QuikPak A4000T-060/040

(Digitally reconstructed by Greg Donner for quality/clarity)

Chapter 1: Introduction

Congratulations on your purchase of the A4000T-060/040 accelerator. This product represents the most powerful performance upgrade available for any Amiga, anywhere. The accelerator board plugs into the local bus of any Amiga model A4000 Tower equipped with version 3.1, or later, of the Kickstart ROM.

Product Specification

The A4000T-060/040 accelerator is a plug-in board for the A4000 Tower computer that is based on Motorola's 68060 or 68040 CPU. Along with acceleration provided by the 68060/040 processor, the board provides up to 128 MB of user-installable memory and an optional 32-bit DMA SCSI-2 controller. For enhanced system performance, the board also has support for EDO (Extended Data Out) DRAMS. The board can be configured with either standard or EDO DRAMs in industry-standard SIMM sizes of 4 MB, 8 MB, 16 MB or 32 MB, allowing the user to choose the best cost/performance per application.

Among its features are:

- Support for either 3.3V 68060 or 5V 68040 processors.
- Asynchronous support for CPU speeds from 40 MHz to 66 MHz.
- Maximum CPU memory access at 66 MHz of over 118 MB/sec.
- Maximum DMA access to local memory of over 20 MB/sec.
- Motorola MC68040 CPU includes:
  - Integrated Floating Point arithmetic Unit
  - 4-Kilobyte instruction cache
  - 4-Kilobyte data cache
- Motorola MC68060 CPU includes:
  - Integrated Floating Point arithmetic Unit
  - 8-Kilobyte instruction cache
  - 8-Kilobyte data cache
- Supports four industry-standard, 72-pin SIMM sockets offering up to 128 MB of user-installable memory in SIMM sizes of 4 MB, 8 MB, 16 MB and 32 MB with access times of 60 or 70 ns.
- Support of EDO (Extended Data Out) DRAM for enhanced performance.
- Support of 68040/060 Full Burst mode.
- IEEE Floating-Point Library and instruction emulation software for support of the 68060 CPU and on-chip floating unit (FPU). This software includes fixes and enhancements for the 68060 CPU to insure optimum performance and compatibility with the Amiga's 3.1 Kickstart ROM.
- Optional on-board 32-bit DMA SCSI-2 controller upgrade.

This product requires version 3.1 (or later) of Kickstart. The user is responsible to secure and have this installed. Installation of this product requires some degree of mechanical ability and precautions against electrostatic discharge. The user assumes all risks of installation.

FCC STATEMENT

Warning:

This equipment has been designated to comply with the limits for a Class B computing device, pursuant to Part 15 of the Federal Communications Commissions rules. These rules and regulations are designed to provide reasonable protection against radio and television interference in a residential installation. If not installed properly, in strict accordance with the manufacturer's instructions, it may cause interference. If you suspect interference, you can test this equipment by turning it on and off. If you still experience interference with the equipment switched off, then the cause lies elsewhere. If this equipment does cause interference when switched on, any or all of the following suggestions may correct the problem.

- Reorient the antenna or plug on the radio or television receiver.
- Change the relative positions of the computer equipment and the radio or television receiver.
- Plug the equipment into a different outlet so that the peripheral and radio or television are on different circuits.

Caution:

Only equipment with shield-grounded cables (computer input-output devices, terminals, printers, etc.) certified to comply with Class B limits, can be attached to this device. Operation with non-certified equipment may result in communications interference.

Your house AC wall receptacle must be a three-pronged type (AC grounded). If not, contact an electrician to install the proper receptacle. If a multi-receptacle switch box or "power strip" is used to connect the computer and peripherals to AC, then all receptacles must share a common ground.

If necessary, contact your dealer or an experienced radio-TV technician for additional suggestions. You may find the following FCC booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." The booklet is available from the U.S. Government Printing Office, Washington, DC 20402, stock no. 004-000-00345-4.

