --- | 04 |
| I | LOGMODE LU 6.2 | HACNET (LM-Statement) | Session Modename | OBISL62S (single Session) OBISL62P (par- allel Session) |
| --- | --- | --- | Transaction Pgm. Send | H01STP |
| --- | --- | HACNET (TPN-Statement) | Transaction Pgm. Recv. | H01RTP |
| --- | --- | --- | Partner Trans- action Pgm | K01RTP |
| K | LU 6.2 Name | HACNET (LU-Statement) | | OBISAMUL |

2.5 Site Access

Give a sketch building layout.



Information

In the sketch please show the approximate measurements and the type of floor covering.

- **loading dock(s)**
- **hallway(s)**
- **elevators**
- **uncrating area(s)**
- **data center, etc.**

Access to the archive room (elevator, stairs, door widths, etc.):

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Dimensions (height and width) and location of smallest door or opening:

.....

.....

Loading dock specifications (dock height, type of ramps, weather protection, etc.):

.....

.....

.....

Site Access

On the day of delivery, the customer supplies a forklift ?
..... yes < > no < >

During the mechanical installation, the customer supplies a pallet lifting truck?
..... yes < > no < >

Availability of material handling equipment:
.....
.....
.....

Preferred/required local cartage company:
.....
.....
.....

Location for uncrating:
.....
.....
.....

Preferred time of day for unloading and moving materials:
.....
.....
.....

Off hours/weekends, accessibility for installation team:

.....

.....

.....

Procedure for obtaining building passes:

.....

.....

.....

Procedure for scheduling the elevator, loading dock, etc.:

.....

.....

.....

Waste disposal considerations:

.....

.....

.....

Bargaining unit considerations:

.....

.....

.....

2.6 Media/Tape Units

Media:

Will media be used which are already in use?

yes < > no < >

Does the media supplier deliver media with barcode?

yes < > no < >

Does the customer label the media himself?

yes < > no < >



Information

If the customer labels the media himself, the information sheet “Application of barcode labels” must be observed.

The labeled media must be available as agreed.

If possible, ADIC/GRAU Storage Systems should have a limited number of labeled media to be able to test the barcode reading.

Please order cleaning tapes for cleaning of tape units and label these (ADIC/GRAU Storage Systems recommends : 10 barcode labels/cleaning tape).

Define the position of the cleaning tapes in the Quadro tower.

2.7 Specification of Barcode Labeling



Information

Each customer or other supplier, attaching barcode labels to media must observe the information sheet “Application of barcode labels”.

He is responsible for affixing the labels in the correct reading direction.

2.7.1 Application of Barcode Labels to 3480 Cartridges



Information

It is very important that the position (in the recess of the cartridge) of all labels in the system is the same.

This will help avoid a performance loss incurred by reorientation of the robot.

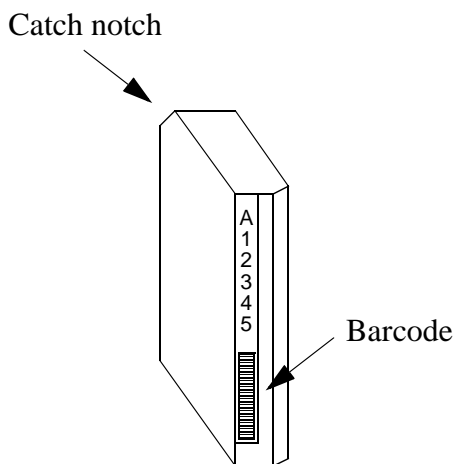


Fig. 2-1: Correct Position of Barcode Label on 3480 Cartridge

- a) Turn the cartridge so the catch notch of the tape end is on top.
- b) Stick the barcode label onto the cartridge recess.
Pay attention to the
 - orientation (figures on top, barcode on the bottom)
 - parallelity with the recess

2.7.2 Coding

Be sure to observe the following points when coding the barcode:

- Normally the barcode will have 6 digits (more are possible)
- Not allowed are
 - 000000
 - *CL...
 - *FR...
 - *11...
 - *12...
 - *21...
 - CLEAN
 - blanks
 - asterisks (*) not in leading position
 - underlines

3 Templates for Configuration and Layout

The templates on the following pages are provided as aids in determining optimal system configuration and layout.

All templates in this section are drawn to a scale of $\frac{1}{4}'' = 1'$ (1:48).

