WarpEngine™

40MHz 68040 Accelerator with up to 128MBs of 32Bit Local 040 Burst Memory and Fast SCSI-2 HardDrive Controller

User's Guide and Installation Manual

MacroSystem Development

MacroSystem Development
Presents
WarpEngine™

Revision 0.9 - By Lilliane M Carter

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"The WarpEngine" William Coldwell Steven L. Kelsey Robert Tingley
Music: Paula Graphics/Special Effects: Denise & Lisa
Original Soundtrack available on Floppy Disk.

The WarpEngine would not have been possible or be what it is, without the following people:

Our significant others, who put up with us during the development of this (and still do, for reasons we will never understand)., along with the supporting cast of:
Rudy Amid, Dave Baker (Lattice Semiconductor), Brian Cerveny, Ken Dyke, Scott Ellis, Seth Harman, R. S., Delphine Tomei, Roger Uzun, John Wiederhim, Chris Wolf.

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Dedicated to the original Amiga, Inc. team, for making all of this happen in the first place.

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For many years, Robert Tingley, Steve Kelsey and I have worked on projects geared towards getting the ultimate Amiga, using leading-edge technology. The WarpEngine is the result of all of that hard work. With our combined experience in Amiga hardware and software, we have taken her into the desktop workstation realm.

We are Amiga users too. We love our Amigas. We put together a design that we believe will change "how" you use your Amiga. By being optimized for memory access and SCSI speed, along with raw CPU power, you can do more with your Amiga in less time. Faster rendering. Faster compiling. Quicker screen refreshing.

During the design phase, we listened to suggestions from other Amiga users. Professional users, whose jobs depend on the Amiga. Regular, everyday Amiga users who wanted their Amigas to do something it couldn't already do, because of speed or memory limitations. We looked at what was out in the market, and what was supposed to be coming out from the competition, and have come up with what we consider to be the best product.

We'd like to thank you for purchasing the WarpEngine.

Get Warped!
Bill

Internet: billc@iceeube.cryogenic.com
April 13th, 1994 - Portland, Oregon

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1. Introduction to the WarpEngine

The WarpEngine from MacroSystem Development is a revolutionary new accelerator for the Commodore Amiga 3000/4000 family of computers. It incorporates high speed '040 burstable local memory access of up to 128 Megabytes using JEDEC standard 72 pin SIMMs. This expansion device provides you with high speed '040 acceleration and a SCSI 2 FAST DMA controller, which is the fastest available on the market today.

What makes the WarpEngine so revolutionary, is the high speed local bus memory, coupled with the blazing speed of the '040, along with an intelligent DMA SCSI-2 FAST controller, that doesn't take up any Zorro slots.

This manual will explain how to install and use the WarpEngine and it's related software. Please also read any existing readme-files on the disk, because there will always be updates.

2. Theory of Operation

This section attempts to give the reader a little insight into the design of the WarpEngine product. If you are not interested in such technical matters, please skip to section 3.

2.1 Why an Accelerator?

The purpose of adding an accelerator to an Amiga system is to speed up and enhance that system. The accelerator speeds up the system by replacing certain resources with faster and more capable ones. The more often these resources are used, the more time is saved, thus providing an effective speed up. The accelerator can also enhance the system by adding new resources that were not present in the original system. Use of these resources can often make possible operations which were previously impossible or unreasonably time consuming or complicated, again leading to an effective speed up in the system's performance.

When added to a standard A4000 system, the WarpEngine offers higher CPU performance, larger memory capacity, faster memory access, and the addition of a high speed SCSI bus controller. All of these work in concert to provide faster system performance, higher data throughput and new input/output device support.

2.2 Design Overview

The WarpEngine is an asynchronous accelerator which installs in the Local Bus Expansion Slot of the Amiga A3000 and A4000 series of microcomputers providing a 68040 microprocessor, area for DRAM memory expansion, and a fast SCSI bus controller.

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The major areas of design are therefore:
  * *Amiga Local Bus interface*
  * *68040 CPU and bus control*
  * *DRAM interface*
  * *SCSI controller interface*

Other areas of design include:
  * *Clock generation and distribution*
  * *Autoconfig control and Autoboot ROM*
  * *Bus arbitration and DMA control*

The design is implemented on an eight layer Printed Circuit Board (PCB) with double-sided Surface Mount Technology (SMT) components mixed with double-sided Through-Hole Technology (THT) components. The PCB has two pad layers (top and bottom component surfaces), four primary signal routing layers, and a pair of power and ground planes.

2.3 Amiga Local Bus Interface

As you will see in the next section, the 68040 bus is completely synchronous, is staticly sized at 32-bits and can operate at frequencies up to 40 MHz. The Amiga Local Bus is based on the 68030 microprocessor bus and operates both synchronously and asynchronously, supports dynamic bus sizing of 8, 16, and 32-bit devices, and operates at either 16 or 25 MHz. The differences between the 68030 and 68040 busses are quite significant and led to a major portion of the WarpEngine design.

When a bus cycle is started by either the 68040 or the on-board DMA SCSI controller, a decoder circuit decides whether or not the cycle is targetted at one of the WarpEngine's resources. If not, the cycle is converted to the protocol of the Local Bus and the cycle is completed by the Amiga system. This conversion process includes synchronizing the cycle to the Local Bus clock, translating transfer attributes from 68040 to 68030 style values, producing the required handshaking signals, waiting for the acknowledgement signals,

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emulating the 68030's dynamic bus sizing protocol, and resynchronizing the result back to the 68040 bus. There are also several other signals that must be converted or conditioned as they enter or leave the WarpEngine from/to the Local Bus Expansion Slot.

