adaptec, inc.

ACB-2070A
Installation Guide

PC'S AND DRIVES SUPPORTED BY THE ACB-2070A

The Adaptec ACB-2070A controller board has been successfully tested in the following personal computers:

IBM PC

IBM XT

Compaq Portable[3]

Compaq Deskpro[3]

Compaq 286 Portable[1,3]

Compaq 286 Deskpro[1,3]

AT&T 6300[2]

Leading Edge[1]

Sanyo

Notes:
1. *ACB-2070A requires product P/N 401400 Revision C or later.*
2. *Requires AT&T motherboard ROMS version 1.21. With Revision 1.36, the switch number 3 on the switch block 1 (located on the motherboard closest to the back of the unit) must be in the "off" position.*
3. *Compaq format utility requires 17 sectors/track and thus will not function with the ACB-2070A. To format, use the IBM PC-DOS or Microsoft MS-DOS format utility.*

The Adaptec ACB-2070A controller board has been successfully tested with the following drives. Contact the drive vendor listed to verify current models and revision levels supporting 2,7 RLL.

Vendor	Model	2,7 RLL Capacity*
Seagate	ST-238R	33 MB
	ST-277R**	65 MB
	ST-4077R**	68 MB
	ST-4144 R**	123 MB
Lapine	Titan LT300	32 MB
MiniScribe	3438	31 MB
	6128	20 MB
	8438	31 MB
Microscience	HH-330	31 MB
	HH-738	31 MB
	HH-1050**	66 MB
Toshiba	MK56FA**	105 MB
Priam	V150	62 MB
	V170**	90 MB
	V185**	101 MB
Rodime	RO201E	16 MB
	RO202E	31 MB
	RO203E	47 MB
	RO204E	63 MB
	RO352	16 MB
Okidata	OD526	31 MB
	OD540	50 MB
PTI (Peripheral Technology)	PT325R	31 MB
	PT338R	45 MB
Tandon	TM263	31 MB
	TM755	62 MB
Syquest	SQ319R	16 MB
Microstorage	MS212R	16 MB
Ricoh	RH-5130	16 & 33 MB

NOTE:
The ACB-2070A runs drives from 5 MB to 64 MB for DOS 2.0, 2.1, 3.0, 3.1 and MS-DOS 2.11.

*Contact drive vendor for exact revision of drive. Adaptec will not accept returned material of ACB-2070A's if running on drives and revisions not on this list and approved by the drive vendor.

**These drive capabilities format to greater than 64 MB and require a partitioning I/O driver to get the full capacity. This driver is available from Ontrack Computer Systems, (612) 941-4504 or Chase Technologies, (201) 894-5544.

HARDWARE AND SOFTWARE REQUIREMENTS

The ACB-2070A can be installed in an IBM PC/XT or equivalent IBM-compatible computer. The successful installation of the Adaptec ACB-2070A requires the following hardware and software.

Hardware

1. IBM PC or XT or equivalent IBM-compatible computer with:
   a. One 5¼" floppy diskette drive
   b. One available system expansion slot
   c. Room for one 5¼" or 3½" Winchester (hard) disk drive
2. 5¼" or 3½" Winchester disk drive(s) having the industry-standard ST506 interface and qualified with RLL encoding.
3. External power supply or power booster to support the power required by the Winchester disk drive. If using an IBM XT or a very low power drive in the IBM PC, this is not required.
4. 20-pin and 34-pin flat ribbon cables to connect the drive to the controller.

Software

1. IBM PC/XT DOS version 2.0, or newer revisions.
2. (Optional) A customer-supplied loadable device driver is needed for three to eight logical units or for systems using more than 64 MB of total disk capacity. Available from Ontrack Computer Systems (612) 941-4504 or Chase Technology (201) 894-5544.