Chapter 2: Getting Started

This chapter provides an overview of the remainder of this document. Although we have attempted to present all relevant information in a complete and systematic fashion, each individual user may need to reference particular discussions out of sequence. This manual is organized as follows:

Chapter 1: Introduction
Chapter 2: Getting Started
Chapter 3: A4000T-060/040 Accelerator Configuration
Chapter 4: A4000T Motherboard Configuration
Chapter 5: Hardware Installation
Chapter 6: Software Installation
Chapter 7: The optional on-board 32-bit DMA SCSI-2 controller upgrade

The A4000T-060/040 accelerator is a very easy product to use. In most cases, your accelerator is ready right out of the box. The first few chapters of this manual describes configuring the jumpers and installing 32-bit SIMMs. In subsequent chapters, hardware and software installation is described. Finally, in Chapter 7, the optional on-board 32-bit SCSI-2 controller upgrade is discussed.

Chapter 3: A4000T-060/040 Configuration

Configuration Options

The A4000T-060/040 accelerator is normally shipped with 0 MB of 32-bit memory installed. It is expandable to 128 MB, using various combinations of SIMMs. The procedure for adding memory and configuring the board is outlined below.

Even if you are not making configuration changes to the A4000T-060/040 board, we recommend that you check the board's jumper positions, as received, against the factory default configuration settings presented in Tables 3.1 and 3.2. These jumpers may have become dislodged during shipping.

Caution: The A4000T-060/040 accelerator board uses CMOS technology components. They are extremely sensitive to static discharge or physical shock. Always be sure to ground yourself by touching a GROUNDED metal surface prior to handling the board or its components. Do not drop or physically jar the board or its components. Failure to observe these precautions may result in irreparable damage to the accelerator board.

"What you need"

In most cases, no tools are required to configure the accelerator board. It is always a good idea, when handling electronic components, to note the precaution above and if possible to use a suitably grounded anti-static wrist strap. If you do not use an anti-static strap, make sure to touch some grounded metal surface prior to handling SIMMs or other components.

Jumpers

All user-configurable settings on the accelerator board are accomplished through the use of jumper pins and shorting blocks. (See Figure 3.1). Located around the board are a number of upright metal pins. These are connection points for various open circuits on the board. To configure options, you can install a shorting block onto a pair of pins, completing the circuit.

All 3-pin jumpers have polarity which is indicated either by a pointed end on the jumper pin mount itself or in white ink on the surface of the circuit board (polarity is irrelevant on a two-pin jumper). On 3-pin jumpers, pin one is the pin closest to the pointed end. (See Figure 3.2).

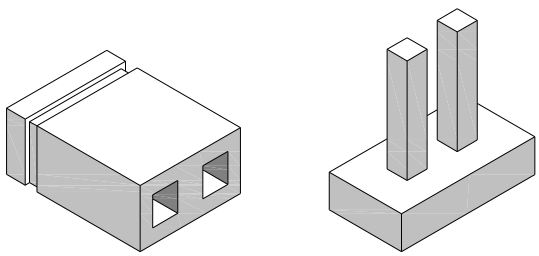


Figure 3.1 – Jumper block and pins

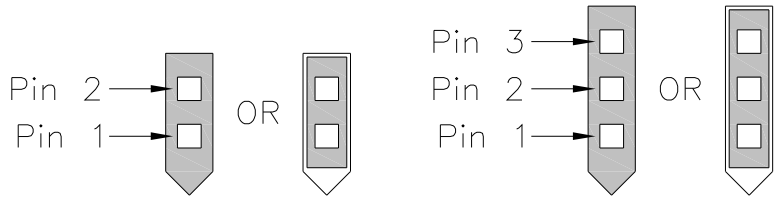


Figure 3.2 – Jumper pin numbering for 2- and 3-pin jumpers

Jumper	Open (OFF) Position	Closed (ON) Position	Default
JR1	Non-Burst Mode (any number of SIMMs)	Burst Mode (increments of 2 SIMMs)	ON
JR2	CPU speed vs. DRAM access	See Table 3.2 below	OFF
JR3	Reserved		OFF
JR4	Reserved		OFF
JR5	4 MB or 8 MB SIMMs Support	16 MB or 32 MB SIMMs Support	OFF
JR6	Single-sided SIMMs (4 MB or 16 MB)†	Double-sided SIMMs (8 MB or 32 MB)†	OFF
JR7	EDO DRAM Support Disabled	EDO DRAM Support Enabled	OFF
Jumper	**Pins 1 and 2**	**Pins 2 and 3**	**Default**
JP9	CPU Power, 5V (68040 Only)	CPU Power, 3.3V (68060 only)	*
JP8	CPU Clock Selection for the 68040	CPU Clock Selection for the 68060	*
JP10	ROM type 27C256 (VCC)	ROM type 27C512 (A16)	1 and 2

Table 3.1 – Jumper Settings and Definitions

Note: * Items marked with an asterisk are settings dependent upon the configuration that you purchased.
† Single-sided refers to SIMMs with either 4 MB or 16 MB of memory. Double-sided refers to SIMMs with either 8 MB or 32 MB of memory.

