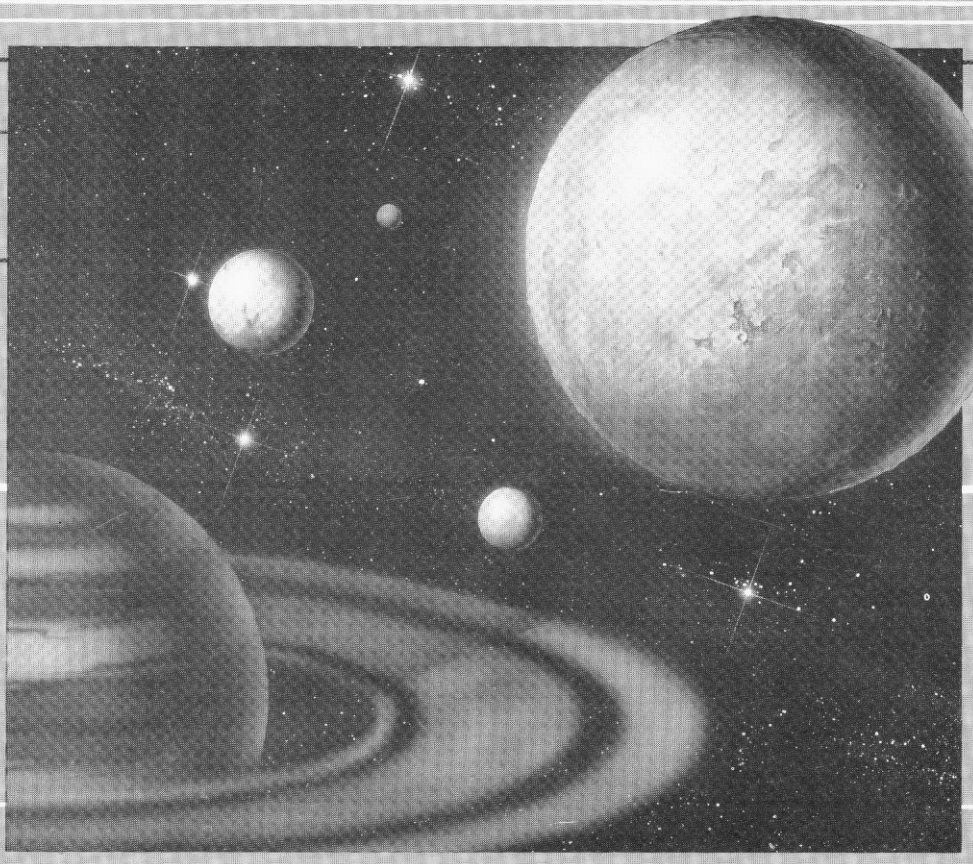
ACCELERATOR IIe™

For Apple® II, II Plus and IIe



OPERATIONS MANUAL

Titan
TECHNOLOGIES, INC.

310 West Ann
Ann Arbor, MI 48104
Phone: (313) 662-8542

REGISTRATION CARD

Please fill out and return at your earliest convenience, the enclosed registration card. This will enable Titan Technologies to notify you concerning future updates and *new* software releases relating to the Accelerator IIe board.

SERVICE

If your Accelerator IIe board should require service, please return it to the dealer from whom it was purchased, or send it postage paid directly to Titan Technologies. Be sure to include proof of purchase.

Ship to: Titan Technologies, Inc.
310 W. Ann
Ann Arbor, MI 48104

ACCELERATOR IIe—USER'S MANUAL

Congratulations! You are ready to more than triple the power of your Apple II, II Plus, or IIe.

There are two ways to use this manual:

(1) Read Section 1 for quick installation. You can refer to Section 2 as a reference at your convenience.

(2) Read Section 2 for a more detailed explanation of the Accelerator IIe's functions.

The Accelerator IIe is an improved model of our older Accelerator II. If you happen to be familiar with the Accelerator II, you will note several changes which make the Accelerator IIe simpler to use.