3.1 Configuration with 1 Robot and 1 Quadro Tower

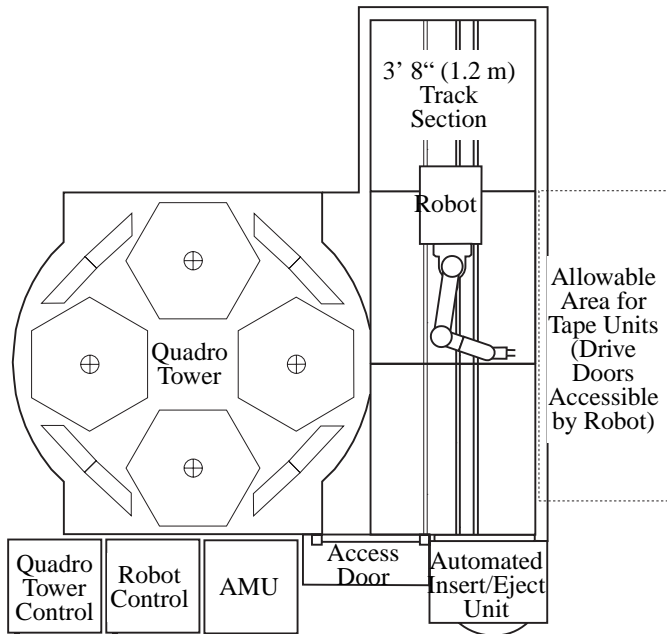


Fig. 3-1: 1 Robot and 1 Quadro Tower (scale 1/4" = 1')

3.2 Configuration with 1 Robot and 2 Quadro Towers

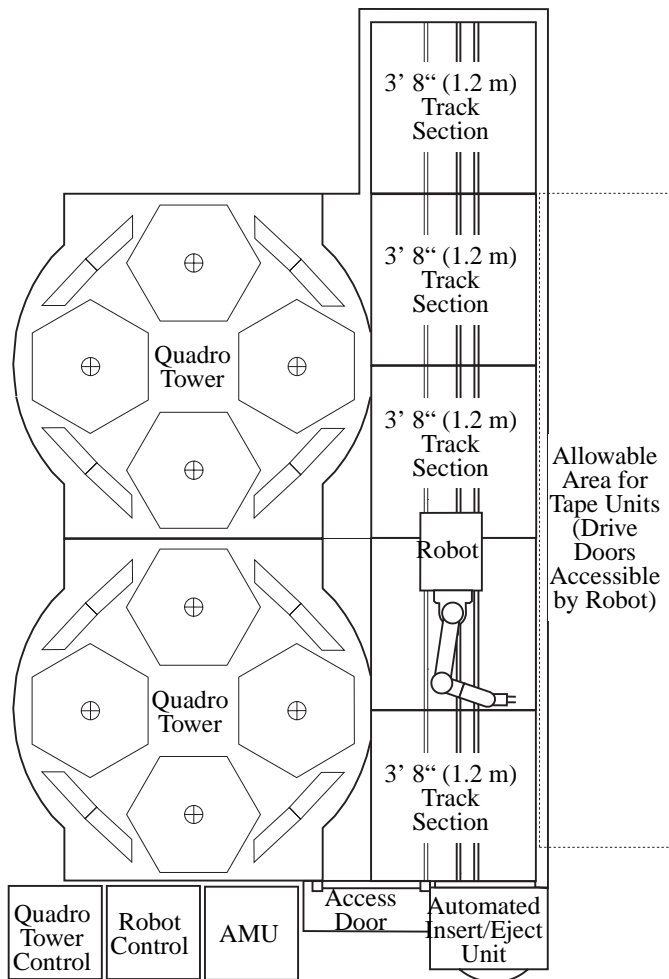


Fig. 3-2: 1 Robot and 2 Quadro Towers (scale: 1/4" = 1')

