

# 1. Outline of Turbo-486EX

## 1.1 Features of Turbo-486EX:

- Contributes greatly to improving the operability and speed of CAD, CG, Windows applications, and numerical calculation software.

vinegar.

- You can comfortably multitask in Windows 386 enhanced mode.
- You can speed up existing applications as they are. Average CPU speed is 2-5 times faster than 180386. Existing DOS applications such as Ichitaro, Shinmatsu, Multiplan, Lotus 123 and Windows, etc. Almost all of the software up to can be executed at high speed as it is.

- Equipped with a highly versatile and highly functional clock generator that generates 1, 1.5, 2, and 3 times the clock of the main unit.

Available. Therefore, it is compatible with future CPUs that can operate at higher frequencies.

- The i80486DX equipped model can supply an internal clock from 16MHz to 60MHz.
- The i80486DX2 equipped model can supply an internal clock from 32MHz to 120MHz.
- Reliable design with a high-performance cooling system that combines heat dissipation fins and fans
- It is equipped with Intel's 80486DX series and has a built-in floating-point coprocessor. The numerical data processor also operates with a high-speed internal clock, so a large speed improvement can be expected compared to the 180387.
- Detailed cache control is possible with on-board DIP switches
- Control software for i80486 CPU built-in cache is included.

### 1. Turbo-486EX Model 33

CPU : i80486DX-33

clock : Switchable between 1x, 1.5x, 2x and 3x the main unit clock

Operation is guaranteed with a clock of 33MHz or less.

cache : Built-in cache memory of 8KBytes in CPU

Coprocessor: Built-in arithmetic coprocessor in CPU

### 2. Turbo-486EX Model 50

CPU : i80486DX-50

clock : 1x, 1.5x, 2x or 3x the clock of the main unit can be switched

Operation is guaranteed with a clock of 50MHz or less.

cache : Built-in cache memory of 8KBytes in CPU

coprocessor : Built-in math coprocessor in CPU

### 3. Turbo-486EX Model 66

CPU : i80486DX2-66

clock : Switchable between 2, 3, 4, and 6 times the clock of the main

unit Operation is guaranteed with a clock of 66 MHz or less.

cache : Built-in cache memory of 8KBytes in CPU

Coprocessor: Built-in math coprocessor in CPU

### 4. Restrictions

Some software that depends on CPU speed and that does not support i80486 cannot operate.

It may have.

When using the internal expansion memory board (PIO-DA134 series) of an IO DATA device with

PC-9801DA, the memory board expansion option board (EX-134) and the Turbo-486EX board physically

may prevent the memory board from being inserted. However, the expansion option board that has been fi

(EX-134S) is available, so please contact us.



## 1.2 Operating clock

The Turbo-486EX CPU clock can be selected from 1x/1.5x/2x/3x the PC clock. In addition, the model 66 (with i80486DX2) doubles the clock frequency inside the CPU. The relationship between the CPU installed in each model and the clock frequency is as follows.

Turbo-486EX model 33	Equipped with 80486DX-33MHz
Turbo-486EX Model 50	Equipped with 80486DX-50MHz
Turbo-486EX model 66	Equipped with 80486DX2-66MHz

operating clock	1x	1.5 times	2 times	3 times
Model 33 (equipped with DX-33MHz)	20MHz(16MHz)	30MHz(24MHz)	40MHz(32MHz)	60MHz(48MHz)
Model 50 (with DX-50MHz)	20MHz (16MHz)	30MHz(24MHz)	40MHz(32MHz)	60MHz(48MHz)
Model 66 (equipped with DX2-66MHz)	40MHz(32MHz)	60MHz(48MHz)	80MHz(64MHz)	120MHz(96MHz)

\*The shaded area is the range where operation is guaranteed within the CPU specifications. Figures in parentheses are at 16MHz clock.

The model 33 has a 33MHz 80486DX and the maximum operating clock is 33MHz. However, it may work even at 40MHz, although it is over-spec.

The model 50 has a 50MHz 80486DX and a maximum operating clock of 50MHz. However, it may work even at 60MHz, although it is over-spec.

The model 66 has a 66MHz 180486DX2 and the maximum operating clock is 66MHz. However, it may work even at 80MHz, albeit over-spec.

The CPU manufacturer and our company do not guarantee the operation when using the overspec clock. Overclocking is the responsibility of the user.



## 2. Setting up the Turbo-486EX

Please read the installation instructions and software settings before using the Turbo-486EX. In order to take full advantage of the Turbo-486EX's performance, it is necessary to set the cache driver and memory switch.

### 2.1 Installation of Turbo-486EX

To install the Turbo-486EX board, remove the CPU (80386) from the PC and install it in the CPU socket.