BOARD LAYOUT

The ACB-2070A is shown in Figure 1. This figure shows the location of the firmware, BIOS, jumpers and connectors. Note that Pin 1 of the connector is located closest to the PC bus edge connector.
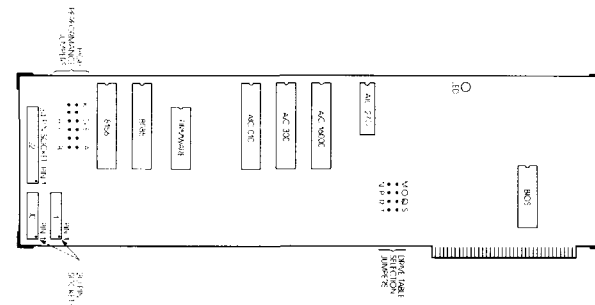

Figure 1. Board Layout

INTEGRATION INTO THE SYSTEM

To install the Adaptec ACB-2070A board into your system you must first configure the drive(s), set the controller jumpers and connect the drive cables properly. This section describes all the necessary steps needed to successfully install this hardware.

The controller must match the drive parameters, i.e., number of heads, number of cylinders, step pulse rate, etc. in order to function successfully. The drive parameters are divided into two categories; one being the drive changeable parameters and two, the controller changeable parameters.

DRIVE SELECTION AND TERMINATION

The drive changeable parameters are the drive selection switches (or jumpers) and the drive termination. These parameters allow a drive to be selected as drive 0, 1, 2 or 3. This is accomplished by changing the drive address selection switches or jumpers.

Before the drives can be cabled to the controller the drive cable terminator must be properly set. The terminator, as its name implies, must be at the end of each cable in order to have the controller and drive communicate properly. The controller has a permanent terminator built in. The disk drives, since they can be connected in a daisy chain configuration have a removable terminator. This is usually a 16-pin DIP resistor package. The last physical drive in the chain must have its terminator installed.

CONTROLLER JUMPER SELECTION

The controller changeable parameters are defined as the variables that can be changed to accommodate the different drive characteristics. These parameters can easily be changed by jumper(s) or defined by the user for the drive being used.

DRIVE TABLE SELECTION JUMPERS

The ACB-2070A has drive tables for the most commonly used drives. These tables reside in the Adaptec ACB-2070A BIOS EPROM.

The drive tables in the ACB-2070A BIOS support the drives as defined in Table 1. These drive tables are selected by jumpers on the board. Other drives can be attached to the ACB-2070A by use of the user-defined parameters described in the software installation section.

NOTE:
The ACB-2070A is shipped already configured to be used with a Seagate ST-238 38 MB RLL (25 MB MFM) unformatted, or equivalent 25 MB drive. (See BIOS Table 0 of Table 1.)

TABLE 1.
ACB-2070A DEFAULT DRIVE TABLES

	BIOS Table 0	BIOS Table 1	BIOS Table 2	BIOS Table 3
Drives Supported	Seagate ST-238 MiniScribe 3438		Tandon TM 755 Vertex V150	Micro-science HH-330
Formatted With MFM	20 MB	10 MB	40 MB	20 MB
With RLL	30 MB	15 MB	60 MB	30 MB
Step Pulse Code (Rate)	3 (13 µSec)	3 (13 µSec)	3 (13 µSec)	3 (13 µSec)
Number of Data Heads	4	2	5	4
Number of Cylinders	615	612	981	612

These four tables are selected by jumpers M-N, O-P for drive 0 and Q-R, S-T for drive 1. Table 2 defines the jumper selection of each drive and table.

TABLE 2.
JUMPER SELECTION OF DRIVE TABLES

BIOS Table for Drive 0	Installed	Removed
0	M-N and O-P	—
1	M-N	O-P
2	O-P	M-N
3	—	M-N and O-P

BIOS Table for Drive 1	Installed	Removed
0	Q-R and S-T	—
1	Q-R	S-T
2	S-T	Q-R
3	—	Q-R and S-T

NOTE:
No need to worry about these jumpers if format parameters are specified in primary format section.