3.3 Configuration with 1 Robot and 3 Quadro Towers

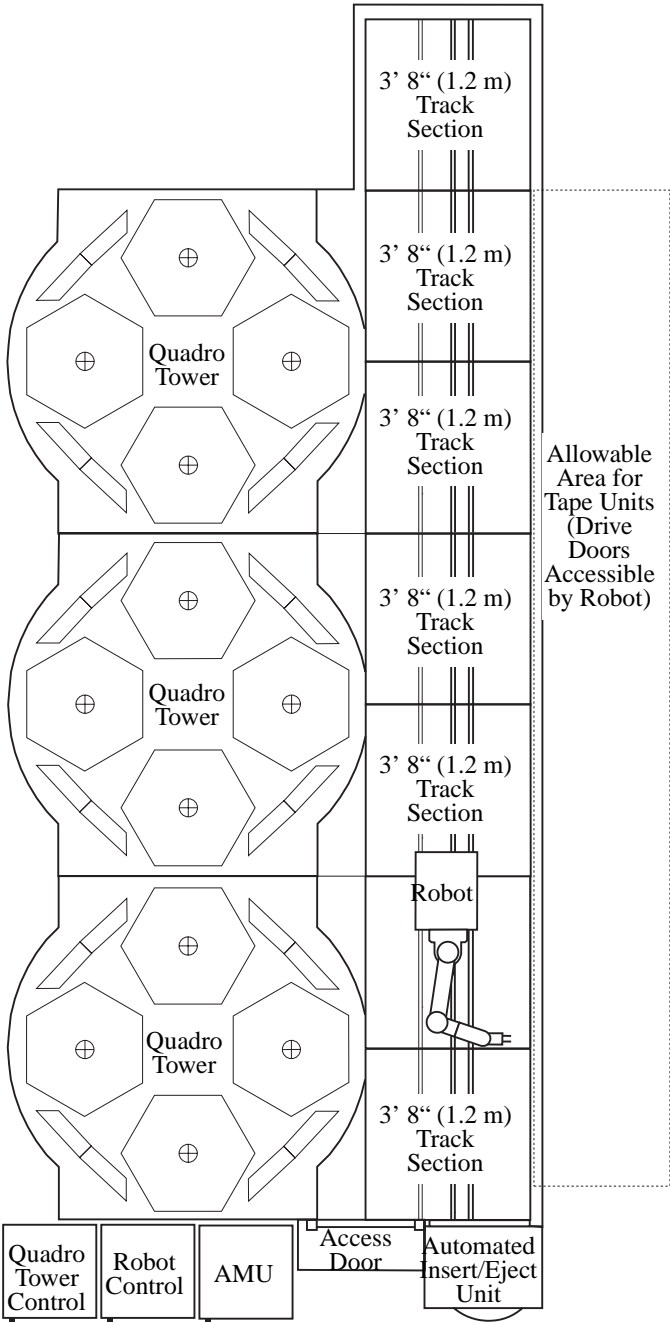


Fig. 3-3: 1 Robot and 3 Quadro Towers (scale: 1/4" = 1')