CPU Speed vs.	JR2 Setting	68060 66MHz	68060 50MHz	68040/060 40MHz
DRAM Access	OFF	50 ns	60 ns	70 ns
DRAM Access	ON	60 ns	70 ns	80 ns

Table 3.2 – CPU Speed vs. DRAM Access Time

CPU Power: A Word of Caution!

The A4000T accelerator is designed to handle either a 5V 68040 or a 3.3V 68060. Table 3.1 shows the proper position for this jumper based on the type of CPU installed. If the incorrect voltage is applied to either type of CPU, the CPU will malfunction and could become permanently damaged. Always be absolutely sure that JP9 is jumpered correctly before power is applied.

Memory

The A4000T-060/040 accelerator has four SIMM sockets (CN1-CN4) which are located on the upper half of the component side of the board (see figure 3.3). The board is designed to support "burst mode" and EDO type DRAMs in SIMM sizes of 4 MB, 8 MB, 16 MB and 32 MB (parity is not required). However, in order for the board to function properly, it must be configured correctly and several limitations must be observed for optimal performance. These configurations and limitations are discussed in the following sections.

Memory Size

Jumpers JR5 and JR6 determine the size of the memory supported by the accelerator. Basically, JR5 sets the addressing range or boundary of each SIMM socket (4 MB or 16 MB) and JR6 determines the order or way the sockets get addressed. For example, setting JR5 on and JR6 off would mean that each SIMM installed is expected to be 16 MB. If 4 MB SIMMs were installed, in this example, only the first 4 MB SIMM would show up since there would be an address gap of 16 MB between each SIMM socket. By removing jumper block JR5, the boundary of each SIMM socket would change to 4 MB, allowing all 4 MB SIMMs to be mapped as contiguous memory.

JR6 determines the order in which each SIMM socket gets addressed. Adding jumper block JR6 effectively means that instead of one bank of memory per socket there are two banks. This option allows both 8 MB and 32 MB SIMMs to function properly. An 8 MB SIMM really consists of two 4 MB banks and a 32 MB SIMM consists of two 16 MB banks.

The ordering in which SIMMs should be installed always starts with CN1 and ends with CN4. The number of SIMMs installed can be from one to four depending on the jumper settings of JR1. However, in order for "Burst Mode" to work, there must always be an even number of SIMMs installed. (See section on Burst Mode).

Burst Mode

For optimal performance, the board should always be set for "burst mode" operation. To set this option, jumper JR1 must be on. For this option to function properly, there must always be an even number of SIMMs installed, and each pair of SIMMs must be the same size. This is true whether the SIMMs are 4 MB, 8 MB, 16 MB or 32 MB.

Mixing Memory Sizes

It is possible in a limited way to mix SIMM sizes. The restrictions and limitations are as follows:

1. Always set JR5 for 16 MB.
2. If 8 MB or 32 MB SIMMs are used, always set JR6 for double-sided mode.
3. Always install the larger SIMM sizes in the first sockets and the smaller SIMM size last.
4. No more than one smaller size SIMM will show up as mapped when used with larger SIMM sizes.
5. No more than one single-side SIMM will show up as mapped when used with double-sided SIMMs.
6. If "burst mode" is set, the above restrictions apply, but as was mentioned before, there must always be an even number of SIMMs installed, and each pair must be the same size.

As an example to illustrate the above restrictions, if you had a 16 MB SIMM and a 4 MB SIMM, the 16 MB SIMM would be installed in socket CN1 and the 4 MB SIMM in socket CN2. Also, jumper JR5 would be set to match the largest SIMM size. In our example, this would require JR5 to be set for 16 MB SIMMs.