TABLE 3.
HIGH-PERFORMANCE JUMPERS

Jumper	Installed	Removed
A-B	Reserved	Reserved
C-D	Reserved	Reserved
E-F	Drive 0 is a Removable Cartridge Drive, SQ319R	Soft-sectored ST506-type drive.
G-H	Drive 1 is a Removable Cartridge Drive, SQ319R	Soft-sectored ST506-type drive.
I-J	Selection of J0 and J1 Reversed	Selection of J0 and J1 as defined in next Section.
K-L	Self Diagnostics	—

DRIVE AND CONTROLLER CABLING

Now that the drive and controller are configured, they can be connected together. The controller has three cable connectors J0, J1 and J2.

The connector locations and pin orientation for ACB-2070A connectors are shown in Figure 1.

NOTE:
When mounting in the IBM PC/XT, pin 1 of the connector and cable will be facing down. The two connectors J0 and J2, along the outside edge of the board, are used when only one drive is present. All three connectors J0, J1 and J2 are used when two drives are present. Remember that the last physical drive in the chain must have the terminator installed.

Mount the drive, controller and cables inside the PC.

ACB-2070A PRIMARY FORMATTER

At this point, the disk must be formatted with a primary format. Primary formatting is not supported by DOS 2.0; however, it is supported by the ACB-2070A BIOS through "DEBUG." Unlike other controllers, the ACB-2070A needs no extra software to perform the primary formatting. The primary format defines address fields and data fields on each track of the disk. After this is completed, bad blocks can be flagged and a directory created by a DOS "FORMAT" command.

The drive parameters, i.e., answers to all questions, can be inputted by a DOS redirected I/O file. This will ease integration of drive and controller in a manufacturing environment.

NOTE:
A customer-supplied device driver is needed if more than two logical units are used or more than 64 MB of hard disk capacity is used. Adaptec does not supply such a driver.

To use the primary formatter, perform the following steps:
1. Boot DOS 2.0 or newer revisions from the DOS SUPPLE-MENTAL PROGRAMS diskette.
2. Type "DEBUG," the computer will respond with a "-".

NOTE:
Underlined characters are user inputs, <RET> means return key and parentheses mean comments.

A>DEBUG <RET>
–   (DEBUG prompt)

3. Type the following sequence:

-G = C800:CCC <RET>

ADAPTEC ACB-2070A FORMAT PROGRAM

Enter sector interleave (3 to 9):n <RET>

3-to-1 is the optimum interleave factor for the IBM PC/XT. Experimentation with different interleave factors is the best way of determining the optimum interleaving factor for your application. 3-to-1 is the fastest interleave for 2,7 RLL (7.5 Megabits/second) that the IBM PC/XT can accept.

Enter Drive ID (0/1):0 or 1 <RET>

This value specifies which physical drive is to be formatted. It follows the hardware switch setting on the drives.

Should we use the default parameters (Y/N)Y or N <RET>

The default parameters refer to the current drive table selected by the jumpers for that drive (0 or 1), see Tables 1 and 2.

You have two choices: "Y" for jumper default drive parameters or "N" for user-defined drive parameters.

JUMPER DEFAULT DRIVE PARAMETERS ("Y" RESPONSE)

A "Y" will invoke the default drive table selection as defined by the jumpers M-N, O-P, E-F for drive 0 and jumpers Q-R, S-T, G-H for drive 1. This will skip to the question for defect byte offset encoding.

USER-DEFINED DRIVE PARAMETERS ("N" RESPONSE)

An "N" will invoke the user-defined drive parameters feature described below and will ignore the jumper default drive table selection.

NOTE:
The following parameters are for the Seagate ST-238 drive and are shown for example only. Insert your drive parameters in place of these. The Adaptec ACB-2070A controller board allows you to go from 16 MB to 64 MB with no special software.

NOTE:
Enter all values in decimal.

Number of logical units for this drive (1-8):M <RET>

The ACB-2070A allows you to partition a single physical drive into many equal logical units. The units can be up to 32 MB each (a restriction of DOS format) having a maximum of eight units for one or two physical drives. In the example for the ST-238 drive, if M=2, the 30 MB physical drive will be divided into two equal logical units of 15 MB each.