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SECTION 1—INSTALLATION

STEP 1. DON'T TAKE THE ACCELERATOR IIe OUT OF THE PINK ANTI-STATIC BAG YET.

STEP 2. Turn off the power to your Apple.

STEP 3. Put a piece of aluminum foil on the table next to your Apple.

STEP 4. Take the cover off the Apple.

STEP 5. Make a list of the contents of each slot in a table like the one below:

Slot 0 _____ *(or auxiliary slot)*	Slot 4 _____
Slot 1 _____	Slot 5 _____
Slot 2 _____	Slot 6 _____
Slot 3 _____	Slot 7 _____

STEP 6. If you have an Apple II or II Plus, we recommend that you put your Accelerator IIe in slot 0. If you have a memory board in slot 0 now, move it to another slot or just take it out. The Accelerator IIe contains its own built-in language card with 16K of memory, so you don't really need another 16K memory board.

STEP 7. On your slot table, mark the slot number(s) that contain DISK CONTROLLER CARD(S), MODEM INTERFACE, VIDEO DIGITIZER CARD, or other interfaces to time-sensitive devices. A time-sensitive device is one whose controlling software makes iterative timing calculations. This does not include memory boards, 80-column cards, or printer interfaces.

STEP 8. Touch the Apple's power supply (long metal box on your left as you look into the Apple) to discharge any static electricity on your fingers. Then remove the Accelerator IIe from its pink bag and put the board on the aluminum foil. Make sure each pin on the back of the Accelerator is touching the aluminum foil to prevent static buildup.

STEP 9. Find the block of small switches on your Accelerator IIe board. Switches 1 to 7 correspond to slots 1 to 7. For each slot with a time-sensitive device (refer to your slot table), set the corresponding switch OFF. Set switch 8 OFF. Set all the other switches ON.

For example, if you have a disk controller card in slot 6 and a modem in slot 4, your switches should now match the settings shown in Figure 1.

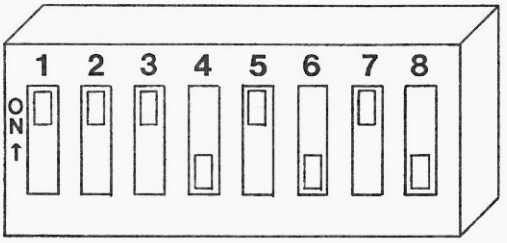

Figure 1. Switch Settings (example)

STEP 10. Find the block of jumpers on the upper right of the Accelerator IIe. Refer to Figure 2. There are 7 jumper positions. The top jumper goes with slot 1, the next with slot 2, etc. The bottom jumper goes with slot 7. Now for each slot where you have any type of memory board, *remove* the corresponding jumper (small plastic gadget). If you have an Apple IIe, ignore the auxiliary slot. For an Apple II or II Plus, the Accelerator IIe will not recognize a memory board in slot 0. Thus there is no jumper for slot 0. We recommend that you put the Accelerator IIe in slot 0 of an Apple II or II Plus.

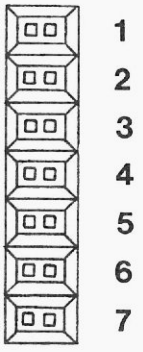

Figure 2. Jumpers

STEP 11. Make sure the power is turned off for your Apple. Touch the power supply again. Now plug the Accelerator IIe into slot 0 on your Apple II or II Plus, or into any available slot on your Apple IIe. Slot 3 is a good choice for the Apple IIe, since the Accelerator IIe will work in slot 3 whereas most other cards won't.

STEP 12. Replace the cover to the Apple.

STEP 13. If you do NOT have a Z-80 card, skip this step. If you have a Microsoft Z-80 Softcard or another Z-80 card which uses direct memory access, you must use the pre-boot disk which came with your Accelerator IIe before you run any Z-80 (CP/M) software. You do not need the pre-boot if you have a Z-80 card which does not use direct memory access. Consult your Z-80 card manual if in doubt.