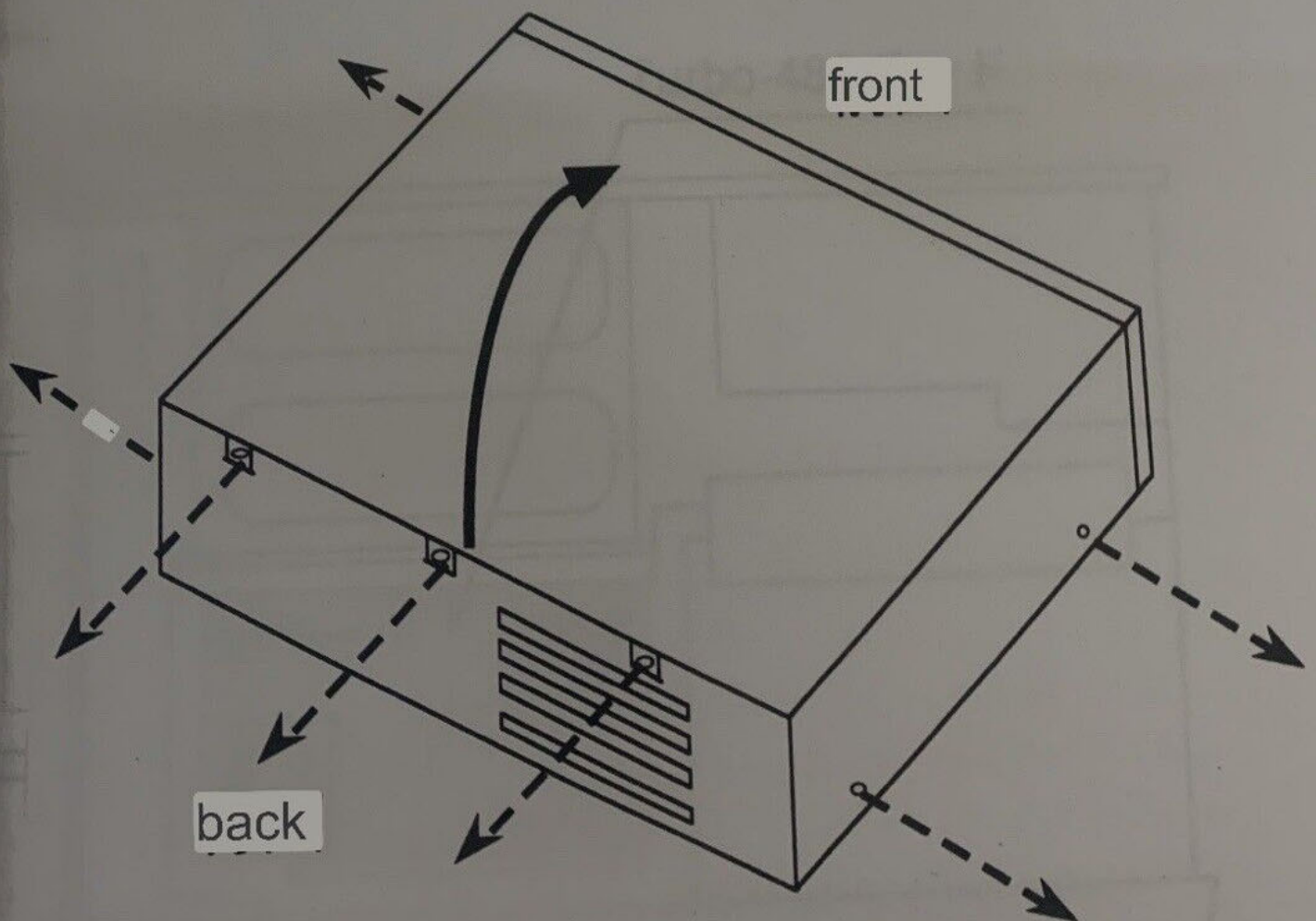
Please follow the steps below.

(1) Turn off the power switch and unplug the main unit's power cable. (2)

Remove the 4 screws on the side of the main unit with a screwdriver.

(3) Loosen the 3 screws on the upper back of the main

unit. (4) Pull up the body cover from the rear side and remove it.



PC-98 body

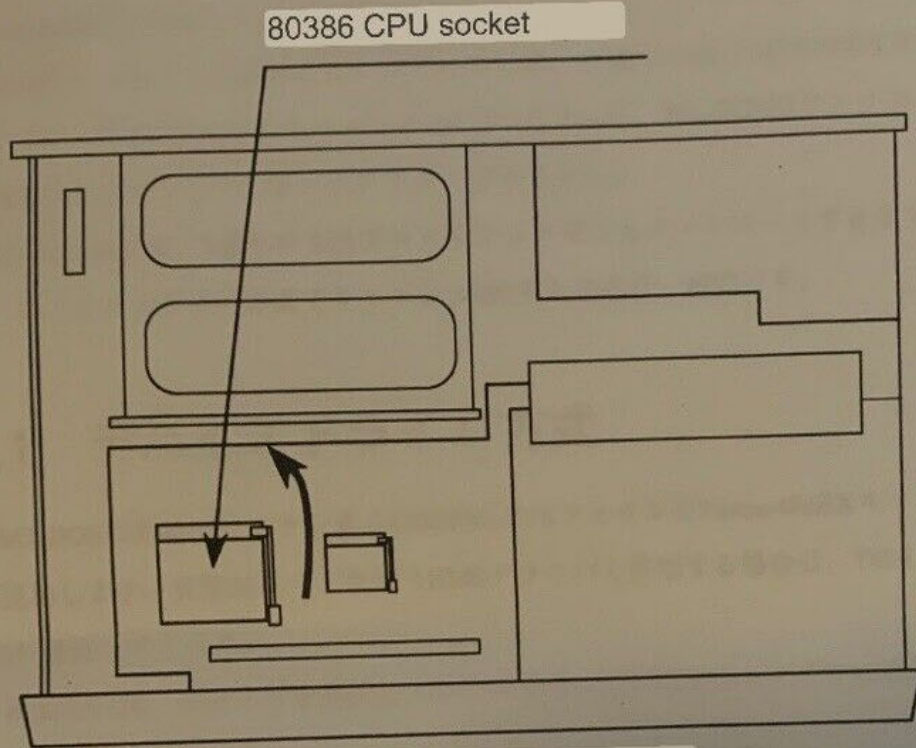


(S) Pull up the CPU socket lever and remove the 80386CPU.

