The Pegasos book

« Le livre du Pegasos »
Compilation of articles on the Pegasos
Volume 2 : The Pegasos

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Le WiKi du Pegasos et de MorphOS

Contents

1 Specifications of the Pegasos

1.1 Presentation

The Pegasos is based on a microATX motherboard using RISC PowerPC processors from IBM and/or Freescale (various G3 & G4 processors). Thanks to its modular design the Pegasos has been adapted to a multitude of uses. Current interface standards are integrated on-board in order to allow many peripherals to be connected to it.

Created in 2001 by Gerald Carda with the support of Thomas Knabel and the company bPlan, this machine is now sold by Genesi, which owns bPlan.

This machine has evolved since its creation : during the summer of 2002, the first Pegasos judiciously baptised "Betatester" had just started to be sold to whoever agreed to sign a NDA ("Non Disclosure Agreement"). History will testify to the problems of data corruption encountered by the development team with the Northbridge then used, Articia S, developed by the American company Mai. The Northbridge is a fundamental element of any motherboard. It is responsible for memory management, processor interconnects, the PCI/AGP buses and the L2 cache mask. A new Pegasos appeared in December 2002 with a corrective hardware patch called April 1 at the Amiga Show in Aachen, Germany. Unfortunately, this "patch" was not enough and the Pegasos with the designation April 2 was introduced in March 2003. Ultimately, certain problems could never be solved (in particular with the G4 processor module), complicated by the understandably souring relationship with Mai and problems of Articia S provisioning, Genesi (parent company of bPlan) announced in April 2003 the intended abandonment of Pegasos I, and the new development of its successor, Pegasos II, with re-examined specifications and equipped with a Northbridge from Marvell, the Discovery II.

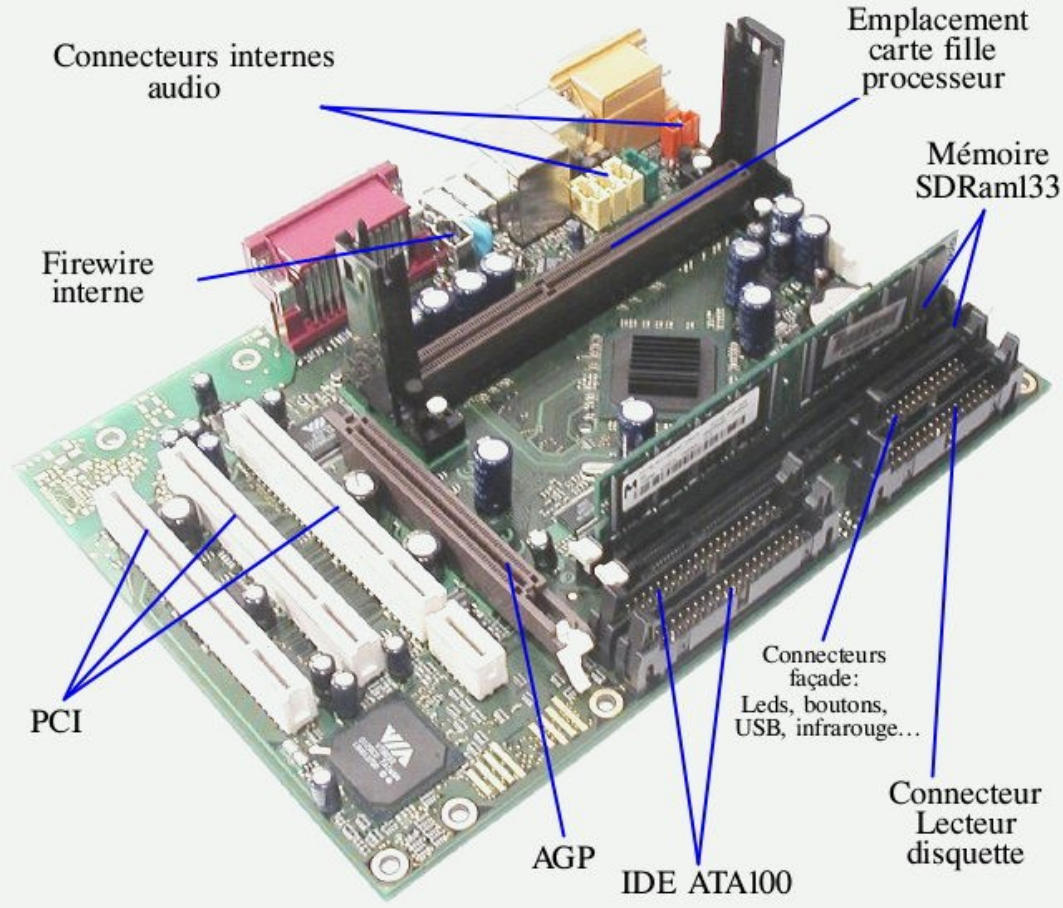
The Pegasos is a unique machine, it is neither a clone of PC nor a clone of Macintosh, even if their characteristics are close. The Pegasos can handle many operating systems like MorphOS, Linux (Debian, Gentoo, Yellow Dog Linux...) or MacOS X via Mac-On-Linux.