Step pulse rate (0 to 7):3 <RET>

The step pulse rate is defined in Table 4. Many drives that are currently available will provide high performance, i.e., lower access times, when used with option 3. If a slower nonbuffered step rate drive is used, option 0 is required. Refer to the Disk Drive OEM Manual for the fastest buffered seek step rate.

TABLE 4.
SEEK STEP PULSE RATES

Code	Seek Step Pulse Rate
0	3.0 milliseconds
1	Reserved
2	30 microseconds
3	13 microseconds
4	200 microseconds
5	70 microseconds
6	Reserved
7	Reserved

Number of heads (1 to 16):4 <RET>
Number of cylinders:615 <RET>

For other disk drives, see the Disk Drive OEM Manual for these values. In this case, the drive has four data heads and 615 cylinders. Minimum value of cylinders = 1, maximum = 1024.

The following prompts allow the user to specify the method of entering defects. When entering a defect list, it may be put in a separate file or entered from the keyboard.

Specify the Defect Byte Offset encoding: MFM or RLL (M/R)?M or R <RET>

All drive manufacturers give a list of defective areas on the disk. This defect list gives the location of defects in one of two forms. One form is cylinder, head and byte offset. The other is head, cylinder and byte offset. Normally the byte offset is given in MFM encoding. Many drive vendors are also giving the byte offset in RLL encoding. Either MFM or RLL encoding can be used. If MFM is used, the controller multiplies by 1.5 to determine the RLL equivalent defect.

If no defect list is available, press 'M' then 'C' and two <RET>'s. The controller will flag defects that it finds during track verification in data and ID fields. **This does not guarantee that all defects will be detected and mapped. Drive manufacturers do more rigorous analog and temperature testing to create their defect lists.**

Enter defect list as "Cyl/Head/Byte" or "Head/Cyl/Byte" (C or H): C or H <RET>

Type defect file name or press Enter:

Enter the defect list in the format selected above, i.e., cyl/head/byte or head/cyl/byte. The cylinder, head and byte offset are separated by "/" marks. For example, 31/2/4054 means cylinder 31, head 2 and 4054 bytes offset.

The defect list may reside in a DOS file or be inputted from the keyboard. If a DOS file is used, enter its name here. The DOS file is ended by a carriage return as shown below. The file name must have an extension (e.g., DRIVE.DEF).

If entering from the keyboard, press <RET> and the following will be shown:

    Enter defect locations as Cyl/Head/Byte
    (or Head/Cyl/Byte) (a blank line will end the list):

For example:
31/2/4054 <RET>
257/4/2253 <RET>
541/3/3415 <RET>

    Are the above parameters correct (Y/N)? Y or N

An 'N' will return to the beginning of the format program. When 'Y' is selected, the following will be shown:

    Formatting Drive...

The drive is now being formatted. When finished, the track verification begins, this takes approximately 40 seconds per Megabyte.

The track verification takes longer than most controllers. The reason for this is that an extensive check is being made using worst case data patterns.

During track verification the following will be shown:

    Verifying Format in Logical Unit 0...
    Cylinder XXXX

    Verifying Format in Logical Unit X...
    Cylinder XXXX

    Format Completed...
    Run this program again (Y/N)? Y or N

Now the primary format is complete. If needed, rerun the format for drive 1. When finished answer 'N' to return to the DOS > A prompt and continue.

If defects occur during format, the following text will appear on the screen:

    Mapping Defects...
    Reformatting Track—Cylinder XXXX, Head XX, Sector XX
      (When 26 sectors are used)
    Formatting ALT Track—Cylinder 611, Head 3
      (When alternate track is assigned)

NOTE:
Alternate tracks have reduced the total drive capacity.

    Verifying Format in Logical Unit X...
      * Verify Error—Logical Unit X, Cylinder XXXX, Head XX,
        Sector XX

    Controller Error Code: 91, BIOS Error Code: 10
    Reformatting Track

The cylinder number is the physical, not the logical, cylinder number of the drive. BIOS error codes are found in Table 5.

