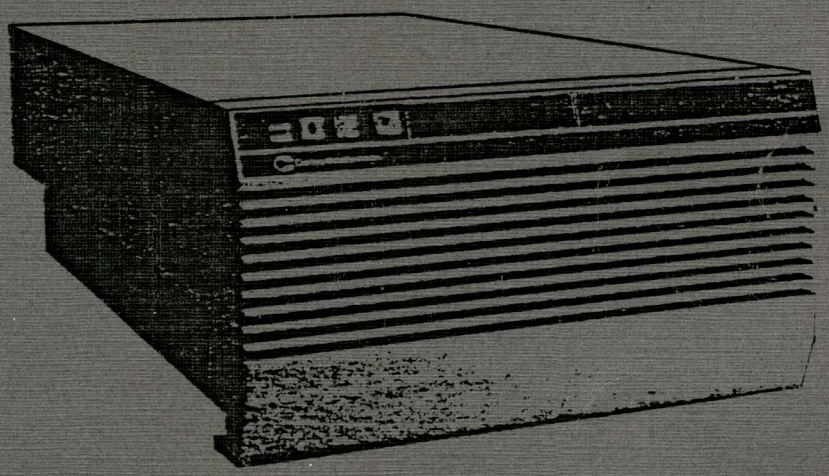
AMS 200/300
INSTALLATION MANUAL



Century Data Systems
A Xerox Company

Part Number 76251-204

AMS 200/300

INSTALLATION MANUAL

December 1985

Century Data Systems
A Xerox Company

RECORD of REVISIONS	
REVISION	NOTES
0	ORIGINAL ISSUE—January 1985
-1	Add AMS 300 Disk Drive Information—March 1985
-2	Minor changes—May 1985
-3	Cabinet changes, Section 6—June 1985
-4	Update manual—December 1985

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the technical manuals, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This product met the FCC Class A requirements when tested using shielded cables, for both the Radial and Bus cables, which were grounded at the point of entry into the disk drive and also at the system/controller end of both cables.

CONTENTS

ILLUSTRATIONS

TABLES

SECTION 1
INTRODUCTION

GENERAL

This manual contains installation and operating information and instructions for the Advanced Marksman Series (AMS) 200/300 Disk Drive manufactured by Century Data Systems, (CDS) a Xerox Company located in Anaheim, California.

DESCRIPTION

The AMS 200/300 Disk Drive (Figure 1-1) is a high performance modular disk storage unit designed to attach directly to a Digital Equipment Corporation (DEC) MASSBUS. The AMS 200 Disk Drive can store 174.4 megabytes and the AMS 300 can store 256.2 megabytes of 16-bit formatted data and replaces a single port DEC RP06 or RM05 Disk Drive. The AMS disk drive used with the host computer RH MASSBUS disk interface is hardware and software compatible with the PDP-11/70 minicomputer and the VAX family of superminicomputers.

The AMS disk drive can be configured as a conventional disk or with the DYNAMIC DATA RELOCATION™ feature that can be selected at any time. When the disk drive is in the DYNAMIC DATA RELOCATION mode, it identifies and moves the most actively accessed data to other locations so as to reduce the access time while continuing to respond to host computer requests. After moving this data, the disk drive copies high use data from the magnetic media into its semiconductor memory to further improve access performance. Two techniques are retained in the semiconductor memory. One is known as "Caching". Second, sequential file access requests are identified and anticipatory data retrievals are made from the magnetic media to the semiconductor memory. This technique is known as "Look-Ahead". By using these capabilities and properly configuring the AMS disk drive into the host computer system, substantial improvements in both disk and computer system performance can be achieved during periods when the system is being heavily utilized.

The AMS disk drive consists of a sealed disk module, drive motor, four printed circuit boards containing the drive and MASSBUS interface electronics, and power supplies. The disk module is hermetically sealed and uses an absolute breather filter for pressure balancing.

The sealed disk module contains the storage media on a spindle, read-write and servo recording heads on a voice coil actuator, and an absolute filter for cleaning the internally circulated air. Seek, read and write operations in the disk drive are carried out under instructions from the built-in MASSBUS Interface. Communications with the host computer are implemented via the standard MASSBUS protocol allowing compatibility with existing DEC software, and PDP-11/70 and VAX computers that

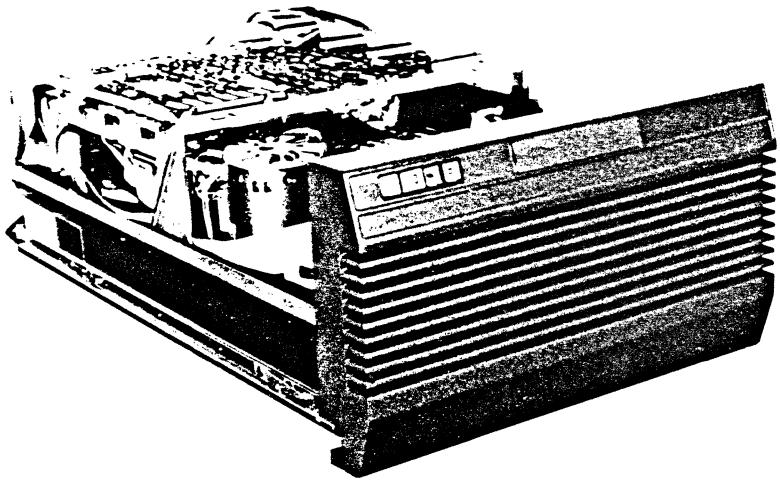


Figure 1-1. AMS 200/300 Disk Drive

support the MASSBUS. Execution of disk instructions is performed by microprocessor controlled electronics contained on easily accessible logic cards.

The microprocessor executes instructions in a high level language under the supervision of a multi-tasking operating system. This resident software implements all of the performance and compatibility features of the AMS disk drive as well as providing data error detection and correction, transparent handling of media flaws on the disk, and front panel selection of optimization and self-test. The AMS disk drive does not require any special power failure or recovery precautions because the data and their physical locations are always stored on the magnetic media of the disk itself. After power failure, all data is recovered by the disk drive during its normal power-up and self test sequence.

The closed loop air system, the design of the electronics package, and the servo track positioning mechanism allow the installation of the AMS disk drive in normal office environments.

During operation the read/write heads of the AMS disk drive fly above the recording surface, thereby eliminating wear of both heads and media surface. Data integrity is superior to that found in past large disk systems because the WINCHESTER style read/write heads fly much closer to the media surface. The AMS disk drive contains an electronic carriage lock that automatically locks the head carriage when power is removed.

The AMS disk drive was designed for reliability and does not require any scheduled preventive maintenance.

MANUAL ORGANIZATION

The contents of this manual are divided into seven sections.

Section 1—Introduction
Section 2—Unpacking and Inspection
Section 3—Installation Checkout
Section 4—Operational Checkout
Section 5—System Interface Cabling
Section 6—Disk Drive Cabinet
Section 7—Maintenance Diagrams

Section 1 describes the AMS 200/300 Disk Drive in general, technical characteristics and special tools. Section 2 contains unpacking and disk drive inspection before installation. Section 3 details unlocking the head carriage and system cabling. Section 4 describes the operational checkout after power is applied. Section 5 shows interface cabling with a Passive Dual Access feature. Section 7 contains wiring and schematic diagrams that relate to the AMS 200/300 and the cabinet assembly.

RELATED DOCUMENTS

Companion documents for the AMS 200/300 Disk Drive include:

AMS 200/300 Product Description Manual . . 76251-90X
AMS Disk Drive Technical Manual 76236-10X
AMS Maintenance Diagrams 76236-70X
AMS Parts Catalog 76236-50X
Model T2003 Exerciser Technical Manual . . . 76271-10X
Model T2005 Maintenance Test Controller
Installation and Operation Manual 76223-20X

SPECIAL TOOLS AND TEST EQUIPMENT

Special tools are those necessary to maintain the equipment but not normally found in a standard tool kit. The AMS disk drive requires no special tools. Test equipment is considered as devices that attach to the AMS disk drive and are used to perform the necessary tests to determine the operational status of the disk drive.

Test equipment is necessary only if the front panel is not used or if the system is not to be used to perform any necessary testing of the disk drive.

CDS has two devices that are capable of testing the disk drive. The Model T2003 Exerciser (referred to as an intelligent exerciser) is capable of being attached to the I/O system cable connectors on the I/O and control PWB and performs all operations the system performs including writing and reading with verification. The T2005 can also be attached to the exerciser connector, without disconnecting any cables, and perform limited testing of the disk drive.

Table 1-1 provides the test equipment part numbers.

TABLE 1-1. TEST EQUIPMENT PART NUMBERS

Name	Part Number
Model T2003 Exerciser (SMD)	21642-002
Model T2005 MTC	23015-001

UNIT DIFFERENCES

Century Data Systems (CDS) assigns an eight digit part number to all parts, subassemblies, assemblies and products used or built by the company. Each part number is divided into a five digit basic number followed

by a three digit dash number. The dash number is used to define any differences in the basic part.

The part number for the AMS 200 Disk Drive is 60033-XXX. The -201 is AMS 200 and the -301 is an AMS 300 Disk Drive.

Each unit carries an identification (ID) tag showing the part number with the appropriate dash number as well as the unit's serial number. There are two ID tags for each unit. One is located on the right side of the sealed disk compartment and the second one is located on the back of the disk drive enclosure above the AC input assembly.

TECHNICAL CHARACTERISTICS

Table 1-2 lists the operating technical characteristics for the AMS disk drive.

TABLE 1-2. DISK DRIVE CHARACTERISTICS

Recording Characteristics	
Disk diameter	14 inches
Number of disks	5
Number of data surfaces	9.5
Number of data heads per surface	2
Number of data heads per drive	19
Number of data cylinders	(815, AMS 200) 823, AMS 300
Number of CE cylinders	(12, AMS 200) 4, AMS 300
Number of tracks per cylinder	19
Number of 16 bit words per sector	512
Number of sectors per track	34
Number of sectors per cylinder AMS 200	418 data and 228 spare
Number of sectors per cylinder AMS 300	608 data and 38 spare
Total capacity (megabytes) 16-bit data words AMS 200	174.4 MB
Total capacity (megabytes) 16-bit data words AMS 300	256.2 MB
Performance Characteristics	
Access time to cache and read look-ahead buffers	0.25 milliseconds (ms)
Typical one cylinder seek time	4.5 ms
Maximum one cylinder seek time	5 ms
Average random seek time	25 ms
Maximum seek time	50 ms
Average rotational latency	8.33 ms
Average random access time	33.3 ms
Data transfer rate	1.21 megabytes per second
Data bit cell time	103.3 nanoseconds
Bit Interfacing Characteristics	
Computer Interfaces	MASSBUS, single port
Cabling	Three forty conductor flat ribbon cables
Maximum drives supported on the MASSBUS	8
Mechanical Characteristics	
Weight	138 lbs (63 kg)
Mounting	Computer cabinet, 10.5 inches of vertical panel space in a standard 19 inch wide RETMA cabinet
Mounting Dimensions	19 inches (48.3 cm) wide (front panel), 10.5 in (26.7 cm) height (front panel), 30 in (76.2) deep as measured from behind front panel into the cabinet. Main chassis width (behind the front panel 17.8 in (45.2 cm)
Optional Characteristics	
Start-up Time (Head Load and first seek after AC power applied to spindle motor)	25 seconds
Time for self-test and initialization completion (Start light on)	55 seconds
Disk rotational speed	3600 rpm +2/−6%
Stop Time (Retract heads and stop disk rotation)	30 seconds

TABLE 1-2. DISK DRIVE CHARACTERISTICS (Continued)

Electrical Requirements

Direct current power ..... none
Alternating current (AC) Power Phase ..... single
Voltage ..... 110, 115, 220, 240 (±10%) (selected by setting internal power supply jumpers)
Frequency ..... 50 or 60 Hz ±1 Hz (The frequency selection must be specified in the drive configuration)
Power sequencing ..... Timed, operator switch selectable time interval from front panel
Surge (starting) current ..... 23 amps @ 60 Hz 115 VAC for 15 seconds
12 amps @ 50 Hz 220 VAC for 15 seconds
Operating (running) current ..... 4.5 amps @ 115 VAC 60 Hz
Power consumption ..... 620 Watts @ 115 VAC 60 Hz

Environmental Specifications

Operating temperature ..... 50°-104° (10°C-40°C)
Storage temperature ..... −40°F to +140°F
Temperature gradient
Operating ..... 18°F (10°C) per hour
Storage ..... 36°F (20°C) per hour
Drive cooling (internal) ..... Forced air (fans) 150 CFM (4.5 mm^3/min)

Relative humidity

Operating ..... 10% min, 90% max RH with a wet bulb temperature limit of 80°F (27°C—no condensation)
Storage ..... 5% min, 95% max (no condensation)
Heat dissipation ..... 2085 BTU/hr @ 115 VAC 60 Hz; 2540 BTU/hr @ 230 VAC 50 Hz

Barometric pressure

Operating ..... −1000 to 10,000 feet, −304 to 3045 meters (32 to 23 inches HG, 81 to 59 cm HG)
Storage ..... −1000 to 40,000 feet, −304 to 12,190 meters

Vibration

Operating ..... 0.012 inches (0.030 cm) displacement from 20 Hz to 40 Hz sinusoidal motion
Storage ..... ±1.5g maximum 5 Hz to 500 Hz for one hr along each of the mutually perpendicular axes, with a 20 minute sweep time

Shock

Operating ..... The equipment in non-operational status shall not suffer damage or fail to operate according to specifications, when subjected to 18 impact of 5g (±10%) consisting of 3 shocks along each direction of three mutually perpendicular axes. Each shock impulse shall be a half sine wave with a time duration of 11 ±1 millsecond

Storage or Shipping

Cleanliness ..... Normal office environment. Provision must be allowed not to install unit directly exposed to outside weather nor exposed to unusual chemical or atmospheric gas conditions. The air should have less than five million particles (0.5 micron or larger in diameter) per cubic foot of air, under these conditions, the air filtering system of the drive can maintain the particle count within acceptable limits.
Air Flow ..... 150 CPM (4.5M^3/min). Provision must be allowed for unrestricted air flow entering from the the front of the drive and exhausting from the rear.

Hardware Compatibility

Data Format ..... 16-bit words
Computer Compatibility PDP-11/70; VAX-11/750; VAX-11/780; VAX-11/782; VAX-11/785
Controller Compatibility RH70, RH750, RH780

Mounting Configurations

1. Mounting attitudes for the basic drive without enclosure:
   Horizontal ..... spindle pulley down
   Vertical ..... unit on side, motor on top

2. Mounting attitudes for the drive with enclosure:
   Horizontal mount

3. Enclosure
   The enclosure, for use with the AMS disk drive can be configured in any one of the following:

   a. Desk top enclosure

   b. Rack mounted (fixed)

   c. Slide mounted

   d. Four drawer cabinet

   The enclosure provides mounting for the sealed mechanical assembly, drive control boards, interface and controller board and power supply. The AC distribution for the power supply is located on the back panel of the enclosure and an operator control panel is located on the front. The enclosure also provides all necessary cooling required for a free standing drive. Care should be taken to provide adequate ventilation for drives mounted in racks or cabinets.

4. Rack Mount Slides
   The AMS disk drive enclosure can be ordered with a set of slides that mount between the enclosure and a standard RETMA rack and provides forward travel of the drive to extend clear of the rack for ease of maintenance and installation. The enclosure fits in a standard 19" x 30" rack.

SECTION 2
UNPACKING AND INSPECTION

GENERAL

The AMS 200/300 Disk Drives are packaged for shipment in a double walled corrugated container reinforced with ethafoam. For overseas shipment, the corrugated container is placed inside a padded plywood box.

This section contains instructions for unpacking the disk drive, in preparation for installation. Instructions for inspecting the disk drive, during unpacking, are included, in case there is evidence of mishandling during shipment.

UNPACKING

The disk drive shipping container is shown in Figure 2-1.

If the exterior condition of the shipping container indicates mishandling or abuse, with the likelihood of possible interior damage to the unit, unpacking should be carried out in the presence of the carrier or his agent, where possible. In any case, units should be unpacked and checked for shipping damage as soon as received. Inspection of the SHOCKWATCH and TIP-N-TELL labels may indicate if the shipping container was mishandled during shipment. The following procedure is based upon current packing methods. After inspecting the exterior of the corrugated container for obvious shipping damage, proceed as follows:

CAUTION

Two people should be used to move the shipping container prior to unpacking. The shipping weight of the enclosure, drive and power supply is approximately 138 pounds (63 kg).

1. Move the shipping container to a suitable work area. Cut and remove the strapping around the corrugated container.

2. The outer sleeve of the shipping container has flaps that open, see Figure 2-1. Open the flaps, remove and retain any loose items and/or documentation from the top of the inner container.

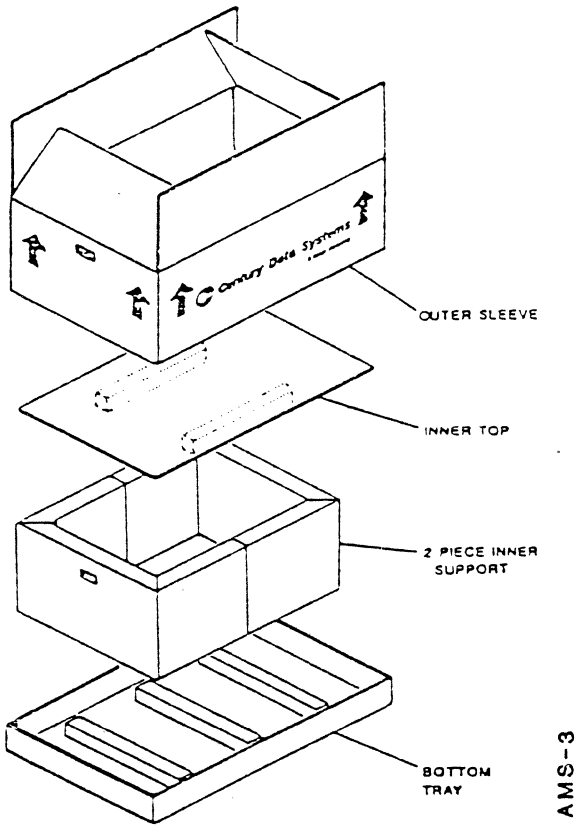


Figure 2-1. Shipping Container

Note

Each drive is shipped with a flaw map listing all correctable and uncorrectable media flaws. This list should be kept with the disk drive.

3. Remove the outer sleeve, inner top, and inner supports, by lifting up and off.

4. Carefully lift the enclosure up (two people should be used) and slide the shipping container bottom tray out from under. Set the enclosure down.

5. Remove the enclosure top by removing the six phillips-head screws (two at the front corners and two on each side (front and back) see Figure 2-2. Lift top up and off.

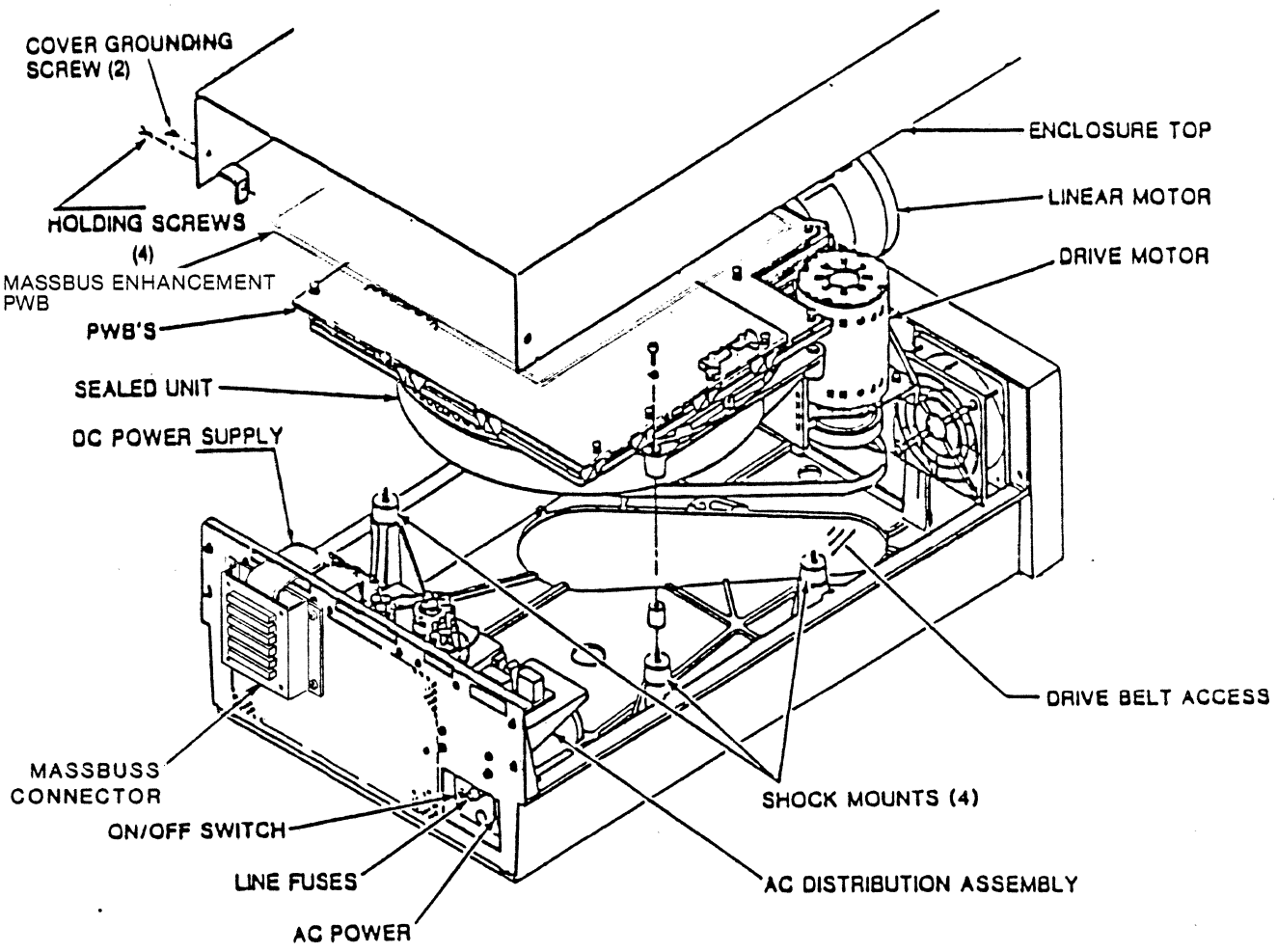


Figure 2-2. Disk Drive with Enclosure

SECTION 3
INSTALLATION CHECKOUT

GENERAL

This section contains the recommended procedures for unit installation checkout prior to online use of the disk drive.