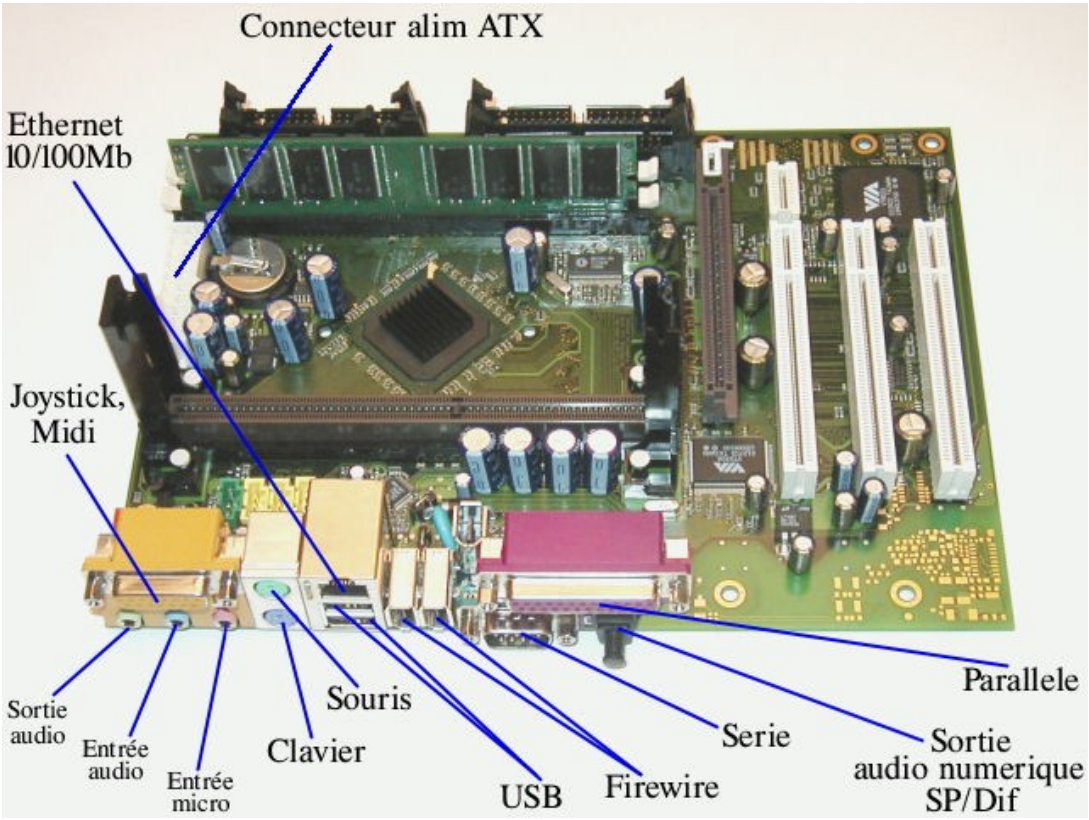
In January 2006, Genesi freely placed the documentation, technical diagrams and component list of the Pegasos II's rev.2b5 motherboard at the disposal of the members of http://www.power.org. This lead to Pegasos II thus becoming an "Open hardware" computer, everyone able to freely create a copy or a clone of it.

In November 2006, the production and the sales of the lastest Pegasos were officially announced by Genesi.