TABLE 5.
BIOS ERROR CODES

Code	Error
01	Bad Command Passed to Disk I/O
02	Address Mark Not Found
04	Requested Sector Not Found
05	Reset Failed
07	Drive Parameter Activity Failed
09	Attempt to DMA Across 64K Boundary
0B	Bad Track Flag Detected
10	Bad ECC on Disk Read
11	ECC Corrected Data Error
20	Controller Failure
40	Seek Operation Failed
80	Attached/Failed to Respond
BB	Undefined Error Occurred
FF	Sense Operation Failed

PARTITION AND FORMAT DESCRIPTION
Logical drive C: is always the first logical unit on drive 0. Logical drive D: is the second logical unit, which could be on drive 0, if large disk partitioning is used.

The disk must now be partitioned for DOS 2.0 and the format verified.

1. Insert a copy of DOS 2.0 that contains "FDISK" and "FORMAT" in floppy drive A.
2. Type FDISK and Select option 1: Create a DOS partition (See Chapter 4 of DOS Manual).
   If needed, repeat FDISK for drive D using option 5.
3. When complete, type FORMAT C:/S. If needed, repeat for drive D, using FORMAT D:.

This will create a DOS directory, verify the primary format and flag any bad (defective) sectors. Since the Adaptec defect handling scheme was used, there will be no bad sectors. From this point on, you can boot from the hard disk, copy files and operate your software applications.

You are up and running!

ADAPTEC ABC-2070A
TROUBLESHOOTING CHECKLIST
☐ Probable problems: 1701 error; power-on failure; primary format failures, DOS failures.

☐ Check jumpers on the disk drive, be sure that it is not set for a radial-selected drive.

☐ Check jumpers on controller, especially jumpers E-F, and G-H. Be sure jumper K-L is removed.

☐ Check cables, be sure J0 goes to drive 0, J1 goes to drive 1, and J2 goes to both drives. Be sure that pin 1 on the controller is connected to pin 1 of the drive. If only one drive is being used, connect the cables to the connectors along the edge of the board. Check that jumper I-J is removed.

☐ Check that the terminator on the drive is properly set.

☐ Check that the power supply can support the added current required by the drive. Be sure the +5V and +12V voltages are correct. Verify their requirements with the drive vendor.

☐ If using the user-defined drive values (not the four BIOS tables), be sure that the values are entered correctly.

☐ Refer to the list of 2,7 RLL drives and systems supported for compatibility.

If you require further information or other technical support, please contact your dealer:

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F.C.C. CERTIFICATION

This equipment generates and uses radio frequency and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in *Subpart J or Part 15 of FCC Rules*, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

    Reorient receiving antenna.
    Relocate the computer with respect to the receiver.
    Move the computer away from the receiver.
    Plug the computer into a different outlet so that computer and receiver are on different
        branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful.

    "*How to Identify and Resolve Radio-TV Interference Problems.*"This booklet is
    available from the U.S. Government Printing Office, Washington, DC 20402, Stock
    No. 004-000-00345-4.