Problems found during unit inspection in Section 2 must be corrected before proceeding further.

Prior to actual installation of the AMS 200/300 Disk Drive consideration must be given to the physical location alloted to the unit.

1. Determine if there is sufficient cabinet space.

2. Check to see that the proper electrical power is in reach of the installed unit.

3. Check that adequate air cooling for the unit is available.

4. Determine if the unit will be subject to excessive vibration in the location that it will be installed.

The AMS disk drive should be installed in a normal office environment not directly exposed to outside weather or exposed to unusual chemical or atmospheric gas conditions. Provisions must be allowed for unrestricted air flow entering through the front of the drive and exhausting from the rear. To accomplish this, a minimum of two and a half (2.5) inches clearance should be provided at the rear of the drive.

To ensure the AC (alternating current) external power matches the voltage and frequency specified, check the model number of the drive. The model label on the rear of the unit indicates the voltage and frequency for which the drive is presently configured. Changing the voltage requires moving a tap on the power transformer located in the power supply assembly. A frequency change requires replacement of the drive belt and motor assembly.

CAUTION

The procedure required to convert between a low line voltage (100-120 VAC) and a high line voltage (220-240 VAC), and between 50 and 60 cycles per second (Hz) frequencies is complex. Never operate the drive at the wrong frequency or voltage because the power supplies and AC spindle motor may be severely damaged.

Check that the AC electrical power to which the drive will be attached meets the following conditions:

1. Correct voltage and frequency.

2. Adequate current carrying capability. (To determine this, total the unsequenced starting current requirements of all the devices attached to the circuit. This must be less than the circuit and circuit breaker capacity. Note: Do not change the breaker to one in which current capacity exceeds that of the circuit.)

3. Local, secure grounding. (The computer chassis, the power line ground wire and/or the neutral should be attached locally to a well grounded object such as water pipes—*not* gas lines—rather than at a remote power station.)

4. When the disk drives are shipped from Century Data Systems, both logic (DC) ground and frame/chassis (AC) ground are connected together at pin E5 on the power supply located in the extreme right hand rear of the unit. Before operation, remove the black wire from pin E5 and install it on pin E6 to isolate the grounds.

5. Surge current and noise protection. (This is important in areas where lightning and other electrical disturbances are common. Built-in cabinet isolation transformers and circuit surge protectors can be used to provide protection.)

The AMS disk drive is normally mounted inside a standard 19-inch (RETMA) computer cabinet with the site's own fixed cabinet rails or with the optional rack slide mounting kit. If fixed rails are to be used, the unit will rest on the rails. If the computer cabinet is inclined forward, the disk drive may fall out unless secured by the optional rack slides.

Ten and one half (10.5) inches of vertical cabinet space must be provided for mounting. If possible, select a mounting location within the cabinet containing the computer or in an expansion cabinet immediately

adjacent and attached to the main computer cabinet. This does not prevent the disk drive from being assigned a unit select address anywhere in the normal MASSBUS addressing range, but it considerably simplifies the AMS disk drive power cabling and interface connections.

The MASSBUS connection to the AMS disk drive can be accomplished using either flat ribbon or round cables. The disk drive should be attached to the MASSBUS so that there is less than 100 feet (30 meters) between it and the MASSBUS controller located within the computer. Allowances should be made for the internal cabling of each drive on the MASSBUS. In the case of the AMS disk drive, this internal length is 2 feet (0.6 meters). If flat ribbon cable is used, be sure that it conforms to the 40 conductor standard with FCC approved shielding and is terminated at each end. These cables may be ordered with the disk drive or from other vendors. An optional flat-to-round MASSBUS cable transition bracket and round MASSBUS cables may be additionally ordered with the AMS disk drive. These options are useful when the unit is mounted within a cabinet that is separated from the computer cabinet.

Next, ensure that the cabinet and room cooling capability can accommodate the disk drive within the temperature range acceptable for system operation. Table 3-1 lists the operating temperature range and heat dissipation of the AMS disk drive. Add this figure to the total heat dissipation for other system components, and then adjust the result to compensate for such factors as the number of personnel, the heat radiation from adjoining areas, and the sun exposure through windows. This will indicate the approximate cooling requirements for the entire system. One should allow a safety margin of at least 25 percent above the maximum estimated requirements.

TABLE 3-1. AMS 200/300 DISK DRIVE COOLING REQUIREMENTS

Volage	Frequency	Operating Temperature	Heat Dissipation (BTUs/hr.)
115 AC	60 Hz	10°C to 40°C (50°F to 104°F)	2185
230 AC	50 Hz	10°C to 40°C (50°F to 104°F)	2540

Finally, locate the MASSBUS Terminator Pack Kit (DEC part number 7009938) that should be supplied with your MASSBUS disk subsystem. If you are attaching your AMS disk drive to a MASSBUS interface of one of the tape controllers. Determine which controller has the terminating resistors. The MASSBUS termination should be placed on the last physical device (disk or tape controller) in the MASSBUS string.

INSTALLATION

CAUTION

The disk drive, power supply, and enclosure weighs approximately 138 pounds (63 kg). Use care when moving.

1. Install enclosure (with unit) in the desired location and position.

Note

During shipment, the disk drive R/W heads and associated head carriage assembly must be held stationary to prevent damage to the heads or the disks. After the disk drive has been moved to its operating position, the head carriage assembly must be unlocked allowing the heads to move. The AMS units have an electronic carriage lock which is automatically activated.

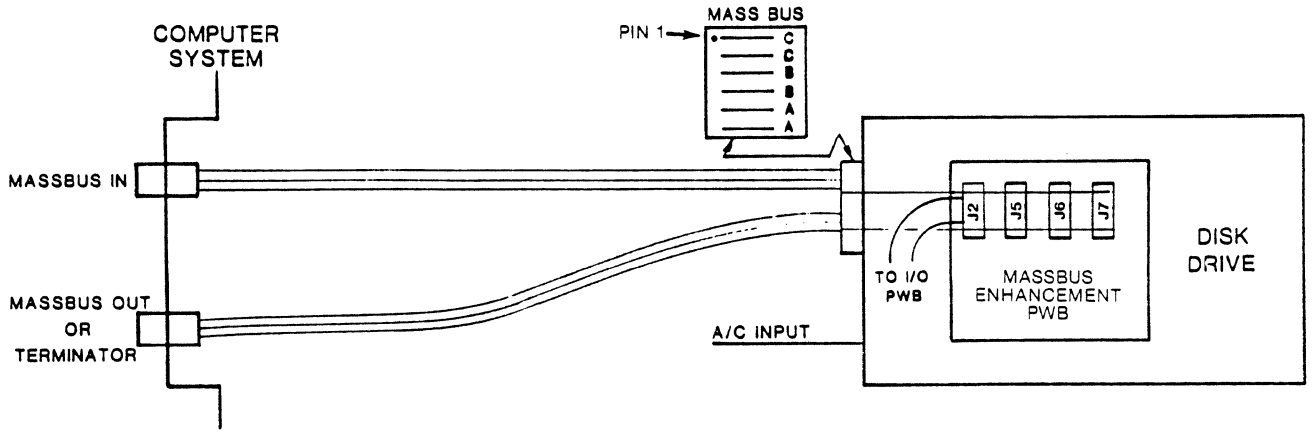
2. Units with the electronic carriage lock will automatically lock the carriage when power is removed. Without dc power applied to the disk drive, a solenoid plunger, inside the sealed unit, engages a notch in the head carriage, preventing it from moving out of the "landing zone" position. This is the normal condition whenever the disk drive is moved. Applying dc power actuates the internal solenoid and separates the plunger from the head carriage notch, allowing it to respond to commands from the head positioning servo system. Actually, solenoid operation is logically associated with the BRAKE/ signal (i.e., Not-Braking status), so the solenoid will also be deenergized, locking the head carriage, while the spindle is being braked to a stop. Spindle braking normally happens only after the heads have been relocated over the "landing zone."

3. Ensure all cables are seated firmly in their connectors.

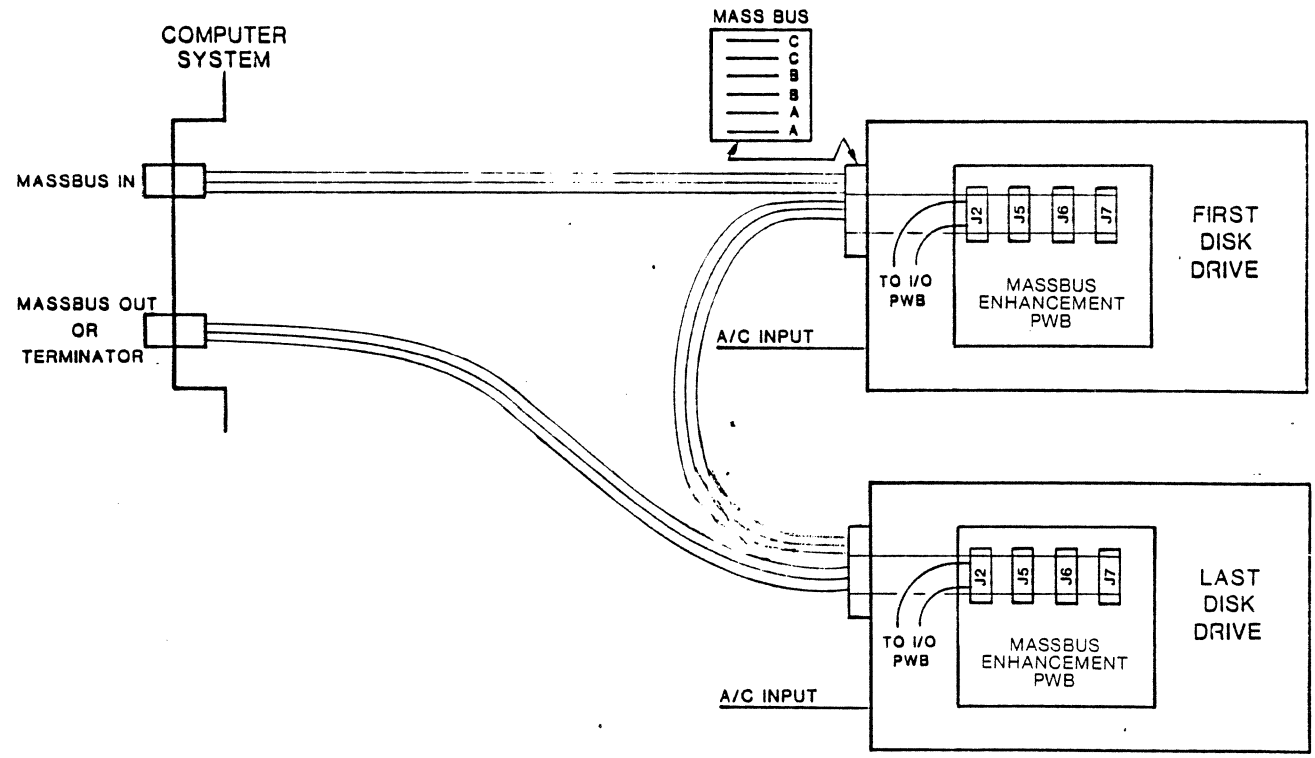
4. Connect the system cables as shown in Figure 3-1. Interconnecting I/O and Control Cabling for Single Access is shown in Figure 3-2. The I/O and Control PWB must always have an SMD terminator in the BUS OUT connector (J1). The terminator part numbers are shown in Table 3-2.

TABLE 3-2. TERMINATORS

Internal SMD Terminator	CDS P/N 25790-001
MASSBUS Terminator	DEC P/N 7009938



(A) SINGLE ACCESS/SINGLE DRIVE



(B) SINGLE ACCESS/MULTIPLE DRIVE

Figure 3-1. System Cable Diagram (Single Access)

5. Install terminator in the appropriate jack as follows:

   a. The edge of the terminator PWB opposite the connector goes down.

   b. The ground wire on the terminator plugs to the spade terminal on the left (from rear, facing forward).

6. Metal cover safety ground is assured by a screw and lockwasher on each side at the rear of the machine. If the cover is removed during installation, these screws and lockwashers must be reinstalled along with the cover, prior to operation.

7. Install the AC power cord into the connector at the rear of the unit. Refer to Figure 3-1. Note also that

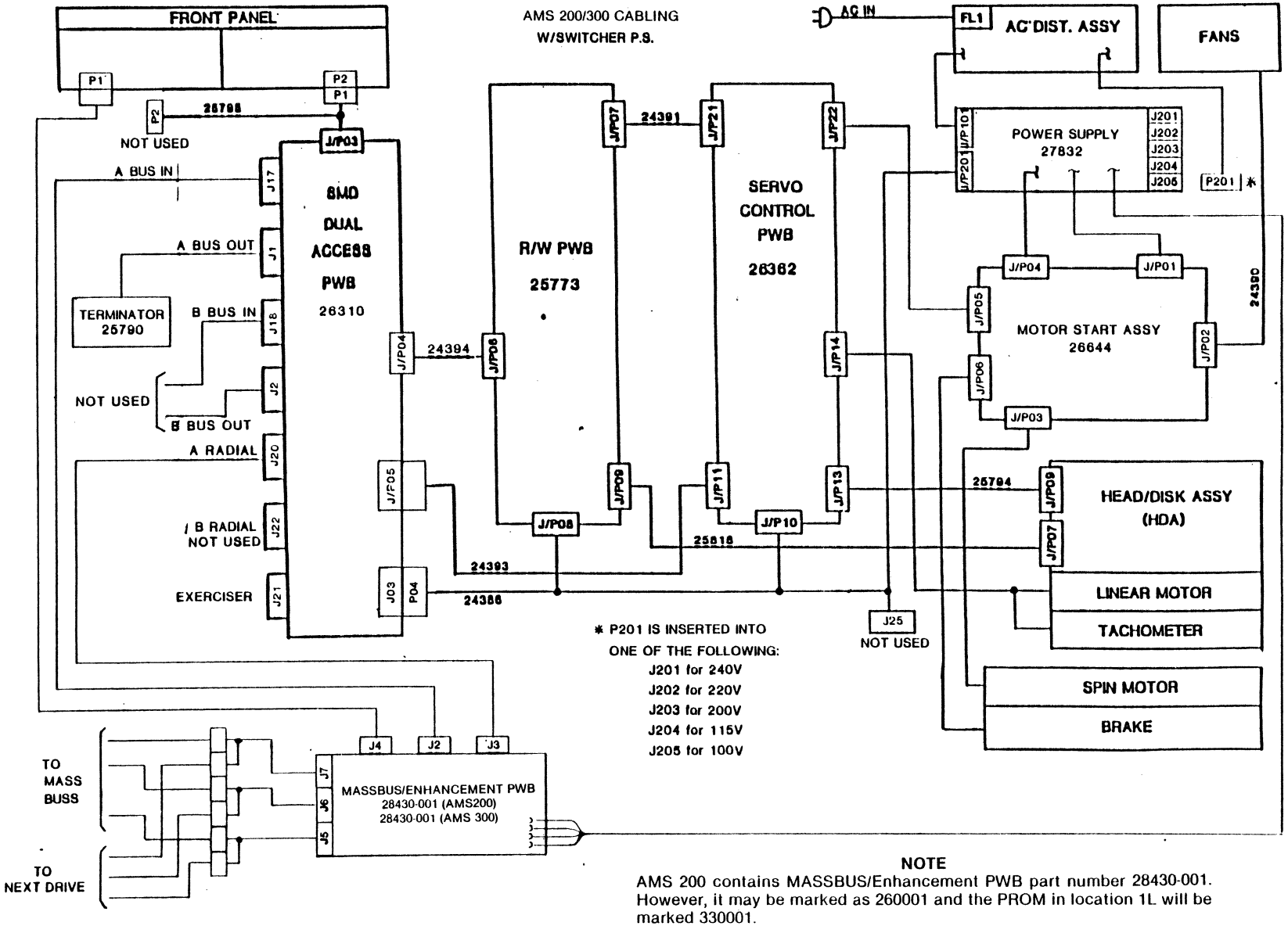


Figure 3-2. AMS 200/300 Disk Drive Internal Cabling

NOTE

AMS 200 contains MASSBUS/Enhancement PWB part number 28430-001. However, it may be marked as 260001 and the PROM in location 1L will be marked 330001.

AMS 300 contains MASSBUS/Enhancement PWB part number 28430-001. However, it may also be marked as 260001 and the PROM in location 1L will be marked 330011.

there are two AC input fuses here as well as the power on switch.

Dip Switch Setting for I/O and Control Dual Access PWB P/N 26310-001

Note

The switch setting information given below for switches S1, S2 and S3 is for reference only. Refer to Figure 3-3 for proper setting of these switches when used with the AMS 200/300 Disk Drives.

Maximum Cylinder Switch (see Figure 3-3)

The setting of this switch (S3-8) is used by the disk drive control firmware to determine the maximum legal cylinder address. When this switch (S3-8) on I/O and Control PWB is closed, the maximum legal cylinder address is address 844. With the switch in the open position, the maximum legal cylinder address is 822. Set the switch to the open position (822) for the AMS 200/300 Disk Drive.

Local/Remote Switch (see Figure 3-3)

The Local/Remote switch (S3-7) determines whether the disk drive is to be sequenced up and down locally (by the front panel START switch only) or remotely (by the PICK and HOLD signals issued by the system controller). The PICK and HOLD signals are routed from the system controller to each disk drive serially. To initiate a sequence-up function, the PICK and HOLD signals are routed to the first disk drive, starting its sequence-up function. When the first disk drive is up to speed, the signals are routed to the next disk drive and so on down the line until all disk drives are sequenced up.

When the switch (S3-7) is in the LOCAL (closed) position it is not necessary to issue a PICK or HOLD signal and sequencing is done by opening and closing the front panel START switch. When it is in the REMOTE (open) position PICK and HOLD signals must be issued from the system controller (START switch must be closed). For AMS 200/300 Disk Drives this switch must be open.

Fault Indicator Reset Switch (see Figure 3-3)

Nine different fault conditions are indicated by individual LED's located on the I/O & Control PWB. During maintenance (fault finding) the Fault Indicator Reset switch (S3-6) can be used to reset the fault flip-flops (switch closed) which causes the fault LED's to turn off. During normal operations, this switch should be placed in the open position, allowing a fault condition to set the appropriate fault flip-flop and turn on the LED. If the switch was kept in the closed position, fault conditions would be reported to the system, but would not be captured in a fault flip-flop. Table 3-3 shows the fault LED's.

TABLE 3-3. I/O AND CONTROL PWB

LED	Condition/Fault
DS1	Overtemperature (Linear Motor)
DS2	DC Unsafe
DS3	Power Amplifier Unsafe
DS4	Read/Write Fault
DS5	Read Error
DS6	Write Error
DS7	Read Only
DS8	Offset Or Not On Cylinder
DS9	Seek Error
DS10	A Priority
DS11	A Reserved
DS12	B Priority
DS13	B Reserved
DS14	Fault

Sector Switches (see Figure 3-3)

The switches are set for 34 sectors when used with the MASSBUS adapter.

On Cylinder Offset Reset Switch (see Figure 3-3)

The On Cylinder Offset Reset switch (S1-8) allows for SMD or CMD compatibility of the interface signal ON-CYLINDER. With the switch closed, signal ON-CYLINDER drops at the beginning and end of an Offset Operation (CMD). With the switch open, signal ON-CYLINDER drops at the beginning of an Offset Operation only (SMD). Set this switch to the open position for AMS 200/300 Disk Drives.

Reserve Timer Switch (see Figure 3-3)

This switch (S1-7) is the Dual Access Reserve Timer mode switch. When the switch is open, the first access to select the drive, reserves the drive until that access specifically releases the drive by activating Control Tag and Bus Bit 9. When the switch is closed, the reserve status of the drive is automatically released 500 milliseconds after the end of an I/O operation. For AMS 200/300, always place this switch in the open position.

Degate Switches (see Figure 3-3)

Access A Degate switch (S1-5) and Access B Degate switch (S1-6) are used to place the disk drive online or offline to the system cabled to the associated access.

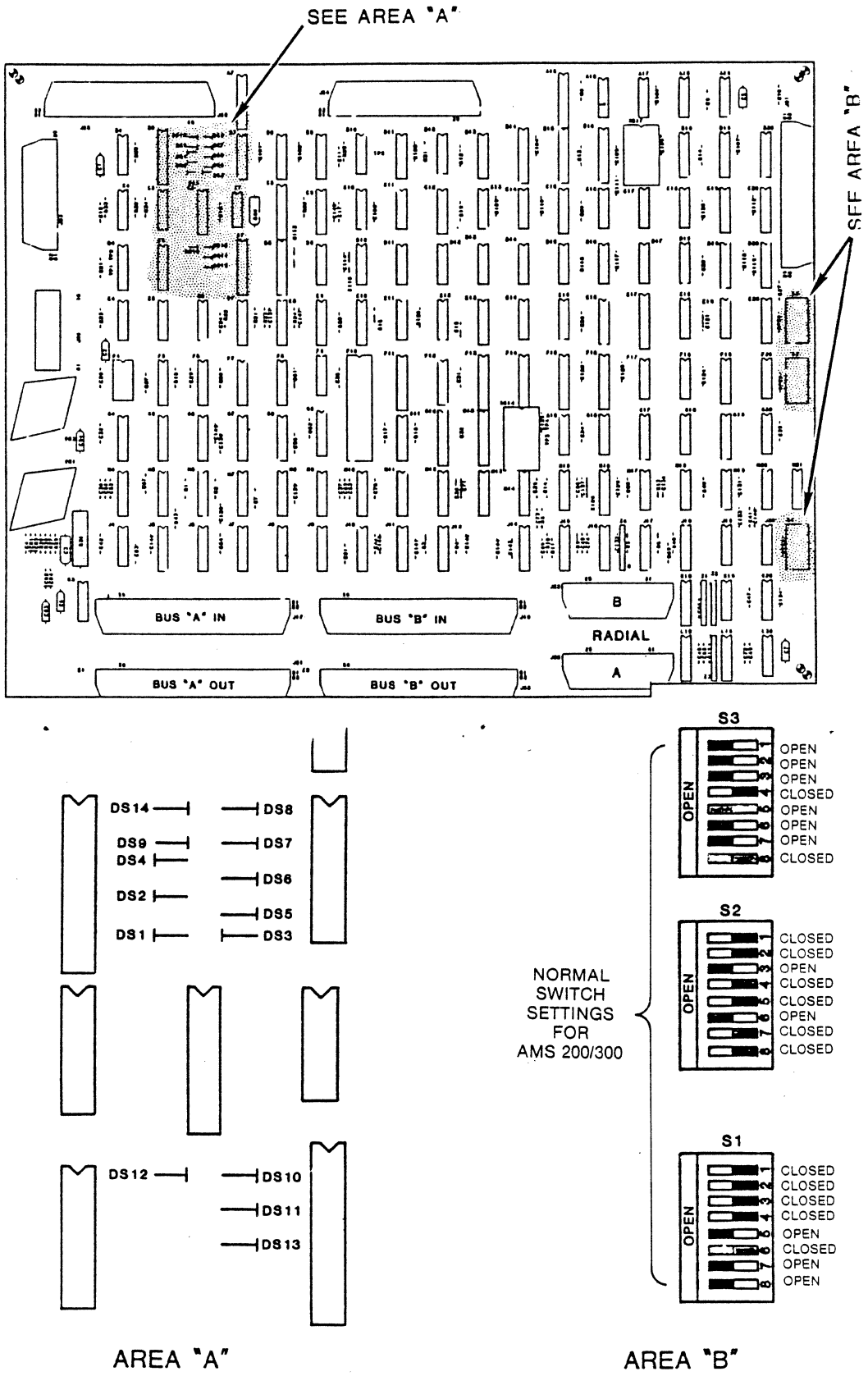


Figure 3-3. I/O and Control PWB Switches and Indicators

However, the controller (enhancement PWB) is always connected to the A access and the B access is unused. The switch should be set to the closed position for AMS 200/300 Disk Drives.

