adaptec, inc.

ACB-5500 User's Manual

1.4 BOARD LAYOUT

The component layout of the ACB-5500 is shown in Figure 1-1.

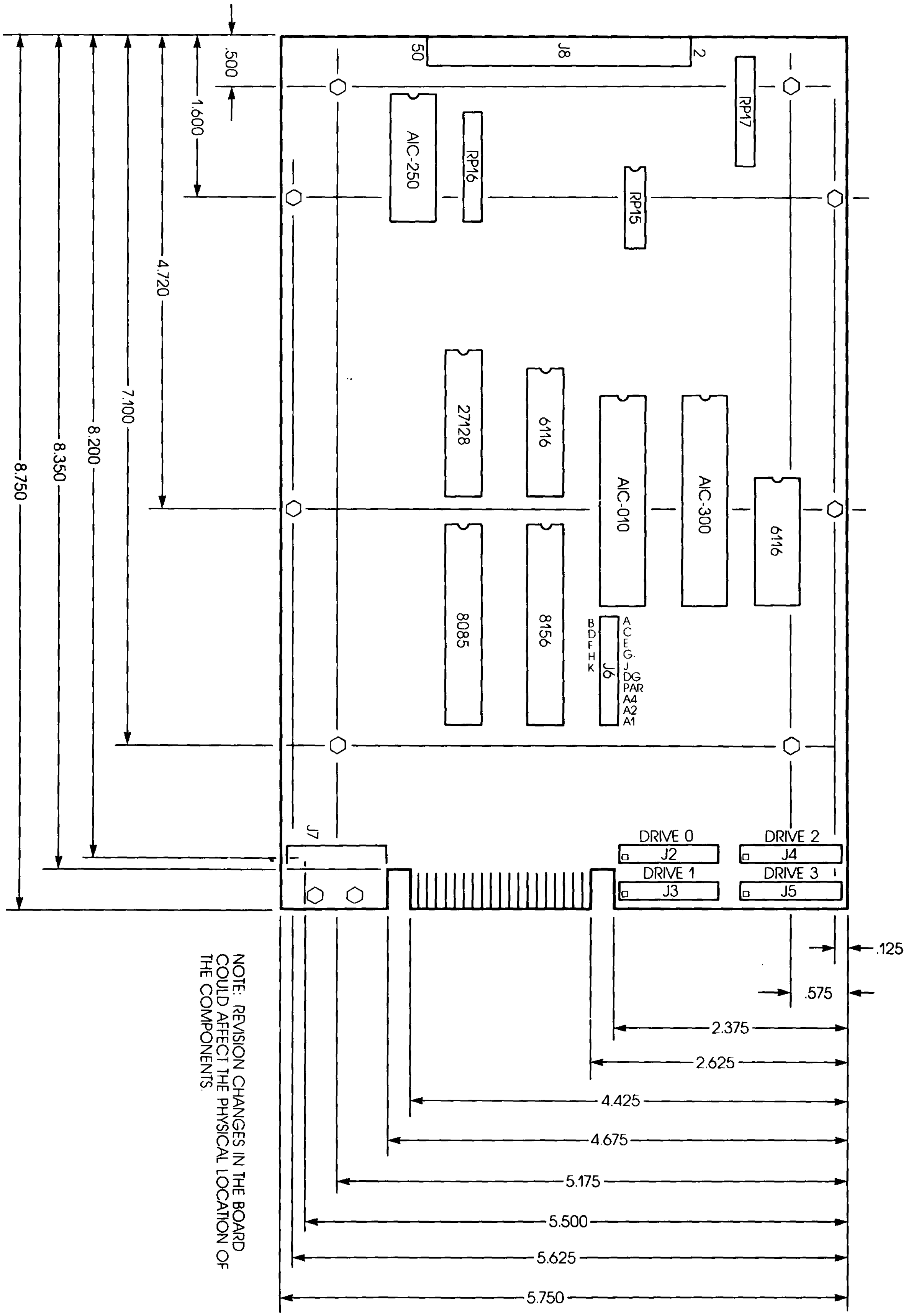

FIGURE 1-1. ACB-5500 BOARD LAYOUT

3.Ø INSTALLATION

The ACB-55ØØ is a self-contained circuit board. All logical and electronic functions required for its normal operation are contained on the circuit board. The ACB-55ØØ is simple to install, operate, and maintain.

3.1 UNPACKING

The ACB-55ØØ is shipped in a protective carton with shock-absorbing material and static-protecting material completely surrounding the card. The carton should be examined for external damage as it is opened. The cards were physically inspected when packed. Any mechanical damage to the cards should be reported to the carrier and to Adaptec as soon as possible.