When all is said and done, though, bus cycles that access motherboard resources (like Chip RAM, Fast RAM, custom chip registers, I/O ports, and even the Zorro-II/III expansion bus) are compatible with the 68020 and 68030 processors. It is worthy to note here that the WarpEngine does not affect nor is it affected by Buster/DMAC/Zorro-III problems. The WarpEngine will operate correctly with, but will not fix, the older chips and their problems. Even the WarpEngine's onboard DMA SCSI controller will function properly in systems with older chips. This is because the SCSI controller is on the 68040 bus and is controlled by the Warp Engine's circuitry, so it is not subject to the problems and limitations of the Zorro bus and the custom chip set.

2.4 68040 CPU and Bus Control

The WarpEngine utilizes the Motorola MC68040 microprocessor as its main CPU. The 68040 is a highly integrated microprocessor with an integer execution unit, a floating-point execution unit, and dual (instruction and data) memory management units and 4kByte caches. Most Amiga software developed for the earlier Motorola processors (68000, 68010, 68020 and 68030) and math coprocessors (68881 and 68882) will work on the 68040. However, there are some exceptions, especially in the area of games. There are some differences between each processor in the family, but mostly only in the supervisor programming model. Most, if not all, of these differences are taken care of in the Amiga's system software. Application software that is written according to the published Amiga guidelines should work fine on the 68040.

As mentioned in section 2.3, the 68040 bus is completely synchronous and operates at frequencies up to 40 MHz. The bus protocol consists of a set of transfer attributes and several control signals. All output signals are driven out on and all input signals are sampled in on the rising edge of the bus clock. The state of the bus can be tracked by a hardware state machine, providing enhanced protocol utilization and fault detection. The bus control logic also performs address decode, transfer control, interrupt and reset control, and bus arbitration.

2.5 DRAM Interface

An important feature of the WarpEngine is its memory expansion architecture. The WarpEngine provides four JEDEC standard 72-pin SIMM (Single In-line Memory Module) sockets for the addition of 32-bit DRAM modules. Each module may contain either page mode or static column mode DRAMs with access times of 80, 70 or 60 ns (nanoseconds). Each module may also be either 4, 8, 16 or 32 megabytes in size. You may freely mix or match modules of any of these types, speeds and sizes.

The DRAM interface design is optimized for 60ns DRAMs at 40MHz, 70ns DRAMs at 33MHz, and 80ns DRAMs at 28MHz or slower. You can use faster DRAMs at a given frequency without penalty but also without gain. If you choose to use slower DRAMs than stated above at a given frequency, an additional wait state can be added to provide reliable but slightly slower operation.

The WarpEngine's DRAM design supports the 68040's burst transfer protocol for both reading and writing whole cache lines (16 bytes) to and from memory. For normal transfers, four clock cycles are required to transfer a longword (4 bytes). For burst transfers, each additional longword requires only two clock cycles, totalling 10 clock cycles for four Iongwords (or 16 bytes). A convenient notation for this is 4/2/2/2, where each digit describes the number of cycles required to access a longword. At a given frequency, these numbers can be used to compute the bandwidth

of the memory interface. For example, at 40MHz a 4/2/2/2 memory design yields a memory bandwidth of 64MB/s (megabytes per second). In comparison, the A4000 with the original A3640 CPU card operates 7/7/7/7 at 25MHz for a bandwidth of 14.3MB/s.

2.6 SCSI Controller Interface

The WarpEngine design incorporates the NCR 53C710 SCSI I/O Processor for maximum SCSI bus performance and system throughput. The 53C710 is a third generation, intelligent SCSI processor capable of performing SCSI bus transactions conforming to both SCSI-1 and SCSI-2 standards, including asynchronous transfers up to 5 Megabytes per second and fast synchronous transfers up to 10 Megabytes per second. The 53C710 also has a host bus interface compatible with the 68040, supporting 32-bit data transfers and cache-line burst transfers. And since it has a full 32-bit address bus, it can DMA into the entire Amiga address space, avoiding problems and slow downs caused by DMA Mask limitations.

2.7 Clock Generation and Distribution

The 68040 microprocessor requires both a bus clock (BCLK) and a processor clock (PCLK). The PCLK must be exactly twice the frequency of the BCLK and both must meet several technical waveform specifications. Many other circuits on the WarpEngine also require one or both of these clocks. That means for a board running at 40MHz, several 40 and 80 MHz clocks need to be generated and distributed on the board. This is done by a special Phase Locked Loop (PLL) clock driver device that takes a simple crystal oscillator input and generates several clock signals with guaranteed waveform and relationship specifications.

The WarpEngine also provides a 50MHz clock to the SCSI controller for synchronous SCSI transfer timing. This clock is divided down internally to a program controlled frequency

appropriate for the SCSI unit being talked to. This 50MHz clock is also divide by two (down to 25MHz) and driven onto the motherboard to provide a clean, 25MHz system clock source. Motherboard jumpers allow the user to select which clock source will be used; the clock from the motherboard oscillator, or the clock from the Local Bus Expansion Slot. For a 25MHz system, which clock source you choose should make no difference. For a 16MHz A3000 system, configuring the motherboard to use the 25MHz clock provided by the WarpEngine can make a significant difference in system performance. In any case, the WarpEngine is designed to interface asynchronously to the Local Bus at whatever frequency is provided to the Expansion Slot (up to 25MHz).