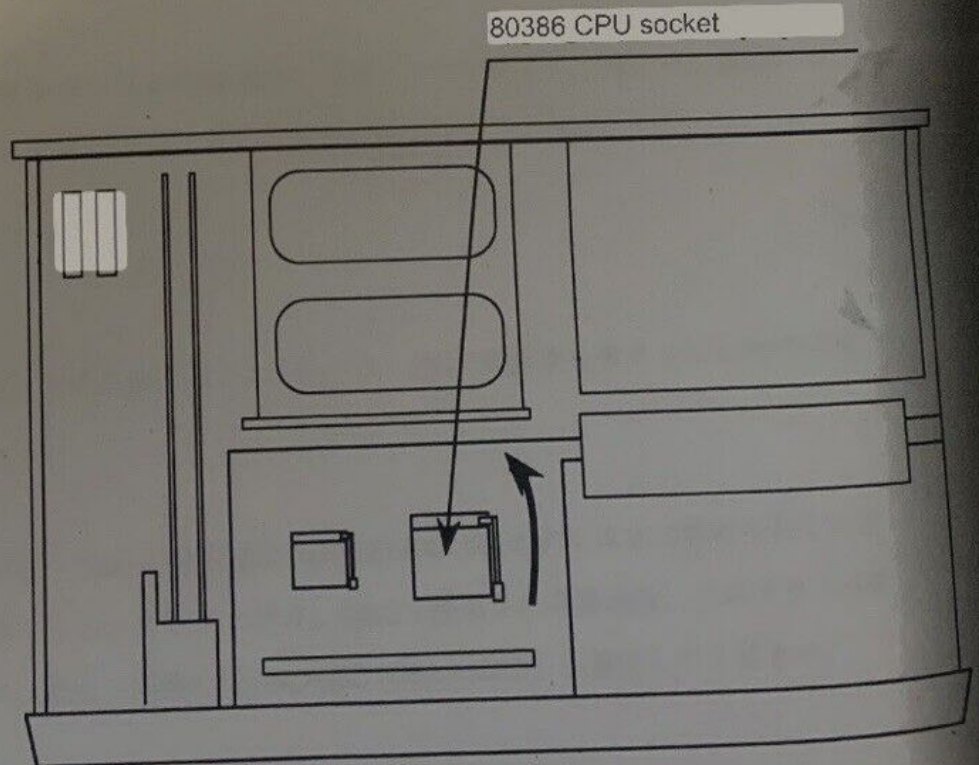
If the internal expansion RAM board is installed, remove the RAM board before starting work.

stomach. Insert the removed 80386 CPU into the attached mat and keep it in a safe place.

If you have installed the 80387 math processor, it is not required for the Turbo-486EX, so remove it and save it. In this case, restore the jumper plug of the personal computer that was changed when the numerical processor was installed. For details, refer to the instruction manual for your computer.



PC-9801RA/DA



PC-98RL



(For PC-9801RA/DA, see (6-1). For PC-9801RE, see (6-1).)

(6-1) For PC-9801RA/DA, first insert only the attached 132-pin IC socket into the CPU socket of the main unit and slowly lock the

lever. The Turbo-486EX board cannot be directly socketed into the 80386. Always attach only the IC socket to the 80386 socket first.

Then plug the Turbo-486 board into the IC socket. At this time, pay attention to the insertion direction. Also, make sure that the

pins of the CPU board are properly aligned with the IC socket.

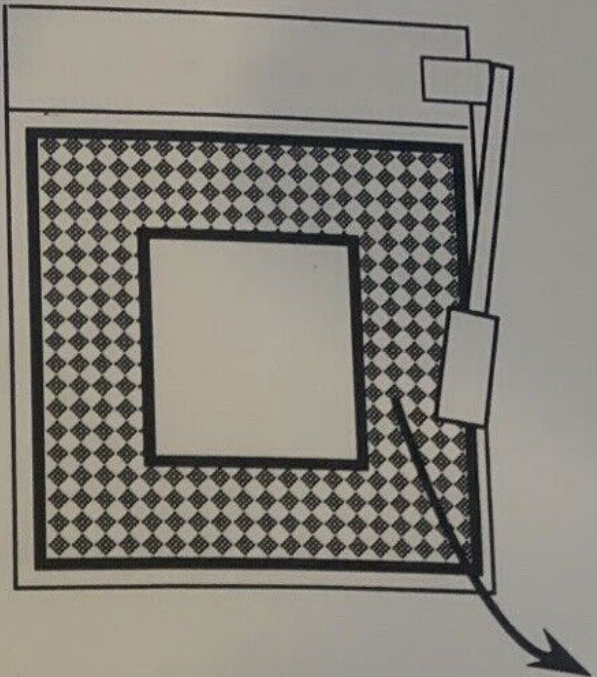
Insert the CPU board correctly all the way by pressing the pin part (the part where the sticker is attached) from directly above with considerable