1.2 The Pegasos I motherboard specifications

- MicroATX CHRP board (236 mm x 172 mm)
- Open Firmware
- Bus up to 100 MHz
- PowerPC G3 750 processor at 600 MHz (external board)
- 2 SDRAM PC133 connectors up to 2 Gb
- 3 32bits PCI at 33 MHz with riser board on option
- 1 AGP x2 bus
- 3 USB 1.1 connectors (2 externals, 1 internal)
- 3 IEEE1394/Firewire ports at 100, 200 and 400 MBits (2 externals, 1 internal)
- 1 Ethernet 10/100 Mbit port
- VIA VT82C686 (AC97) sound chip integrated : Phono 3.5mm input and output line jacks, micro input, digital optical output (S/PDIF)
- Internal connector for infra-red interface
- 2 IDE ATA 100 connectors for connecting up to 4 peripherals
- 1 floppy drive connector (SUGAR 34 pins)
- 2 PS/2 connectors for keyboard and mouse
- 1 serial RS232 DB9 port
- 1 parallel DB25 port
- 1 DB15 port for joystick or midi interface





1.3 The Pegasos II motherboard specifications

- MicroATX CHRP board (236 mm x 172 mm)
- Open Firmware
- G3 PowerPC at 600 MHz or G4 at 1000 MHz (external card)
- 2 memory PC2100 DDR-266 connectors up to 8 Gb
- 1 AGP x1 bus
- 3 USB 1.1 connectors (2 externals, 1 internal)
- 3 32bits PCI at 33 MHz with riser board on option
- 3 IEEE1394/Firewire ports at 100, 200 and 400 MBits (2 externals, 1 internal)
- 1 Ethernet 1 Gigabit port
- 1 Ethernet 10/100 Mbit port
- VIA VT82C686 (AC97) sound chip integrated : Phono 3.5mm input and output line jacks, micro input, digital optical output (S/PDIF)
- Internal connector for infra-red interface
- 2 IDE ATA 100 connectors for connecting up to 4 peripherals
- 1 floppy drive connector (SUGAR 34 pins)
- 2 PS/2 connectors for keyboard and mouse
- 1 serial RS232 DB9 port
- 1 parallel DB25 port
- 1 DB15 port for joystick or midi interface

1.4 The processor card

The processor of the Pegasos is not on the motherboard but is instead provided on a separate board. This swappable CPU card allows easy hardware upgrades.
The G4 processor cards are equipped with a fan, whereas no cooling system is needed for the G3. The processor cards designed for Pegasos II can not be used on a Pegasos I and vice versa for the Pegasos I.

2 Pegasos versions

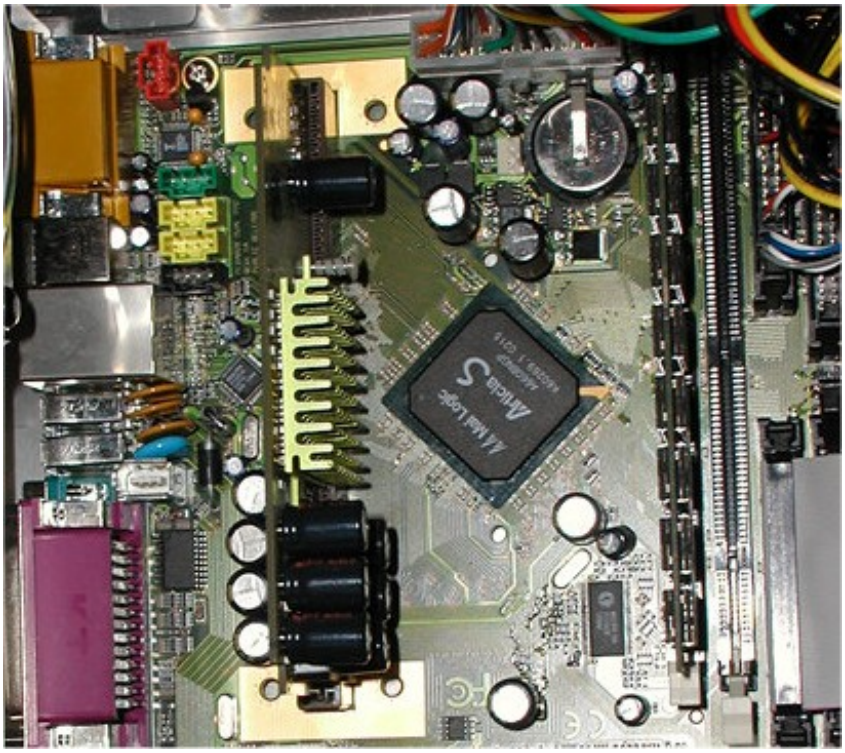
The Pegasos exists in several versions :

- Pegasos I (also called "non-aprilized" Pegasos or Betatester)
- Pegasos I April 1
- Pegasos I April 2
- Pegasos II
- Open Desktop Workstation (or ODW, with a Pegasos II motherboard)

April is the name of the corrective hardware patch for the Articia S Northbridge. In its first version, it fixed a certain number of problems associated with the Articia S, and even more in version 2. The majority of "non-aprilized" Pegasos were exchanged without charge for versions with April fixes. The word "April" comes from a pun "No Mai (May) without April" meaning that Articia, the chip produced by the company Mai, does not have any value without the corrective measures implemented in April revisions. This certainly proved to be true in the end as Mai went bankrupt in the face of many lawsuits.