3.4 Configuration with 2 Robots and 3 Quadro Towers

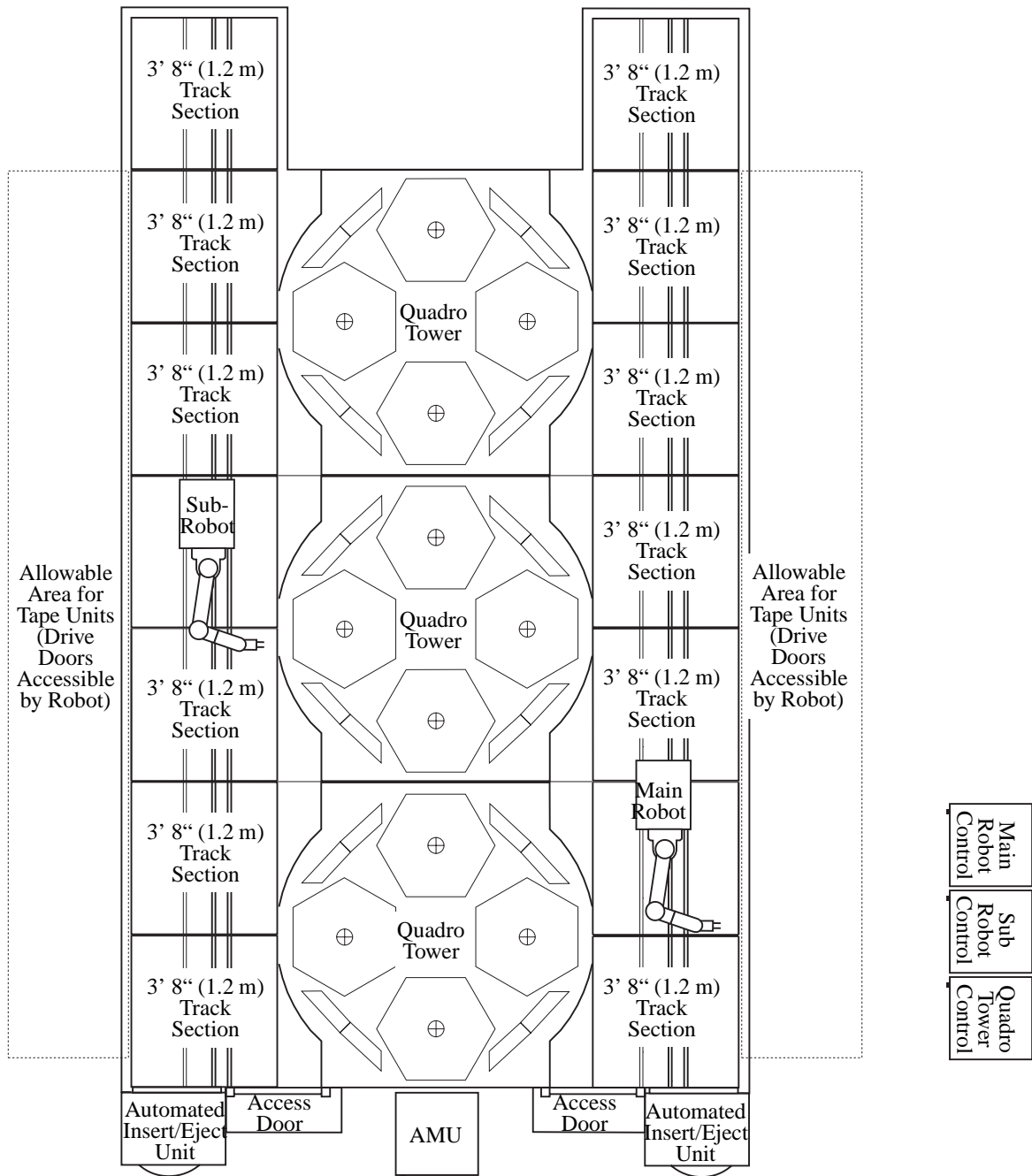


Fig. 3-4: 2 Robots and 3 Quadro Towers (scale: 1/4" = 1')

3.5 Configuration with 1 Robot and 17 Linear Rack Segments

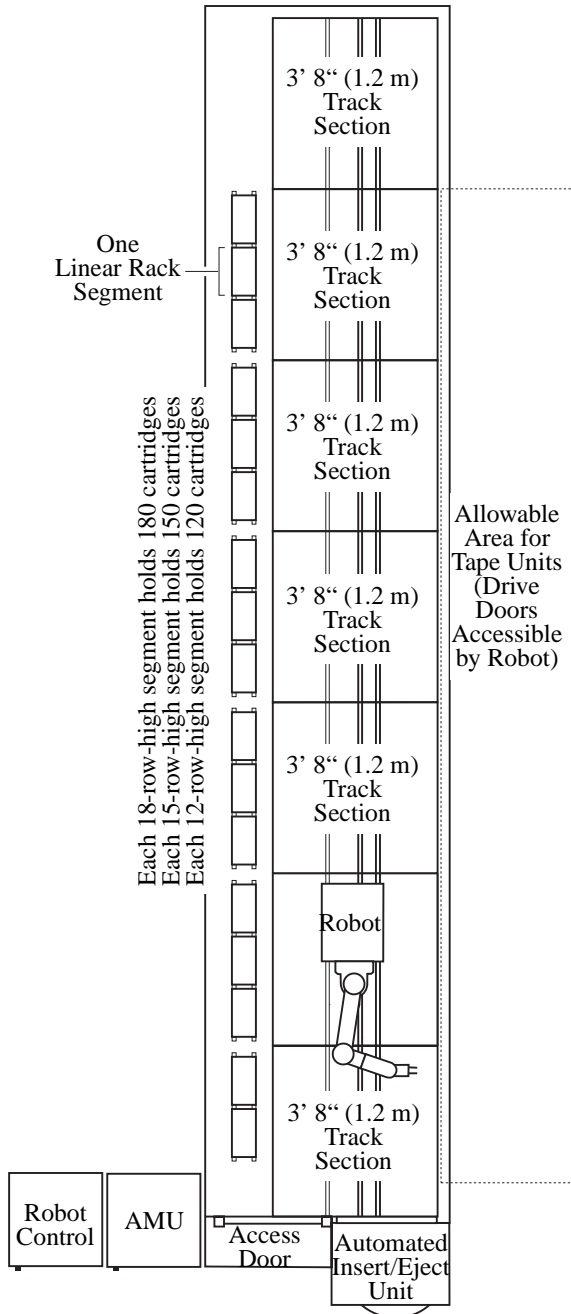


Fig. 3-5: 1 Robot and 17 Linear Rack Segments (scale: 1/4" = 1')