Unit Address Switches (see Figure 3-3)

In systems with more than one disk drive, each drive will be assigned a different unit address. In systems with only one disk drive the unit address for the drive is usually "zero". The unit address switches (S1-1 thru S1-4) on the Dual Access PWB are in parallel with the unit address plug on the front panel of the enclosure. If the front panel plug is to be used, the switches must be left in the open position to prevent interaction with the front panel address plug. The unit address is set by these switches for drives without a front panel. Each switch is binary weighted and when open equals a binary 'one' in that weighted position. Because the AMS 200/300 has its own controller (enhancement PWB) the address switches must always be zero. Set switches S1-1 thru S1-4 to the closed position.

OPERATOR CONTROLS AND INDICATORS

Operating controls and status indicators are on the front of the AMS disk drive, beneath a removable front panel cover, and on the power supply chassis at the rear of the unit. Other switches and controls are located within the disk drive. These are not used during normal operation and are accessible only by removing the top cover. They are set at the factory and should only be changed if a malfunction is suspected.

At the rear of the disk drive is the AC ON/OFF switch next to the AC power cord and it controls the application of AC and DC power to the drive and MASSBUS interface.

The front of the AMS disk drive contains two switch and indicator sets. One can be observed and changed with the front panel and cover attached. These indicators are used to indicate status during normal operation. The other set of indicators and switches which are infrequently changed are located behind the front panel cover. (See Figure 3-4.)

The functions of these switches and indicators (Figure 3-4) is to allow disk operating settings to be altered and certain functions to be invoked. In general, these operations are done by entering the binary selection number into the disk drive controller switches, then pressing and holding the front panel button (S5) for approximately one second until an acknowledging red light (WAIT) goes on. When the button is released, the switch selection is read by the controller and the operation is performed.

Some operations (see Table 3-5) erase disk data or momentarily make the disk non-existent to the host. To protect the operator from invoking these functions by mistake, the operator is given a second chance to correct an operation by pressing the front panel button (S5) a second time before a warning pattern shifts slowly down the red panel ERROR/STEP lights. A function is not completed if the button (S5) is not pushed and released on time (within 9 seconds).

If an error occurs during the execution of a function, it is reported to the operator on the red lights for approximately 30 seconds.

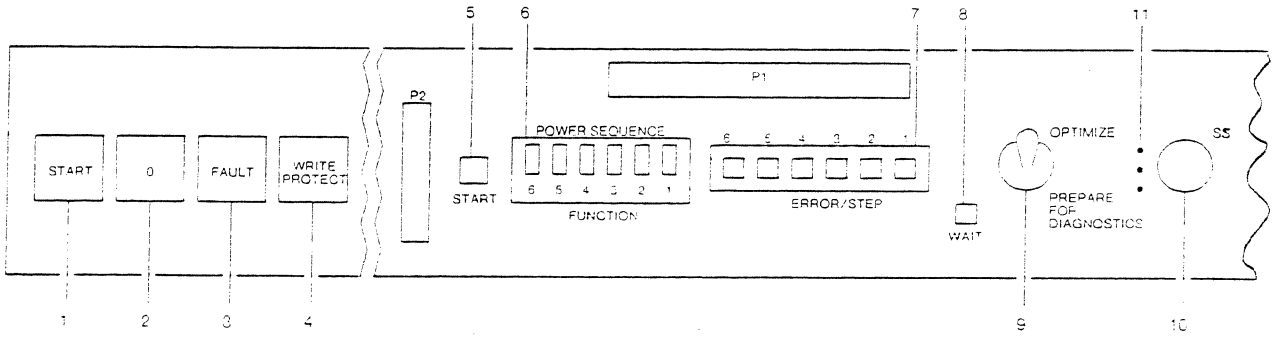


Figure 3-4. Front Panel Controls & Indicators

TABLE 3-4. CONTROLS AND INDICATORS

Control/Indicator	Description/Function
1 START Switch/Indicator	IN position turns on the drive motor and positions the heads over the data tracks. OUT position moves the heads to the landing zone area, turns off the drive motor, and activates the brake to stop the disks. During power-down, this indicator will continue to flash until power is removed from the drive. This is due to the MASSBUS controller continually polling the MASSBUS.
2 Ready Indicator/ Logical Address Plug (White) (MASSBUS Unit No.)	Indicates that the drive is powered up and the logical address of the drive (SMD only) is stamped on the indicator lens. Flashes during the power up until the drive is ready and during power down until the disks have stopped.
3 FAULT Push-button Switch/ Indicator (Red)	Indicates that an unsafe operating condition has been detected and that corrective action is required. Pressing the switch will clear any fault condition that no longer exists.
4 WRITE PROTECT Switch/Indicator	WRITE PROTECT (ON) position disables the write logic for read-only disk protection. OFF position enables all data operations. Note: An electrical interlock prevents switch actuation from disrupting a write operation in progress.
5 START Light	This normally hidden is useful only to service personnel.
6 POWER SEQUENCE/ FUNCTION Switches	The dip switches numbered 1, 2, 3 and 4 are read during power-on in order to control the delay before the drive motor is energized. This is useful in larger systems to avoid the higher power surge of having multiple motors starting simultaneously. Each delay increment is used to run the internal self test loop. Note: Switches 5 and 6 must be set to zero or the test will loop forever. If switches (1-6)=Hex 3E, the self test will loop forever even if the switches are cleared. Power cycling the disk is then required to operate the disk. If switches (1-6)=Hex 3F, the disk will not be connected to the controller. Both 3E and 3F are only useful to service personnel. SWITCH NUMBER (Open=1, Closed=0) 4 3 2 1 APPROXIMATE DELAY BEFORE STARTING MOTOR 0 0 0 0 Immediate 0 0 0 1 30 Seconds 0 0 1 0 60 Seconds 0 0 1 1 90 Seconds 0 1 0 0 2 Minutes 0 1 0 1 2 Minutes 30 Seconds 0 1 1 0 3 Minutes 0 1 1 1 3 Minutes 30 Seconds NOTE: Switches 5 and 6 must be 0!! NOTE: For the DIP switches, 0 is closed and 1 is open. These switches and switches 5 through 8 are also used to perform certain functions on the MASSBUS adapter, as explained in Table 3-5.
7 ERROR/STEP Indicator	These red lights display the step number being executed during the power-on self-test. In addition, they display other error codes, conditions or activity. Table 3-6 explains the meaning of the numbers displayed in these lights.
8 WAIT Indicator	This red light turns on during power up and whenever the Prepare for Diagnostics is changed, and indicates that the Controller has yet to achieve the indicated state. There may be a long delay after setting the switch to Prepare for Diagnostics before this light goes off. The ERASE RESET function may be used to make the disk instantly ready for diagnostics, if the disk data has already been backed up.

TABLE 3-4. CONTROLS AND INDICATORS (Continued)

Control/Indicator	Description/Function
9 OPTIMIZE/ PREPARE FOR DIAGNOSTIC Switch	During normal operation this switch is set to the OPTIMIZE position s that the adapter performs DYNAMIC DATA RELOCATION, caching and read look-ahead. However, to run the host computer-based diagnostics, the switch must be placed in the PREPARE FOR DIAGNOSTICS position, which turns OFF caching and safely relocates stored data to its home position. This relocation may take up to about 17 minutes, during which time the WAIT LED will remain lit. The PREPARE FOR DIAGNOSTIC switch can be changed at any time, including during normal on-line system operation. If time is a factor, and if the data is properly backed-up on other media, a destructive ERASE-RESET function (described later) can make the controller ready for diagnsotic immediately.
10 PUSHBUTTON S5 Switch	This is used in conjunction with the switches to execute front panel functions on the AMS 200/300 Disk Drive, such as off-line formatting.
11 3-Pin Header	The bottom two pins are used with a factory adapter to read the ERROR/STEP function on a CRT.

TABLE 3-5. SWITCH SELECTIONS

Selections Switches 7654321*	Hex	Function	Requires a Second S5 Press?	Description
0000000	00	Seq. Delay	N/A	Sequence up immediately.
0000001	01	Seq. Delay	N/A	Sequence up after 30 seconds.
0000010	02	Seq. Delay	N/A	Sequence up after 60 seconds.
0000011	03	Seq. Delay	N/A	Sequence up after 90 seconds.
0000100	04	Seq. Delay	N/A	Sequence up after 120 seconds.
0000101	05	Seq. Delay	N/A	Sequence up after 150 seconds.
0000110	06	Seq. Delay	N/A	Sequence up after 180 seconds.
0000111	07	Seq. Delay	N/A	Sequence up after 210 seconds.
0001001	09	Change Search Mode	No	Moves Search mode cyclically through values 0-7. Seek and Search commands are always executed in diagnostic mode, but in performance mode their execution is determined by the Search mode value and the current contents of cache. **Search Mode** (Action in Performance mode) 0 Always seek/search 1 Never seek/search 2-7 Seek only if sector currently addressed by MASSBUS registers RPDA, RPDA is not within cache memory. Search only if sector addressed by RPDA, RPDA is not within cache memory. Search only if sector addressed by RPDA + Search mode # (#2-7) is *not* in cache, (i.e., the proper value for search mode value between 2 and 7 is operating system driver dependent) and is the expected time delay between the termination of the search function and the issuing of the following transfer commanded by the host.

TABLE 3-5. SWITCH SELECTIONS (Continued)

Selections Switches 7654321*	Hex	Function	Requies a Second S5 Press?	Description
0001010	0A	Decrease Look-Ahead	No	Controls the number of sectors that the controller will read past the end of the host request when look-ahead is "triggered". The default is 16 (=HEX 10). When pressed, the new number is displayed on the front panel lights in binary. (The look-ahead count is stored on the disk. See function #C, "Write Tables".)
0001011	0B	Increase Look-Ahead	No	Controls the number of sectors that the controller will read past the end of the host request when look-ahead is "triggered". The default is 16 (=HEX 10). When pressed, the new number is displayed on the front panel lights in binary. (The look-ahead count is stored on the disk. See function #C, "Write Tables".)
0001100	0C	Write Tables	Yes	Save current internal tables on disk as is done constantly during dynamic data relocation. This insures current values of search mode and look-ahead are retained even if power down occurs before another relocation occurs.
0010111	17	Auto-ECC	No	Controls the enabling of automatic ECC correction. Selecting the function acts to toggle the enable. After the function is invoked, a single front panel light indicates ECC enable was off but is now on. No front panel lites on indicate ECC enable was on but is now off.
0011000	18	Increment Look-Back	No	Used to speed up disk access during interleaved operation. Set to 9 for COSMOS operation. Set to 0 for standard RP06.
0011001	19	Decrement Look-Back	No	Used to speed up disk access during interleaved operation. Set to 9 for COSMOS operation. Set to 0 for standard RP06.
1011110	5E	Reset-User Flaws	Yes	Service personnel only!! Format and reset the cylinder tables and the map of the disk flaws found by the find-flaws front panel function (user-flaws). This effectively clears the user flaw information and performs an erase-reset function.
1011111	5F	Reset-All Flaws	Yes	Service personnel only!! Format and reset the cylinder tables, the user flaw map, and the manufacturer's flaw map. This deletes all of the information about disk media flawas which is used to make the disk appear "perfect". This should only be used by service personnel in the very rare event that a malfunction has caused these flaw maps to be destroyed. Find-flaws should be run for at least 24 hours after this operation.
1100001	61	Restart-Board	Yes	Starts execution of self test as if the AMS disk drive was power cycled.
1100010	62	Erase and Reset Tables	Yes	Initialize cylinder mapping tables to a one-to-one organization and resets all selection to default values. This is also a quick way to make the disk ready for diagnostics. The identity of all relocated data is lost, so this should only be done after the disk data is properly backed up elsewhere. Erase reset must be done before formatting the disk using the host formatting program, so that the normal format organization is obtained. This does not erase the flaw map

TABLE 3-5. SWITCH SELECTIONS (Continued)

Selections Switches 7654321*	Hex	Function	Requires a Second S5 Press?	Description
				table generated by the find-flaws function. It also does some table housekeeping. If this function is not done following a find-flaws function, the start light on the operator control panel will continue to flash after the drive comes ready.
1100011	63	Format	Yes	Formats entire disk except for hidden flaw maps. Clears the host bad sector file. This function is not normally used as it does not format with the standard DEC format.
1100100	64	Find-Flaws	Yes	Finds and maps out disk media flaws to create a "perfect" media disk. This adds flaws to the user flaw map. The entire disk, including the cylinder tables, but excluding the two flaw maps, is checked with multiple data patterns until the button is held down with the switches set to zero. Do not terminate this command by removing ac power or by pressing the start switch. The erase and reset tables front panel function should be run after this function. This test should be run for a minimum of 24 hours to a maximum of 48 hours. **NOTE:** When replacing an HDA assembly, the sequence of functions to be done is 5F, 64 (for 24 hours), and 62. The drive is then ready to be formatted and tested with DEC system diagnostics. Set operating parameters and Write Tables before beginning online operation.

TABLE 3-6. ERROR/STEP INDICATORS

Binary/ Light No. 6 5 4 3 2 1	Hex	Description
		Power On Self-Tests, Error Codes
1 1 1 1 1 1	3F	Power up state (START and WAIT also ON).
0 0 0 0 0 0	0	Start of self-test.
1	1	2910 tests at interrupt level complete.
1 0	2	2910 tests at main level complete.
1 1	3	Check of constants versus EPROM complete.
1 0 1	5	Check of refresh timeout complete.
1 1 0	6	Check of internal and some external registers.
1 1 1	7	Check of 2903 instructions complete.
1 0 0 0	8	Check of parity flip-flop and trivial RAM test complete.
1 0 0 1	9	RAM read/write test #1 complete, first bank.
1 0 1 0	A	RAM read/write test #2 complete, first bank.
1 0 1 1	B	RAM read/write test #3 complete, first bank.
1 1 0 0	C	RAM read/write test #1 complete, second bank.
1 1 0 1	D	RAM read/write test #2 complete, second bank.
1 1 1 0	E	RAM read/write test #3 complete, second bank.
1 1 1 1	F	Microcode self-test complete.
1 0 0 0 0	10	High level language initialized.
1 0 0 1 0	12	External register test #2 complete.
1 0 0 1 1	13	RAM addressing test complete for bank 1.
1 0 1 0 0	14	RAM addressing test complete for bank 2.
1 0 1 0 1	15	Long RAM pattern test complete for bank 1.
1 0 1 1 1	17	Internal SMD port loop back test complete.
1 1 0 1 0	1A	Past self-test, initialization step 1 complete.
1 1 0 1 1	1B	Past self-test, initialization step 2 complete.
1 1 1 0 0	1C	Past self-test, initialization step 3 complete.
1 1 1 0 1	1D	Disk selected and returned good status.
1 1 1 1 0	1E	Successful initialization of tables from disk complete.
		Other Error Codes
1 1 0 0 0 0	30	27128 EPROM 0-16K located in 6CI failed checksum.
1 1 0 0 0 1	31	27128 EPROM 16-32K located in 6C2 failed checksum.
1 1 0 1 0 1	35	Illegal front panel function requested by operator.
1 0 1 0 1 0	2A	The AMS 200 failed to write the updated tables to the disk. Check that write lock is OFF and that the disk is ready. The problem must be corrected and the function repeated, since any changes to the tables will be lost when power is cycled.

SECTION 4
OPERATIONAL CHECKOUT

GENERAL

This section contains disk drive offline and online testing information and procedures. The procedures in this section must not be performed until Section 3 procedures have been accomplished. Before proceeding check the following:

a. System cabling complete

b. Switches are set as described in Section 3.

c. AC power cord installed.

d. Disk drive cover removed as described in Section 2.

e. Ground jumper removed from E5 position and installed on E6 of the power supply.

Note

The disk drive user may elect to perform an on-line operational checkout using available Digital Equipment Corporation (DEC) diagnostic routines and system benchmark programs if desired. When doing so the AMS 200 Disk Drive is operated as an RP06 Disk Drive. The AMS 300 Disk Drive is operated as an RM05 Disk Drive.

OPERATIONAL CHECKOUT

Extensive testing of the AMS disk drive was performed prior to shipment, ensuring each unit shipped meets or exceeds the published specifications.

The following list of test functions and procedures are to be used if an operational checkout of the disk drive is desired prior to installing it with the system.

The AMS disk drive can be tested as a standard SMD device once the controller PWB is unplugged. Refer to the AMS 315 Installation Manual for details.

INSTALLATION SETUP

Procedure (See Figure 4-1)

1. Insure all power is removed from drive.
2. Remove access panel on the front panel of the disk drive.
3. Insure that all FUNCTION switches are off (down).
4. Install device address plug.
5. Set the switch to PREPARE FOR DIAGNOSTICS (down).
6. Turn power on to the unit and verify that the DC power LED's on the Servo Control Printed Wire Board (PWB) are illuminated. See Figure 4-2.
7. Press the START switch on the front panel. The drive motor should begin to spin. Once the drive is up to speed the START lamp should light solid.
8. A self-test procedure is initiated during this phase. If the drive fails to come READY, refer to Table 3-7 for error code as displayed on ERROR/STEP LED's on the front panel.

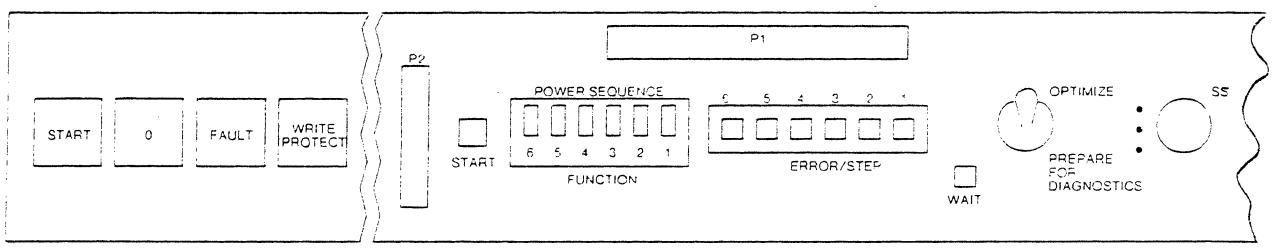


Figure 4-1. Front Panel Switches and Indicators Under Access Panel

OPERATION

The AMS disk drive is designed to operate online under control of the operating system with minimum interaction with an operator. Operator action is required for the following:

a. Sequencing the drive up or down, independent of the system, by using the front panel START switch.

b. Protecting the data stored on the drive by setting the front panel WRITE PROTECT switch ON.

c. Clearing a drive fault by pressing the front panel FAULT switch.

RUNNING UNDER UNIX™

When running under UNIX operating system the read look-ahead should be set to 4 or 8 sectors. This setting is dependent on particular system characteristics and can be varied until optimum system performance is achieved. To set this proceed as follows: (Refer to Figure 4-1.)

1. Set the switch to PREPARE FOR DIAGNOSTICS (down).

2. Set FUNCTION switches 2, 4 up, all others should be down.

3. Press the S5 pushbutton, the ERROR/STEP lights 4, 3, 2, and 1 should be on. Continue to press the S5 pushbutton until the proper count (S3=4, S4=8) sectors is found. Either 1000 or 100.

4. To do a write table function, set FUNCTION switches 3, 4 up, all others down and press the S5 pushbutton. Set all function switches down.

5. Set the switch to OPTIMIZE (NORMAL).

If a disk flaw is encounered while running under UNIX the flaw must be reassigned. To reassign flaws proceed as follows:

Note

The AMS 200/300 Disk drive contains an Automatic Error Correction switch that may be enabled depending on system. Because most UNIX™ do not use ECC, the user may want to enable this auto-ECC capability. Refer to Table 3-6.