2.8 Autoconfig Control and Autoboot ROM

The WarpEngine uses the Amiga's Zorro-III Autoconfig protocol to configure the SCSI controller and Autoboot ROM. This hardware and software mechanism allows the system software to determine what resources are available and to properly configure them. The WarpEngine informs the system that it is an I/O type card of a certain size and that it has an Autoboot ROM. The system responds by assigning the WarpEngine a unique base address and then by finding and executing the initialization routine located in the Autoboot ROM. This routine configures the Warp Engine's hardware resources (like DRAM) and then, if the jumper settings indicate that Autoboot is enabled, loads the SCSI device driver into memory.

2.9 Bus Arbitration and DMA Control

The WarpEngine supports two types of DMA, and therefore two types of bus arbitration. First, there is the onboard DMA SCSI controller that competes with the 68040 and the Local Bus for mastership of the WarpEngine's main bus. Once the SCSI controller has ownership of the bus, it runs bus cycles just like the 68040 does and has access to onboard DRAM as well as all motherboard resources. Arbitration between the 68040, the SCSI

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controller and the Local Bus is done by an efficient bus arbitration state machine based on the 68040 specification. The second type of DMA is from the Amiga Local Bus, which includes the SCSI controller on the A3000 motherboard and Zorro bus DMA devices. A sperate bus arbitration state machine conforming to the 68030's bus specification arbitrates this interface and interacts with the 68040 arbiter. This allows Local Bus DMA devices to access the WarpEngine's onboard DRAM.

3. WarpEngine Installation in a Commodore A4000

3.1 Disassembling Your Amiga 4000

Make sure that you are properly grounded by wearing a grounding strap or by touching the metal side on your Amiga chassis.

1. **ATTENTION:** First turn off the power button to your Amiga and all peripherals and remove all connecting cables, especially the power!

2. Using a Phillips-head screwdriver, remove the two screws at the upper corners of the rear of the main unit. Put these screws aside.

3. Grasp the cover on both sides and slide it backward and up. Set it aside.

4. Remove the front faceplate. The faceplate has several plastic tabs that hold it to the metal case. Squeezing the tabs and pushing them through the metal case holes releases the faceplate. Using needle nose pliers makes this task much easier.

5. Unscrew the front mounting bracket screws of the front drive bay. Set screws aside. Disconnect the power and ribbon cables, noting the orientation of the connectors before you remove them so that you can replace them properly when putting your A4000 back together. Remove front drive bays by sliding the bracket and drives straight out the front of the metal case.
Set aside in a safe place.

6. Remove the four mounting bracket screws holding the IDE drive. Set screws aside. Disconnect the power and ribbon cables from the IDE drive noting the orientation of the connectors before you remove them so that you can replace them properly when putting your A4000 back together. Lift bracket and drive straight

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up and out of your A4000. Set aside in a safe place.

7. There are three different configurations the A4000 comes in. Find your particular configuration below and follow the instructions on how to install the WarpEngine.

   7.1. If you have a A4000/30 with the CPU on the motherboard your 200 pin CPU slot will be vacant. Proceed to Section 3.4.

   7.2. If you have a A4000/30 with an '030 card in the CPU slot, you will need to remove it. Take proper anti-static measures by grounding yourself. If you are not wearing a wrist strap then touch the metal chassis of the A4000 for a moment to dissipate static. To remove processor module, grasp the module at either end of the slot connector and lift up. Lifting elsewhere on the processor module can result in damaging your module or connector. Remove plastic standoffs and set aside. You will want to wrap the processor module in anti-static wrap and store in a safe place. Proceed to Section 3.4.

   7.3. If you have an A4000/40 with an '040 card (Commodore A3640) in the CPU slot, you will need to remove it. Take proper anti-static measures by grounding yourself. If you are not wearing a wrist strap then touch the metal chassis of the A4000 for a moment to dissipate static. To remove processor module, grasp the module at either end of the slot connector and lift up. Lifting elsewhere on the processor module can result in damaging your module or connector. Remove plastic standoffs and set aside. You will want to wrap the processor module in anti-static wrap and store in a safe place. If you purchased the WarpEngine without a 68040 processor and you are using the processor from the processor module, you will need to remove it at this point for placement in the WarpEngine. Proceed to section 3.2 for instructions on how to do this.

8. If you are installing a 68040 that you have purchased separately please refer to Section 3.3.

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3.2 Removing the 68040 from your Amiga's Processor Module

NOTE: You will need a chip puller for this task. This is a extremely delicate task that requires the proper tools. If you do not have these available to you please contact your local Commodore authorized dealer/service center.

1. Remove the processor module from the CPU slot.

2. Remove the 68040 chip by inserting a flat blade screwdriver vertically on one side of the heat sink retaining clip and twisting the screwdriver to release the clip.

3. Using the chip puller, carefully remove the chip, taking care not to bend any pins.

4. When you have removed the chip, place it on a piece of conductive foam for protection.

5. You are now ready to install your 68040 in the WarpEngine. Proceed to section 3.3.

3.3 Installing the 68040 onto the WarpEngine

1. To install your 68040 chip in the socket provided on the Warp Engine, you will need to locate pin 1 on the socket and on the chip you are installing. Pin 1 on the WarpEngine is denoted by a rounded edge on the socket. Pin 1 on the 68040 is indicated by an L-shaped mark on the corner of the chip.