CAUTION

All circuit boards containing VLSI circuitry have some sensitivity to electrostatic discharge. The ACB-55ØØ is no exception. Proper handling precautions, including personnel grounding and work surface grounding, should be taken to prevent circuit stress which can cause premature circuit failure.

3.2 PREPARATION OF INSTALLATION AREA

The ACB-55ØØ is generally designed into the host system or the peripheral disk system. Proper attention should be given to the location of the ACB-55ØØ so that the necessary ventilation, installation clearances, and cabling paths are provided.

The power output is low enough so that convective ventilation will be sufficient if the air and surrounding surfaces are at a temperature of 55 degrees Centigrade or less. If this requirement cannot be met by the system enclosure in its worst case environment, then the system enclosure must provide for appropriate ventilation and cooling.

Care should be taken to support the card mechanically. Any appropriate combination of the eight mounting holes provided can be used, depending upon the forces to which the system will be subjected. No conductive material should come in contact with the ACB-55ØØ.

Installation clearances, both for the ACB-5500 and the selected power and signal cabling configuration, should be sufficient to optimize system cost, manufacturability, and maintainability.

The ACB-5500 emits a small amount of radio-frequency signals. Extremely sensitive components, such as high bandwidth analog sensors, should be properly shielded from the ACB-5500. Normal case construction is sufficient to shield the ACB-5500 as required by the FCC. If FCC compliance is required, and the SCSI cable leaves the box in which the ACB-5500 is installed, the high-frequency signals generated by normal SCSI operation may require connector and cable shielding.

The ACB-5500 and all other partially shielded electronic devices are sensitive to high-power, high-frequency electrical or magnetic sources. The ACB-5500 should be protected from such sources while it is operating. In particular, unshielded switching power supplies should be physically isolated from all electronic boards and their interconnecting cables. External noise sources, such as welding machines and radio transmitters, should be similarly isolated from electronic systems. Cable and connector shielding may be required in some environments.

An appropriate power source must be provided. Care should be taken to prevent ground loops and other power disturbances.

Proper programming support must be provided to generate the required command sequences. Additional program support must be provided to manage the SCSI protocols. Any system supporting Adaptec's ACB-4000, nondisconnecting ST506/412 disk controller, will also support the ACB-5500. Use of the advanced performance-oriented functions will require a more powerful SCSI host adapter that supports disconnect/reconnect, command linking, and arbitration. Use of the advanced command functions requires expanded software support. Adaptec's host adapters will provide the required SCSI protocol services, but must receive the commands to be executed from appropriate system software.

3.3 INSTALLATION

The following steps are required for installation of the ACB-5500 into a system properly designed to accept it. These steps are separate from any other testing and installation procedures required by other portions of the system, but can often be done in conjunction with those other installation steps.

1) Inspect the ACB-5500 for obvious physical damage before installing.

2) Install the proper jumpers (see Section 3.4) to enable the desired ACB-5500 functions and to define the address of the ACB-5500 on the SCSI Bus.

3) Install the ACB-5500 with appropriate mounting hardware.

4) Make the required cable connections to the ACB-5500. The cable connections are:

J7 - Power cable
J8 - SCSI cable
J2, J3, J4, J5 - ST506 data cable (radial connections as required)
J1 - ST506 control cable.

5) Install ST506 drives according to the manufacturer's directions. The drives must have appropriate drive select address and bus terminators set. The last ST506 drive on the control cable daisy chain must be terminated.

6) Power on the system and perform any power-on test procedures required by the system.

7) Format the attached drives. (See Section 3.7.)

   Note: In a production environment, the drives may be optionally formatted by a dedicated ACB-5500 manufacturing work station before installation. Since all parameters are stored on the drive by the formatting procedure, further formatting or parameter specification is not required after installation. The ACB-5500 will autoconfigure to the drive parameters at power-on time.

8) Perform appropriate system test and verification procedures. Errors related to drive operation, ACB-5500 operation, SCSI operation, and certain installation errors will be indicated through the normal SCSI error presentation mechanism.

3.4 CONFIGURING THE ACB-5500

The ACB-5500 has a number of options that must be selected by the installation of hardware jumpers located at position J6 on the controller. The function of each jumper pair is shown in Table 3-1. The jumper header is designed to accommodate jumpers with optimum reliability, the jumper pairs may be wire-wrapped together.