force. At this time, since the IC socket has a large number

of pins, it is very hard to insert it into the socket, so you need to

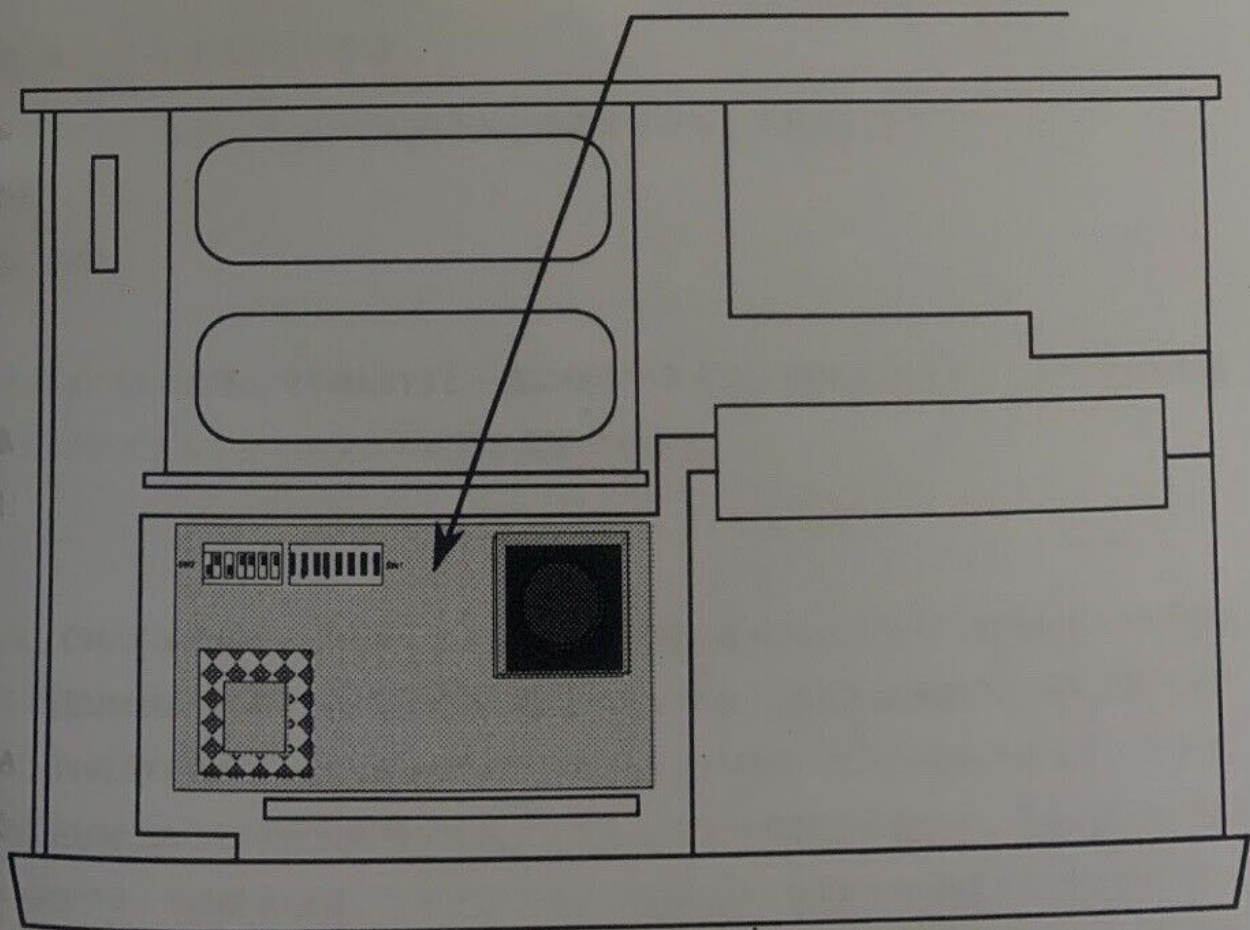
push it firmly until you feel the insertion.

At this time, if the insertion method is insufficient, the computer may not start or the program may run out of control.



132 pin socket installation

Turbo-486 board



PC-9801 RA/DA



### 3. Cache control

The i80486 has 8 Kbytes of cache memory built into the CPU. The speed improvement of the 80486 over the i80386 is largely due to the contribution of this cache memory. However, the 180486CPU does not operate the built-in cache memory after power-on or reset. A special program must be run to operate the cache memory. Even if the Turbo-486EX board is installed, there is no improvement in speed if the cache is turned off. Please turn on the cache by one of the following methods.

The floppy disk attached to Turbo-486EX contains a program for controlling the cache memory. Back up the supplied floppy disk with the DISKCOPY command before use. In particular, IPL cache ON programs cannot be seen as MS-DOS files, so they can only be backed up using the DISKCOPY command.

Turbo-486EX can control cache memory in 3 ways. When using with MS-DOS, it is common to use the device driver method to turn on the cache.

#### 3.1 Device driver method

Add the Turbo-486EX cache driver "T486.SYS" to the CONFIG.SYS file on the MS-DOS boot disk. If you use it with EMS drivers that use virtual 86 mode, register T486.SYS before them (on the previous line).

Specifically, use an editor to add the following lines to your CONFIG.SYS file.

```
DEVICE=T486.SYS
```

Next, copy T486.SYS to the root directory of the boot disk. For example, if the boot disk is A: drive and the Turbo-486 disk is in C: drive, copy as follows.

```
A>copy c:t486.sys a:¥
```

Reset the CPU with the reset switch, or turn on the power of the computer and turn on the cache from the next time. can start.

The cache control driver is included in the disk that comes with T4862.SYS in addition to T486.SYS. This driver is a cache driver for OS/2. If used with OS/2, register this driver in CONFIG.SYS. Also, set "PROTECTONLY=NO" at the same time.