2. Orient the chip so that the pin 1 locations of both the socket and the chip match. Note the mark on the MC68040 on the diagram on the following page. Insert the oriented 68040 into the heat sinc socket so that one of the heat sink clip holders should be next to pin 1 of the 68040, the other should be near the SCSI connector.
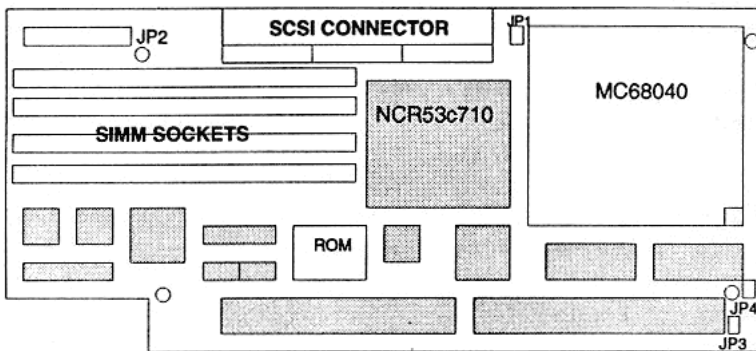
3. Set the chip down on the socket. When you have determined that all of the pins are resting in their socket holes, press the chip firmly down in the socket.

4. When the chip is fully seated in the socket, place the heat sink on top of the chip and snap the retaining clip over it onto the heat sink socket tabs.

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3.4 Different Configurations for the WarpEngine

1. If you are going to add memory to the WarpEngine, please refer to Section 3.5.

2. If you are going to add SCSI device(s) on the WarpEngine, please refer to Section 3.9.

3. If you do not plan to add any of the above at this time, proceed to Section 3.14.

3.5 Memory

There are two ways in which you can install memory onto the WarpEngine. One is to remove the FAST memory (SIMMs) from the motherboard (up to 16 meg). This is the most logical way to proceed since it is inexpensive and provides a 3x-5x speedup over RAM access that go to the motherboard. This, of course, means faster rendering and calculations.

The other way to install memory is to purchase it separately. On the following pages you will find instructions on how to install the memory.

The WarpEngine takes 4, 8, 16, or 32 Megabyte SIMM modules. The WarpEngine uses 32 bit modules that come in 4 different sizes:

The 4MB SIMM is a 1MBx32b SIMM module. This module is single sided with eight 4Mb DRAM chips.

The 8MB SIMM is a 2MBx32b SIMM module. This module is double sided with sixteen 4Mb DRAM chips.

The 16MB SIMM is a 4MBx32b SIMM module. The module is single sided with eight 16Mb DRAM chips.

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NOTE: The 16MB SIMM may be double sided and contains thirty-two 4Mb DRAM chips. This module is not recommended, as it is usually very large, and consumes a lot of power. Although it will work, we recommend that you use the single sided 16MB SIMM module. We will not guarantee that the WarpEngine will function properly with multiple double-sided 16MB SIMM modules because of the additional loading on the memory bus, and the additional power loading.

The 32MB SIMM is a 8MBx32b SIMM module. This module is double sided with sixteen 16Mb DRAM chips.

You can install any of the listed SIMM sizes, mix and match, even if they are of different sizes.

3.6 Contigious Memory

Any time you install the same type and size of SIMMs, you will get contigious memory. For example, if you install two 32MB SIMMs, you will get 64MB of contigious memory. Now, if you install a 16MB in the third socket (SIMM2), this SIMM will also be contigious, giving you 80MB of contigious memory. If you were to add a fourth SIMM module of 16MB or less, it will result in a seperate memory block that is not contiguous with the 80MB block.

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3.7 Removal of SIMMs From the A4000 motherboard

If you have an Amiga 4000/40, you may remove the 2 (or more) SIMMs from the motherboard FAST RAM area and place them on your WarpEngine.
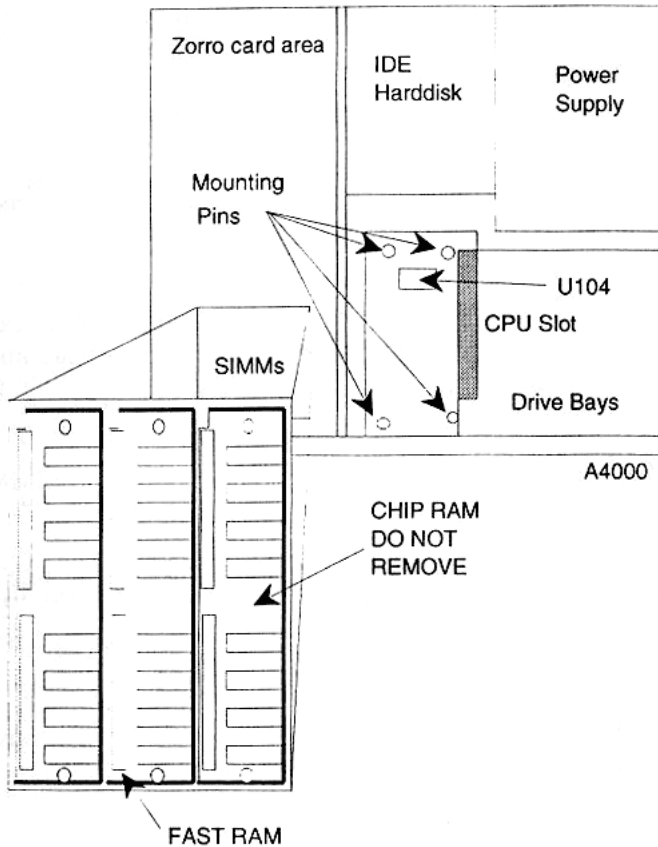
The SIMMs are located on the lower left of the motherboard. You will have to remove any expansion cards to see the SIMMs.

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Examine the SIMMs and take note of its memory speed by looking for a -6 (60 ns), -7 (70 ns), -8 (80 ns), or -60, -70, or -80. Refer to the memory speed chart to see if you can use those SIMMs on your WarpEngine.

| *SIMM Speed*	*CPU speed*
60 ns	40 MHz
60 or 70 ns	33 MHz
60, 70, or 80 ns	25/28 MHz

NOTE: It is possible to use slower speed SIMM modules by adding a wait state to memory accesses (putting a shunt on Jumper E), yielding a slower 5/3/3/3 access. This will allow you to use 80ns memory with a 33 or 40MHz processor with reduced performance.