To use the pre-boot, just boot the Accelerator IIe pre-boot disk. It is already set for the "disable" option, which is what you need. Now remove the pre-boot disk, insert your regular CP/M disk, and press the space bar. Run your programs as usual. Your CP/M software will not speed up, since it is not using the Accelerator's 6502. To get back to 6502 operation for DOS or Pascal, you must reboot the system. Just turn the power off and back on to get accelerated 6502 operation.

STEP 14. All your software (except CP/M programs requiring a Z-80 card) will now run approximately 3-1/2 times faster! If you want to slow down (in order to play games, perhaps), you can use the pre-boot disk provided with your Accelerator IIe board. Just boot this disk before you run your game. Move the cursor to the "slow down" position with the right arrow key. Now remove the pre-boot disk, insert a regular DOS or Pascal disk, and press the space bar. Run your program as usual.

STEP 15. For more information, read Section II at your convenience.

LIMITATIONS:

1. The Accelerator IIe will not speed up CP/M software running on a Z-80 card. All other applications will run approx. 3-1/2 times faster.

2. The Accelerator IIe is not compatible with the Corvus Omninet or other DMA (direct memory access) devices.

3. The Accelerator IIe will not access the second bank of a Saturn 32K RAM Board, although the built-in language card on the Accelerator IIe effectively replaces this second bank.

4. A few programs are not compatible with the CMOS 6502 because they treat newly implemented op-codes as no-ops.

SECTION 2—ACCELERATOR IIe INFORMATION

PROCESSOR

The Accelerator IIe is based on a CMOS 6502 microprocessor running at 3-1/2 MHz. This replaces the Apple's 1 MHz 6502 processor for all computation. The Accelerator's clock is derived from the 7M signal on the expansion bus. The frequency is divided by 2 for normal operation of the Accelerator. Synchronization of off-board cycles is accomplished by cycle stretching.

CMOS parts are particularly sensitive to static electricity, and for this reason the Accelerator IIe should be handled with some care. Ground yourself by touching the Apple's power supply before removing the Accelerator IIe from its anti-static bag. Place the board on a piece of aluminum foil or other conductor to set the switches and jumpers. Be sure every pin on the back of the board is touching the conductor during the operation. Once the board is plugged in, never touch it without first touching the power supply. Avoid excess handling of the Accelerator IIe. The board should always be kept either in its anti-static bag or in one of the Apple's slots.

MEMORY

The Accelerator IIe contains 80K of fast (150 ns) RAM. This memory serves 3 functions: (1) 48K of the Accelerator's RAM replaces the Apple's main (lower) RAM, (2) 16K acts as a built-in language card, and (3) the remaining 16K serves to store the ROM language in fast RAM. Memory on the Apple's main board is not used. However, other memory boards will operate as usual under the Accelerator IIe's control. An exception is the Saturn 32K RAM Board.

Whenever the system is powered up, the Accelerator IIe automatically copies the ROM language into its RAM. The ROM language is Applesoft for an Apple II Plus or IIe; Integer for an Apple II. The 16K of RAM used for this purpose is made to operate as a pseudo-ROM by disallowing any write operations to the pseudo-ROM space. This feature allows maximum speed improvement for running the ROM language.

When the alternate language (Integer for an Apple II Plus or IIe; Applesoft for an Apple II) is loaded, it automatically goes into the Accelerator's built-in fast language card whenever the Accelerator IIe is in the system and not disabled. The same is true for Pascal. The Accelerator's language card is always addressed from slot 0, so it is accessible to software which assumes a language card in slot 0. On the Apple IIe, the Accelerator's built-in language card functions exactly the same as the Apple's built-in language card. On an Apple II or II Plus, no other board can be accessed from slot 0 when the Accelerator IIe is in use; therefore, we recommend installing the Accelerator IIe in slot 0.

Refresh for the dynamic RAM on the Accelerator IIe occurs during slow (1 MHz) cycles of the Accelerator's 6502, which are executed periodically for this purpose. Two RAM cycles are run during this one slow processor cycle. If a slow cycle is run for some other reason (disk access, for example), the RAM will generally be refreshed during this cycle to avoid adding unnecessary slow cycles.

