adaptec, inc.

ACB-2072 Installation Guide

PC'S AND DRIVES SUPPORTED THE ACB-2072

The Adaptec ACB-2072 controller boa successfully tested in several personal cc ing, but not limited to the following:

IBM PC

IBM XT

IBM Personal System/2, Model 30

Compaq Portable[1]

Compaq Deskpro[1]

Compaq 286 Portable[1]

Compaq 286 Deskpro[1]

AT&T PC 6300[2]

Leading Edge

Sanyo

Notes:

1. *Compaq format utility requires 17 and thus will not function with the format, use the IBM PC-DOS or Mic format utility.*
2. *Requires AT&T motherboard ROM. With Revision 1.36, the switch num switch block 1 (located on the mo closest to the back of the unit) mu "off" position.*

sectors/track
ACB-2072. To
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S version 1.21.
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uter Corporation.
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AT and T is a registered trademark of American Telep
Compaq is a registered trademark of Compaq Com
IBM PC, IBM XT and IBM Personal System/2 are tradem
Business Machines Corp. IBM is a registered tradem
Business Machines Corp.
MS-DOS is a registered trademark of Microsoft Corp

BY

d has been
mputers includ-

The Adaptec ACB-2072 controller board has been successfully tested with drives from the companies listed below. Contact the drive vendor to verify current models and revision levels supporting 2,7 RLL.

Vendor	Telephone Number
Fujitsu	408-946-8777
Lapine	408-262-7077
Microscience	415-961-2212
Microstorage	408-986-0770
MiniScribe	303-678-2122
Okidata	609-235-2600
Priam	408-346-4600
PTI (Peripheral Technology)	415-724-1486
Ricoh	408-424-6700
Rodime	408-725-0222
Seagate	408-438-6550
Syquest	415-490-7511
Tandon	805-523-0340
Toshiba	408-727-3939

Contact drive vendor for exact revision of drive. Adaptec will not accept returned material of ACB-2072s if running on drives not approved by the drive vendor.

Some drives format to greater than 64 MB and require a partitioning I/O driver to get the full capacity. Such a driver is available from Ontrack Computer Systems, (612) 941-4504.

HARDWARE AND SOFTWARE REQUIREMENTS

The ACB-2072 can be installed in any IBM PC/XT or equivalent IBM-compatible computer. The successful installation of the Adaptec ACB-2072 requires the following hardware and software.

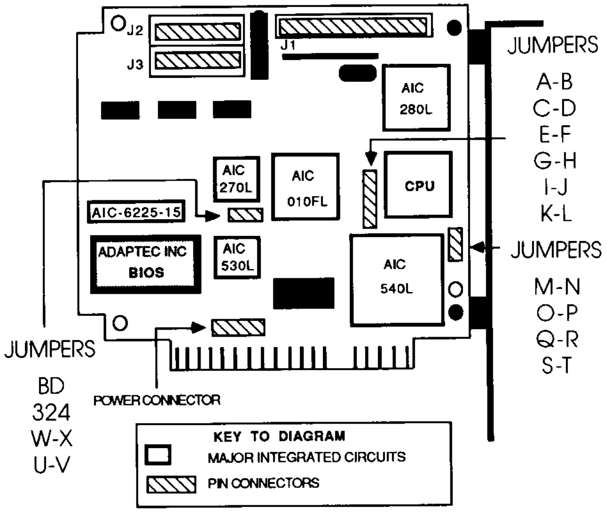
Hardware

1. IBM PC, XT or Personal System/2, Model 30 or equivalent IBM-compatible computer with:
   a. One 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 ST412/506 interface and qualified for 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.

ACB-2072 BOARD LAYOUT



INTEGRATION INTO THE SYSTEM

To install the Adaptec ACB-2072 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 the 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 [illegible]-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 characteristics of different drives. 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-2072 has drive tables for the most commonly used drives. These tables reside in the Adaptec ACB-2072 BIOS EPROM.

The drive tables in the ACB-2072 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-2072 by use of the user-defined parameters described in the software installation section.

NOTE:
The ACB-2072 is shipped already configured to be used with a 30 MB RLL drive (4 heads, 615 cylinders). (See BIOS Table 0 of Table 1.)