NOTE: If you are going to remove the motherboard SIMMs, take proper anti-static measures by grounding yourself. If you are not wearing a wrist strap then touch the metal chassis of the A4000 for a moment to dissipate static.

1. CAREFULLY, look at the two "fingers" holding the top SIMM in place. They are very delicate.

2. Using _your_ finger, move the clip over slightly and that side of the SIMM should be released. Do the same for the other side. The SIMM should now be free to pull out. Place it in a safe, static free area.

3. Remove the other SIMMs the same way, but **DO NOT** remove the double sided CHIP RAM SIMM.

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3.8 Installing Memory on the WarpEngine

Put the WarpEngine on a table, with the 68040 on your left. Orient the SIMM so that the notch is on the left.

Notch
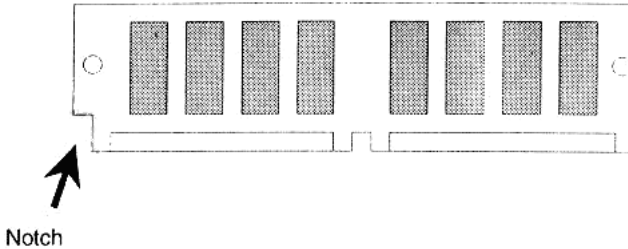
Note: You will want to place the largest (in memory size) SIMM that you have in SIMM4 and work your way down to SIMM1.

1. Insert the gold or silver fingers of the SIMM into the SIMM socket (start with SIMM4 on the WarpEngine) at about a 45 degree angle. The SIMM will "sit loosely" in the socket, if you have the notch on the correct side, and notch on the bottom in the correct position.

2. Using your fingers, rotate the SIMM towards you until it is locked into place by the tabs at either end of the socket.

3. Repeat for all of the SIMMs you wish to use on the Warp Engine.
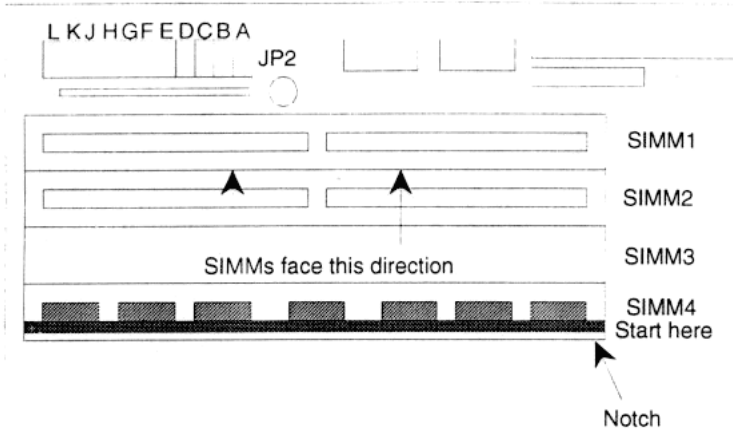
JP2: (bold characters denote default configuration)
B: SIMM Bank Size - Off: Dual sided **On: Single Sided**
C: SIMM Module Size - Off: 16M/32M **On: 4M/8M**
D: Wait State - **Off: no wait state** On: wait state

Memory Configuration Chart

B	C	Description	Largest SIMM
0	0	Double sided, 16Megabit density	(32MB)
0	1	Double sided, 4Megabit density	(8 MB)
1	0	Single sided, 16Megabit density	(16MB)
1	1	Single sided, 4Megabit density	(4MB)

0 = Shunt is not on the jumper
1 = Shunt is placed on the jumper

Examples:
4, 4 Megabyte SIMMs: B=ON   C=ON
1,16 Megabyte SIMM   B=ON   C=OFF

NOTE: If you install a 16 Megabyte module first, and you install an 8M module afterwards, you will need to set your jumpers to:
B=OFF C=OFF

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3.9 Connecting SCSI Devices to the WarpEngine

If you wish to connect an internal SCSI device (one that fits in the A4000 case), you will need to use the standard 50 pin to 50 pin flat ribbon SCSI cable that came with your WarpEngine.

Note: If you wish, you may move your IDE harddrive to the area below your floppy drive, in the drive bay. This will free up that area for use with an internal SCSI harddrive.

If you wish to connect more than one internal device, make sure that the cable has adequate length and enough 50 pin female connectors for your devices. If you wish to connect external SCSI devices to the WarpEngine, you will need to purchase a 50 pin flat ribbon cable to a 50 pin high-density Centronics connector. This cable is available from MacroSystem Development for a nominal charge. You will be able to connect a standard 50 pin high density Centronics connector.

To connect an internal device to the WarpEngine, refer to the diagram below. Connect one end of the 50 pin flat ribbon cable into the SCSI connector, noting the orientation of pin 1 of the cable (usually denoted with a red stripe). Connect the other end into your SCSI device, observing the same precautions.
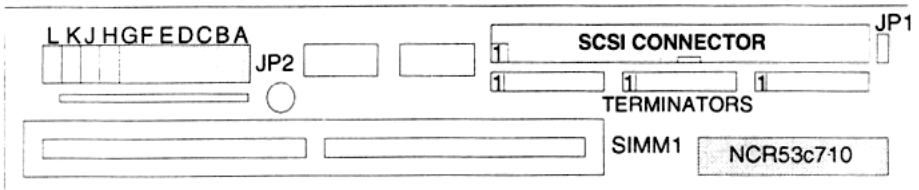