TABLE 3-1. CONFIGURATION JUMPERS

A	o o	B	- SCSI Reset Option
C	o o	D	- Reserved
E	o o	F	- Hard-Sectored Lun0
G	o o	H	- Hard-Sectored Lun1
J	o o	K	- Reserved
	o o	Diag	- Diagnostic Mode
	o o	Par	- Parity Enable
	o o	A4	- SCSI Address 2^2
	o o	A2	- SCSI Address 2^1
	o o	A1	- SCSI Address 2^0

3.4.1 SCSI RESET OPTION

The installation of the A-B jumper will cause the ACB-5500 to initiate a "Hard" reset in response to an SCSI bus reset. Without this jumper installed, a "Soft" reset will result. The effect of both a "Hard" and "Soft" reset are detailed in Section 4.1.3.2.

3.4.2 HARD-SECTORED/REMOVABLE DRIVES

The installation of the E-F or G-H jumpers will indicate to the ACB-5500 that a hard-sectored drive is attached as logical Unit 0 or 1, respectively. The presence of a jumper will cause the ACB-5500 to use the sector pulse input from the drive. The jumpers must only be installed if a hard-sectored drive is attached. Hard-sectored drives must either be logical unit 0 or 1.

3.4.3 DIAGNOSTIC MODE

The installation of the DIAG jumper will cause the ACB-5500 to continuously repeat a diagnostic self test. Appendix A details this self test.

3.4.4 PARITY ENABLE

The installation of the PAR jumper will cause the ACB-5500 to check for bus out (data into the ACB-5500) parity errors. This jumper should only be installed if all SCSI devices communicating with the ACB-5500 generate SCSI data parity. The ACB-5500 will always generate parity on bus in data.

3.4.5 SCSI BUS ADDRESS

The installation of jumpers A4, A2, and A1 set the SCSI bus address for the ACB-5500. SCSI devices can have an address of 0 to 7 but no two devices can have the same address.

3.5 POWERING-ON THE ACB-5500

Once the ACB-5500 is properly configured, the controller may be powered on. When power is supplied to the system, the controller will enter a power-up mode and wait for a maximum of 18 seconds for the drive to become ready. During the 18-second power-on sequence, the controller performs a self test and begins checking for drives 0,1, 2, and 3 to become ready. If the host sends a command requiring access to a drive before it has become ready (and before 18 seconds have elapsed), the controller will accept the command and continue to check for a ready status. Once the drive comes ready, the controller will then execute the command; if 18 seconds elapse, and the drive does not come ready, a DRIVE NOT READY (04_H) error will result. The controller will then check for a ready status on the next command requiring access to that drive.

Once a drive comes ready, the controller will recalibrate the head to track 0. If the drive starts at track 0, the controller will step the head off of track 0 to confirm that the drive can seek and that the track 0 signal was valid. With the drive's ability to seek confirmed, the controller then seeks back to track 0. The drive actuator (if it can be seen) appears to make a short 'blip.'

The controller then attempts to read from track 0, parameter information which is written during formatting. If the drive is unformatted, or had been formatted by other than an Adaptec controller, the parameter information is not present. The controller then sets "blown format" to warn the user that the drive is unusable, the reset sequence is stopped and the controller is ready for a command. The drive must be formatted to allow a READ or WRITE access to disk data.

If the drive is correctly formatted, the controller will seek the drive to the last cylinder and read the largest block address present. The parameter information and largest block addresses are saved by the ACB-5500.

Once the last block address has been read, the controller will seek the drive back to track Ø, stopping several times in 'zones' to read the defect count within each zone. This defect count is also saved in the controller to allow it to better predict the location of a block on the disk for accurate seeking.

Once a drive is formatted, the host can determine the drive size (READ CAPACITY, 25_H, command) and self-configure without any driver software modification. This device independence provides a major advantage for host systems using true SCSI controllers over the SASI-like units that send parameters at a reset and with commands.

3.6 COMMUNICATING WITH THE ACB-55ØØ

The SCSI bus is a simple bus to interface. However, a quick reading of the SCSI spec may leave you lost due to its extreme attention to detail. Also, some SASI-like controllers exist on the market which allow some deviation from the ANSI/SCSI protocol. The important point to remember in designing a drive routine is that once the controller is started by the host, THE CONTROLLER CONTROLS THE SCSI BUS. The controller drives the data direction line (I/O), the phase lines (C/D and MSG), and initiates data transfers (REQ). The host driver should make no assumptions about the bus phases or byte counts. In addition, the controller can (and will) change phases between operations while going through intermediate phases. Thus, the phase lines (C/D and MSG) are only valid when the controller asserts REQ. Do not write your driver or allow your hardware to follow phases when REQ is not active or it may be 'fooled' by phase changes between REQ. Also, other controllers only support some six-byte commands, thus some users have set up counters in their software to send a six-byte command. Since the ACB-55ØØ controller supports six- and 1Ø-byte commands, the hardware/software should not count out the command bytes but rather should send command bytes as long as the controller requests them. Trust the controller; it 'knows' how many bytes it needs.