To recognize the various versions of Pegasos I, the motherboard must be observed.

- Pegasos I or Betetester without April: there is no additional chip at the edge of Articia S :



- April 1: two additional chips in "Mickey Mouse Ear" configuration. One of the chips is aligned slightly on the right of one of the side of Articia S..

- April 2: two additional chips in "Mickey Mouse Ear" configuration. One of the chips is centred compared to Articia S.

2.1 Differences between Pegasos I and Pegasos II

Pegasos I and its successor, Pegasos II are very close in their design. Despite everything, certain components are different, in particular because of the use of a different Northbridge in Pegasos II. A Northbridge is again used to control and act as an interface to certain elements on the motherboard. Articia S from MAI is used on Pegasos I while Pegasos II is structured with Discovery II from Marvell.

Here principal differences between the two mother boards:
-Northbridge: Articia S for Pegasos I (Discovery II for Pegasos II)
-Memory Type: SDRam PC133 for Pegasos I (SDRam-GDR PC2100 and over for Pegasos II).
-Theoretic limit of 2 Gb of memory on Pegasos I (8 Gb on Pegasos II)
-Use of ECC memory was strongly recommended on Pegasos I (however it does not matter on the Pegasos II)
-AGP x2 slot on Pegasos I (AGP x1 slot on Pegasos II)
-Ethernet: 10/100 Mb from the Pegasos I (Ethernet 10/100/1000 Mb from the Pegasos II)

Note: the AGP x1 bus speed has no significant impact according to Ralph Schmidt because the memory on the board is sufficient to store the required textures. This function is influenced by the speed of the AGP bus. In practice, the AGP x1 bus on the Pegasos II is faster than the AGP x2 bus of the Pegasos I due to the increase of bandwidth to the processor.

For the details of the different specifications of these two models, see the "Presentation of Pegasos" part.

2.2 Specifications of the ODW

The ODW (Open Desktop Workstation) is a computer equipped with a Pegasos II motherboard and distributed directly by Genesi. It is in fact a well equipped Pegasos II:

- Pegasos II motherboard with a Freescale's G4 1.0GHz CPU
- 512Mb DDR RAM
- 80Gb ATA100 hard disk
- Dual-Layer DVD±RW drive
- ATI Radeon 9250 graphic card - DVI, VGA and S-Video output
- Low Profile Small Footprint Tower Case or a Desktop Oriented Case (92x310x400mm)
- USB 2.0 expansion ports

For more information, see "http://www.pegasosppc.com/odw.php".

3 Hardware compatibility

3.1 Supported graphics cards (MorphOS 1.4.5 + 3D drivers v2)

Without any 3d hardware acceleration:
- 3D Labs / Texas Instruments Permedia2
- 3D Labs / Texas Instruments Permedia2v

With 3d hardware acceleration on Pegasos I and II:
- ATI Radeon 7000VE (RV100)
- ATI Radeon 7200 (R100)
- ATI Radeon 7500 (RV 200)
- ATI Radeon 8500 LE (RV 200)
- ATI Radeon 8500 (RV 200)
- ATI Radeon 9000 SE (RV 250)
- ATI Radeon 9000 (RV250)
- ATI Radeon 9000 Pro (RV250)
- ATI Radeon 9100 (RV200)
- ATI Radeon 9200 SE (RV 280)
- ATI Radeon 9200 (RV 280)
- ATI Radeon 9200 Pro (RV 280)
- ATI Radeon 9250 (RV 280)
- 3DFX Voodoo3 2000 (Avenger)
- 3DFX Voodoo3 3000 (Avenger)
- 3DFX Voodoo3 3500 (Avenger)
- 3DFX Voodoo4 4500 (Napalm)
- 3DFX Voodoo5 5500 (Napalm) (recognized as a Voodoo4, only one GPU used)
- SIS 305
- SIS 300
- SIS 6326

Note: on Pegasos I, it is apparently not possible to make a PCI card with TV tuner work if the graphics card is AGP, because of a bug with Articia S. That is however possible with a PCI graphics card (example Voodoo 3 2000 PCI) + a TV tuner card, or even an AGP graphics card with a video tuner. There is no problem of this type on the Pegasos II.