JP1: SCSI Termination power

3.10 SCSI Termination

You will need to terminate the SCSI bus at both ends of your cable. Generally, there will be termination resistors in the Warp
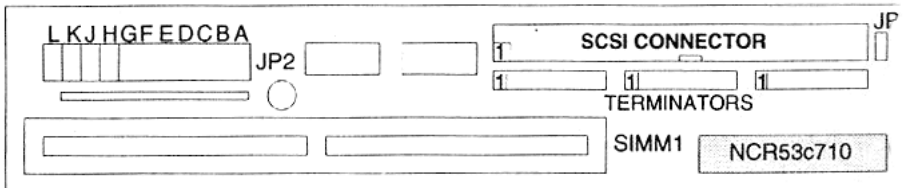
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Engine (Refer to the diagram above, located next to the SCSI connector), and on your last device attached to the SCSI cable. If your last device is an external CDROM or tape drive, there may not be an external terminating block, but instead, it may have a switch or jumper. Refer to the device's operational manual to find out if the SCSI terminators have to be powered by the SCSI bus. If this is true, you will need to place a shunt on JP1.

The diagram below gives two examples of how proper termination is attained.
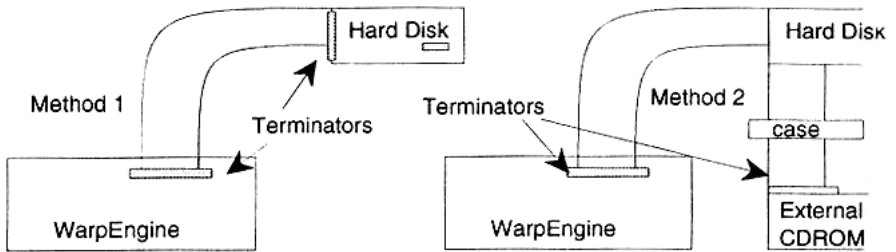
3.11 SCSI Configuration

If you wish to connect SCSI devices to the WarpEngine, you will have to configure the proper jumpers. The WarpEngine comes from MacroSystem Development with no jumpers on the SCSI configuration pins. You will have to select one of the following configurations.

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SCSI Jumper Configuration Chart

<u>K</u>	<u>J</u>	<u>H</u>		<u>Description</u>
0	0	0	-	SCSI Autoboot disabled
0	0	1	-	Delay, LUN Scan, No Synch
0	1	0	-	Delay, LUN Scan, Synch 200 ns
0	1	1	-	Delay, LUN Scan, Synch 100 ns
1	0	0	-	LUN Scan, Synch 200 ns
1	0	1	-	LUN Scan, Synch 100 ns
1	1	0	-	Synch 200 ns
1	1	1	-	Synch 100 ns

0 = Shunt is not on the jumper
1 = Shunt is placed on the jumper

Delay (Delay) is a 10 second pause to allow slower drives to power up before being queried upon startup. Logical Unit Number (LUN) scan searches for all LUNs of a particular ID. Synchronous (Synch) negotiation allows a quicker protocol handshake and data transfer from the SCSI device. Synch 100 ns is for fast synchronous, which allows a faster transfer rate, while Synch 200 ns is a slower one.

It is recommended that you start with H, J, and K jumpered, which gives you no delay, no LUN scan, and 100 ns Synchronous negotiation. This will give you the fastest that the WarpEngine can do. You will have to work your way down, if your SCSI device does not handle this. Worst case is H is jumpered, J and K opened (Delay, LUN scan, no Synch).

3.12 Setting SCSI IDs

The WarpEngine is configured to SCSI ID 7. It scans the SCSI bus for devices, starting at ID 0, up to ID 6. You will want to put your SCSI hard drive at ID 0, to facilitate quick boot up. Do not put multiple devices at the same ID, doing so will confuse the WarpEngine, and other devices on the SCSI bus. Refer to the owner's manual for the device to see how to configure it's ID.

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3.13 Hard Disk LED

The WarpEngine does not come with an LED shunt due to space constraints. You may connect the H.Disk LED for the IDE drive, onto a hard drive's LED connector.

3.14 Installing the WarpEngine in your Amiga 4000

NOTE: If you have a early Amiga 4000 that has a processor module with a 28MHz oscillator in U104, change the jumpers at JP100 and JP104 from "Internal Clock" to "External Clock".

1. Insert the plastic standoffs that you removed from your processor module, into the holes provided on the A4000 motherboard in the holes by chips labelled U152 and U890, before installing the WarpEngine.

NOTE: You will find that the WarpEngine installs easier if you insert the standoffs onto the motherboard first, rather than inserting them onto the WarpEngine.

2. At this point you will begin the actual installation of the Warp Engine into your A4000. Please take the appropriate anti-static measures to avoid static discharge from causing damage to your WarpEngine by grounding yourself. If you are not wearing a wrist strap then touch the metal chassis of the A4000 for a moment to dissipate static.

3. If you have not already done so, remove the WarpEngine from the anti-static bag. Clip the Heatsync onto the 68040.

4. Align the WarpEngine so that the 200 pin connector is directly over the CPU slot connector on the A4000 motherboard.

6. When it is properly aligned, press down gently on the Warp Engine at either end of the 200 pin connector. If it does not seat in the slot connector easily, it is not properly aligned. Try aligning it

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again.

NOTE: Once you have the WarpEngine installed, you will want to verify that everything operates properly. Plug your video cable and power cable in. Turn on the power switch located on the front of the power supply. If everything is functioning properly then you should get the Amiga boot screen (a purple screen with the Amiga logo and a disk animation). If you do not get a boot screen, turn your power off, disconnect the power cable and make sure that your WarpEngine is properly seated. If you do get a boot screen, then turn your power off and remove the power cord from the back of the A4000 and continue reassembling.