T486.EXE and T486P.EXE are programs for controlling the built-in cache. These two programs are specified in advance in the PATH on the hard disk or in the floppy disk to be used.

Copy it to disk. This

program has three functions:

### 1. Display the current state.

When invoked without parameters, the current state (ON/OFF) is displayed.

[Example of use]

```
A>t486
```

```
Turbo-486 Cache Control Program (c)1991 Kyoto Micro Computer Co. LTD.
```

```
Cache = ON
```

### 2. Turn on the built-in cache.

If you start with "ON" as a parameter, the built-in cache will be enabled.

[Usage example]

```
A>t486 on
```

### 3. Turn off the built-in cache.

If you start with "OFF" as a parameter, the built-in cache will be disabled.

[Example of use]

```
A>t486 off
```

This program can be used together with T486.SYS described in 3.1. You can change the cache status with this program even after starting with cache ON in T486.SYS.

[Note]

T486.EXE does not work if the CPU is in virtual 86 mode. In other words, customers using EMS drivers (EMM386.SYS, VEMS.DRV, VMM386.SYS, etc.) that use the virtual 86 mode cannot use it. In this case, incorporate the device driver so that T486.SYS turns on the cache. However, coexistence with those supporting the VCPI standard such as MELEMM.386 is possible. The program for that is T486P.EXE. T486P.EXE enters protected mode (that is, exits virtual 86 mode) and takes control of the cache. Starting T486.EXE in virtual 86 mode automatically restarts

T486P.EXE.



If you use Turbo-486EX in MS-DOS environment, you can control cache by methods 3.1 and 3.2, but if you turn on cache with disk BASIC or game software, please use IPL method.

In the IPL method, insert the included floppy disk into the disk drive and turn the power on or reset. Then, the program that turns on the cache is read from the floppy disk, and the following message appears message is displayed.

1991 (c) Kyoto Micro Computer

Turbo-486 Cache ON

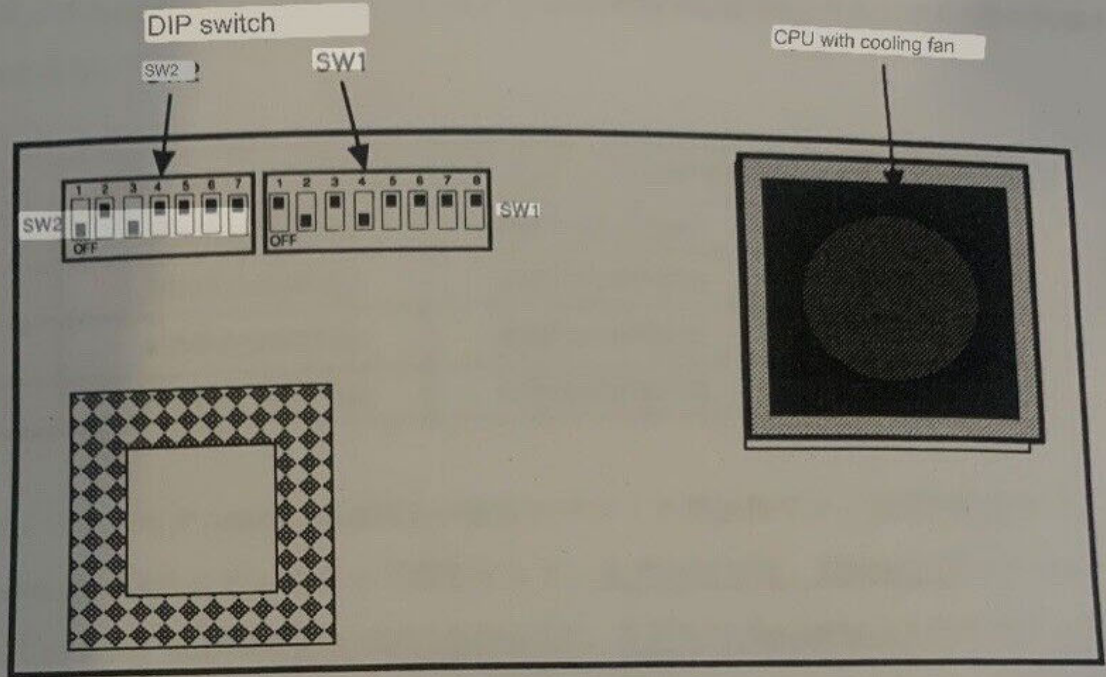
Push Any Key for Restart

The CPU built-in cache is now ON. Next, by replacing the floppy disk with the desired floppy disk and pressing the key, the desired system or game software can be started with the cache ON. You can also reboot from the hard disk without inserting the floppy disk.