3.6 Quadro Tower System Components (Track on Right)

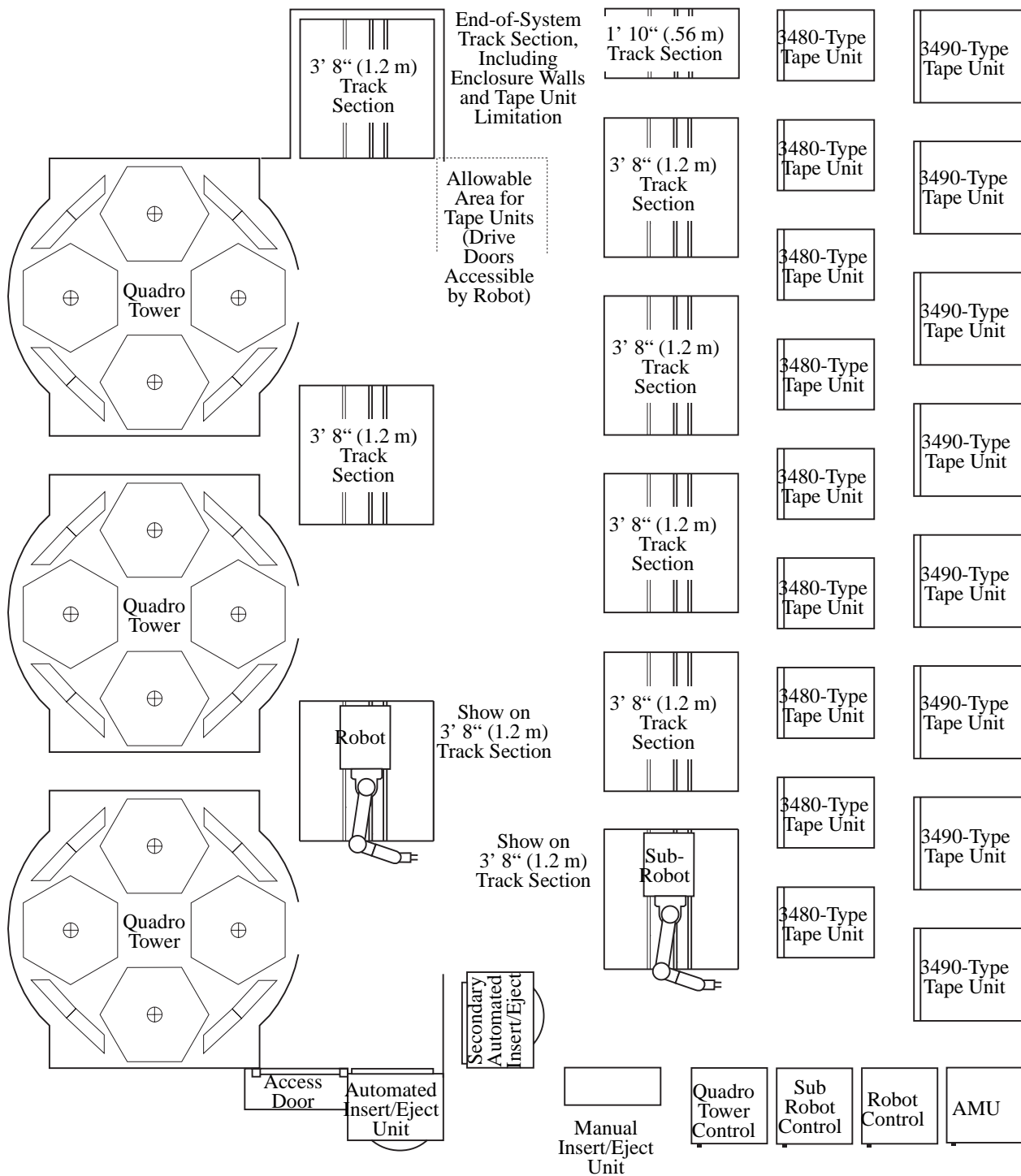


Fig. 3-6: Quadro Tower System Components (Track on Right)