3.15 Reassembling your Amiga 4000

1. Replace the IDE drive and bracket. Attach the ribbon and power cables, noting the correct orientation. Replace the four mounting bracket screws. Tighten snugly.

2. Replace front drive(s) by sliding bracket with drives into front bay and attaching ribbon and power cables, noting the correct orientation. Replace the two mounting bracket screws. Tighten snugly.

3. Replace the front faceplate by inserting tabs into Amiga chassis.

4. Replace any expansion cards that had to be removed.

5. Replace the cover on the Amiga 4000, reconnect the power and monitor cables and any other peripherals. Turn on your "Warped" computer and your monitor and have fun.

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4. Software

4.1 SCSItools

SCSItools is a random-access-device initialization and partitioning program. What that means is that you can take a SCSI harddisk and prepare it for use by the WarpEngine. ***SCSItools allows you to change some very sensitive areas concerning your harddisk, so use this program with EXTREME discretion***. You will want to use SCSItools if your hard disk has not been setup up for use under the Amiga OS before.

Note: SCSItools is easy to use, yet it is very powerful. If there is any data already on the hard disk, if you are not careful, you could lose it.

When you start SCSItools, you will be presented with an information requester. Click OK, and SCSItools will scan your SCSI bus for devices. For all of the devices it finds, SCSItools will show its information in the device list box. If a device connected to the WarpEngine does not show up, try clicking on the SCAN IDs button, to cause SCSItools to rescan the SCSI bus.

Note: If a device still refuses to come up, check your cabling and termination.

4.2 The Main Screen

This area of SCSItools lets you choose which device that you want to perform the functions below on.

Selecting *QUIT* will exit the program and update the RigidDiskBlock of a device, if necessary.

Selecting *SCAN IDs* - Re-scans the WarpEngine's SCSI bus for all devices attached. It is good for catching devices that were missed when the program was invoked, or getting removable media that you may have just inserted. If a device does not appear

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on the device list display, then check the cables and power.

Selecting *PARTITION* lets you set up the drive for use under AmigaDOS. You will be able to split a harddrive into smaller sections.

Selecting *INITIALIZE* lets you prepare the drive for first time use. This function is not necessary if the drive is already low-level formatted for use on the Amiga, but will aide in quickly setting up your device

NOTE: *** This causes the drive to lose ALL data. ***

Selecting *EDIT RDB* whisks you away to a screen that allows you to change some of the flags on the RigidDiskBlock. This does not cause the drive to lose data.

4.3 THE EDIT RDB SCREEN

This area of SCSItools shows you some important information that it determined about a particular device.

THE RDB FLAGS

This area of SCSItools lets you change some important flags telling the WarpEngine how to talk a particular device.

Selecting *EXIT TO MAIN* will exit to the Main screen and update your RigidDiskBlock, if necessary.

NO RESELECT - Not used at this time.
SYNCHRONOUS - Not used at this time.

Note: Reselect/Disconnect is defaulted to on, while Syncronous is based on the SCSI Configuration jumpers.

Checking *LAST LUN* will tell the WarpEngine at the AutoBoot

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time, to not search for more logical unit numbers after this one. For embedded SCSI devices, this should always be checked for to help speed up the AutoBoot process.

Checking **LAST ID** will tell the WarpEngine at AutoBoot time, to not search for any other SCSI devices after this one. This is used to tell the WarpEngine that there is no higher SCSI IDs.

Note: This will help speed up the AutoBoot process, but since the Warp Engine will not search beyond this device, it should only be checked with caution.

4.4 The Partition Screen

This area of SCSItools lets you create, edit or delete logical partitions on a particular device for use with the WarpEngine under AmigaDOS.

Selecting **EXIT TO MAIN** will exit to the Main window and update your RigidDiskBlock if necessary.

UPDATE - Not used at this time.

Selecting **ADD** will let you add a partition to the harddisk if there is any space remaining. This partition will already be formatted by SCSItools and usable after a reboot. The new partition will be half of the remaining space available.

Selecting **EDIT** will let you change the attributes and size of the selected partition. Sizing a partition will cause the loss of data in the selected partition.

Note: BACKUP THE PARTITION BEFORE CHANGING ITS SIZE.

You can also change the DOS type, Mask and MaxTransfer.

Selecting **DELETE** will let you delete the selected partition.

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This will free up the area that the partition used. You can now create a new partition (or smaller partitions) in its place. Or, you can edit the last partition to use all of the newly available space.

Note: You may only delete the last partition.

4.5 Quick Startup

If you have a new hard disk, the quickest way to get it set up, is to select the device in the device list box, then click on the initialize button. A requester will come up to make sure this is what you really want to do. If you select "Format", then _ALL_ data will be erased from the disk. You can then click on it, and after a little while it will finish, and ask you if you want to select the entire size of the hard disk to be a partition. You can select "Yes" here, and once it is done, you can exit SCSITools and reboot. Your partition will then show up on your Workbench, and you may copy files to it.

4.6 Advanced Features

SCSItools allows you to add, edit and delete partitions on the hard drive, edit and display RigidDiskBlock parameters, and low level format hard drives.

4.7 Partitions

A partition on your hard drive is a logical drive on your Amiga. You can add as many partitions as your hard drive has space for. Each partition will appear as a disk icon on your Workbench.

Note: This version of SCSItools only handles FastFileSystem DOS1 (0x444F5301) when creating a DOS root block. It will show "UNKNOWN" when displaying partitions created with a different DOS type, including DOS3 (0x444F5303), which is the default DOS type when you format a

partition under the Amiga OS. This will be addressed in a later version of
SCSItools.