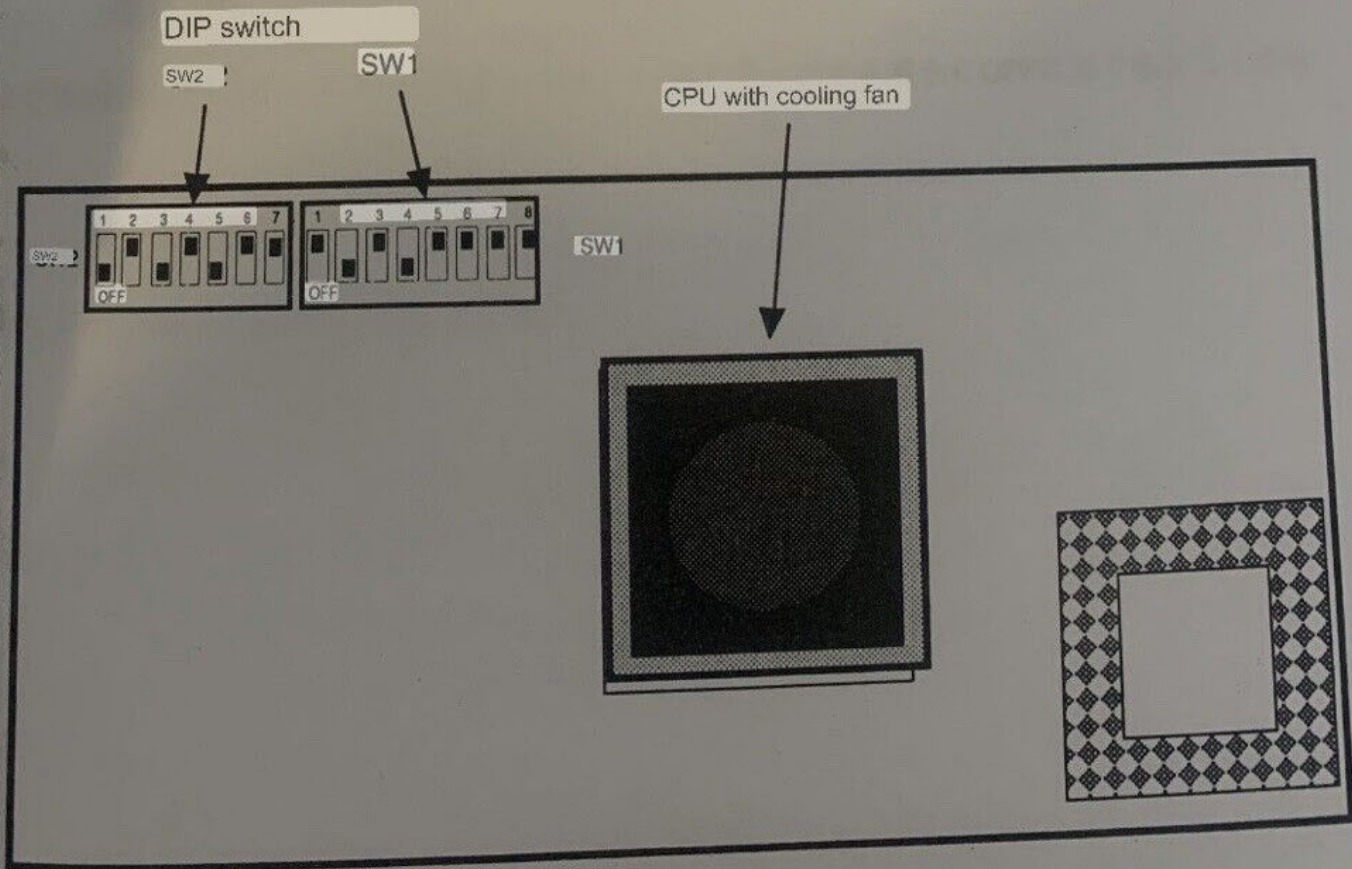
This method also works for MS-DOS, but the two methods mentioned above are smarter to boot the system. to come.



The Turbo-486EX has two DIP switches on board. These switches are for switching the operating clock of the CPU and controlling the built-in cache. Normally, there is no problem with the state at the time of shipment. Before changing the DIP switches, please understand the following explanation.