3.7 Quadro Tower System Components (Track on Left)

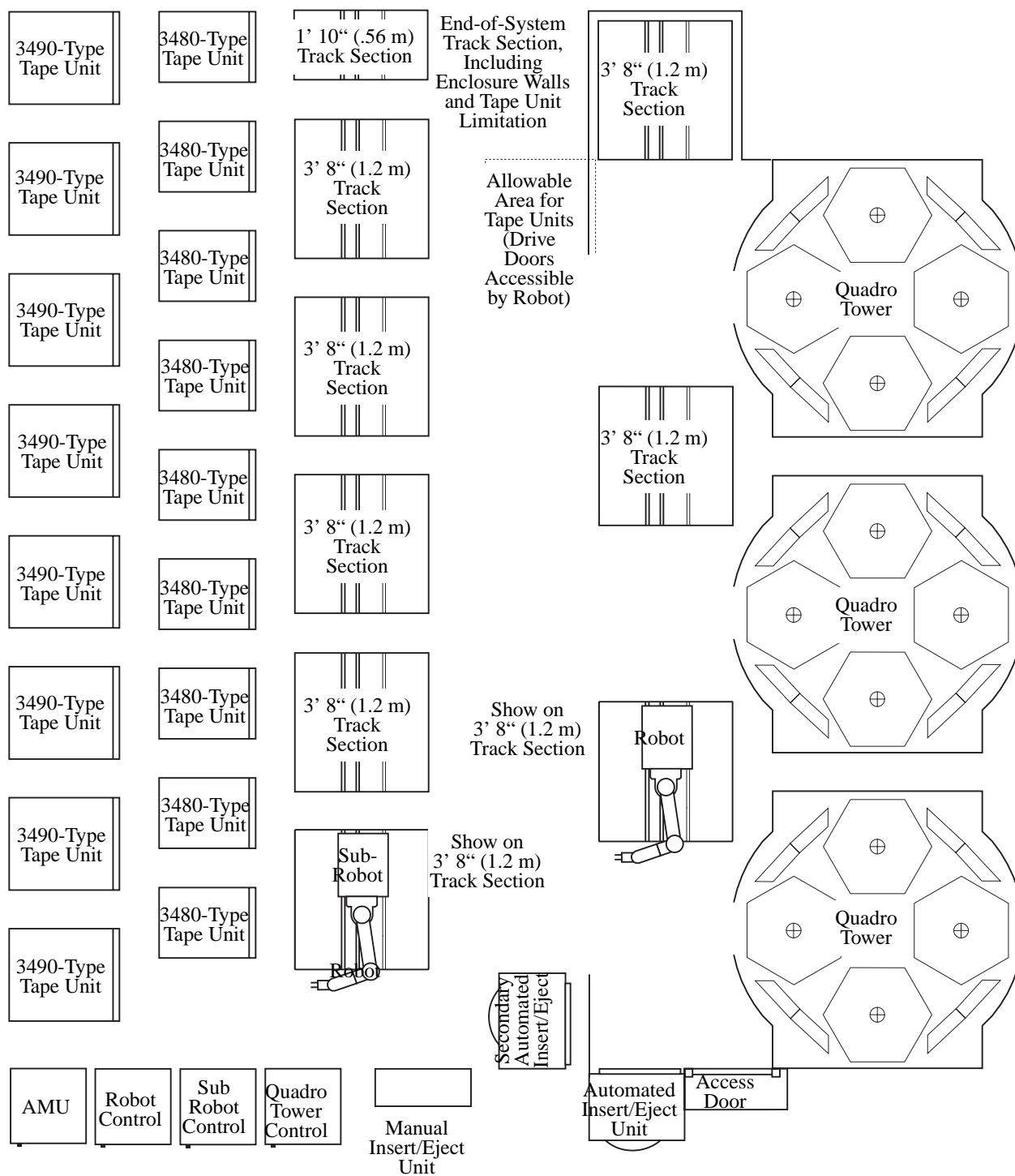


Fig. 3-7: Quadro Tower System Components (Track on Left)