ACCESS TO I/O SPACE

The Accelerator IIe automatically slows down to 1 MHz for one cycle whenever an address in the range C000 to CFFF is accessed. These addresses are used to send information to printers, disk drives, modems, etc., and to enable or disable memory cards. Devices such as disk drives and modems, which depend on timing calculations, require additional computation to be done at 1 MHz. Memory boards require 1 MHz cycles for access to addresses in the range D000 to FFFF. The Accelerator IIe contains an 8-position dip switch and a jumper block to accomodate these requirements.

DIP SWITCH

The 8-position dip switch located at the top of the Accelerator IIe is used to slow down the Accelerator in order to access a slot containing an interface to a time-sensitive device. Peripherals such as disk drives, modems, and video digitizers depend on a timing loop calculation which must be performed at 1 MHz. Switches 1–7 correspond to slots 1–7. If a particular switch is set OFF, then access to the corresponding slot will cause the Accelerator IIe to slow down for 0.5 seconds. This is sufficient time for proper operation of the time-dependent device. Longer disk searches, etc., will access the appropriate slot at least once every 0.5 second.

Thus, before the Accelerator IIe is installed, the switch corresponding to every slot with a time-sensitive device should be set OFF. Switch #8 should also be set OFF. All the other switches should be set ON.

Switch #8 is a manual speed override. When it is set ON, the Accelerator IIe will run at 1 MHz. This switch should always be set OFF for normal operation, since a more convenient slow-down option is provided through the pre-boot software.

JUMPERS

The 7 jumper positions are similar to the switches. The top jumper corresponds to slot 1, the next to slot 2, and so on, with the bottom jumper corresponding to slot 7. When a jumper is *removed* from the board, the Accelerator IIe will slow down for one cycle whenever an address in the range D000 to FFFF is accessed and the card in the corresponding slot is enabled. Thus memory boards will operate in the usual manner.

Use of memory on other plug-in boards will cause a slight decrease in the speed of running a large program, but the difference will seldom be noticeable. Most of the time spent running a data base, spreadsheet, etc. is used in executing program statements. Accessing data from expansion RAM boards requires only a small fraction of the total run time. Thus programs such as VisiCalc will run very close to 3-1/2 times faster, even with 220K of workspace memory. This comparison is based on recalculating the same model with and without an Accelerator IIe.

The Accelerator IIe assumes that all memory boards follow the Apple convention of accessing C0N3 to enable the board, and C0N2 to disable the board, where N = 8 + slot number. All RAM boards tested by Titan to date follow this standard and are fully compatible with the Accelerator IIe.

The Saturn 32K RAM board will be used as a 16K board only. The Accelerator's built-in language card effectively replaces the second bank of the 32K RAM board. The Saturn 64K and 128K RAM boards, which are organized somewhat differently due to their increased memory size, operate as usual. Any standard memory expansion and/or 80-column board in the auxiliary slot of the Apple IIe will operate as usual.

GATE ARRAY

The Accelerator IIe contains a CMOS gate array which is highly sensitive to static electricity. To protect both the gate array and the 6502, observe the cautions described under **PROCESSOR.**

The Accelerator's gate array allows all its required logic to fit on a single board. In particular, the gate array serves to recognize the auxiliary slot on the Apple IIe and to make use of its 80-column display and bank-switching firmware.

Dealers or others who wish to maintain a stock of parts for field repair may purchase Accelerator IIe gate arrays from Titan Technologies, Inc. Gate arrays sold separately will be pre-tested and not returnable, since improper handling will result in failure due to static damage. See the warranty at the back of this manual for information on free factory repairs during the one-year warranty period.

VIDEO DISPLAY

The video display is controlled by the video circuit on the Apple's main board, as usual. Screen access operates at 1 MHz. Video-intensive programs, such as games with elaborate graphics, will run significantly slower than other programs. For most business applications, however, video access will not noticeably affect program speed.