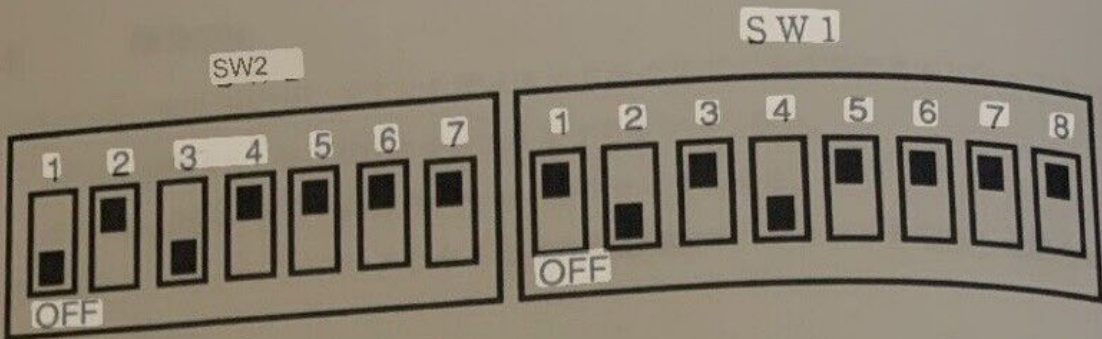
For PC-9801RA/DA



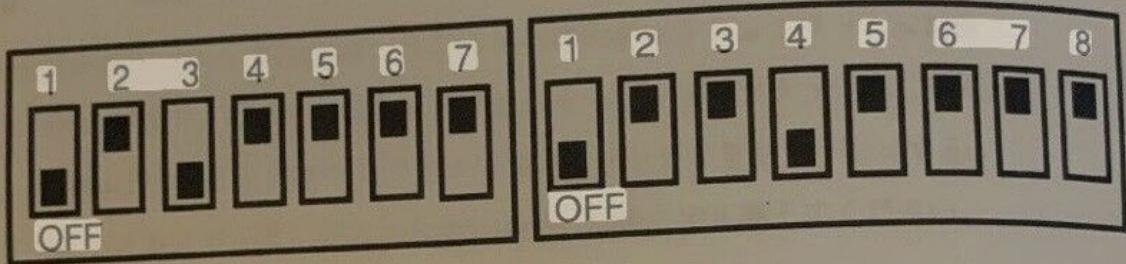


# 4.1 Factory settings

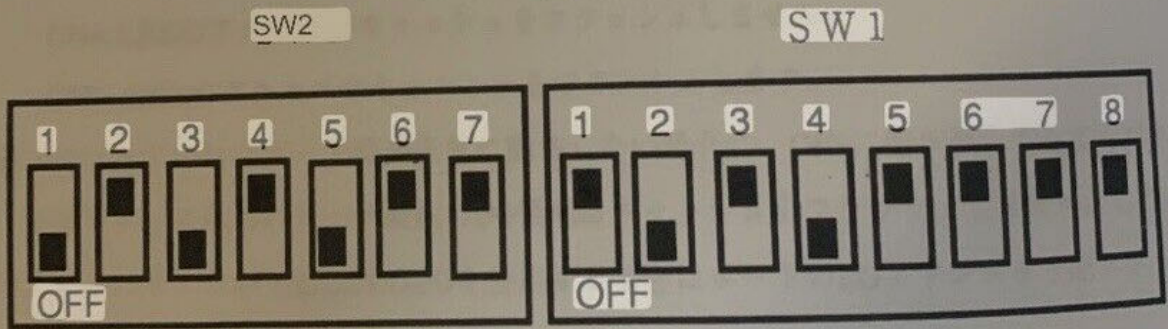
DIP switches are set to the standard state as shown in the figure below at the time of shipment.



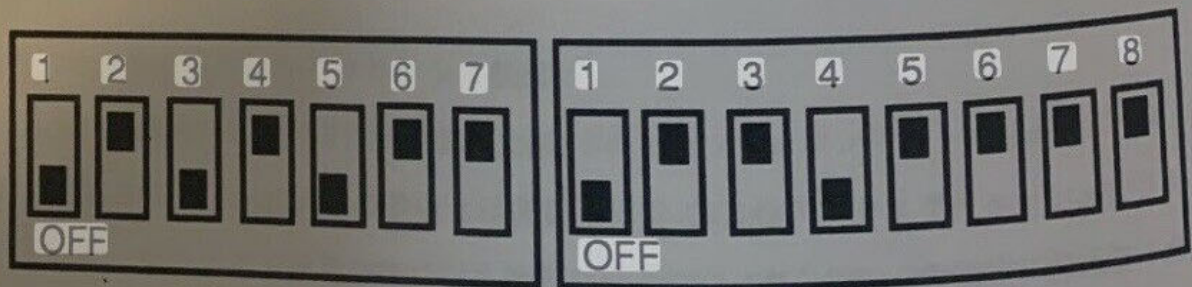
PC-9801RA/DA 用 (50)



PC-9801RA/DA (EL33/66)



For PC-98RL (Model 50)



For PC-98RL (model 33/66)



4.2 Operating  
1 to 3 of SW1 are for controlling the operating clock.

SW1-1.2

clock switching

This is a switch for switching the clock of the CPU. Turbo-486EX can supply 1x, 1.5x, 2x and 3x clocks to 180486. The Model 66 (with i80486DX2) doubles that internal

Works with locks.

clock mode	Body clock at 20MHz	Main body clock 16MHz	SW1-1	SW1-2
1x	20MHz(40MHz)	16MHz(32MHz)	OFF	OFF
1.5 times	30MHz(60MHz)	24MHz(48MHz)	OFF	ON
2 times	40MHz(80MHz)	32MHz(64MHz)	ON	OFF
3 times	60MHz(120MHz)	48MHz (96MHz)	ON	ON

The clock in parentheses is the clock frequency for the model 66 (i80486DX2). The available clock modes depend on the Turbo-486EX model. Model 33 is guaranteed to operate with a clock of 33MHz or less. Similarly, the model 50 is guaranteed to operate at a clock of 50MHz or less, and the model 66 is guaranteed to operate at a clock of 66MHz or less. Operation at higher clock frequencies is overspec so please be careful.

SW1-3 :

Standard ON

Switch to OFF if a parity error occurs during startup or during use, or if the system hangs up.

needed.

SW1-4 :

OFF fixed

Leave this switch in the OFF position.



## 4.3 Cache control during I/O access

SW1 1 to 4 are for controlling cache flush when accessing the I/O port.

**SW1-5** : Standard ON

Cache flush control when accessing PC-9801 peripherals (RS-232C, printer, disk drive)

ON=Do not flush cache on peripheral access.

OFF=Flush cache on peripheral access. If trouble occurs

with peripheral devices such as RS-232C, printer output, and disk access, turn them off.

Please switch.

**SW1-6** : Standard ON

Cache flush control when accessing the PC-9801 graphics I/

O port ON = Do not flush the cache when accessing the

graphics port. OFF = Flush cache on graphics port access.

Switch to OFF if the graphic display is not performed normally.

**SW1-7** : Standard ON

When accessing part of the I/O port area open to the user (DOH-DFH even addresses and EOH to EBH) control cache flushes.

ON=Do not flush the cache on the above I/O accesses.

OFF=Flush the cache on the above I/O accesses.