1. Set the switch to PREPARE FOR DIAGNOSTICS (down).

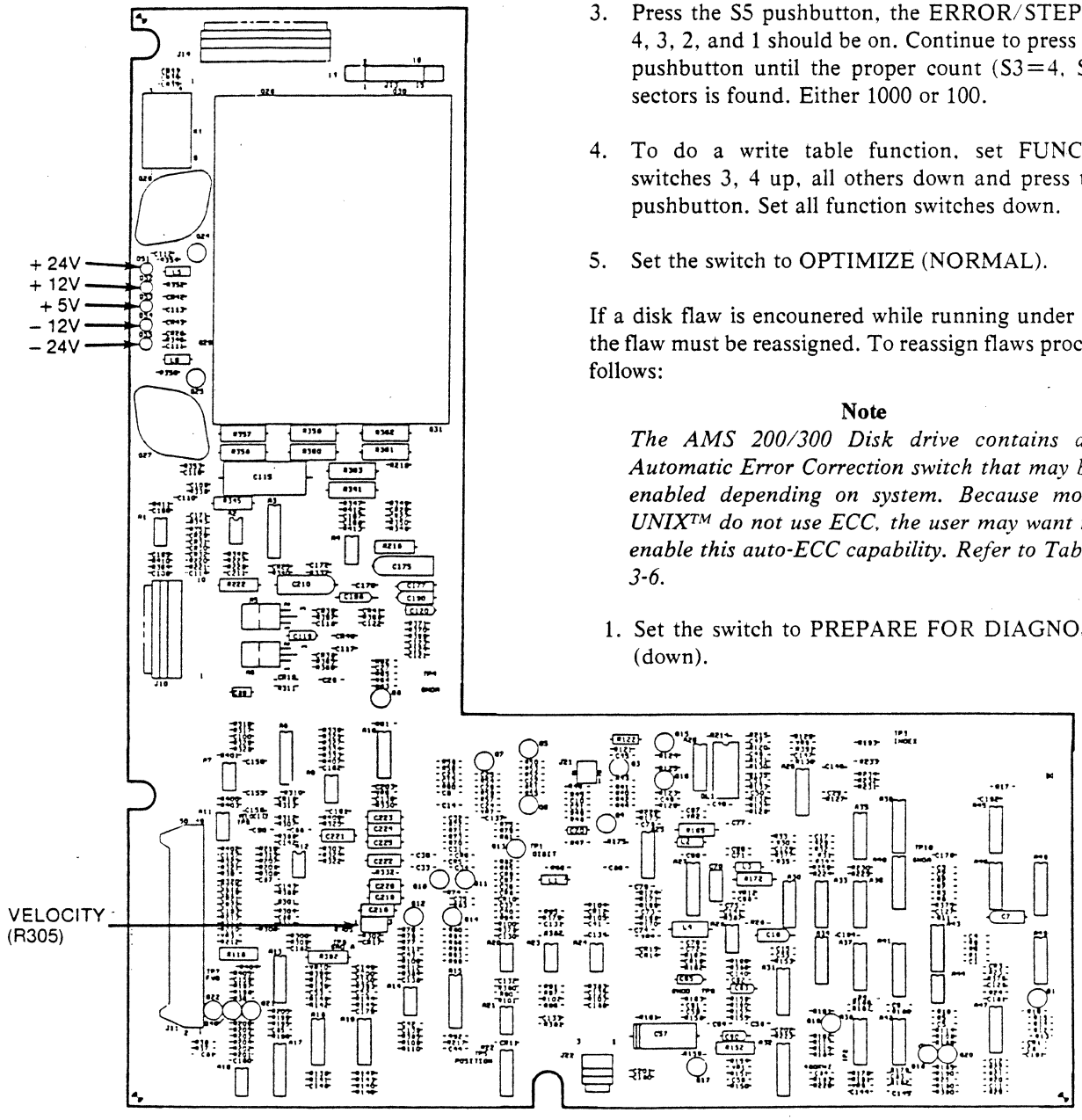


Figure 4-2. DC Power LED's

2. Remove the drive device address plug.

3. Set FUNCTION switches 6, 3 up, all others down.

4. Press the S5 pushbutton twice. (The ERROR/STEP lights will cycle. The disk controller is finding flaws and maps out those flaws to create a "perfect" media. When running flaw-find for the first time, allow 24 hours of continuous running to insure error free operation. For mapping new flaws, run at least 24 hours.

CAUTION

Do not terminate this command by removing ac power or by pressing the START switch.

5. To stop the Flaw-Find set all switches down, install the drive device address plug, and press the S5 pushbutton.

6. Remove the drive device address plug.

7. Set FUNCTION switches 6, 2 up, all others down.

8. Press the S5 pushbutton twice. Perform this function after running flaw-find.

9. Set FUNCTION switches down. Reinstall drive device address plug.

10. Set the PREPARE FOR DIAGNOSTICS switch to OPTIMIZE (NORMAL) (up).

ADDRESS PLUGS

On the AMS disk drive front panel the white light (DEVICE ADDRESS plug), or ready light, actually contains a group of address switches that are activated when the plug is inserted. The AMS 200/300 Disk Drives, always use only address plug 0 (zero).

Host Computer Diagnostic and Utilities

The AMS disk drive is compatible with the Digital Equipment Corporation functional diagnostics and formatting utilities listed in Table 4-1 for a single port RP06 or RM05 disk, using a 16-bit data format.

The AMS disk drive must be operating in the READY FOR DIAGNOSTICS mode so that its tracks and cylinders are located properly according to those expected by these tests. Diagnostics is supplied by Digital Equipment Corporation on various types of media, and these are generally run under the control of the XXDP Monitor on PDP11s or the ESSAA Diagnostic Supervisor on VAXs. For details concerning the operation of these control programs, refer to the appropriate DEC manuals.

TABLE 4-1. DEC DIAGNOSTICS AND UTILITIES WITH THE AMS 200/300 DISK DRIVE AND RP06/RM05

PDP11	
ZRML	Formatter (RM05)
ZRMU	Performance Exerciser (RM05)
ZRJB	Formatter (RP06)
ZRJD	Multi-Drive Exerciser (RP06)
VAX	
EVRAA	Reliability (RP06), (RM05)
EVRAC	Formatter (RP06), (RM05)
EVRBA	Functional (RP06), (RM05)

The RP06/RM05 Functional Controller Diagnostics not only test the AMS MASSBUS adapter, but in addition, they exercise the disk surface and the mechanics of the drive to prove proper operation of the subsystem. Before running these tests, ensure that there is no vital data left on the AMS disks, and it is in the PREPARE FOR DIAGNOSTICS mode. The AMS disk drive need not be properly formatted to use these tests. Each of these tests requires approximately 5 minutes. After a successful run of these diagnostics (with no errors) the AMS MASSBUS Adapter should be considered operational.

Note

For the manual intervention tests, there is no standby indicator on the AMS disk drive since it is inappropriate for a Winchester drive to implement the Unload/Standby command for the changing of disk packs. Whenever the host issues this operator intervention command, the AMS disk drive will go into a simulated standby mode which can be cleared by the operator changing any of the POWER SEQUENCE/ FUNCTION switches.

The RP06/RM05 Formatter Programs are designed to write and verify header and data information on all host accessible disk blocks. They format and test the integrity of the recording surfaces. The functional diagnostics should be run first, and the AMS disk drive should be in the PREPARE FOR DIAGNOSTICS mode.

Because the AMS disk drive incorporates a single board intelligent MASSBUS interface and a non-removable disk, the DEC diagnostics listed in Table 4-2 cannot be executed nor are they useful in verifying proper performance. The RP04/6/RM05 diskless Controller Test and the DCL/RP06 Repair Diagnostics are used to isolate a failure to one of several printed circuit boards

TABLE 4-2. DEC RP06/RM05 DIAGNOSTIC NOT USABLE WITH THE AMS DISK DRIVE

PDP11		
ZRJGAO	RP04/6/RM05	Diskless Controller Test
ZRJHAO	(Parts 1 & 2)	
ZRJEAO	RP04/6/RM05	Dual-Controller Test
ZRJFAO	(Parts 1 & 2)	
ZRJCAO	RP04/6/RM05	Head Alignment Verifications
VAX		
EVRCA	VAX DCL/RP0X Repair Diagnostic	

used in a standard DEC MASSBUS interface. Intelligent, high performance features on the AMS disk drive preclude the exact circuit emulation of a DEC MASSBUS interface. The fact that the AMS interface is all contained on a single board make these diagnostics unnecessary. If there is any malfunction in the AMS MASSBUS interface, the single printed circuit board should be replaced. Since the AMS disk drive is a single controller Winchester disk, the Dual Controller Test and the Head Alignment Verifications are also unnecessary. Only removable pack disk drives require head alignment.

Other online disk utilities such as the BACKUP and the DISK SAVE AND COMPRESS utilities can be run with the AMS disk drive in either the RELOCATE or STATIC mode.

TROUBLESHOOTING

If during operational checkout, problems are found that indicate the MASS BUS Enhancement PWB is at fault, check the items listed below to isolate the fault. In case the fault has been isolated to the drive, refer to the AMS 315 Installation and or Maintenance manual for troubleshooting procedures. The drive may be operated as a stand alone SMD disk drive on an exerciser.

1. Socketed components are a major cause of failures. Components are often jarred loose during shipment. Check all components for bent pins and reseat or replace components as necessary.

2. Check the revision letter of the enhancement PWB to determine if it is a "B" or "C" revision. The pin 1 positions of the buss and radial connectors are reversed. On the "B" revision PWB the red stripe (pin 1) of the buss and radial cables goes to the left side as you are looking at the rear of the drive and these cables have a twist in them. On the "C" revision PWB the buss and radial cables do not have a twist in them and the red stripe (pin 1) goes toward the right side as you are looking at the rear of the drive. Insure that the buss and radial cables are properly installed.

3. Check to insure that the MASS BUSS cables are installed properly on the enhancement PWB and are tight. Loose MASS BUSS cables can cause parity errors.

4. Insure that the ground jumper on the power supply goes to pin E6. If the ground is left on pin E5 as shipped it may cause Read/Write type errors when operated on the MASS BUSS.

5. Check the bottom of the enhancer PWB where it is installed to the metal board stiffeners to see if the star lockwashers or the stiffner itself is shorting to the PWB circuit etch.

6. Check the cable from the front panel to the enhancement PWB. The connector with the strain relief goes to the enhancement PWB and the red stripe goes toward the rear of the drive. At the front panel end, the red stripe goes toward the function switches.

7. Check the power cable to the enhancement PWB and insure that the wires are tight and installed properly. The wires go toward the front of the drive and the small phenolic board goes up (away from the PWB). The end with two black wires goes toward the right side of the drive when viewed from the rear of the drive.

8. If during the operational checkout the following errors are encountered:

   a. Checksum errors—check for mismatched firmware.

   b. Front panel ERROR/STEP LEDs go on and then all off during power up. Check the PROM in location 1H for bent or missing pins, replace if necessary.

   c. If all ERROR/STEP LEDs come on and stay on when powering up, check the PROMs in location 20K and 18H for bent or missing pins, replace if necessary.

   d. If the ERROR/STEP LEDs indicate an 02 when initially powering up the drive, check the EPROMs in location 6CI and 6C2 for bent or missing pins, replace if necessary.

   e. If the ERROR/STEP LEDs show an "F" when initially powering up the drive, this indicates a

CHECKSUM error, check the dash numbers of the PROMs to be sure they are correct.

f. If the drive sequences up immediately when initially turning AC power on before the START button is pushed, this indicates that the buss cable is reversed.

g. If a 62 function won't work (basic read test), this indicates that the radial cable is reversed.

9. After all above checks have been performed, return to Section 3, Table 3-5 and rerun function 62 using the front panel. Restore disk drive to system usage.

SECTION 5
SYSTEM INTERFACE CABLES

GENERAL

This section contains the recommended cable requirements for the AMS disk drive to the MASSBUS interface system. Problems, if any, found during unit receiving inspection must be corrected before proceeding further. If any adjustments or parts replacements are required to put the disk drive online, refer to the AMS Disk Drive Technical Manual for maintenance procedures.

WARNING

This product may not be in compliance with the FCC Class A computing device requirements if operated without the use of properly shielded cables.

CABLES AND CONNECTORS

The MASSBUS connection to the AMS disk drive can be accomplished using either flat ribbon or round cables. The AMS disk drive should be attached to the MASSBUS so that there is less than 100 feet (30 meters) between it and the MASSBUS controller located within the computer. Allowances should be made for the internal cabling of each drive on the MASSBUS. In the case of the AMS disk drive, this internal length is 2 feet (0.6 meters). If flat ribbon cable is used, be sure that it conforms to the 40 conductor standard with FCC approved shielding and is terminated with H855 type connectors at each end. These cables may be ordered with the disk drive or from other vendors such as Digital Equipment Corporation (part numbers BC06R-06/JX through BC06R-50/JX are different length options of a complete DEC cable). An optional flat-to-round MASSBUS cable transition bracket and round MASSBUS cables may be additionally ordered with the AMS disk drive. These options are useful when the disk drive is mounted within a cabinet that is separated from the computer cabinet. Round MASSBUS cables may also be ordered from Digital Equipment Corporation (BC062 series).

Cables of the required number and lengths to interconnect the disk drive, MASSBUS adapter and controller are frequently fabricated on site to match the physical arrangement of the system. Refer to Table 5-1 for pin number designations.

If the AMS disk drive is not to be mounted within the computer cabinet or one immediately adjacent and attached, then the following applies:

1. The MASSBUS cabling connections (A, B and C flat ribbon cables) may be fabricated to substitute for those shipped with the AMS disk drive. Longer flat ribbon cables may be fabricated with standard connectors. Ensure that the total length of the MASSBUS cables does not exceed 100 feet.

2. If the flat ribbon cables from the AMS disk drive must be laid between separated cabinets, they should be protected from foot traffic and other possible damage. These cables should be run under false floors, or a standard above-floor cable protector should be laid over the flat ribbon cables.

Wherever possible, use round MASSBUS cables between separated cabinets.

Finally, ensure that the last MASSBUS device in the string is properly terminated. If the last device is a DEC MASSBUS disk, it should have a DEC Terminator Pack Kit (7009938) on the MASSBUS OUT round cable connector. If the last device is a tape drive, it should either have a DEC Terminator Pack Kit (7009938) on its MASSBUS OUT round cable connector, or it should have the appropriate terminating resistors on its MASSBUS interface boards. If the AMS disk drive is the last MASSBUS device attached, use the DEC Terminator Pack Kit (7009938) supplied with the original MASSBUS disk subsystem. In all cases, the DEC Terminator Pack Kit (7009938) should be installed on the last MASSBUS OUT flat-to-round connector.

Figure 5-1 illustrates the MASSBUS signal line configuration. See Table 5-2 for description of signal lines.

TABLE 5-1. MASSBUS SIGNAL CABLE DESIGNATIONS

Cable	Pin*		Polarity	Designation
MASSBUS Cable A	A	1	−	MASS D00
	B	2	+	
	C	3	+	MASS D01
	D	4	−	
	E	5	−	MASS D02
	F	6	+	
	H	7	+	MASS D03
	J	8	−	
	K	9	−	MASS D04
	L	10	+	
	M	11	+	MASS D05
	N	12	−	
	P	13	−	MASS C00
	R	14	+	
	S	15	+	MASS C01
	T	16	−	
	U	17	−	MASS C02
	V	18	+	
	W	19	+	MASS C03
	X	20	−	
	Y	21	−	MASS C04
	Z	22	+	
	AA	23	+	MASS C05
	BB	24	−	
	CC	25	−	MASS SCLK
	DD	26	+	
	EE	27	+	MASS RS3
	FF	28	−	
	HH	29	+	MASS ATTN
	JJ	30	−	
	KK	31	−	MASS RS4
	LL	32	+	
	MM	33	−	MASS CTOD
	NN	34	+	
	PP	35	+	MASS WCLK
	RR	36	−	
	SS	37	+	MASS RUN
	TT	38	−	
	UU	39		SPARE
	VV	40		BND

*Alternate pin designation schemes

TABLE 5-1. MASSBUS SIGNAL CABLE DESIGNATIONS (Contiued)

Cable	Pin*		Polarity	Designation
MASSBUS Cable B	A	1	−	MASS D06
	B	2	+	
	C	3	+	MASS D07
	D	4	−	
	E	5	−	MASS D08
	F	6	+	
	H	7	+	MASS D09
	J	8	−	
	K	9	−	MASS D10
	L	10	+	
	M	11	+	MASS D11
	N	12	−	
	P	13	−	MASS C06
	R	14	+	
	S	15	+	MASS C07
	T	16	−	
	U	17	−	MASS C08
	V	18	+	
	W	19	+	MASS C09
	X	20	−	
	Y	21	−	MASS C10
	Z	22	+	
	AA	23	+	MASS C11
	BB	24	−	
	CC	25	−	MASS EXC
	DD	26	+	
	EE	27	+	MASS RS0
	FF	28	−	
	HH	29	+	MASS EBL
	JJ	30	−	
	KK	31	−	MASS RS1
	LL	32	+	
	MM	33	−	MASS RS2
	NN	34	+	
	PP	35	+	MASS INIT
	RR	36	−	
	SS	37	+	MASS SPI
	TT	38	−	
	UU	39		SPARE
	VV	40		GND

*Alternate pin designation schemes

TABLE 5-1. MASSBUS SIGNAL CABLE DESIGNATIONS (Continued)

Cable	Pin*		Polarity	Designation
MASSBUS Cable C	A	1	−	MASS D12
	B	2	+	
	C	3	+	MASS D13
	D	4	−	
	E	5	−	MASS D14
	F	6	+	
	H	7	+	MASS D15
	J	8	−	
	K	9	−	MASS D16
	L	10	+	
	M	11	+	MASS D17
	N	12	−	
	P	13	−	MASS DPA
	R	14	+	
	S	15	+	MASS C12
	T	16	−	
	U	17	−	MASS C13
	V	18	+	
	W	19	+	MASS C14
	X	20	−	
	Y	21	−	MASS C15
	Z	22	+	
	AA	23	+	MASS CPA
	BB	24	−	
	CC	25	−	MASS OCC
	DD	26	+	
	EE	27	+	MASS DS0
	FF	28	−	
	HH	29	+	MASS TRA
	JJ	30	−	
	KK	31	−	MASS DS1
	LL	32	+	
	MM	33	−	MASS DS2
	NN	34	+	
	PP	35	+	MASS DEM
	RR	36	−	
	SS	37	+	MASS SP2
	TT	38	−	
	UU	39	H	MASS FAIL
	VV	40		GND

*Alternate pin designation schemes

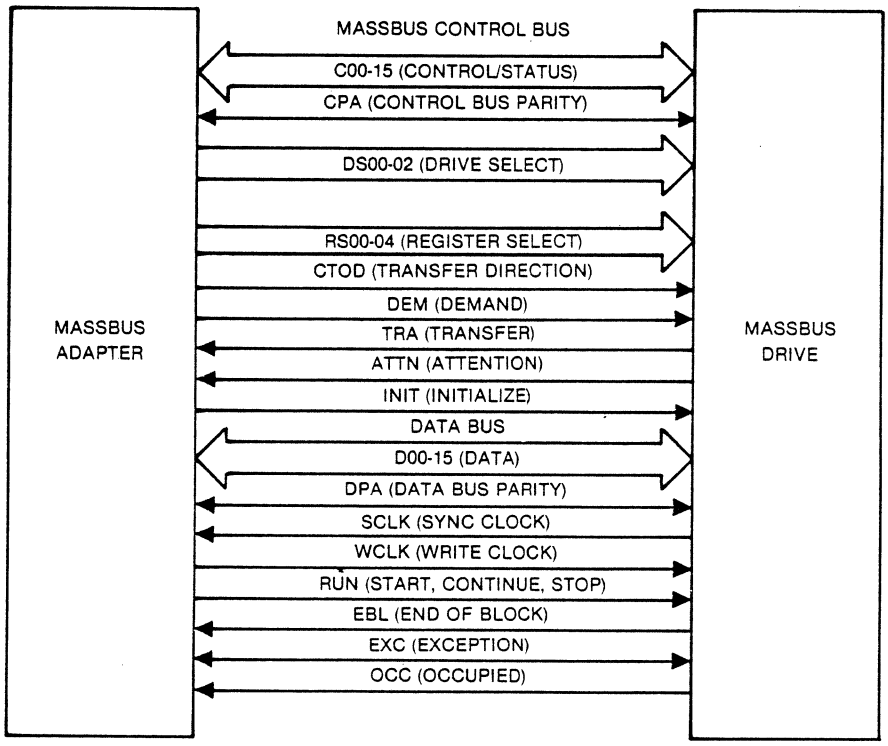


Figure 5-1. MASSBUS Signal Line Configuration

TABLE 5-2. MASSBUS LINE DESCRIPTIONS

SIGNAL LINE	DESCRIPTION
CONTROL BUS	
Control and Status (C00-15)	Transfers 16 parallel control or status bits to or from the drive.
Control Bus Parity (CPA)	Transfers odd control bus parity to or from the drive. Parity is simultaneously transferred with control bus data.
Drive Select (DS0-2)	Transfers a 3-bit binary code from the MBA to select a controller. The drive responds when the (unit) select switch in the controller corresponds to the transmitted binary code.
Register Select (RS0-4)	Transfers a 5-bit binary code from the MBA to select a particular drive register.
Controller to Drive (CTOD)	Indicates in which direction information is to be transferred on the control bus. For a controller-to-drive transfer, the MBA asserts CTOD; for a drive-to-controller transfer, the MBA negates CTOD.
Demand (DEM)	Asserted by the MBA to indicate a transfer is to take place on the control bus. For a controller-to-drive transfer, DEM is asserted by the MBA when data is present. For a drive-to-controller transfer, DEM is asserted by the MBA to request data and is negated when the data has been strobed from the control bus. In both cases, the RS, DS, and CTOD lines are asserted and allowed to settle before assertion of DEM.
Transfer (TRA)	Asserted by the drive in response to DEM. For a controller-to-drive transfer, TRA is asserted when the data is strobed and negated when DEM is removed. For a drive-to-controller transfer, TRA is asserted when the data is asserted on the bus and negated when the negation of DEM is received.
Attention (ATTN)	The drive asserts this line to signal the MBA of any change in drive status or an abnormal condition. ATTN is asserted any time a drive's ATA status bit is set. ATTN is common to all drives and may be asserted by more than one drive at a time.
Initialize (INIT)	Asserted by the MBA to initialize all drives on the bus. This signal is transmitted whenever the MBA receives an initialize command.
Fail (FAIL)	When asserted, this line indicates a power fail condition has occurred in the MBA or the MBA is in maintenance mode.
DATA BUS	
Data (D00-15)	These bidirectional lines transer 16 parallel data bits between the MBA and drives.
Data Bus Parity (DPA)	Transfers an odd parity bit to or from the drive. Parity is simultaneously transferred with bits on the data bus.
Sync Clock (SCLK)	Asserted by the drive during a read operation to indicate when data on the data bus is to be strobed by the MBA. During a write operation SCLK is asserted to the MBA to indicate the rate at which data would be presented by the MBA on the data bus.
Write Clock (WCLK)	Asserted by the MBA to indicate when data written to the drive is to be strobed.
Run (RUN)	Asserted by the MBA to initiate data transfer command execution. During a data transfer, the drive samples RUN at the end of each sector. If RUN is still asserted, the drive continues the transfer into the next sector; if RUN is negated, the drive terminates the transfer.
End-of-Block (EBL)	Asserted by the drive at the end of each sector. For certain error conditions where it is necessary to terminate operations immediately. EBL is asserted prior to the normal time. In this case, the transfer is terminated prior to the end of the sector.
Exception (EXC)	Asserted by the drive or MBA to indicate an error condition during a data transfer command. EXC remains asserted until the trailing edge of the last EBL pulse.
Occupied (OCC)	Indicates acceptance of a valid data transfer command.