DIRECT MEMORY ACCESS (DMA)

The Accelerator IIe uses the DMA channel to redirect data into its own memory. Thus, the Accelerator is not compatible with other DMA devices such as the Microsoft Z-80 Softcard and the Corvus Omninet. The Accelerator must be disabled when using other DMA devices.

Z-80 cards which contain their own memory do not require the DMA line and are compatible with the Accelerator IIe. Some speed improvement should be noted when using the Accelerator with these boards, but the benefits will not be large since most computations do not use the 6502 at all.

INSTALLATION

See Section 1 for installation instructions.

PRE-BOOT DISK

A pre-boot disk is provided for two purposes: (1) to disable the Accelerator in order to run CP/M software on a Z-80 card that uses the DMA channel, and (2) to slow down the Accelerator without giving up the Accelerator's language card. It is expected that the slow down option will seldom be used, except for games which might be too difficult to play at high speed.

To use the pre-boot disk, power up the system with the pre-boot in drive 1. The disable option is the default. To disable the board, simply insert another disk in the drive (such as your CP/M boot disk) and press the space bar.

To slow down without disabling the board, power up with the pre-boot disk in drive 1. Press the right arrow key once to move the cursor to the slow down option. Now insert another disk in the drive (one that you would normally boot) and press the space bar.

To return to high-speed operation, reboot the system without the pre-boot disk.

CONTROL PORT

The Accelerator IIe operating mode may be controlled by execution of a machine language write cycle or BASIC poke according to Table 1.

Table 1

Address	*Data to write*	*Function*
C086	05H	High speed (normal operating mode, set on power-up)
C086	01H	Low speed
C086	0AH	Disable

TECHNICAL SPECIFICATIONS

Power consumption: 450 milliamps on +5 volt supply

RAM: 150 ns dynamic; eight 4164s, two 4416s

CPU: CMOS 4 MHz 6502

PROBLEM CHECKLIST

If you encounter any difficulties in running your system with the Accelerator IIe, check the items in the following list:

1. Are the switches set correctly? For each slot containing a disk controller, modem interface, or other time-sensitive device, the switch with the same number should be set OFF. Be sure that your table of slot contents (see Step 5 of Section 1) is accurate.

2. Are the jumpers set correctly? For each slot containing a memory board, the corresponding jumper should be removed from the board.

3. Is switch #8 set OFF? If it is ON, you will see no speed improvement.

4. Are you running CP/M software? If you experience any problems with CP/M software, you should use the pre-boot disk as described in Step 13 of Section 1.

5. Were you running CP/M software just before your problem arose? If so, reboot the system with a regular DOS or Pascal disk.

6. Is every slot in your Apple occupied? If so, you may need a fan. Try running your Apple with the cover removed for a few minutes to see if you still have the same problem. (Careful—don't drop anything into the computer!)

7. If you have not yet solved your problem, turn off the power, touch the power supply, and remove the Accelerator IIe from your Apple. Put the Accelerator in its pink anti-static bag or on a piece of aluminum foil. Now try your application again. If your problem remains, then something else in your system is not functioning properly. See your computer dealer for assistance.

8. If you have difficulty only when the Accelerator IIe is in your system, make a list of all the cards you have plugged in. Turn off the power, touch the power supply, and put the Accelerator IIe back in. Try the program you were running again to see if you get the same error a second time. Make a note of any differences. Then call your computer dealer or Titan Technologies, Inc. The number for factory technical support is (313) 662-8542. Have your notes, pre-boot disk, and application disk ready, for fastest service. Your dealer or a Titan technician will be happy to assist you in solving your problem.

ACCELERATOR IIe WARRANTY

Titan Technologies, Inc. (Titan) warrants this product to be free of defects in material and workmanship for a period of one (1) year from the original date of purchase to the original user only. During this period, Titan will repair (or, at its option, replace) this product free of charge, provided that it is returned with dated proof of purchase to Titan Technologies, Inc. at the address below. This warranty does not apply, if in the opinion of Titan, the product has been damaged by accident, misuse, neglect, or misapplication as a result of service or modification by other than Titan Technologies.

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