Memory Speed

Depending on the speed of the CPU and the setting of jumper JR2, the board can support several different DRAM speeds (access time). Optimal memory access, hence performance, is always achieved with JR2 off. However, JR2 can be used to add a wait state allowing the user to select the best cost/performance per application. Refer to table 3.2 for the proper setting of JR2 verses CPU speed and DRAM access time.

EDO DRAM

This accelerator can accommodate either normal Fast Page Mode (FPM) DRAMs or EDO DRAMs. If the EDO option is set, then jumper JR7 must be installed, and all SIMMs must be EDO type. EDO DRAMs are considerably faster than normal Page Mode DRAM, reducing the number of wait states during burst mode accesses from two clocks per 32-bit access to one clock per access. All limitations described above apply to EDO DRAMs.

On-Board Fast Memory

Whatever amount of memory is installed in your system, and no matter how it is configured, the Amiga system will always attempt to use this Fast memory before any other kind. Only after all of the onboard fast memory has been consumed will the system use memory on the motherboard. In this way, the accelerator board makes most efficient use of its resources for maximum performance.

Adding DRAM

As stated previously, there are four DRAM SIMM sockets on the A4000T-060/040 accelerator, comprising the upper part of the board. (See Figure 3.3) The operating system will automatically sense whether a SIMM is installed in each socket and will add this memory to the system accordingly.

The SIMM package is a convenient, cost-effective, relatively rugged component with a high degree of reliability. They are much easier to install than single-chip arrangements. A SIMM consists of eight or more tiny memory chips mounted on a single small printed circuit board. All of the connection points for the memory chips are arrayed along one edge of the SIMM and mate with the contacts of a matching SIMM socket on the accelerator board. These SIMM sockets can be populated one at a time, as finances permit, or all at once.

DRAM installation procedure:

1. If you are not using an anti-static wrist strap, be sure to ground yourself before touching the accelerator board or any of its components.
2. Lay the accelerator board on the anti-static envelope in which it was packaged the way that it is displayed in Figure 3.3.
3. Note the location of the SIMM sockets on the upper part of the accelerator board. The sockets are numbered from bottom to top in ascending order (CN1 - CN4).

The SIMMs are designed to fit into the sockets in only one way. Pin 1 of each SIMM is keyed with a notch and will only fit properly if this notch matches the corresponding key of the SIMM socket. Looking at the board as shown in figure 3.3 all socket keys are on the left side of the board. Orient each SIMM so that the notch or pin 1 is on your left and the edge with the silver contacts is pointing down. Simply slide the SIMM in on an angle, rotate it up, and snap it into place.