4.8 Adding a Partition

In the partition window, you can add a partition if you have enough free space on the drive. The default size will be one half of the available space of the hard drive. You may size it larger or smaller, by selecting and editing it.

4.9 Deleting a Partition

In the partition window, you can select a partition, and delete it, if it is the last partition. This is an added measure to protect the data on the other partitions you may have.

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5. Troubleshooting

Before calling MacroSystem Development for technical support, please write down your jumper configurations from the following charts. If you have SCSI devices attached to the WarpEngine, please note where the termination is at, and what types/names of devices they are.

You should also check to make sure the power and connecting cables are properly attached.
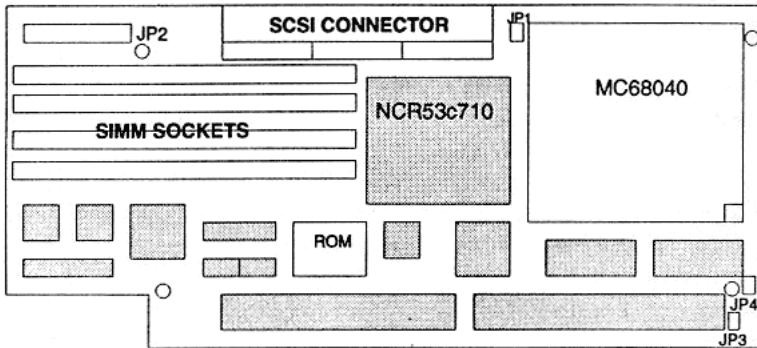
Jumper settings:

TP1: Reserved
TP2: Reserved

JP1: SCSI Termination power
JP2: **(bold characters denote default configuration)**
   A: Mode Select - **Off: 040 active** On: 040 disabled
   B: SIMM Bank Size - Off: Dual sided **On: Single Sided**
   C: SIMM Module Bank Size - Off: 16M **On:** 4M
   D: Wait State - **Off: no wait state** On: wait state
   E: Reserved
   F: MMU disable - **Off: MMU enabled** On: MMU disabled

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G: Cache disable - **Off: Caches enabled** On: Caches disabled
H: SCSI Configuration Jumper \
J: SCSI Configuration Jumper - See chart.
K: SCSI Configuration Jumper /
L: Reserved ON
JP3: Reserved
JP4: Wire clip for A3000 version

Memory Configuration Chart

B	C	Description	Largest SIMM
0	0	Double sided, 16Megabit density	(32MB)
0	1	Double sided, 4Megabit density	(8 MB)
1	0	Single sided, 16Megabit density	(16MB)
1	1	Single sided, 4Megabit density	(4 MB)

0 = Shunt is not on the jumper
1 = Shunt is placed on the jumper

SCSI Jumper Configuration Chart

K	J	H		Description
0	0	0	-	SCSI Autoboot disabled
0	0	1	-	Delay, LUN Scan, No Synch
0	1	0	-	Delay, LUN Scan, Synch 200 ns
0	1	1	-	Delay, LUN Scan, Synch 100 ns
1	0	0	-	LUN Scan, Synch 200 ns
1	0	1	-	LUN Scan, Synch 100 ns
1	1	0	-	Synch 200 ns
1	1	1	-	Synch 100 ns

0 = Shunt is not on the jumper
1 = Shunt is placed on the jumper

Delay (Delay) is a 10 second pause to allow slower drives to power up before being queried upon startup. Logical Unit Number (LUN) scan searches for all LUNs of a particular ID. Synchronous (Synch) negotiation allows a quicker protocol handshake and data transfer from the SCSI device. Synch 100 ns is for fast synchronous, which allows a faster transfer rate, while Synch 200 ns is a slower one.

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6. Commonly asked questions

*Q: *My memory does not appear. Why?*

A: Check your SIMM(s) to make sure that they are either 4M, 8M, 16M or 32M sticks. Check your jumper settings for the type of memory that you have.

* Q: *SCSI device does not appear. Why?*

A: Try setting the K,J, and H jumpers to "Delay, LUN Scan, NoSynch" (refer to chart). Check all cabling to the device, including power. Follow the SCSI cable back to make sure it's connected to the WarpEngine. Check to make sure that there are terminator resistors in the WarpEngine, and on the last device connected to on your SCSI chain. There should only be 2 devices terminated on the SCSI cable (usually the WarpEngine is one of them).

* Q: *I have a black screen on power up. Why?*

A: Check that you have the A4000 power cable connected. Check your monitor cable and power and make sure they are connected as well.

7. Technical Support

MacroSystem Development will provide technical support via the phone Monday thru Friday, 10 AM to 5 PM Eastern Time. We also maintain our own BBS for technical support and try to answer questions on the Internet as well.

To receive technical support you must be registered by sending in your product registration card to us.

Returned Material Authorization MUST be on the outside of the package. To obtain an RMA, you must call or fax MacroSystem Development.

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(503) 257-4823 CryoCafe BBS
Internet: macrosystem@cryogenic.com

7.1 Warranty

For a period of two years from the purchase date, MacroSystem Development warrants the product to be free from manufacturing defects. If a defect is found within the warrantied period, the board must be returned to MacroSystem Development with a copy of your purchase receipt, and an RMA number. The purchaser's sole and exclusive remedy, in the event of a defect, is limited to the correction of the defect, by adjustment, repair, or replacement at MacroSystem Development's discretion. MacroSystem Development shall have no responsibility for shipping expenses, to or from the repair station.

This warranty is null and void, if the WarpEngine has been altered, modified or subjected to abnormal operating conditions. MacroSystem Development is not responsible for any damage caused by or derived from the installation of this hardware product.

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