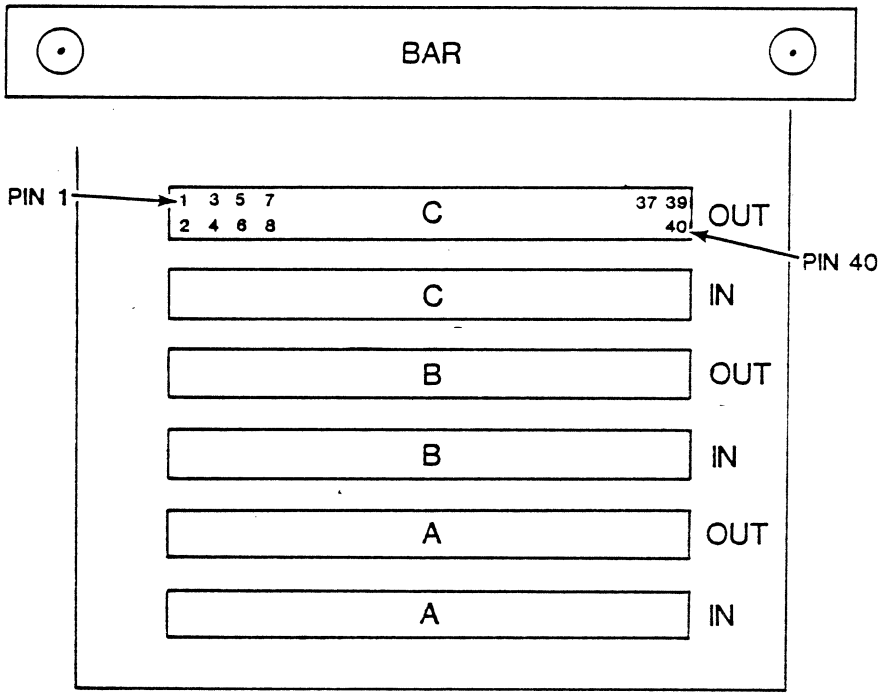
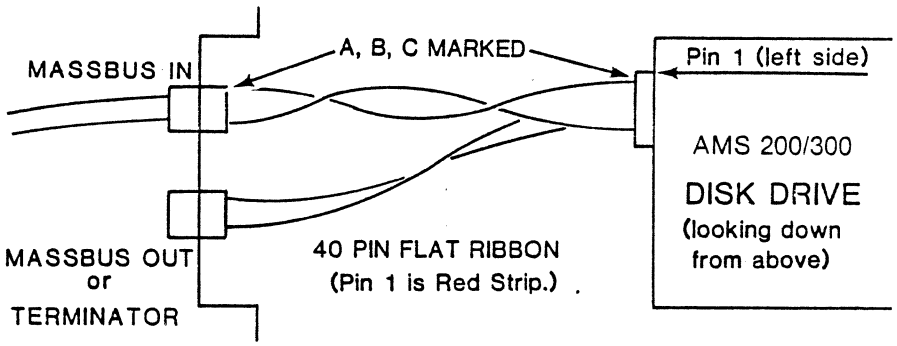


Figure 5-2. AMS 200/300 Disk Drive MASSBUS Connector (rear of drive)



USING OPTIONAL FLAT RIBBON TERMINATOR

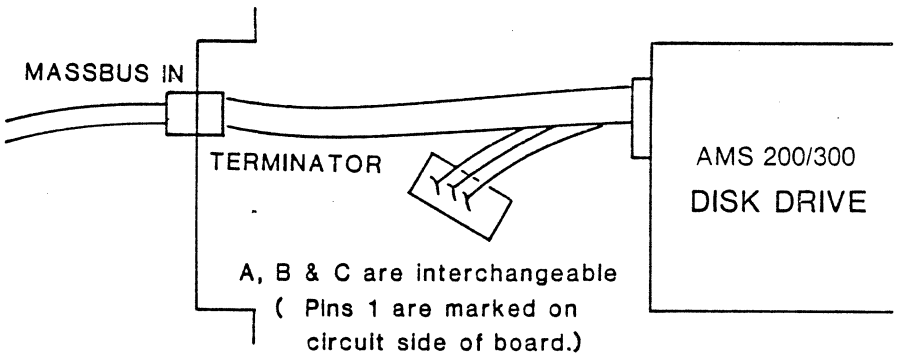


Figure 5-3. MASSBUS to Disk Drive Cabling Diagram

SECTION 6
DISK DRIVE CABINET

GENERAL

This section provides information concerning a custom designed, metal fabricated cabinet. This cabinet is a DEC look-a-like capable of mounting four AMS disk drives within the enclosure. A cabinet rear extension with room for cables and passive dual access switch contains a locking rear door and air filter screen.

CABINET ORDERING INFORMATION

The disk drive cabinet may be ordered from Century Data Systems (CDS) under Part Number 28415-XXX. (See Table 6-1.) The cabinets are completely assembled and cabled in accordance with the customer order; that is, equipped with double rail slide assemblies (Figure 6-1) for four disk drive units, cabling to match, signal distribution PWB's, and Transition Assembly. The disk drive units are installed into the cabinet on the user site.

Order Procedure

Delivery time for special accessories (such as cabinets) should be arranged through your contacts administrator. Normal delivery on most disk drive accessories is 60-90 days afer receipt of purchase order. Contact your contracts administrator for current delivery times and prices.

Before ordering: check the part number and description as shown in this section to be sure you have copied them correctly. Disk drive special tools and exercisers are not listed in this section but are offered for sale. Contact CDS for prices and availability.

SPARE PARTS ORDERING INFORMATION

Users of Century Data Systems disk drives should maintain an adequate supply of spare parts to maintain all the

TABLE 6-1. FOUR HIGH CABINET

Part Number	Dash No.	Panel Quantity
28415-XXX		
BLANK PANEL	—XX1	1
	—XX2	2
	—XX3	3
	—XX4	0
TYPE OF TRANSITION ASSY	—X1X—SWITCH, SHIELDED, MASS BUS OUT	
	—X2X—SWITCH, SHIELDED, SWITCHED BUS OUT	
	—X3X—SWITCH, MASS BUS OUT	
	—X4X—SWITCH, SWITCH BUS OUT	
	—X5X—NO SWITCH, SHIELDED, MASS BUS OUT	
	—X6X—NO SWITCH, SHIELDED, SIG. DIST. BUS OUT	
	—X7X—NO SWITCH, MASS BUS OUT	
	—X8X—NO SWITCH, SIG. DIST. BUS OUT	
① Color		

① First digit of dash no. designates color configuration as defined by customer sales order.

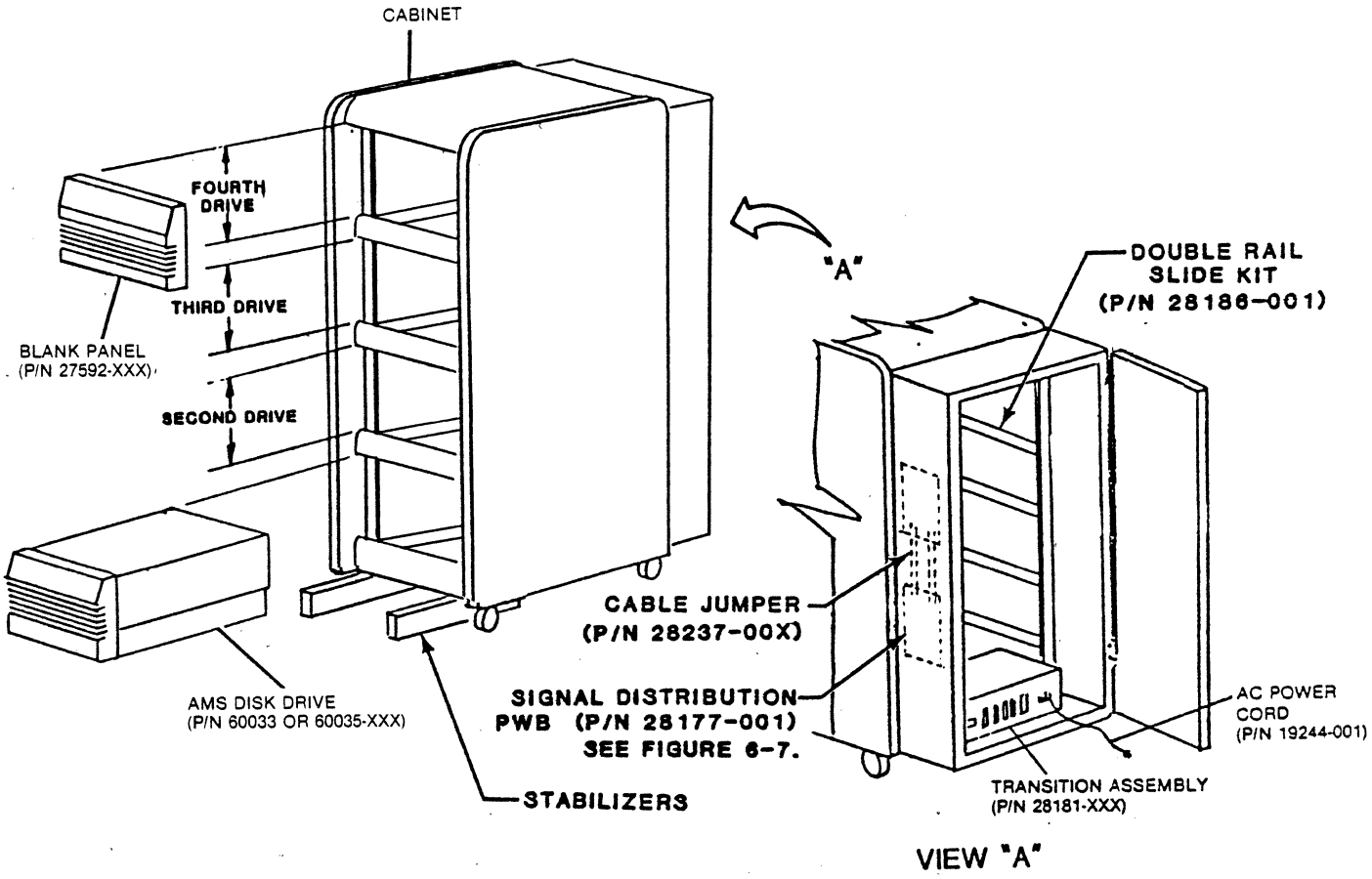


Figure 6-1. AMS Disk Drive Cabinet Assembly

drives in use. Ordering adequate supplies with sufficient lead time will minimize parts shortages and insure a minimum of system down-time. Delivery time is normally 60-90 days after receipt of purchase order. However, delivery on some parts may require a longer time. Contact your contracts administrator for current delivery times.

Emergency (Priority A) orders for spares may be requested by a user, Century Data Systems will try to ship a Priority A order within one working day after receipt of the emergency order. A minimum spare parts order value, including (Priority A) orders is in effect by Century Data Systems. Orders for parts in less amounts will be adjusted to the minimum order value and billed accordingly. Refer to your contracts administrator for further information concerning emergency and minimum parts ordering.

Order Procedure

Before ordering; verify that the needed part is offered for sale by Century Data Systems. Many small parts are not for sale by Century Data Systems but may be obtained from a local vendor. The part needed may be a component or a lower level subassembly that is not available as a replacement part. In this case it is necessary to order a higher level assembly.

Options and accessories including cables and terminators are not listed but are offered for sale. Contact Century Data Systems for prices and availability.

If you have any questions determining the correct part to order, contact your contracts administrator. Give him the model number, serial number of equipment and part number and description of the needed part.

1. To place orders:

   To order parts, send a purchase order or contact your Century Data Systems sales representative or your contracts administrator at

   CENTURY DATA SYSTEMS, INC.
   1270 North Kraemer Blvd.
   Anaheim, California 92806
   714/632-7500

TABLE 6-2. CABINET SLIDE MOUNTING KIT (P/N 28186-001)

Item	Part Number	Description	Qty Per Drive
1	27310-001	Slide, LH	1
2	27310-002	Slide, RH	1
3	28187-001	J-Bar, LH	1
4	28187-002	J-Bar, RH	1
5	27213-001	Stop, Rear, LH	1
6	27213-002	Stop, Rear, RH	1
7	90449-027	Screw, Socket HD	16
8	96619-204	Screw, 100° C&K	4
9	24661-304	Screw, Pan HD	4

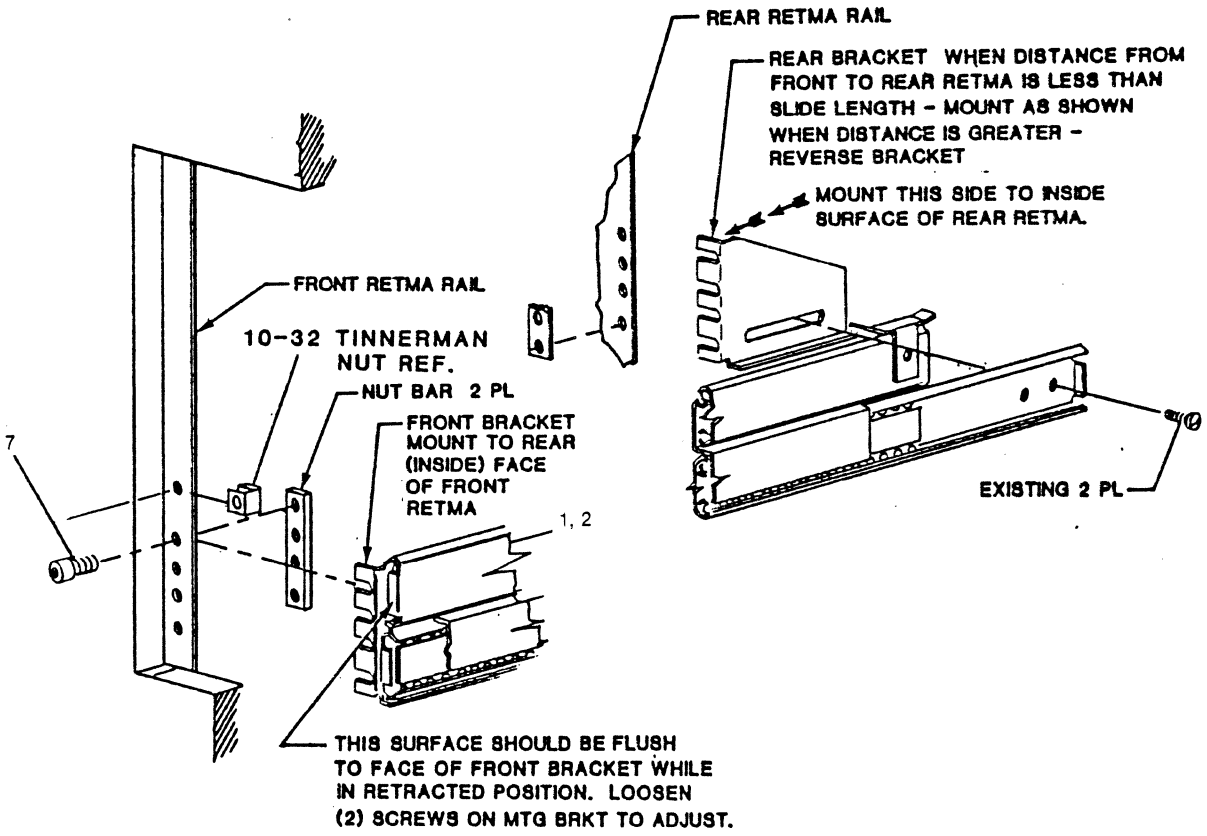


Figure 6-2. Double Rail Slide Installation (LH shown)

2. Specify the following:

   Quantity
   Part Number
   Description
   Purchase Order Number
   Desired delivery schedule
   Delivery address
   Address for invoices
   Special shipping instructions, if any
   Tax exemption number for state to which parts are to be shipped if sale is to be non-taxable.

   Orders can be placed by phone, telex or fascimile but must be followed by a hard copy purchase order.

3. Shipping

   All shipping charges, both to and from Century Data Systems, shall be borne by the customer, including parts under the Replacement/Exchange Program not covered under warranty.

DISK DRIVE INSTALLATION (See Figure 6-3)

1. Open cabinet rear door using key provided.

2. Extend front cabinet stabilizers when installing or removing disk drives.

3. Extend disk drive slides LH and RH fully till latched in open position.

WARNING

Disk drive units are heavy and must be handled with great care. Provide two men for the next step.

4. Lift the disk drive (bottom drive first) and install between track rails, slide to the rear of the cabinet until the slots (Figure 6-3) at rear of drive engage tabs on hold down bracket.

CAUTION

Do not allow full weight of drive on slides till drive slot and tabs are engaged, as load rating on slides could be exceeded, or cabinet could also tip forward.

5. Install four screws (8-32 × ¼ lg), two each side to secure the disk drive in place. (See Figure 6-4B.) Last refer to Figure 6-4 and install rear latch P/N 28291-001 to each drawer J-bar.

6. Connect cables at rear of drive as necessary. Close and lock rear door.

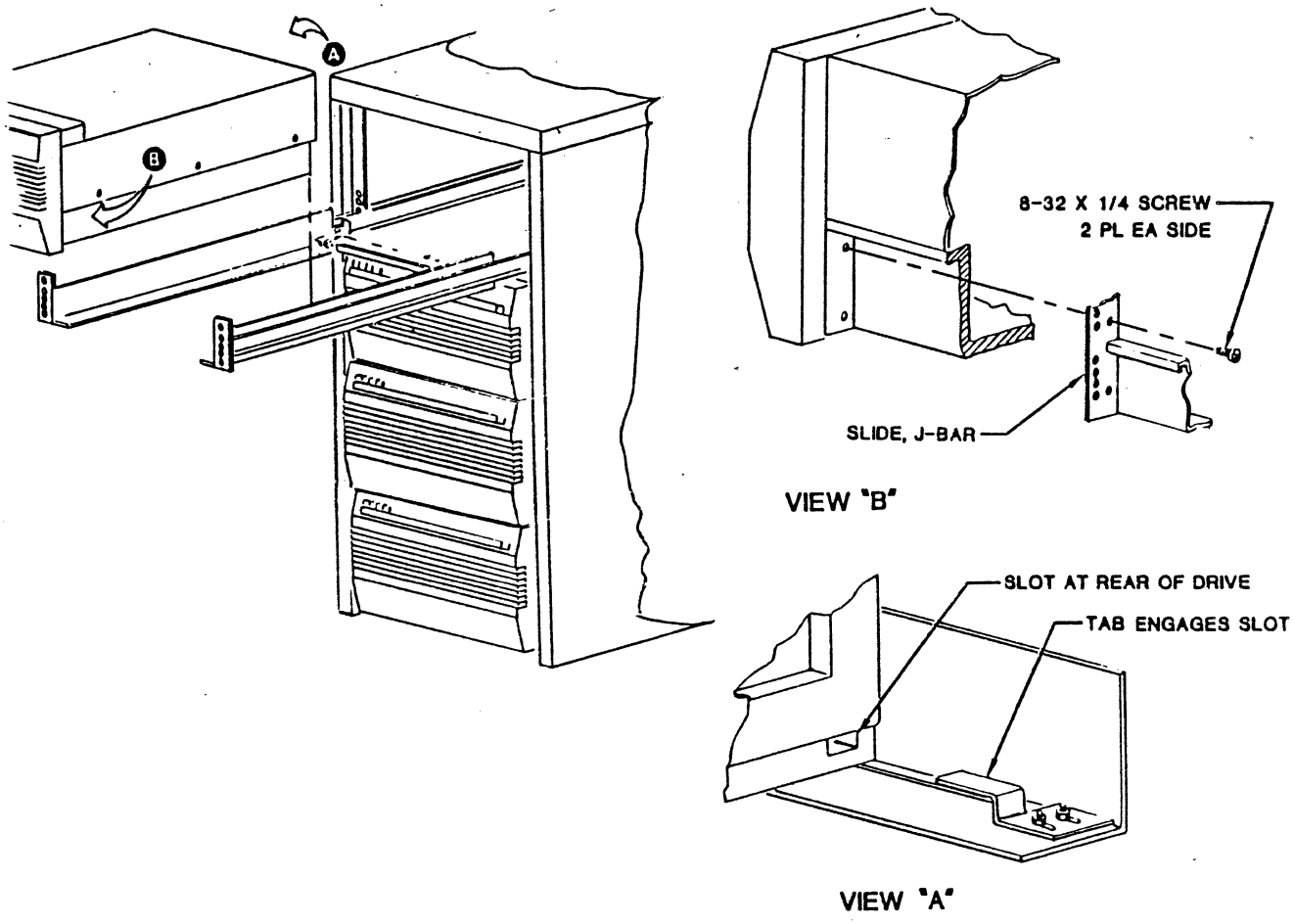


Figure 6-3. J-Bar Installation (LH shown)

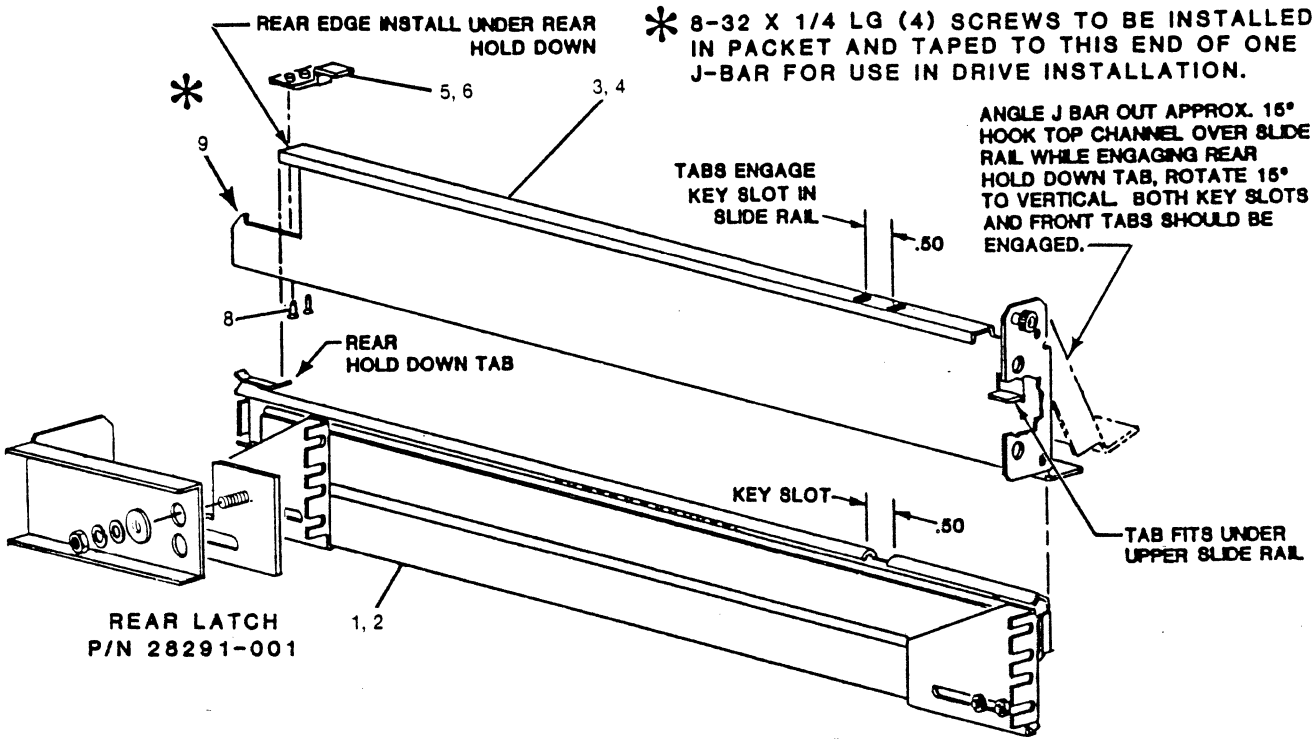


Figure 6-4. Disk Drive Installation

PASSIVE DUAL ACCESS (See Figure 6-5)

The 4 HI cabinet contains a transition box that enables, by means of a mechanical switch located on the front of the transition box to connect the cabinets AMS 200/300 Disk Drives to one of two systems (CPUs). The purpose of this switch is to provide a means by which systems may be quickly and easily reconfigured. Individual disk drive strings may be switched from one CPU to another by operating the transition box dual access switch. In addition entire disk drive groups of strings may be switched in the event of system failure. The D/A switch contains a red and green LED light. When the switch is operated to the left, a green light will illuminate indicating that the disk drives are connected to the A system (CPU). If the D/A switch is operated to the right, a red LED light will illuminate indicating the disk drives are connected to the B system. All disk drives must be sequenced down before changing A or B access switches. A transition box without a switch (see Figure 6-6) is used in place of the transition box when dual CPUs are not in use. The transition box contains three PWBs, (see Figure 6-8) each with a group of relays that are activated when the D/A switch is moved in either the A or B position. The relays are latched in the position selected, and in the event of a power failure will retain the position they were in last. The transition box also contains a 5V power supply to operate the relays. Refer to Section 7 for schematic and wiring diagrams.