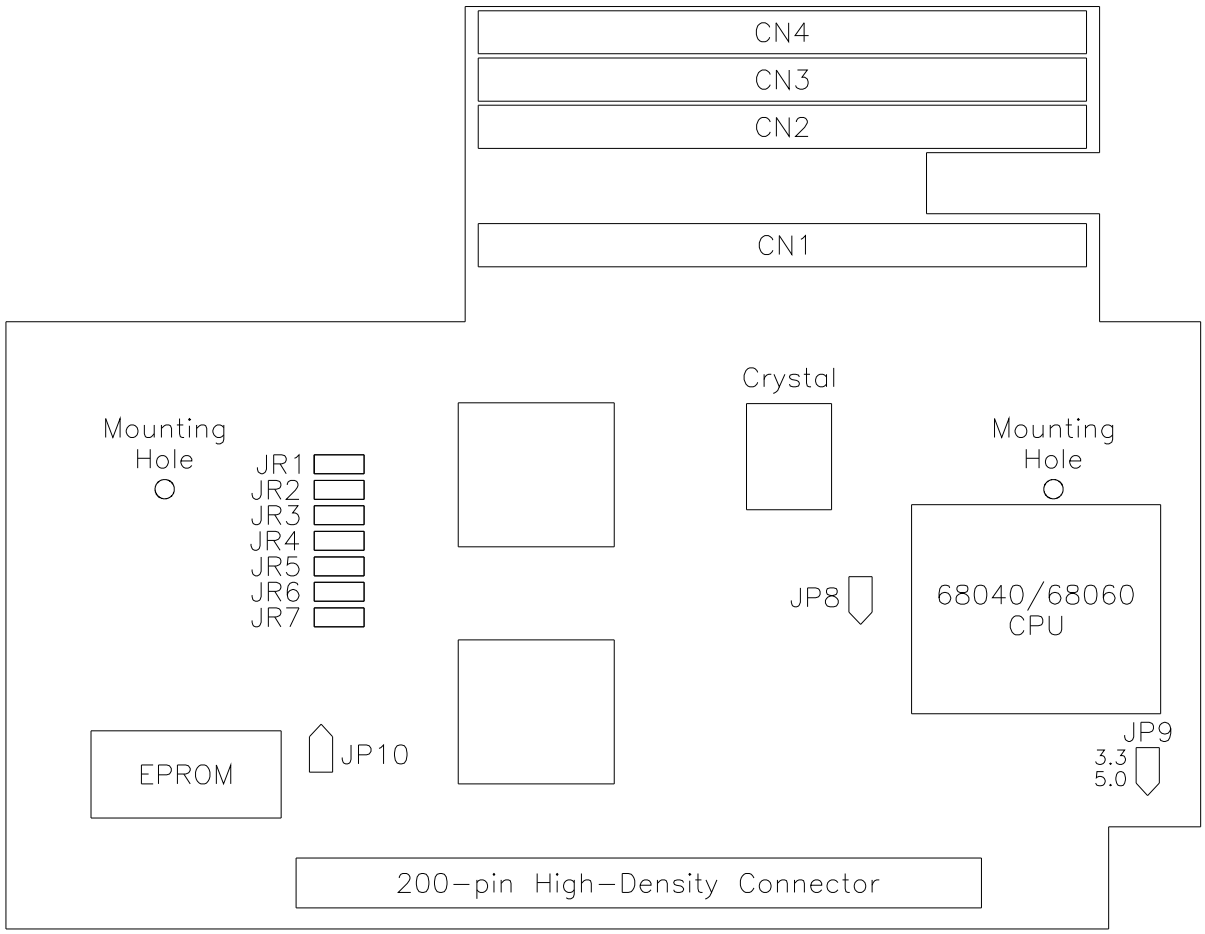


Figure 3.3 - A4000T Board Layout

Chapter 4: A4000T Motherboard Configuration

Setting Jumpers J100 and J104

For the A4000T-060/040 to work properly in the A4000 Tower, two jumpers on the A4000 Tower motherboard will normally need to be changed. Jumpers J100 and J104 are 3-pin jumpers located near the motherboard's 50 MHz oscillator, which is close to the 200-pin high-density connector, CN800. If the original 68040 CPU board is installed, jumpers J100 and J104 will have shorting blocks between pins 2 and 3 which is the side of the jumper marked with the letter "E". With the new accelerator, these shorting blocks must be removed and placed on pins 1 and 2 which is the side marked with the letter "I". Be careful to observe the location of pin 1 on these jumpers. If you cannot locate pin 1, refer to figure 3.2 in chapter 3.

The purpose of these jumpers is to determine from where the main system clock on the motherboard gets its source. This clock can be accessed by the motherboard ("I" standing for "Internal") or can be accessed by the CPU board ("E" standing for "External"). It has been the experience of the accelerator's designer that reliability of the system is improved if the clock's source comes from the motherboard. Setting the jumpers as noted above will provide the most reliable system clock access.

Since these jumpers are located under the CPU board, the best time to change or verify these jumper settings is when the new accelerator board is being installed. Refer to "Chapter 5: Hardware Installation" for more details.

Caution: The A4000 Tower motherboard uses CMOS technology electronic components. They are extremely sensitive to static discharge or physical shock. Always be sure to ground yourself by touching a GROUNDED metal surface prior to handling the board or its components. Do not drop or physically jar the board or its components. Failure to observe these precautions may result in irreparable damage to the motherboard.

Chapter 5: Hardware Installation

"What you need"

You will need a medium cross-point screwdriver to install the accelerator.