3.8 Linear Rack System Components (Track on Right)

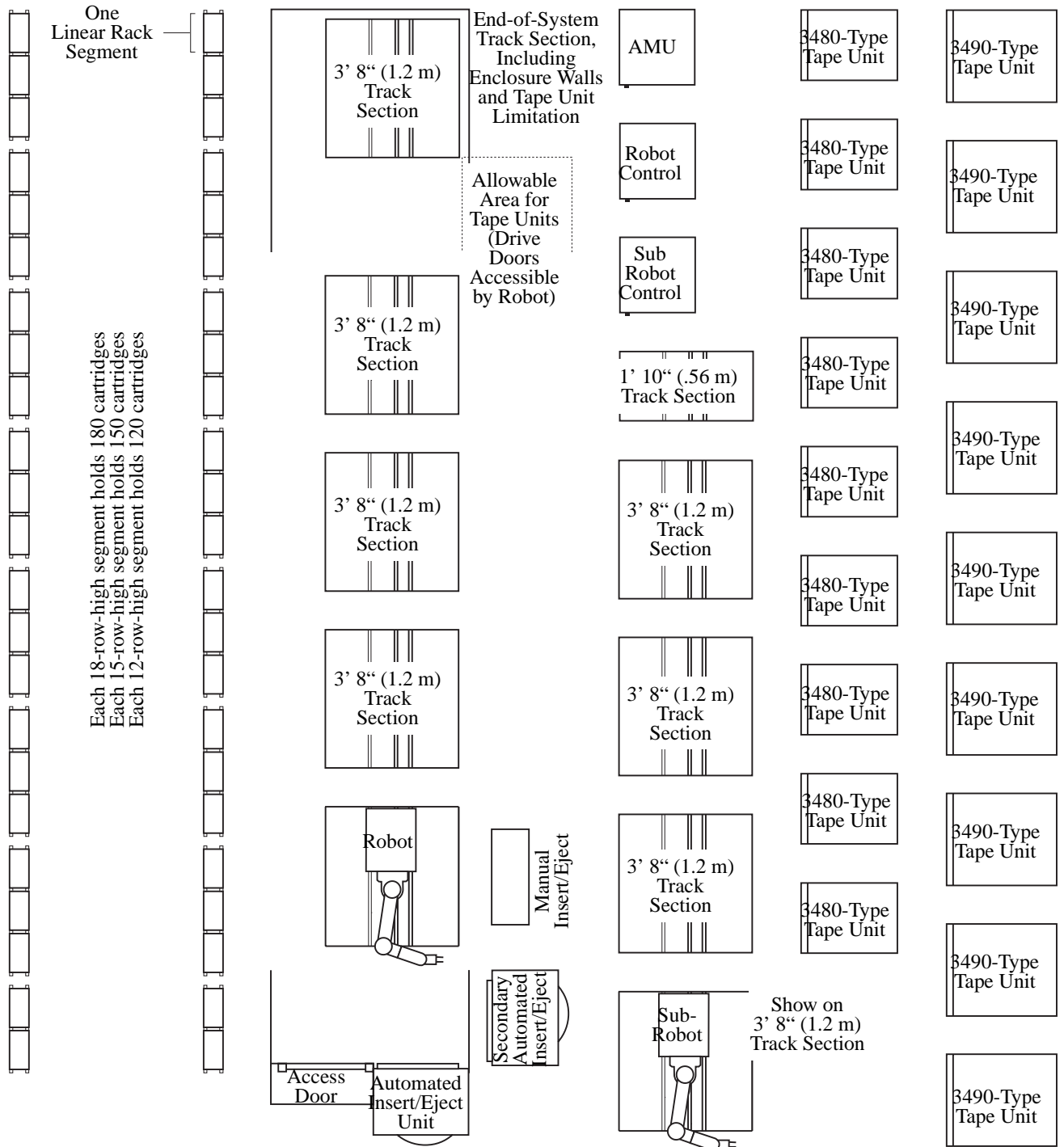


Fig. 3-8: Linear Rack System Components (Track on Right)