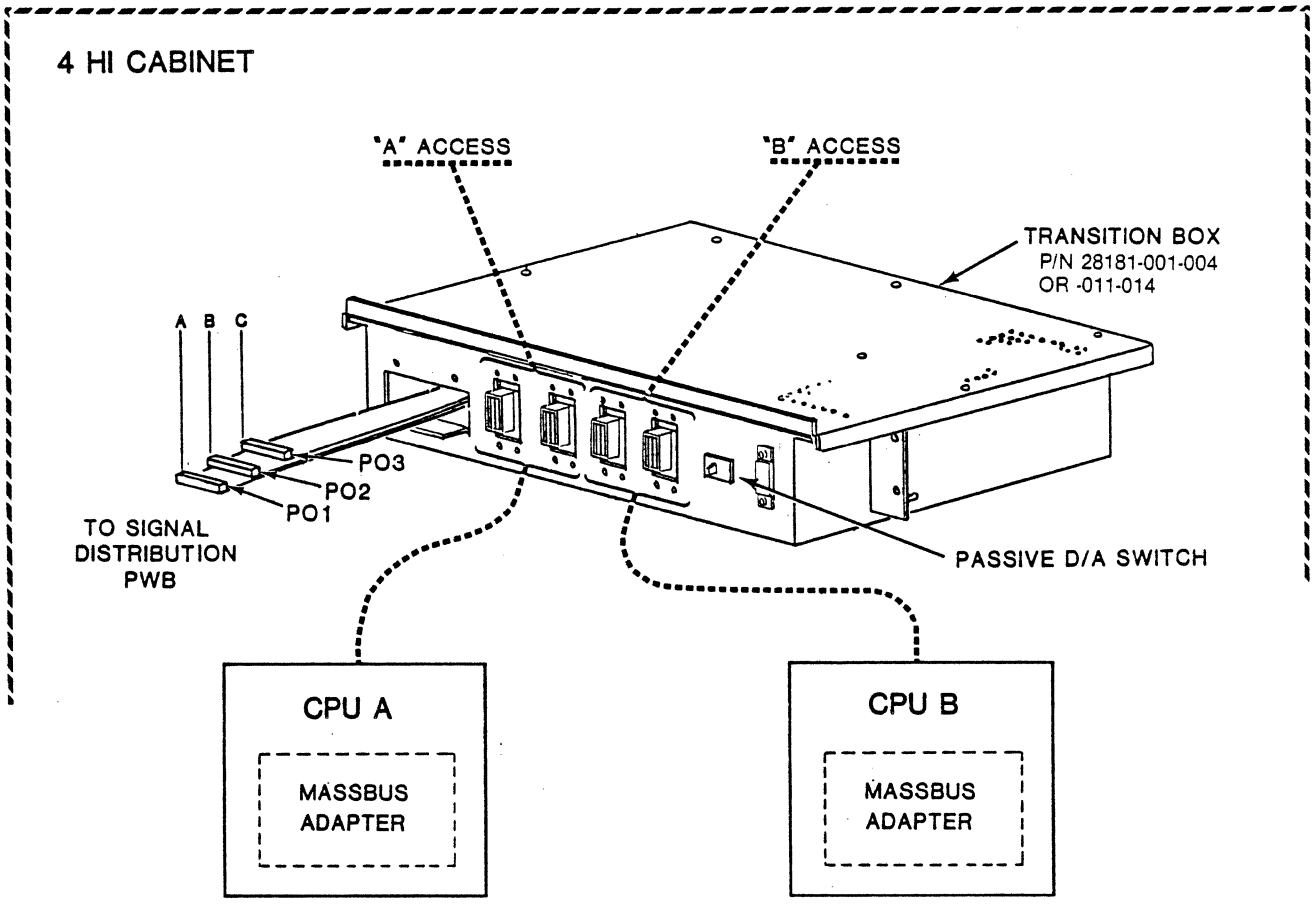


Figure 6-5. Passive Dual Access Cabling Diagram

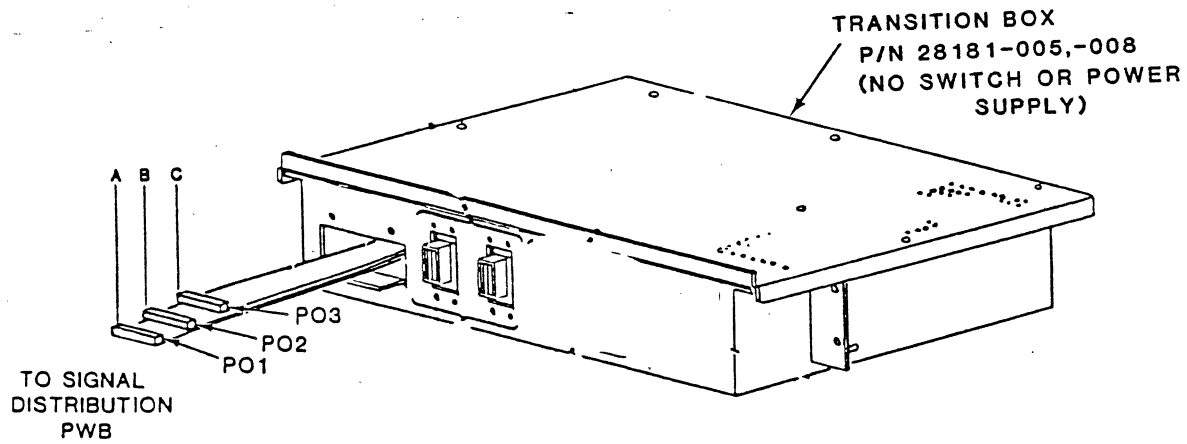


Figure 6-6. Connector Panel Assembly (Used in place of Transition Box)

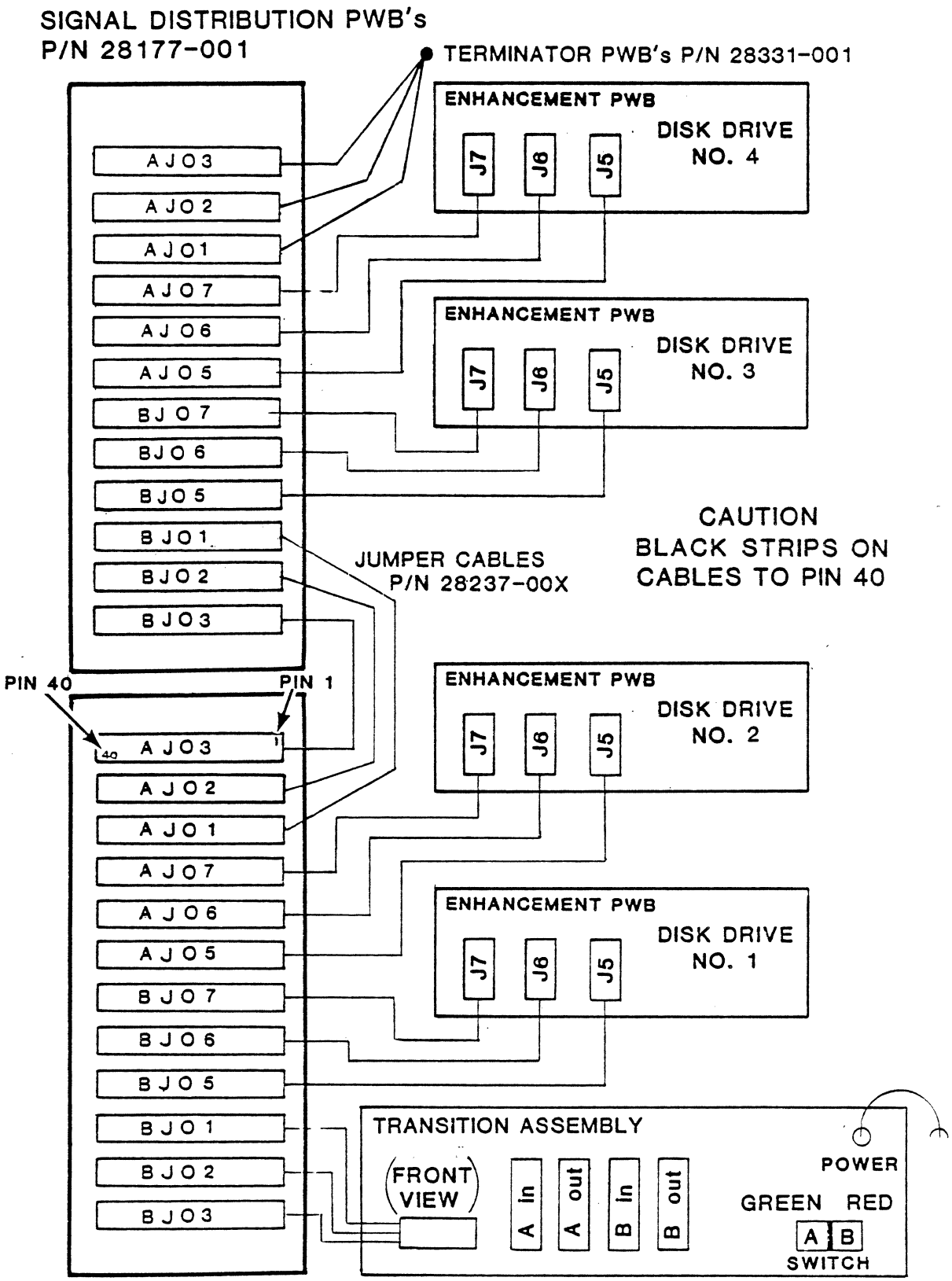


Figure 6-7. Distribution PWB's Cabling Diagram

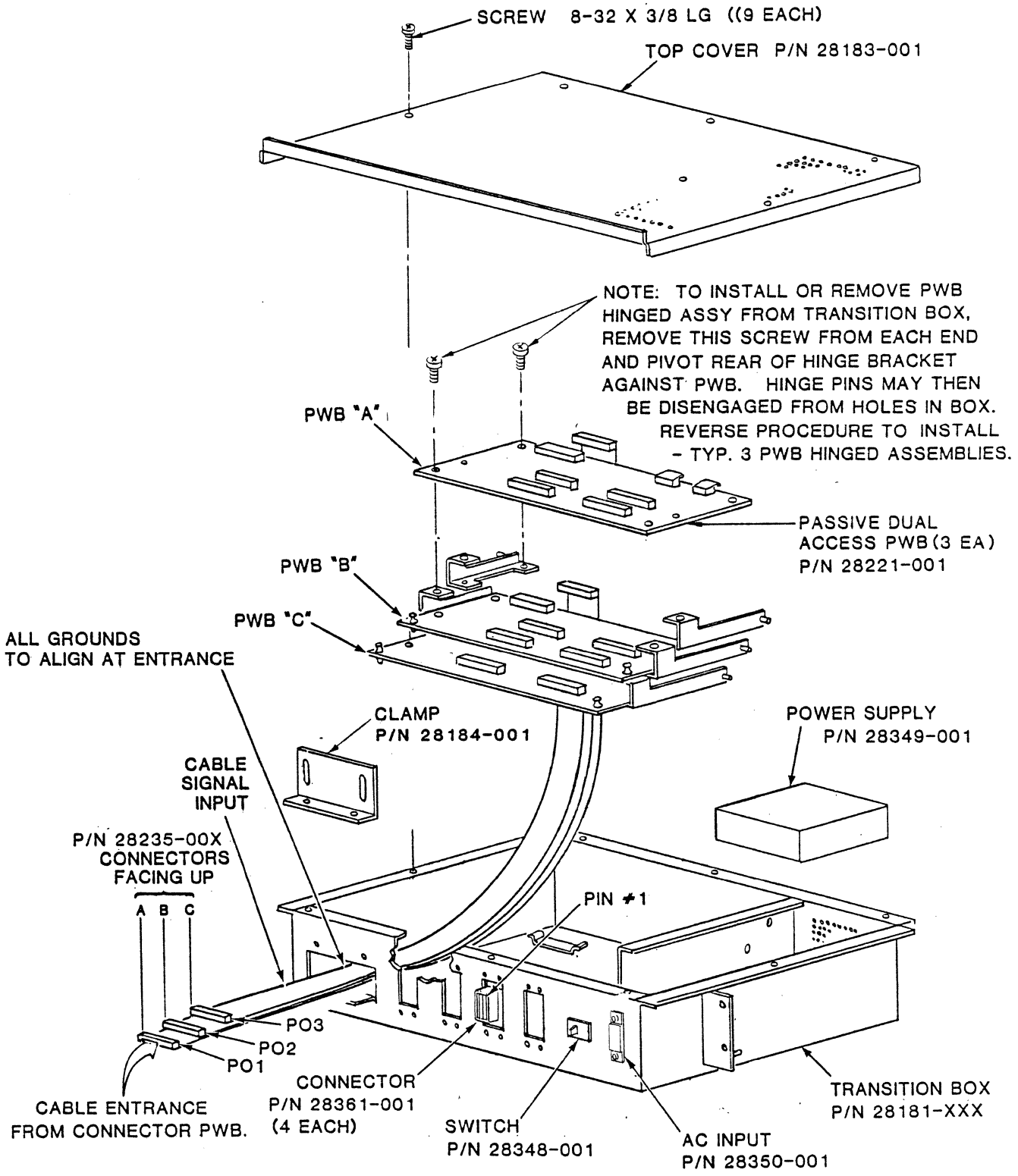


Figure 6-8. Transition Assembly (Exploded View)

SECTION 7
MAINTENANCE DIAGRAMS

This section contains the PWB schematic and wiring diagrams that are unique to the AMS 200/300 Disk Drive and the 4 HI cabinet. All other wiring and schematic diagrams will be found in the AMS 315/513 Maintenance Diagrams Manual P/N 76237-70X.