TABLE 1.
ACB-2072 DEFAULT DRIVE TABLES

	BIOS Table 0	BIOS Table 1	BIOS Table 2	BIOS Table 3
Formatted RLL Capacity	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	612	612	981	615

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 3A.
HIGH-PERFORMANCE JUMPERS

Jumper	
A-B	Installed = D[illegible]
C-D	Installed = Drive 0 is Syque[illegible]
E-F	Reserved [illegible]ive 1 is Syques[illegible]
G-H	Reserved [illegible]
I-J	Reserved [illegible]
K-L	Installed = S[illegible]
BD	Installed = B[illegible] Diagnostics
324	Installed = A[illegible]S Disabled
	[illegible]lternate Address Enabled

TABLE 3B.
JUMPERS W-X and U-V

No Jumpers = Address [illegible]
U-V Only = Address CA[illegible]C800
W-X Only = Address F4[illegible]00
U-V and W-X = Addres[illegible]s C000

DRIVE AND CONTROLLER CABLING

The controller has three cable connectors J1, J2 and J3. Connect J2 to drive 0 and J3 to drive 1. J1 should be connected to both drives with a daisy chain cable.

The connector locations and pin 1 orientation for ACB-2072 connectors are shown in Figure 1. The location of pin 1 can be read off the controller board for each connector.

NOTE:
The two connectors J[illegible] and J2, along the outside edge of the board, are used when only one drive is present. All three connectors J1, J2 and J3 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-2072 PRIMARY FORMATTER

At this point, the disk must be formatted with a primary format. Primary formatting is not supported by DOS; however, it is supported by the ACB-2072 BIOS through "DEBUG." Unlike other controllers, the ACB-2072 needs no extra software to perform 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 DOS "FORMAT" command.

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

To use the primary formatter, perform the following steps:

1. Boot DOS 2.0 or newer revisions from the DOS SUPPLEMENTAL 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-2072 FORMAT PROGRAM

Enter sector interleave (2 to 8):[illegible] <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 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 default drive table selection.

NOTE:
The following parameters are for the MiniScribe 3438 drive or other drives with 4 heads and 615 cylinders and are shown for example only. Insert your drive parameters in place of these. The Adaptec ACB-2072 controller board allows you to go from 16 MB to 64 MB with special software.

NOTE:
Enter all values in decimal.

Number of logical units for this drive ([illegible]):[illegible] <RET>

The ACB-2072 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 MiniScribe 3438 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 higher 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 = 2048.

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.

shown
n (e.g.,

na the

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

If entering from the keyboard, press <RET> o
following will be shown: Y or N

Enter defect locations as Cyl/Head/Byte pro-
(or Head/Cyl/Byte) (a blank line will end th e shown:

For example:
31/2/4054 <RET>
257/4/2253 <RET>
541/3/3415 <RET> ed, the
ely 40 sec-

Are the above parameters correct (Y/N)?
ontrollers.
An 'N' will return to the beginning of the formc s being
gram. When 'Y' is selected, the following will b

Formatting Drive... hown:

The drive is now being formatted. When finish
track verification begins, this takes approxima
onds per Megabyte.

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

During track verification the following will be s

Verifying Format in Logical Unit 0... ed, rerun
Cylinder XXXX to return

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 neede
the format for drive 1. When finished answer 'N
to the DOS > A prompt and continue.

inputted
name here

appear o

Mappin
Reformc ccur during format, the following text will
(Wher the screen:
Formatt
(Wher g Defects...
ting Track—Cylinder XXXX, Head XX, Sector XX
NOTE: 26 sectors are used)
Alternate t ng ALT Track—Cylinder 611, Head 3
Verifying alternate track is assigned)
• Verif
Sect
cks have reduced the total drive capacity.
Controll Format in Logical Unit X...
Reformc Error—Logical Unit X, Cylinder XXXX, Head XX,
or XX
The cylinde
cylinder nu er Error Code: 91, BIOS Error Code: 10
in Table 5. ting Track

number is the physical, not the logical,
ber of the drive. BIOS error codes are found

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

If defects c
appear on

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 and the format verified.

1. Insert a copy of DOS 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. Reboot the system.
4. 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-2072
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 J2 goes to drive 0, J3 goes to drive 1, and J1 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 power 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.

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

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.