3.9 Linear Rack System Components (Track on Left)

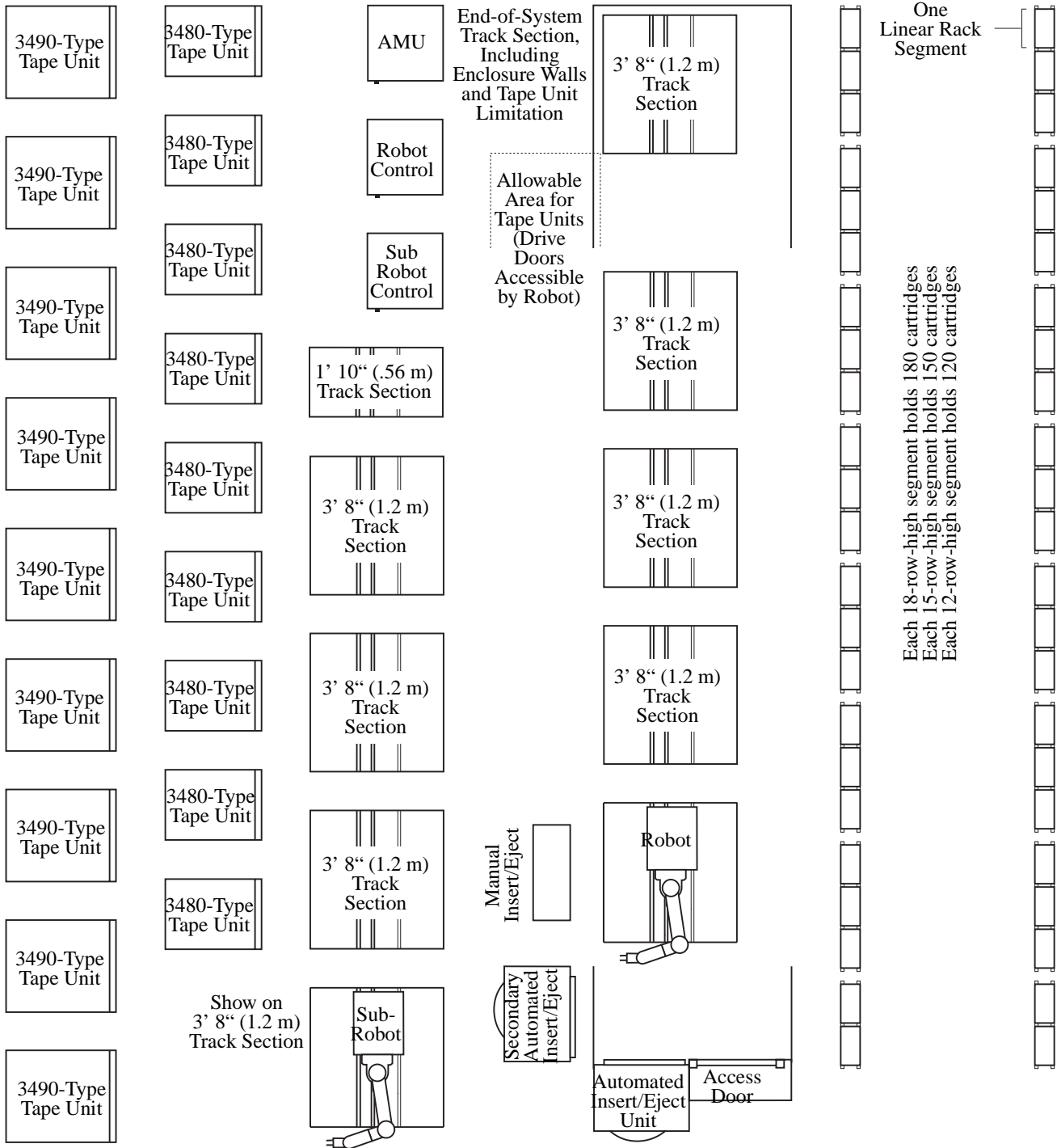


Fig. 3-9: Linear Rack System Components (Track on Left)

../../../../GRAFIK/ADIC GRAU Black.gif @ 72 dpi 1
../../../../GRAFIK/gb0204.eps 1 -3, 1 -19, 1 -31, 1 -33, 2 -3, 2 -14, 2 -18-2 -19
../../../../GRAFIK/gb0216.tif @ 400 dpi 1 -4
../../../../GRAFIK/gb0278.tif @ 320 dpi 1 -7
../../../../GRAFIK/gb0280.tif @ 350 dpi 1 -11
../../../../GRAFIK/gb0334.eps 1 -11
../../../../GRAFIK/gb0344.eps 1 -6
../../../../GRAFIK/gb0499.eps 1 -31
../../../../GRAFIK/gb0500.eps 1 -2
../../../../GRAFIK/gb0501.eps 1 -13
../../../../GRAFIK/gb0502.eps 1 -22
../../../../GRAFIK/gb0503.eps 1 -24
../../../../GRAFIK/gb0504.eps 1 -25
../../../../GRAFIK/gb0505.eps 1 -26
../../../../GRAFIK/gb0506.eps 1 -29
../../../../GRAFIK/gb0507.eps 3 -2
../../../../GRAFIK/gb0508.eps 3 -3
../../../../GRAFIK/gb0509.eps 3 -4
../../../../GRAFIK/gb0510.eps 3 -5
../../../../GRAFIK/gb0511.eps 3 -6
../../../../GRAFIK/gb0512.eps 3 -7
../../../../GRAFIK/gb0513.eps 3 -8
../../../../GRAFIK/gb0514.eps 3 -9
../../../../GRAFIK/gb0515.eps 3 -10
../../../../GRAFIK/gb0517.tif @ 140 dpi 1 -18
../../../../GRAFIK/gb0520.tif @ 100 dpi 1 -9
Helvetica @ 10,0 pt 1 -2, 1 -4, 1 -6-1 -7, 1 -9, 1 -11, 1 -13, 1 -18, 1 -22, 1 -24-1 -27, 1 -29, 1 -31, 2 -3, 2 -19, 3 -2-3 -10
Helvetica @ 10,6 pt 1 -28
Helvetica @ 11,0 pt 1-4 -1
Helvetica @ 12,0 pt 1, 1-4 -1
Helvetica @ 14,0 pt 1, 1
Helvetica @ 15,0 pt 1 -3, 1 -12, 1 -21, 1 -32, 2 -1-2 -2, 2 -4, 2 -10, 2 -14, 2 -18-2 -19, 3 -2-3 -10
Helvetica @ 18,0 pt 1 -1, 2 -1, 3 -1
Helvetica @ 24,0 pt 1
Helvetica @ 30,0 pt 1
Helvetica @ 8,0 pt 2 -19
Symbol @ 12,0 pt 1 -1, 1 -12, 1 -27, 1 -29, 1 -32, 3 -1
Times @ 10,0 pt 1 -6, 2 -6
Times @ 10,6 pt 1 -24-1 -27
Times @ 12,0 pt 1, 1 -1-4 -1
Times @ 7,0 pt 1-4 -1
Times @ 9,0 pt 1 -22, 3 -1
ZapfDingbats @ 12,0 pt 1 -4, 1 -10-1 -11, 1 -29, 1 -31-1 -33