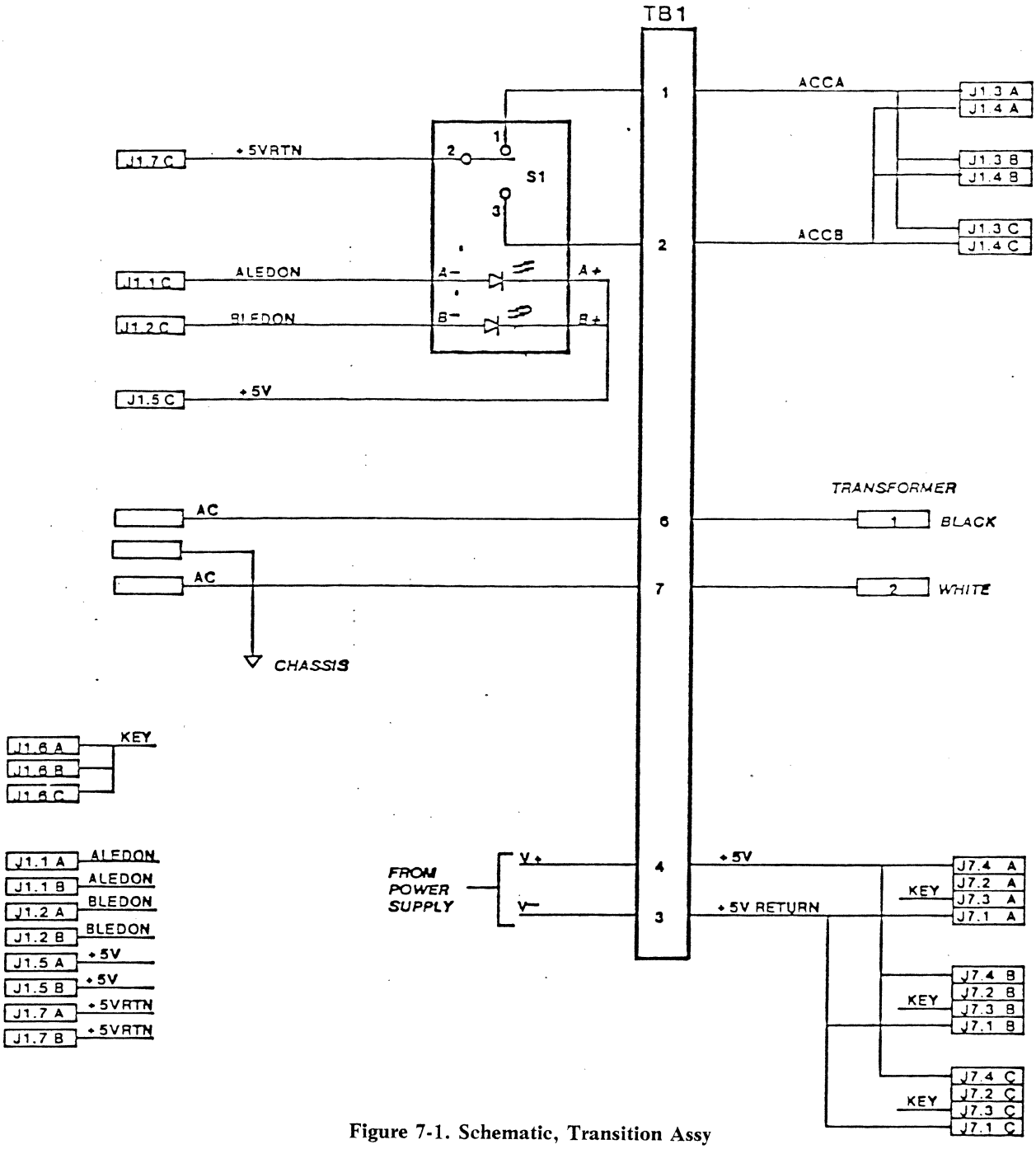


Figure 7-1. Schematic, Transition Assy

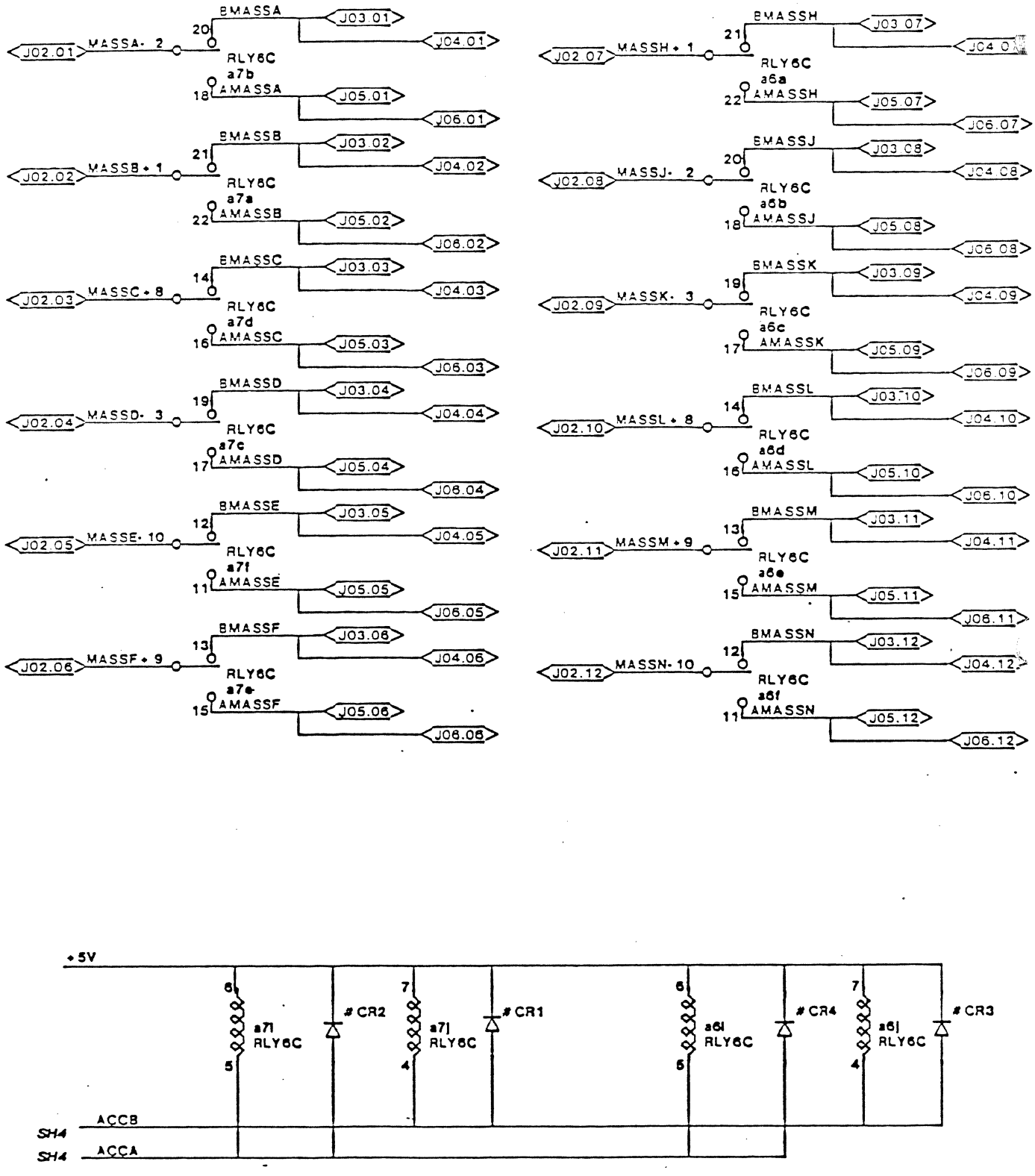
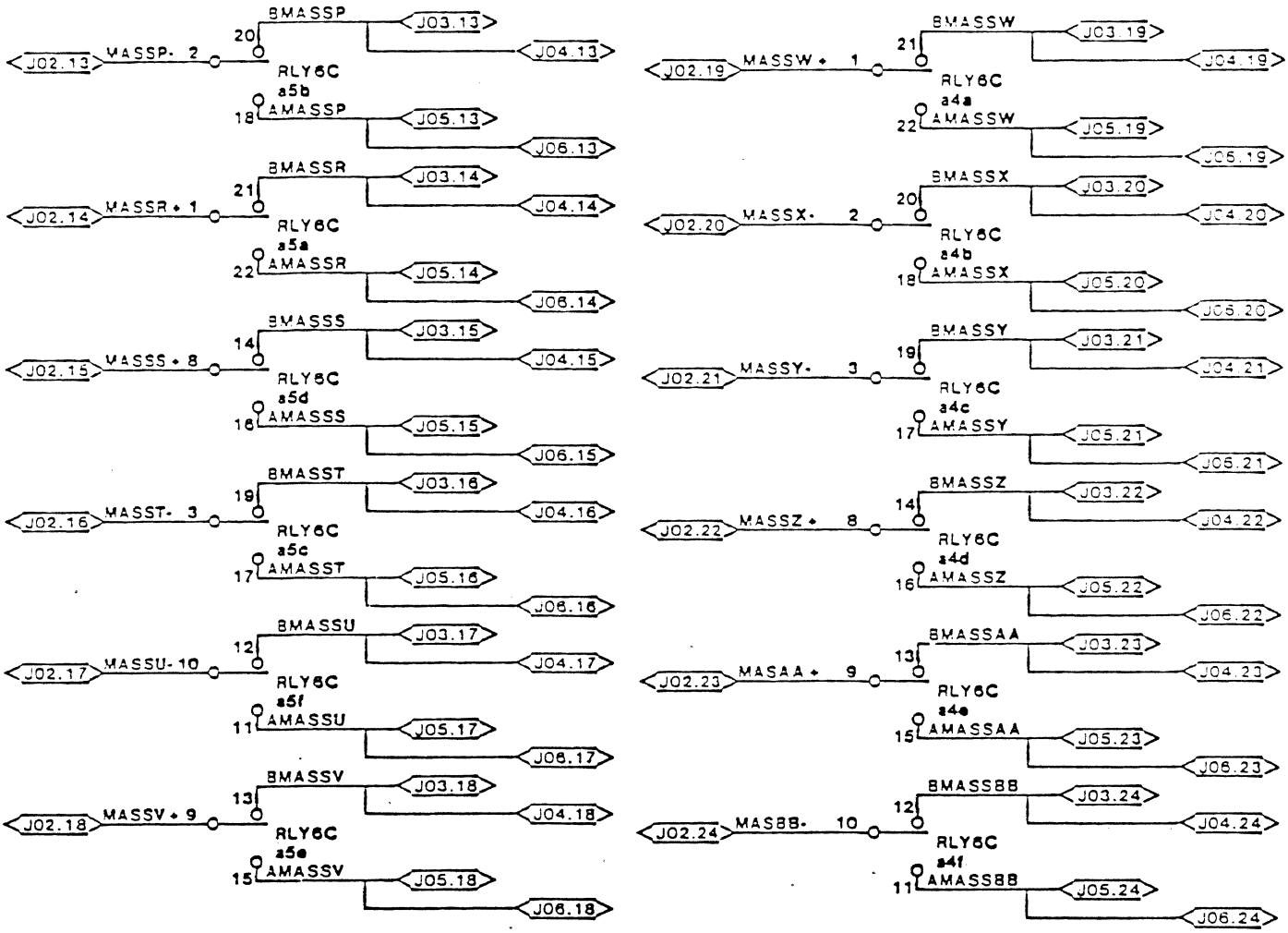


Figure 7-2. Passive D/A Board Schematic (Sheet 1 of 4)



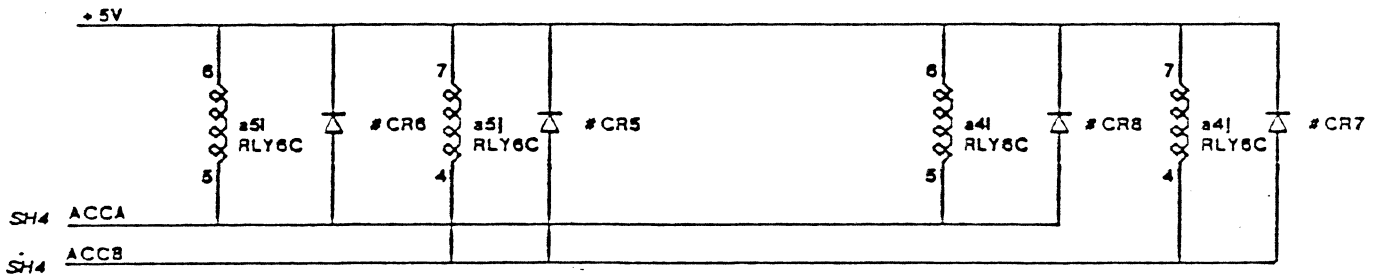


Figure 7-3. Passive D/A Board Schematic (Sheet 2 of 4)

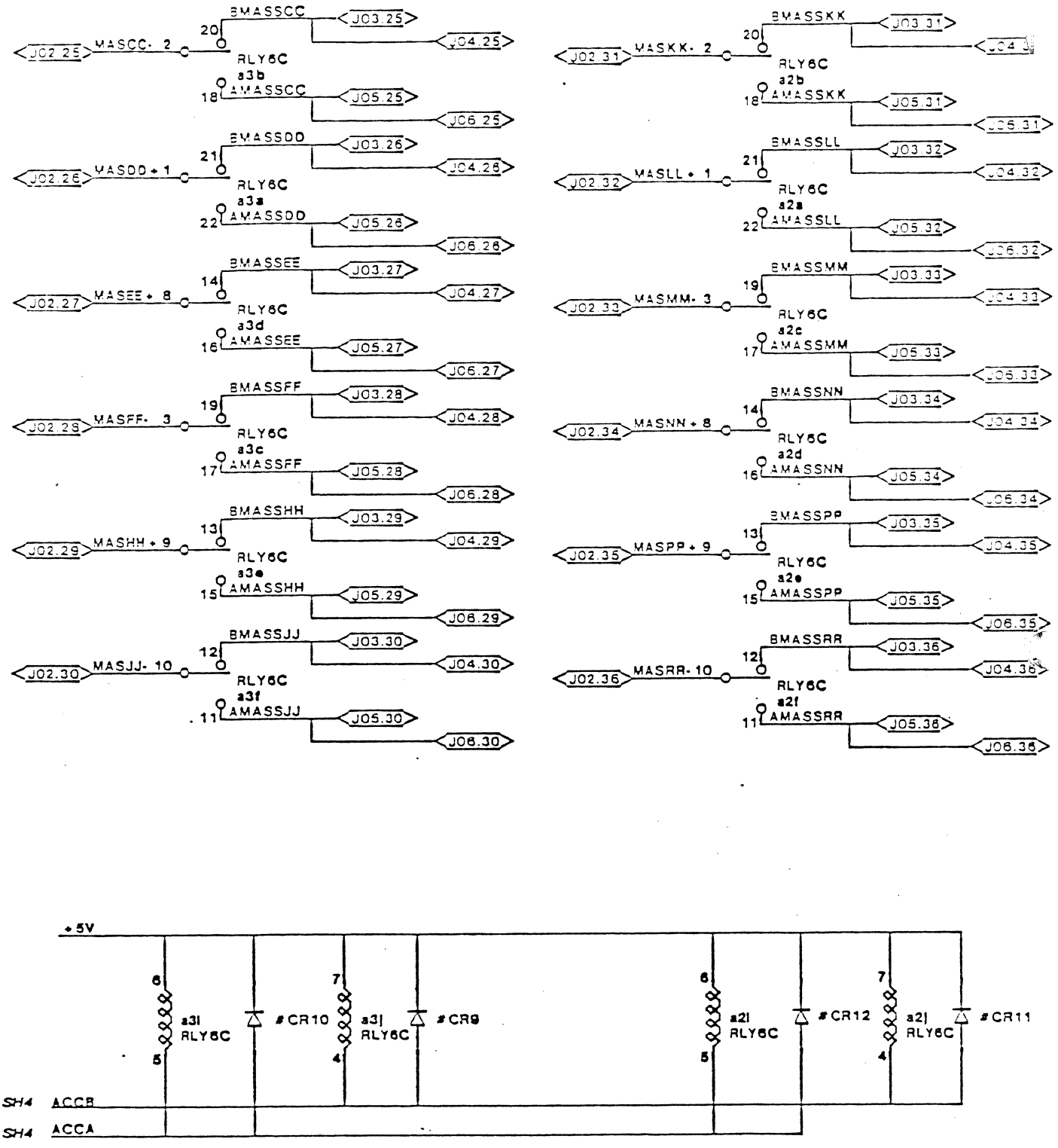
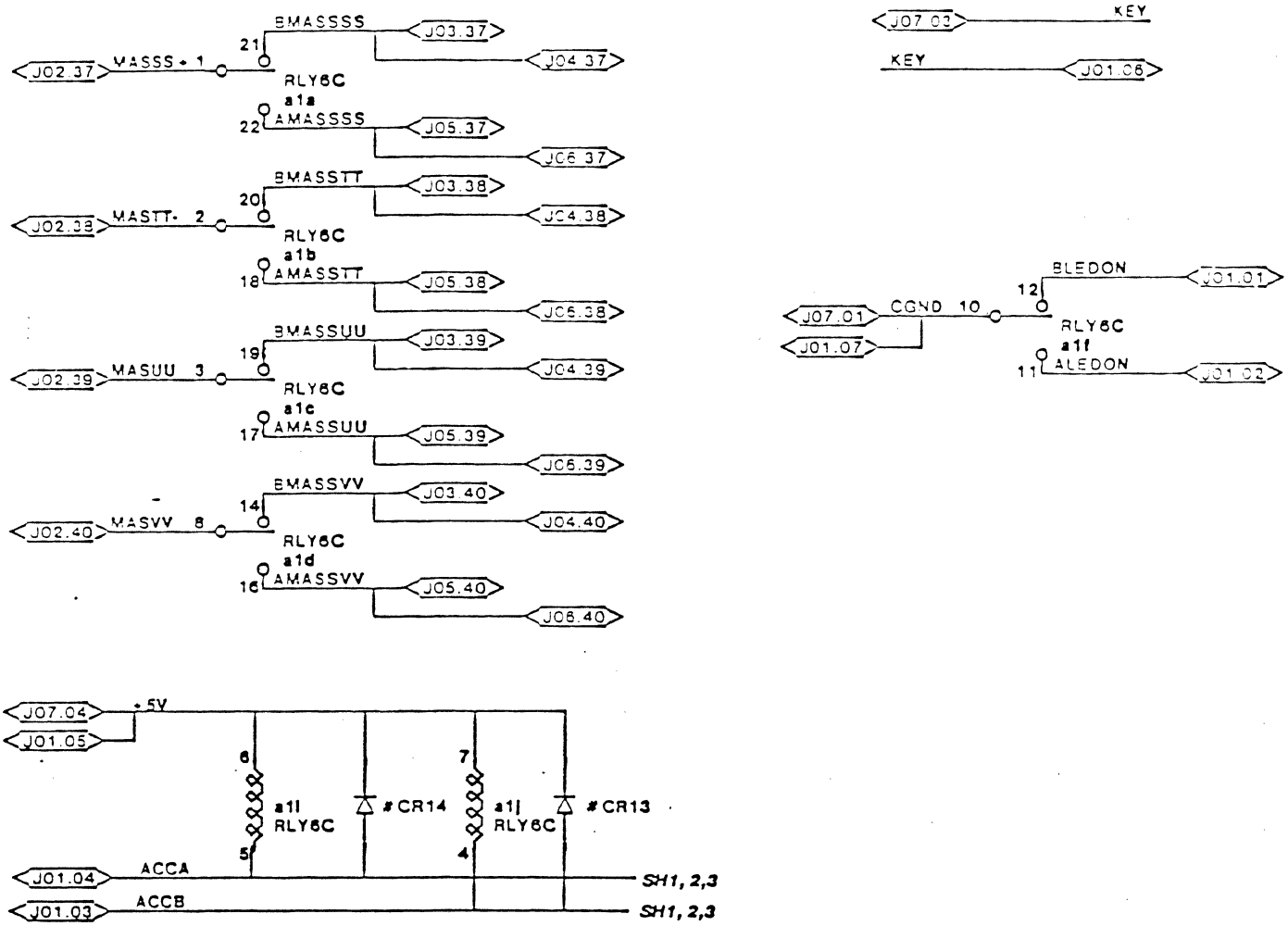
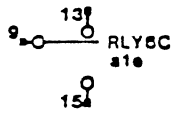


Figure 7-4. Passive D/A Board Schematic (Sheet 3 of 4)

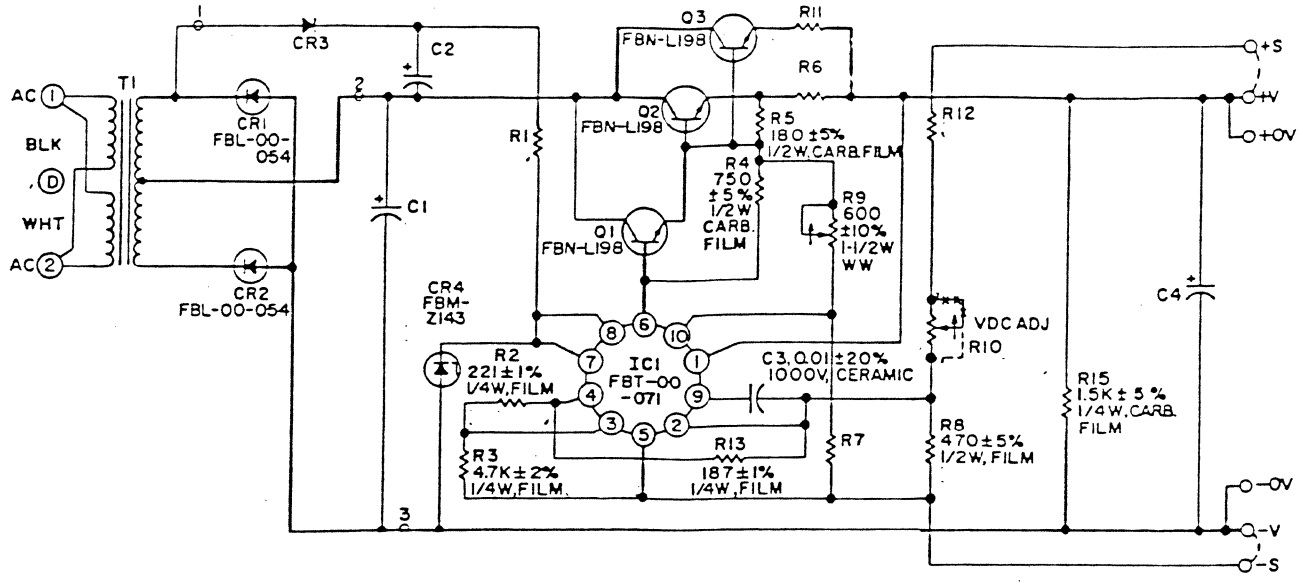


SPARES



REF DES LAST USED	REF DES NOT USED
CR14 a7 J07	

Figure 7-5. Passive D/A Board Schematic (Sheet 4 of 4)



Models	Schematic Components								
	C1	C2	C4	R1	R6	R7	R10	R11	R12
LOS-X-5	-10+100% ELECT 34,000 mf 15 vdc	-10+75% ELECT 47 mf 35 vdc	-10+75% ELECT 470 mf 16 vdc	CARB. FILM. 200 ±5%, ½W	±5% WW 0.10 3W	5% ½W CARB. FILM 2.2K	±10% 1½W WW 1.2K	±5% WW 0.10 3W	¼W FILM Jumper

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE		
		40°C	50°C	60°C
LOS-X-5	5 ± 5%	9.0	7.6	6.2