The sequence of operations for a single command used in the simplest of SCSI applications would be:

1) Select the controller onto the bus (wake it up). Be sure select remains asserted until the controller responds Busy.

2) Send the ACB-55ØØ the appropriate command bytes until it changes phases (do not count bytes). If too many or too few bytes are REQuested, check for valid command op code and proper SCSI REQ/ACK timing.

3) If required, send/receive data until phase changes (do not count bytes; controller will determine data direction).

4) Receive (REQ/ACK cycle) one status byte and save for evaluation (see Section 4.5).

5) Receive (REQ/ACK cycle) one message byte (see Section 4.2).

6) Check status byte. If Busy bit set, resend command; if Check bit set, send REQUEST SENSE (03_H) command to get error.

3.7 FORMATTING WITH THE ACB-5500

A sample MODE SELECT command for a Seagate ST412-type drive is described below:

Step 1: MODE SELECT Command
Drive Type: Seagate ST412:
306 cylinders
Four heads
28 uS step rate
Reduced write current at cylinder 256
Write precompensation at cylinder 256

Hex	Description
	MODE SELECT Command
15	OP Code (15_H) for MODE SELECT
00	Formatting Lun0
00	Reserved
00	Reserved
16	Number of data bytes appended (16_H)
00	Reserved
	Extent Descriptor List
00	Reserved
00	Reserved
08	Length of drive descriptor list
00	Density code
00	Reserved
00	Reserved
00	Reserved
00	High byte of block size to be formatted (256 bytes)
01	Middle byte of block size to be formatted
00	Low byte of block size to be formatted
	Drive Parameter List
01	Interface code (must be 01)
01	High byte of cylinder count
02	Hard-sector drive or removable cartridge
32	Low byte of cylinder count
04	Total number of heads
01	High byte of reduced write current cylinder
00	Low byte of reduced write current cylinder
01	High byte of write precompensation cylinder
00	Low byte of write precompensation cylinder
00	Landing zone position (see STOP, $1B_H$, command)
01	Head step rate (02-12 us, 01=28us, 00=3Ms)

Note: Two additional bytes would be added for a hard-sectored or removable drive (see Section 6.14).

After the MODE SELECT has been transferred to the controller and good completion status has been sent to the host, the drive may be formatted.

Step 2: FORMAT UNIT

Interleave of 1:1
Fill data fields with $E5_H$
One defect at head 2, cylinder 11, 256 bytes from index
Two space sectors per cylinder

FORMAT UNIT command

Hex	Description
Ø4	Op code ($Ø4_H$ for FORMAT UNIT command)
1E	LunØ and indicate fill character and defect descriptor appended
E5	Character to be filled in data fields
ØØ	High byte of interleave (must be ØØ)
Ø1	Low byte of interleave
ØØ	Reserved

FORMAT UNIT Data Block

ØØ	Format entire unit
Ø2	Allocate two spare sectors per cylinder
ØØ	High byte of length of defect list
Ø8	Low byte of length of defect list
ØØ	High byte of cylinder number of defect
ØØ	Middle byte of cylinder number of defect
ØB	Low byte of cylinder number of defect
Ø2	Head number of defect
ØØ	High byte of defect bytes from index
ØØ	Middle byte of defect bytes from index
Ø1	Middle byte of defect bytes from index
ØØ	Low byte of defect bytes from index

The same procedure can be used for formatting single cylinders. Section 6.4.2 contains details on changes required to the FORMAT UNIT command for cylinder level formatting.

The ACB-55ØØ allows you to select the desired interleave factor with the FORMAT UNIT command. The interleave can range from zero to the number of blocks-per-track, minus one. The number represents the number of physical blocks between consecutive logical block numbers, thus an interleave of one means that the sectors are consecutive. (Interleave of zero is the same as an interleave of one).

The use of an interleave factor one allows a maximum transfer rate, but will only be effective with a host adapter and system capable of very high transfer rates. On the other hand, the use of interleaving can maximize the storage capacity of your drive and allows you to time the operation to your operating system.

Table 3-2 shows the number of formatted sectors-per-track for different block sizes and interleaves when using soft-sectored drives.

TABLE 3-2. INTERLEAVED SECTORS/TRACK

SECTOR SIZE	INTERLEAVE	SECTORS/TRACK
256	1	32
256	>1	33
512	1	17
512	>1	18
1024	1	9
1024	>1	9