Amiga 4000T Installation Procedure

This chapter will present the necessary steps to follow when installing a A4000T accelerator into an Amiga 4000. It is not meant to supersede any assembly/disassembly instructions provided by the computer manufacturer. Due to the mechanical and electrical difficulty of installing an accelerator in the A4000T computer it is recommended that installation be done by a qualified dealer or service center. However, if this is unavailable, the procedure given below can be used as a guideline to assist in installation. The user assumes all risks of installation. Also, please remember to observe all previous cautions concerning electrostatic discharge and damage to the board.

1. Lay the computer on its side with the mouse port closest to the top. Remove the screws from the computer's cover. There are five located at the back of the computer: one at the top center, and two along the right and left edge of each side.
2. Remove the cover by pulling forward and away from the base.
3. Once the cover is removed, it is necessary to remove the computer's front bezel. This can be done by carefully prying the front bezel away from the computer's frame.
4. Remove the four screws in the front and the two screws in the back that hold the hard drive sub-chassis in place.
5. Before the hard drive sub-chassis can be removed, there are five cables that must be disconnected from the computer's motherboard. It is very important that care is used in disconnecting these cables. Also, as each cable is removed carefully, make note of the location and orientation of each connector to insure its proper reconnection later. These connectors include two power supply cables, two 50-pin ribbon cables toward the back of the computer, and one 40-pin ribbon cable toward the front.
6. Once the cables are disconnected, the hard drive sub-chassis is removed by lifting the back of the chassis until it clears the metal flanges that the chassis is seated in, and by sliding it out the front of the computer.
7. Carefully remove the original CPU board under the sub-chassis by lifting it from both sides and gently removing it from the 200-pin high-density socket on the motherboard. Note also that the board it held in place by two nylon spacers which physically snap onto the CPU board and motherboard. These spacers will either lift out with the CPU board or will remain connected to the motherboard. A gentle pull will remove these spacers from the old CPU or motherboard.
8. If you want your new accelerator to work, this is very important. Before inserting the new board, jumpers J100 and J104 on the A4000T motherboard should be set as noted in chapter 4 of this manual. Please refer to that chapter of the manual before proceeding any further.
9. Install the nylon spacers on the accelerator in the mounting holes shown in Figure 3.3 by snapping them into place.
10. Gently but firmly install the new accelerator into the 200-pin connector, making sure the spacers line up and snap into the matching holes on the motherboard and that the accelerator's connector is seated solidly into the motherboard connector.

11. Replace the hard drive sub-chassis and all motherboard cables and connectors. Please note that malfunction and/or damage will result if cables are not installed correctly.
12. Replace the bezel and the Amiga's cover.

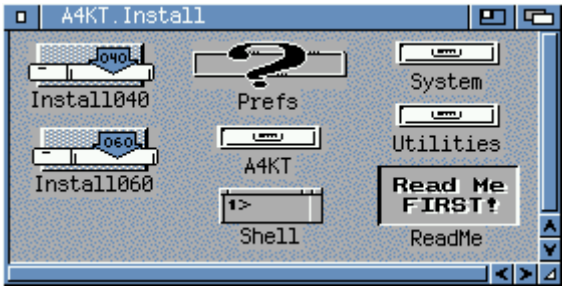
Now that the accelerator is properly installed, you can perform the following power-up test.

Power-Up Test

With the accelerator card configured to your preference and installed, insert all other cards, attach the mouse and keyboard, and connect your monitor and power cables. Insert the A4000T-060/040 install disk in floppy drive "DF0:" (or other bootable floppy drive) and turn on the Amiga. At this point, it is necessary to boot from the install disk since the machine's "Startup-sequence" will usually attempt to install the 68040.library or may contain other incompatible software. The 68040.library is not compatible with the 68060, and will cause the machine to crash. If the machine boots with the install disk properly, you can proceed. However, if the Amiga does not boot, follow this list to determine the cause of the problem:

1. Make certain that the A4000T-060/040 install disk is inserted into "DF0:". You must boot from the install disk initially as noted above.
2. Verify all jumpers on the accelerator and A4000T motherboard, then check them again. The jumper settings mentioned in Chapter 4 are very important and the machine will not boot unless the A4000 Tower motherboard is jumpered correctly.
3. Remove the new accelerator, install the old CPU board and turn on the Amiga, to verify that the computer works properly. If it does not boot, remove all cards and try again. If it still fails to boot, have your dealer or service center examine your Amiga computer.
4. Remove all cards except the new accelerator, and boot the Amiga. If it boots, then add each card one at a time until the entire combination functions or until you have found a card that causes the problem. There may be an incompatibility between some boards in the system, or the motherboard may have an expansion bus problem.
5. If at all possible, test the accelerator in a different Amiga.