Figure 7-6. Transition Assembly Power Supply Schematic

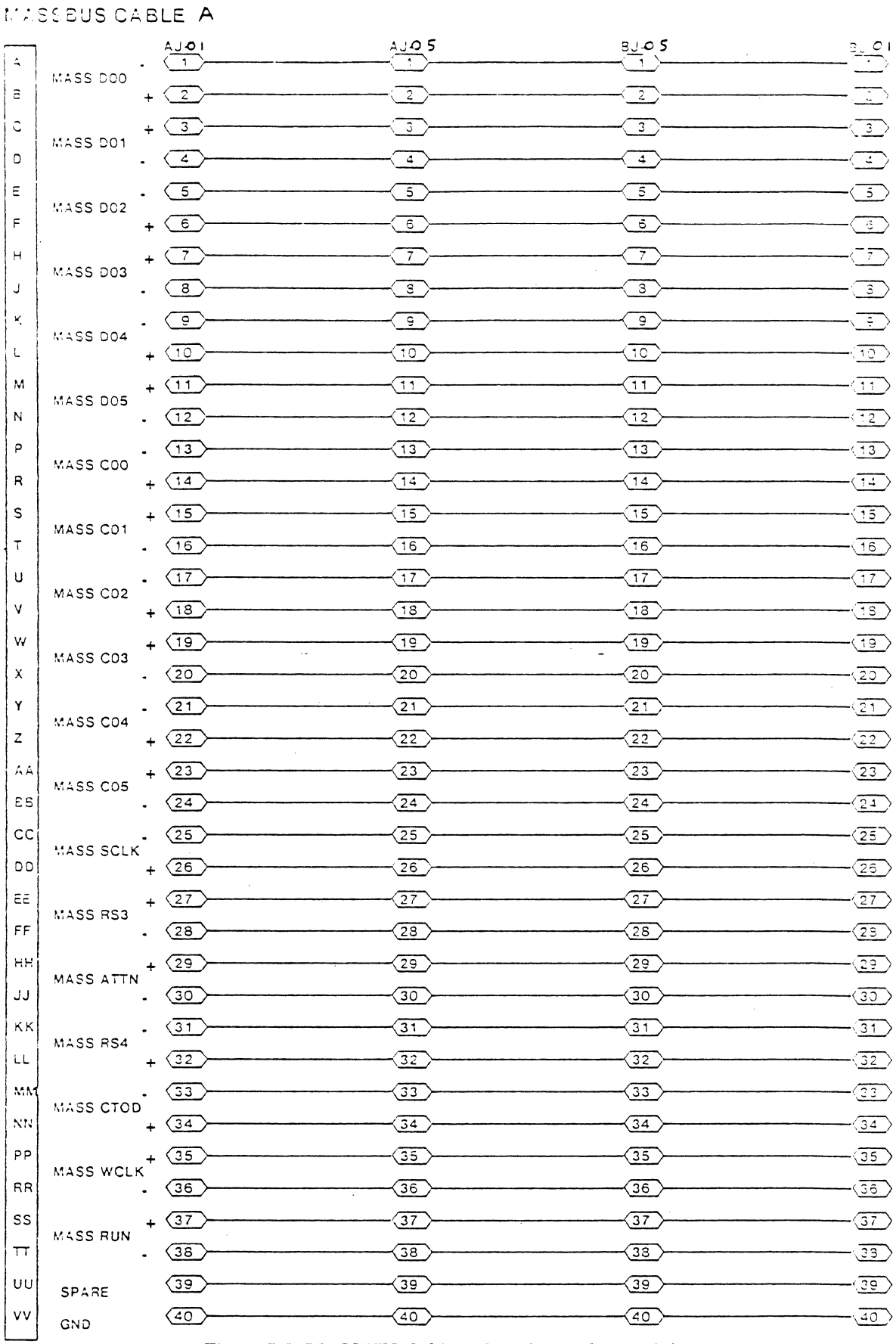


Figure 7-7. MASSBUS Cable A Signal Distribution Schematic

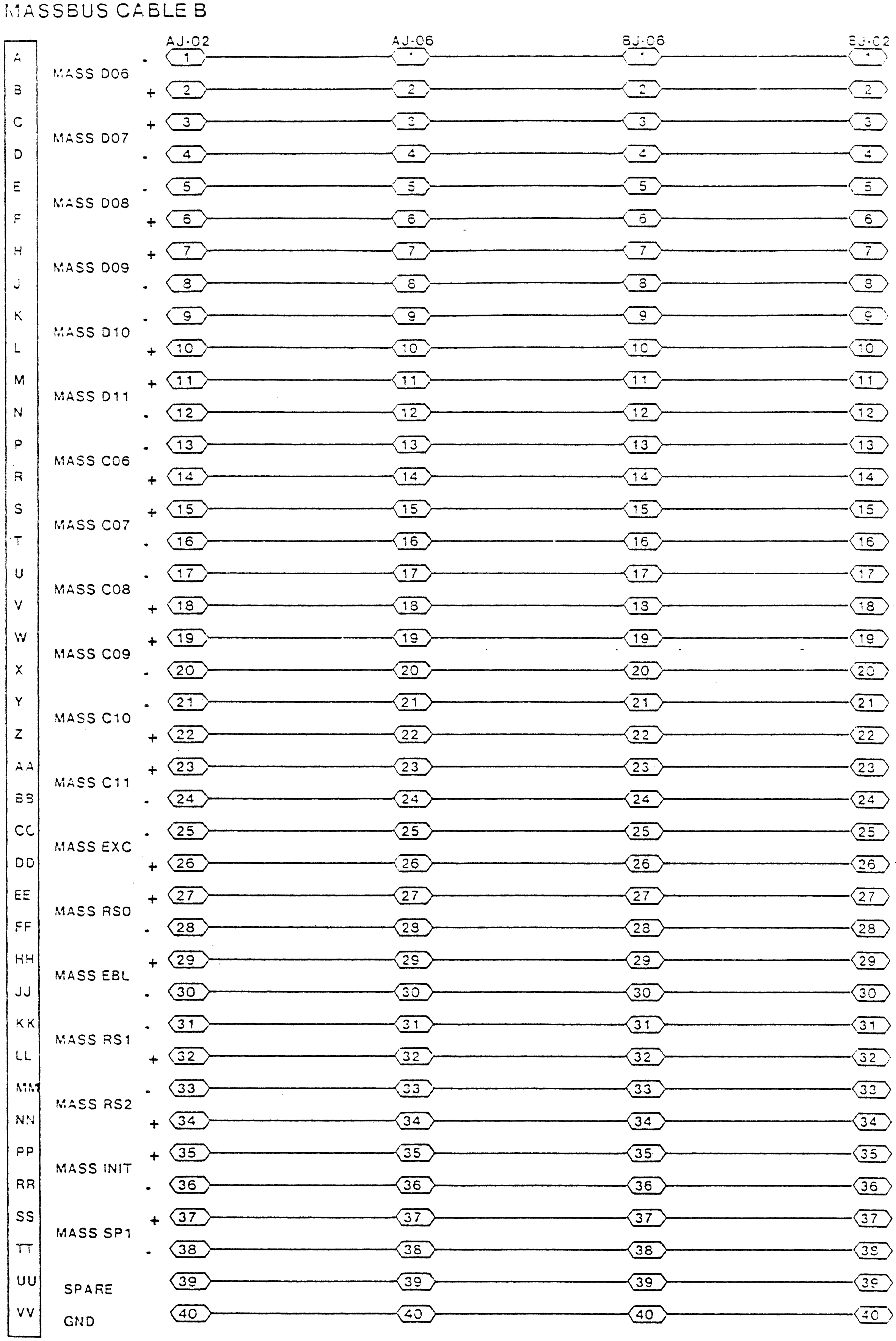


Figure 7-8. MASSBUS Cable B Signal Distribution Schematic

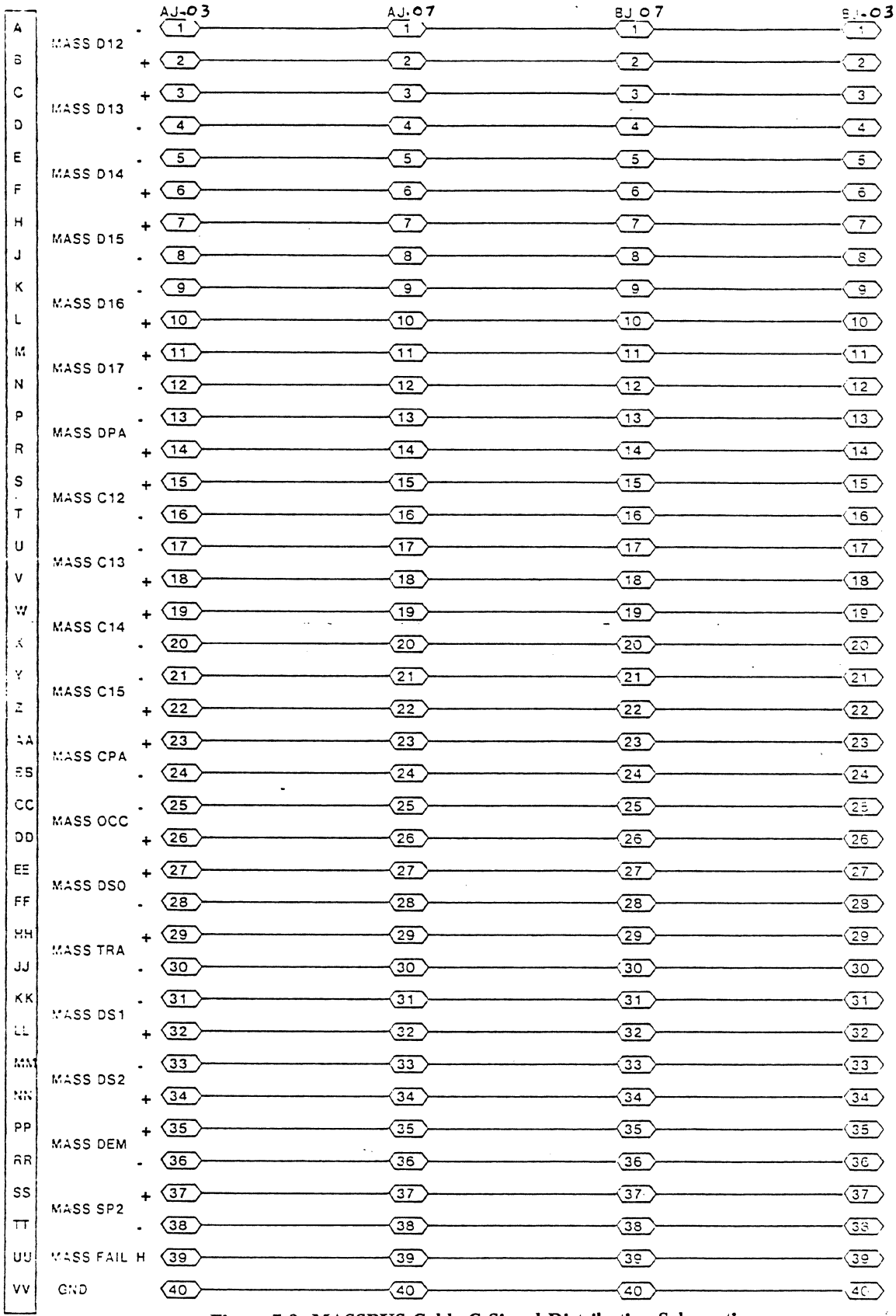


Figure 7-9. MASSBUS Cable C Signal Distribution Schematic

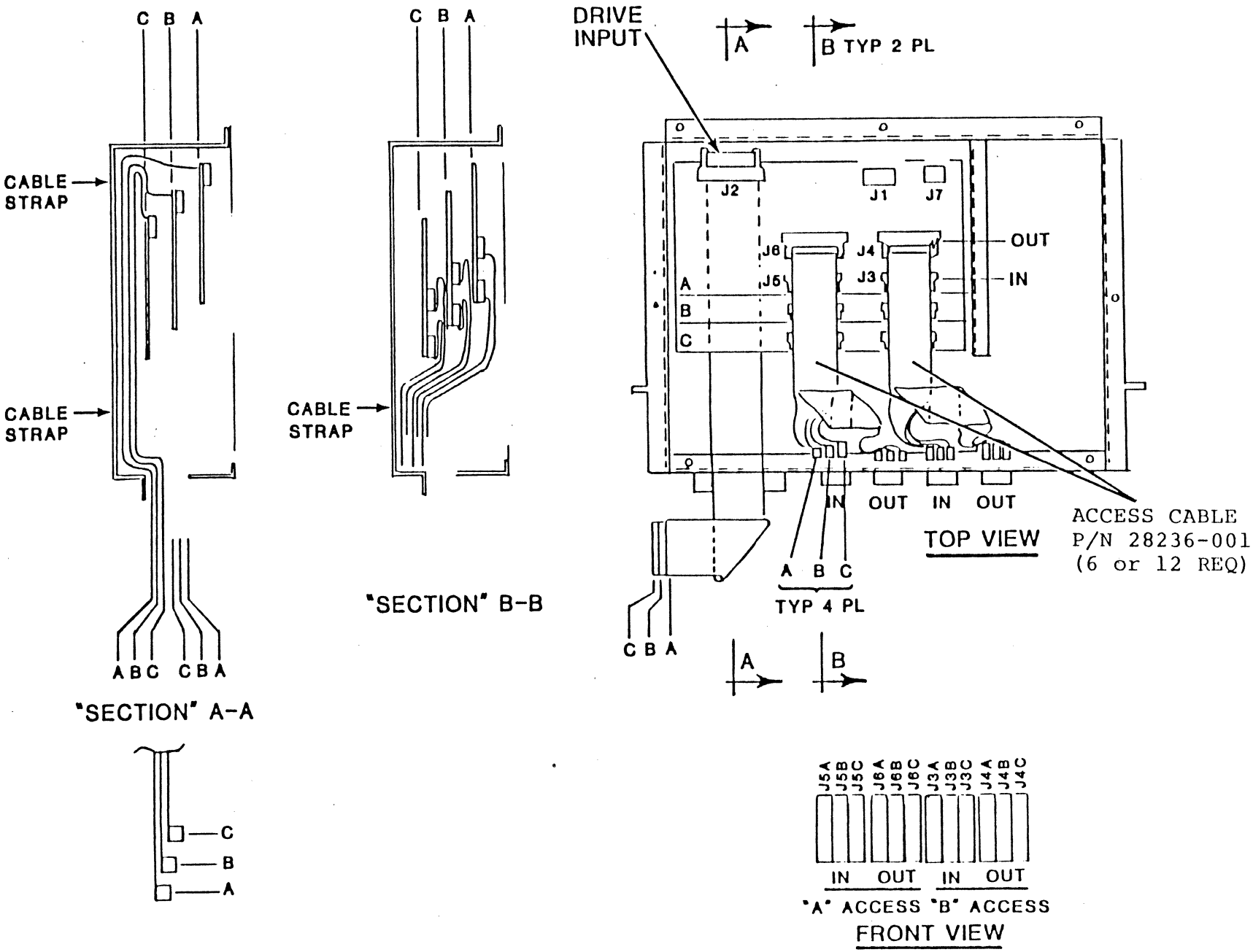


Figure 7-10. Transition Assembly Cabling Diagram

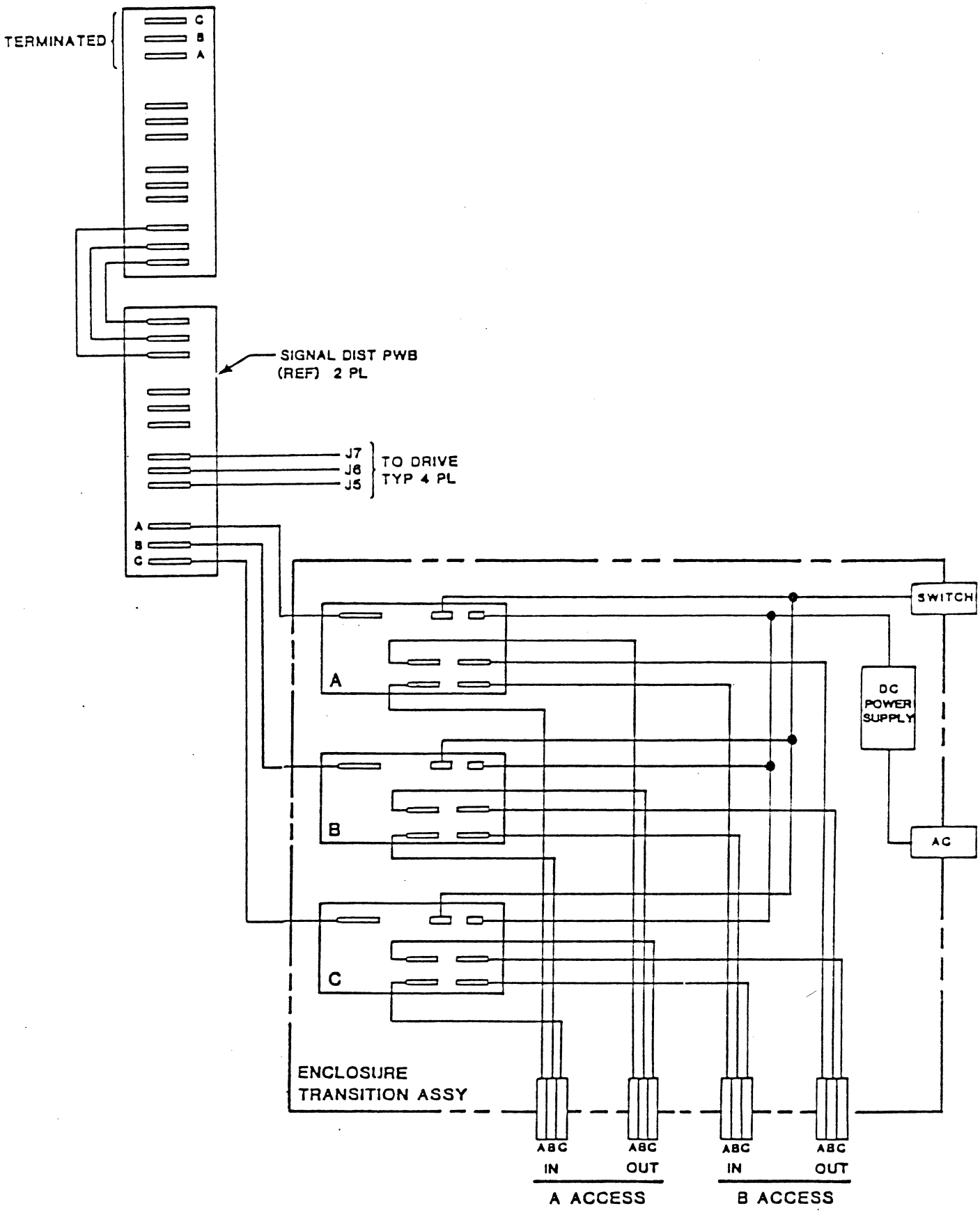


Figure 7-11. Transition MASSBUS Out Wiring Diagram

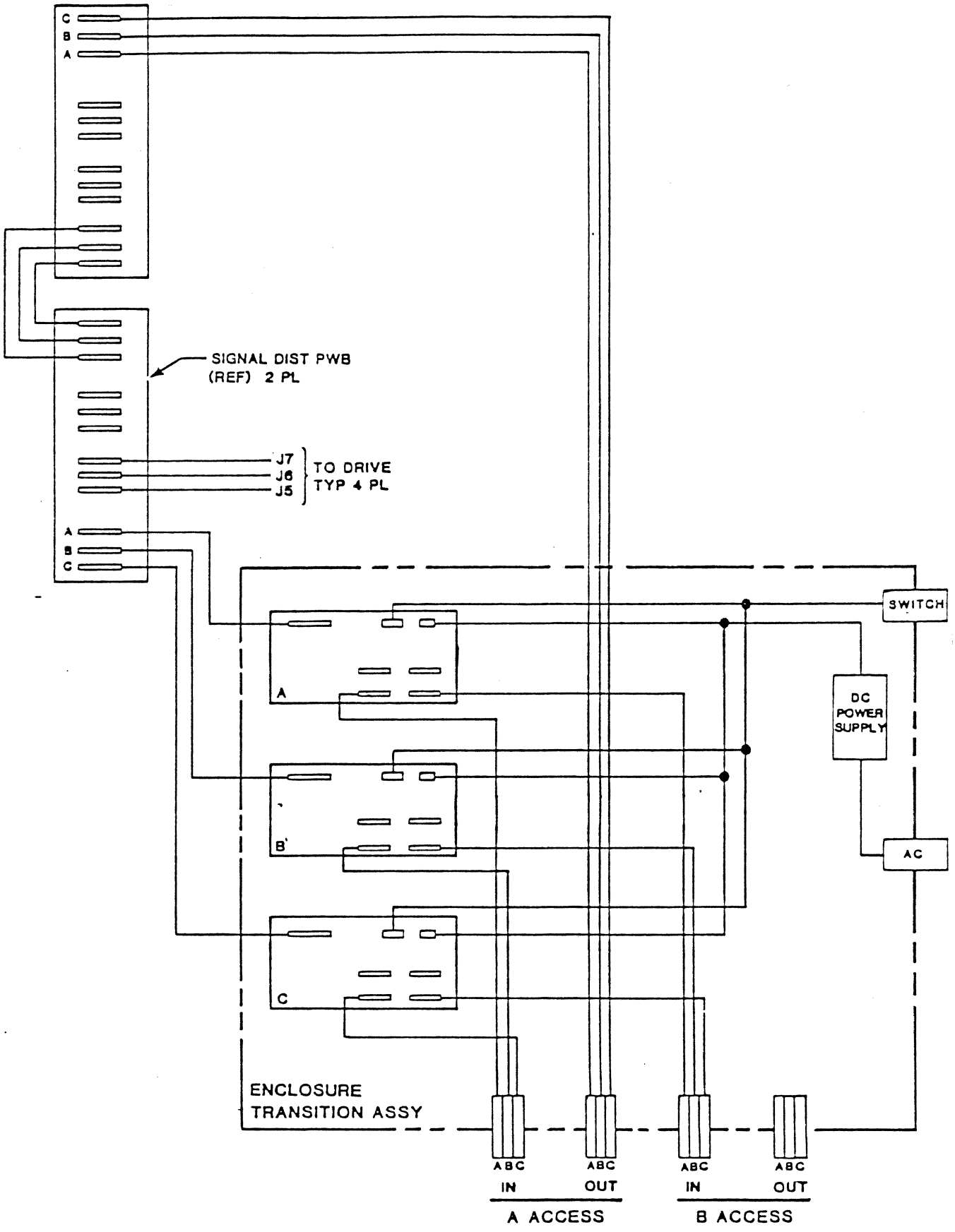


Figure 7-12. Transition Switched Bus Out Wiring Diagram

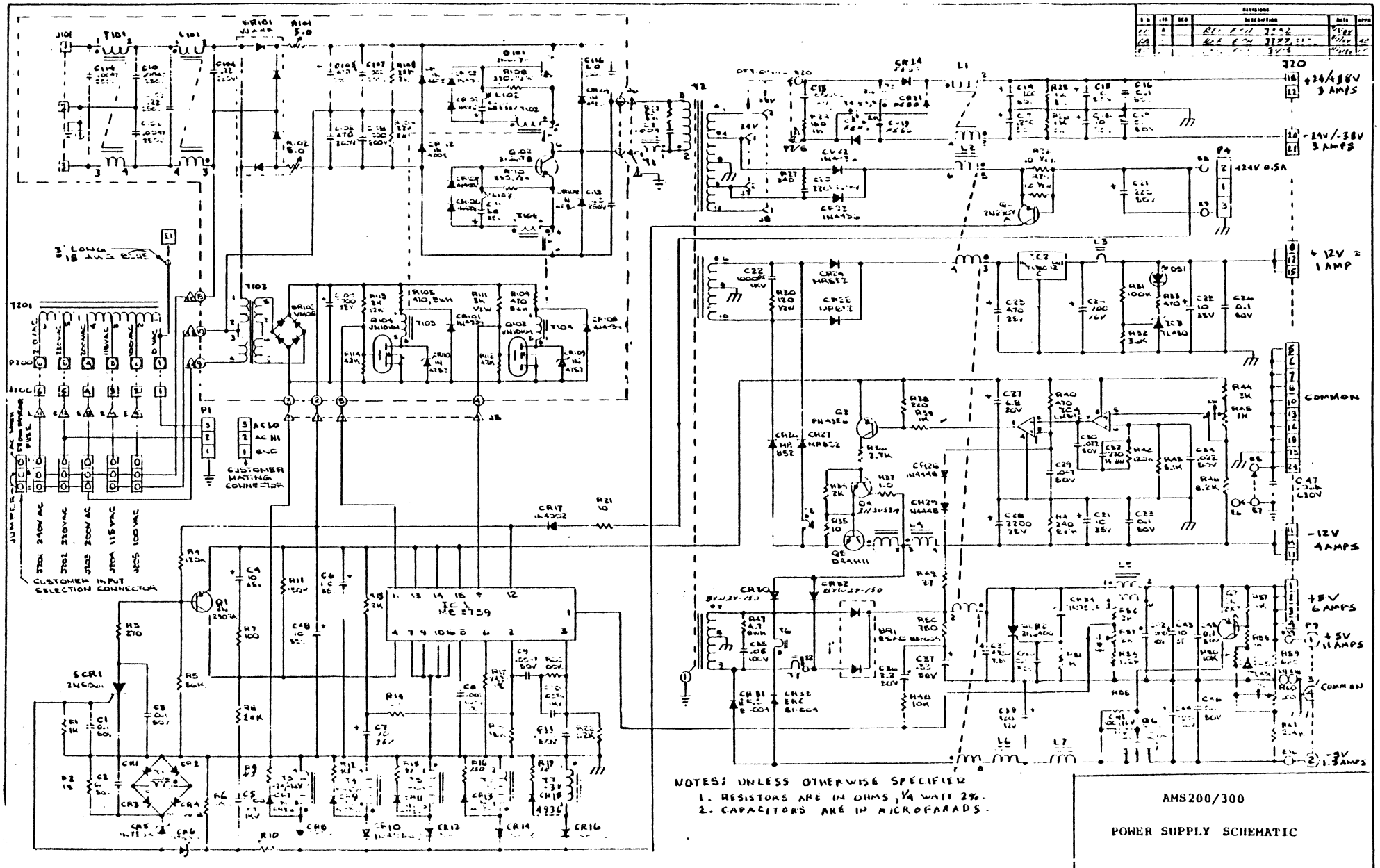


Figure 7-13. AMS 200/300 Power Supply Schematic

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