If boards in expansion slots do not work properly, try switching to OFF. In addition, user-

opened I/O areas other than the addresses above do not flush the cache. Therefore, if the board

that cannot operate uses I/O other than the above, try changing the board's I/O address to the

above address and turning SW1-7 OFF.

**SW1-8** : Standard ON

Cache flush control during I/O access

ON=Enable cache control for I/O specified by SW1-5 to SW1-7. OFF =

Flush cache on every I/O access regardless of SW1-5 to SW1-7 settings. When

this switch is switched to OFF, all I/O regardless of the settings of SW1-5 to SW1-7

Flush internal cache on port access.



4.4 Cache  
DIP switch 2 is for controlling cache operation during memory access.

SW2-1: Standard OFF

Controls cache effectiveness for memory space 80000H-83FFFFH.

ON=Enable caching for the above memory space.

OFF=Disable caching of the above memory space.

Cache control for bank area in normal mode and RAM window area in high resolution mode. If this switch is turned ON in the memory control program that controls the bank area, normal operation may not be possible. Turning this switch ON may speed up the program. When using MELWARE, leave this switch OFF. If bank RAM, etc. cannot operate normally, or if you are using an expansion board that uses this address, turn this switch OFF.

SW2-2: Standard ON

Controls cache effectiveness for memory space 84000H-9FFFFH.

ON=Enable caching for the above memory space.

OFF=Disable caching of the above memory space.

Cache control for bank area in normal mode and RAM window area in high resolution mode. Normally, this switch can be left ON. If you have a program that does not work properly, try switching it to OFF. If bank RAM, etc. cannot operate normally, or if you are using an expansion board that uses this address, turn this switch OFF.

SW2-3: Standard OFF

Controls cache validity for memory space A0000H-BFFFFH.

ON=Enable caching for the above memory space.

OFF=Disable caching of the above memory space.

When using the PC-98RL in normal mode or switching between normal mode and high resolution mode, be sure to turn it off. When using only high resolution mode, turning this switch on may improve the speed.



SW2-4:

Standard ON

Controls the cache effectiveness of the space in the first 16K bytes (10000H-1003FH) of the HMA

area. ON=Enable caching for the above memory

space. OFF=Disable caching of the above memory space.

Programs that use DOS extenders or programs that handle HMA (area exceeding 1M bytes) are correct.

If it cannot operate all the time, it may be better to switch it to OFF.

SW2-5:

Standard ON (OFF for PC-98RL)

Determines whether to cache normal mode BASIC ROM space.

ON=Enable caching of BASIC ROM space.

OFF=Disable caching of BASIC ROM space. When

using disk BASIC in normal mode, switching to ON can improve speed. If you use

BASIC on DOS, you can leave it OFF. When using the

PC-98RL by switching between high resolution mode or normal/high resolution mode, be

sure to turn it off.

SW2-6:

Standard ON

Flush the cache when accessing the user open memory space (C0000H to DFFFFH) in normal mode

control whether to. When switching between normal and high resolution modes, set this

switch to ON as much as possible. If this switch is OFF in high resolution mode, the

The hook speed may be extremely slow.

cache will not be flushed with the above memory access.

OFF = Flush the cache on the above memory accesses.

When a board inserted in an expansion slot in normal mode accesses the above memory space

Please switch it to OFF when there is an abnormality in the operation of the board.

SW2-7:

Standard ON

When accessing the user open memory area (E5000H-EFFFFH) in high resolution mode clear the cache

Controls whether to flush. PC dedicated to normal mode and only in normal mode

Leave ON if used.

ON=Do not flush the cache on the above memory accesses.

OFF=Flush the cache on the above memory accesses.

When a board inserted in an expansion slot in high resolution mode accesses the above memory space

Please switch it to OFF when there is an abnormality in the operation of the board.



# Appendix 1 Cache memory

The 180486 has 8K bytes of cache memory built into the CPU. This cache memory contributes greatly to the speed improvement of the 80486 compared to the 180386. Cache memory is a memory built into the CPU that stores data once read from the memory by the CPU. Data read from memory by the CPU is stored in cache memory. When the CPU accesses data from memory, if the data is already in the cache memory, the CPU can quickly read the data from the internal cache memory rather than from the external memory.

The contents of the cache memory are invalidated when a DMA operation such as disk access or memory window bank switching is executed. This is because the contents of the actual memory and the cache memory may differ. This operation is called "cache flush". This operation is automatically performed by the Turbo-486EX hardware.

With Turbo-486EX, you can control ON/OFF of cache memory with attached software. In addition, the cache operation can be changed with DIP switches for each memory space such as bank memory area/ RAM window area/extended ROM area.

Below is a description of the Turbo-486EX cache control method.

## (1) About DMA

When DMA is performed for disk access, etc., the contents of RAM are rewritten by the DMA controller regardless of CPU operation. Therefore, if rewritten memory data is stored in cache memory, data inconsistency will occur between the two. The cache memory is flushed when a DMA operation is performed to prevent this from happening.

## (2) I/O access

Cache memory can be flushed when the I/O port is accessed by the CPU.

One purpose of this is to extend the interval between consecutive I/O accesses. Compatibility with 180386 is maintained by temporarily reducing CPU execution speed by flushing the cache. Another purpose is to maintain cache coherency when banked memory or RAM windows are switched (when I/O accesses are performed). Therefore, even if the RAM window or bank RAM area is used with cache ON, most programs can operate normally.

Also, which I/O access to flash can be changed with a DIP switch.