Chapter 6: Software Installation



The A4000T-060/040 accelerator includes several programs to maximize your system's performance and to insure compatibility with the 68060. When installing an accelerator with the 68060, the following installation procedure must be completed before the 68060 will boot properly with the normal A4000 Tower "Startup-sequence".

All of these programs can be installed automatically on your system by inserting the A4000T-060/040 install disk in "DF0:" and booting from it. Booting from the install disk instead of your normal boot drive is necessary, particularly with the 68060 to avoid installing the original 68040.library and crashing the machine. After the machine has booted and "Workbench" is loaded, installation of software is accomplished by double-clicking on the **A4KT.Install** icon, and then on the **Install040** icon or **Install060** icon. After the selected icon is open, simply follow the instructions and options given to install the software and optimize your system's performance. Once the installation procedure is complete, remove the install floppy from "DF0:" and reboot your machine from your normal system hard drive.

It should be noted that, since the A4000 Tower normally comes with a 68040 CPU and appropriate libraries, it is only necessary to install the Kickstart remapping utility called "KSRemap" if your new accelerator board comes with the 68040. All other necessary programs for the 68040 are shipped installed. If, however, you purchased an accelerator with a 68060, there are three programs needed by the system to insure maximum performance. These are the CPU060, 68060.library, and the dummy 68040.library. A Kickstart remapping utility is not needed since the 68060 MMU can perform this automatically when the 68060 libraries get installed by the Setpatch utility.

The programs included with the Install disk are noted below:

KSRemap

This program will copy an image of the Kickstart ROM to Fast RAM on the accelerator board for increased performance of the entire system. It can be installed and loaded automatically every time the system boots as noted above or it can be used by double-clicking its icon or run as a Shell/CLI command.

Note: KSRemap is only needed for the 68040. With the 68060, Kickstart remapping is done with the CPU's MMU.

Arguments:

`Remove`	Reset the system ROM vector to point to the Amiga's ROM chips and frees any Fast RAM previously reserved for remapping the ROM.

68060.library

This library is used only for the 68060. The purpose of this library is to patch the operating system for optimal performance with the 68060 and to install a floating point library for the 68060.

68040.library (dummy library)

[Note: This dummy library is obsolete if using AmigaOS 3.1.4 ROMs or later] This library is used only for the 68060. The purpose is to allow the Amiga's "Setpatch" command to install the right library for the 68060. When Setpatch runs, its job is to find the 68040.library file in the "LIBS:" directory and install any patches or libraries it contains. The job of the dummy 68040.library is to point Setpatch to the real 68060 libraries contained in the 68060.library file.

CPU060

The "CPU060" command is similar to the Amiga "CPU" command. When run, this command will inform the user about the state of the 68060 caches and other internal registers and allows for caching options to be modified. To display this information, simply type the command in a Shell/CLI window. To display the options available with this command, type the command followed by a "?".

All cache modes can be turned on and off with the exception of "Copyback mode". "Copyback" is a special cache write mode and can only be turned on by running "Setpatch"; and once on, cannot be disabled until a system reboot.

Beside controlling the 68060 caches, there is also an option for controlling the 68060 Superscalar mode. The option NOMULTI and MULTI select whether the 68060 is running both integer units (Superscalar mode) or is running just one integer unit. Generally, code runs fastest with both integer units on.

For additional information on software and hardware optimization, please consult the README file on the Installation diskette. This file will always contain the latest information which may not be found in the manual.

Chapter 7: 68060 32-Bit DMA SCSI Controller Upgrade

You will be happy to know that your A4000T-060/040 accelerator can be upgraded to include a 32-bit DMA SCSI-2 controller. Since the A4000 Tower comes with a SCSI-2 controller, in most cases, a second slightly faster controller did not seem warranted. However, if you need additional speed and/or SCSI device support, this option can be added to your board. To upgrade your accelerator, there are several components that must be soldered onto the board and the boot ROM must be replaced. Please refer to your dealer for details about this upgrade option.