COPYRIGHT

FIVE YEAR LIMITED LIFE-TIME WARRANTY

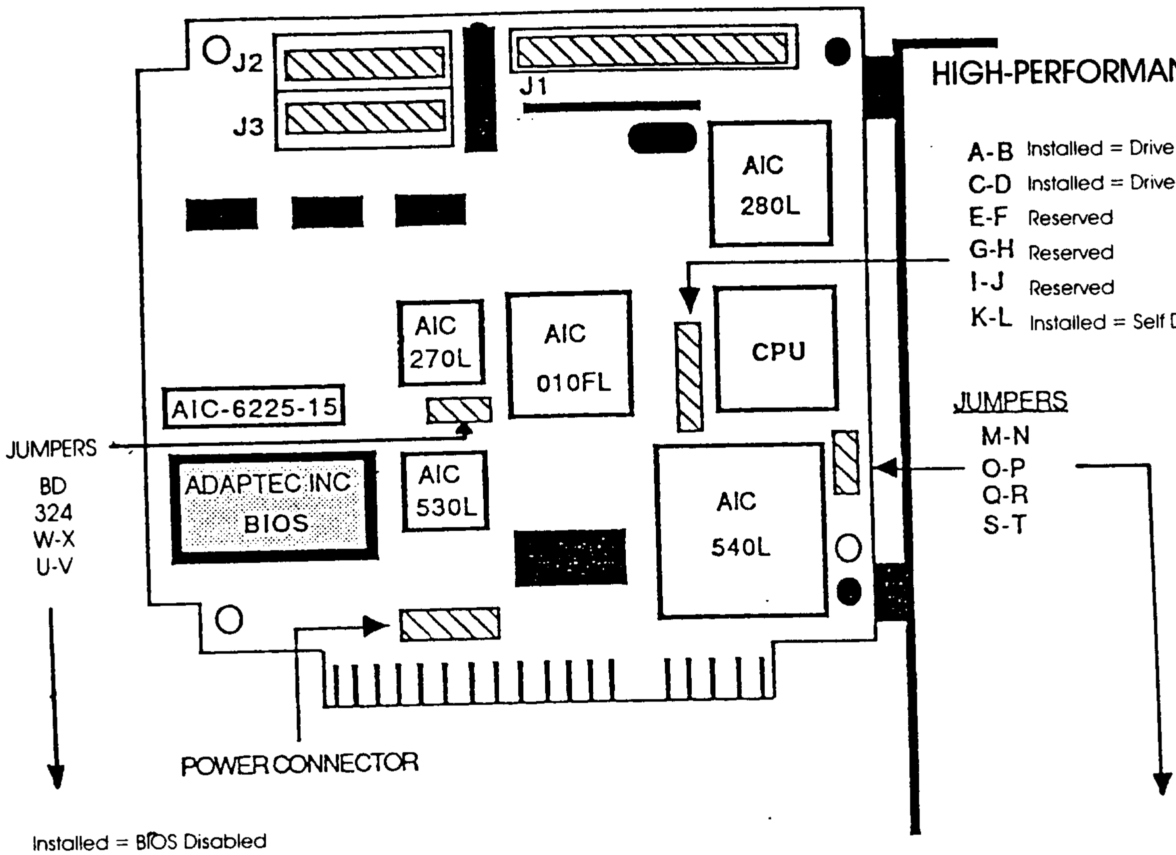
The Seller warrants that the products to be delivered under this purchase order will be free from defects in material and workmanship under normal use and service. Seller's obligations under this Warranty are limited, at its sole option, to (i) replacing or (ii) repairing or (iii) giving credit for, any of such products which shall, within five (5) years from date of shipment, be returned to the Seller's factory, transportation charges prepaid, and which are, after examimation, disclosed to the Seller's satisfaction to be thus defective. THIS WARRANTY IS EXPRESSED IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, STATUTORY, OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON THE SELLER'S PART, AND IT NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR THE SELLER ANY OTHER LIABILITIES IN CONNECTION WITH THE SALE OF THE SAID ARTICLES. This Warranty shall not apply to any of such products which shall have been repaired or altered, except by the Seller, or which shall have been subjected to misuse, negligence, or accident. The aforementioned provisions do not extend the original warranty period of any product which has either been repaired or replaced by Seller. Prior to returning any products to Seller, Buyer must request and obtain a Return Material Authorization ("RMA").

CHANGES

The material in this guide is for information only and is subject to change without notice. Adaptec reserves the right to make changes in the product design without reservation and without notification to its users.

Adaptec, Inc., Milpitas, California 408125-00/MBD 9/87

ACB-2072 BLOCK DIAGRAM



HIGH-PERFORMANCE JUMPERS

A-B	Installed = Drive 0 is Syquest
C-D	Installed = Drive 1 is Syquest
E-F	Reserved
G-H	Reserved
I-J	Reserved
K-L	Installed = Self Diagnostics Enabled

BD	Installed = BIOS Disabled
324	Installed = Alternate Address

JUMPERS W-X and U-V

No Jumpers = Address C800
U-V Only = Address CA00
W-X Only = Address F400
U-V and W-X = Address CC00

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

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.

```
DEBUG               (ST238)
G=C800:CCC
Interleave..............3
Drive ID................0
Default Parameters......N
```

ACB-2072 DEFAULT DRIVE TABLES

BIOS BIOS BIOS BIOS

	Table 0	Table 1	Table 2	Table 3
Formatted RLL Capacity	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	612	612	981	615

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.

```
No. of Logical Units....1
Step Rate...............3
Heads...................4
Cylinders.............615
Defect Byte.............R
Cyl/Hd/Byte.............C
```