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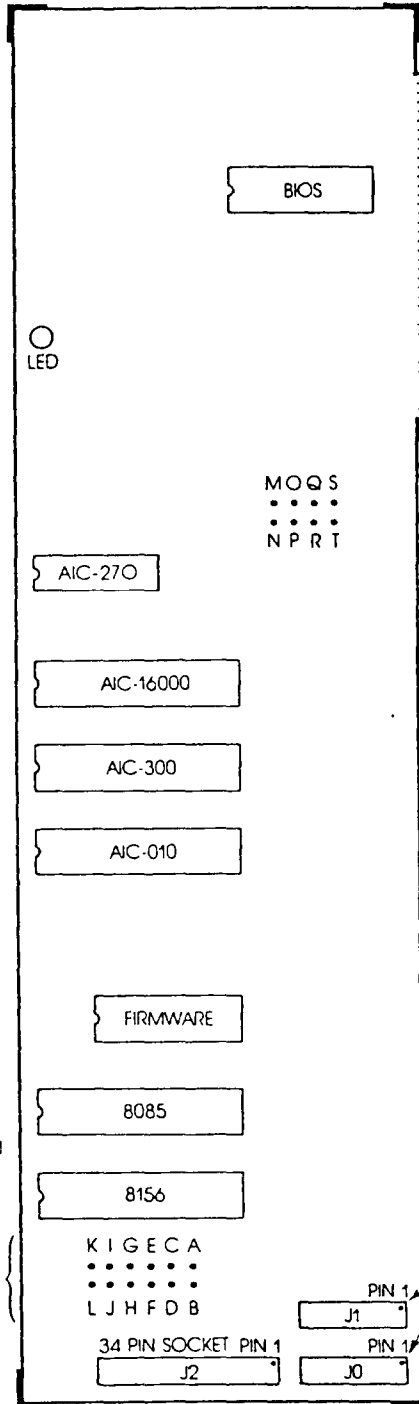
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ACB-2070A

```
DMA          3
IRQ          5
I/O PORTS    320 - 323
BIOS ADDRESS C8000 - C9FFF
```

```
DEBUG              (ST238)
G=C800:CCC
Interleave..............3
Drive ID................0
Default Parameters......N
No. of Logical Units....1
Step Rate...............3
Heads...................4
Cylinders.............615
Defect Byte.............R
Cyl/Hd/Byte.............C
```


LED

BIOS

MOQS
• • • •
• • • •
NPRT

AIC-270

AIC-16000

AIC-300

AIC-010

FIRMWARE

8085

8156

```
K I G E C A
• • • • • •
• • • • • •
L J H F D B
```

HIGH PERFORMANCE JUMPERS

34 PIN SOCKET PIN 1

J2

J1   PIN 1

J0   PIN 1

20 PIN SOCKETS

ACB-2070A DEFAULT DRIVE TABLES

Drives Supported	BIOS Table 0 Seagate ST-238 MiniScribe 3438	BIOS Table 1	BIOS Table 2 Tandon TM 755 Vertex V150	BIOS Table 3 Micro-science HH-330
Formatted With MFM With RLL	20 MB 30 MB	10 MB 15 MB	40 MB 60 MB	20 MB 30 MB
Step Pulse Code (Rate)	3 (13 μSec)	3 (13 μSec)	3 (13 μSec)	3 (13 μSec
Number of Data Heads	4	2	5	4
Number of Cylinders	615	612	981	612

DRIVE TABLE
SELECTION
JUMPERS

These four tables are selected by jumpers M-N, O-P for drive 0 and Q-R, S-T for drive 1. Table 2 defines the jumper selection of each drive and table.

TABLE 2.
JUMPER SELECTION OF DRIVE TABLES

BIOS Table for Drive 0	Installed	Removed
0	M-N and O-P	—
1	M-N	O-P
2	O-P	M-N
3	—	M-N and O-F

BIOS Table for Drive 1	Installed	Removed
0	Q-R and S-T	—
1	Q-R	S-T
2	S-T	Q-R
3	—	Q-R and S-T

NOTE:
No need to worry about these jumpers if format parameters are specified in primary format section.

HIGH-PERFORMANCE JUMPERS

Jumper	Installed	Removed
A-B	Reserved	Reserved
C-D	Reserved	Reserved
E-F	Drive 0 is a Removable Cartridge Drive, SQ319R	Soft-sectored ST506-type drive.
G-H	Drive 1 is a Removable Cartridge Drive, SQ319R	Soft-sectored ST506-type drive.
I-J	Selection of J0 and J1 Reversed	Selection of J0 and J1 as defined in next Section.
K-L	Self Diagnostics	—

SEEK STEP PULSE RATES

Code	Seek Step Pulse Rate
0	3.0 milliseconds
1	Reserved
2	30 microseconds
3	13 microseconds
4	200 microseconds
5	70 microseconds
6	Reserved
7	Reserved