There are in addition problems of colors (or problems "of endianess") in MacOnLinux with the 3DFX Voodoo 5 in 32bits, or with the mode "thousands of colors" (16bits) for the RADEON equipped with the GPU RV280.

3.2 PCI cards with TV tuner

Hauppauge WinTV PVR
Hauppauge WinTV GO (PAL)
Typhoon TV card avec (BT878)
Terra TValue (BT878)
Lifetec LT9415

3.3 Memory

SDRAM PC133 on Pegasos I (registered ECC very recommanded)
SDRAM PC2100 DDR on Pegasos II

Note: DDR with higher frequencies are also compatible with the Pegasos II Motherboard.

For memory compatibility by brands, a table is available on MorphZone :
http://www.morphzone.org/modules/sections/index.php?op=viewarticle&artid=30

Note : Crucial is a brand which is usually very recommended (DDR PC3200 - 400 MHz, guarantee for life) in 256, 512 or 1GB configurations. These modules are available from the manufacturer's website http://www.crucial.com/eu (24h delivery) or via a several online stores (dabs.fr or grosbill.com for example).
References (Pegasos / Generic) :
CT440179 = CT3264Z40B (256 Mb)
CT440180 = CT6464Z40B (512 Mb)
CT440178 = CT12865Z40B (1Gb)

3.4 PCI Network adaptaters

Network adaptater with Realtek RTL8139 chip (10/100MBit)
Network adaptater with Realtek RTL8029AS chip (10MBit).

3.5 PCI SCSI cards

Symbios 89x (more standard models)
Symbios 810, 815, 825, 875
Symbios 710, 770

3.6 CD drives and burners

Normally all standard ATAPI drives are recognized.
Here is a list of some makes and models that have been tested and verified successfully:
LiteOn CDRW 40/12/48 Smartburn (B)
Samsung 52x (B)
Teac 52/24/52 (B)
Plextor PX-W4824A (B)
Asus 48/16/48 (specific attention : no specific driver in MakeCD which implies a 4x burning) (B)
etc...

Abbreviations: (B)urner, (D)rive.

3.7 DVD drives and burners

Normally all standard ATAPI drives are recognized.
Here for example a list of some makes and models that have been tested successfully :

Plextor PX-504A (B)
Plextor PX-108T (B)
MITSUMI DW-7872TE (B)
NEC 3500ND-DVD-RW16x (B)
NEC DVD2500 (B)
LG 4040 DVD (B)
Sony DRU4201 DVD RAM/ROM/CDRW (B)
Sony DDU-1612 (D)
Plextor DVDR+-RW 708A 2Mb Cache (B)
LiteOn 16x (D)
Pioneer DVR-109 (B)
etc...

Abbreviations: (B)urner, (D)rive, (C)ombo DVD/CD.

3.8 Floppy drive

There is no official driver under MorphOS. One can however use a controller from a CatWeasel floppy drive, whose driver is in beta (and which allows the reading of Amiga 68k disks) or a USB flash disk drive (PC format only). The flash disk drive is on the other hand supported under Linux. A "trackdisk.device" is also available on Unofficial MorphOS on SourceForge but without Amiga disks support.

3.9 PCI sound card

Compatible SBLive! cards (cards containing Emu10k1).

3.10USB peripherals

The Poseidon USB stack is compatible with the majority of USB peripherals of the market. The incompatibilities primarily come from the protocol variances of certain manufacturers. Poseidon mainly recognizes USB peripherals like mice, joysticks, hard disk interfaces, multi format readers, scanners, printers, keyboards, hubs and keys.

USB storage peripherals using the "mass-storage" standard are normally very well supported by Poseidon. This configuration recognises them automatically, but you should be sure to have the Fat95 manager in your system directory (L:fat95). Fat95 is freely available on Aminet.

3.11Printers

Many models are recognized thanks to the pilots of TurboPrint. Brands like Brother, Gun, Citizen, Epson, Hewlett Packard and Star are supported. The very recent models (less than 6 months) are not supported by TurboPrint, they will be added in future updates of this software.

4 Known hardware and software problems

The principal known problems that are encountered on Pegasos I and II are as follows:

- Hard disks/unrecognized CD/DVD drives: it should be checked that these IDE peripherals are connected using 80 conductor IDE cable and not 40 conductor.
- Unstable heat sink bolt on G4 module on Pegasos II: check that the fan has not moved on the processor card.
- Certain revisions of Pegasos I April 1 do not have a MAC address
- Pegasos I makes sound distortions during certain graphical operations (viewing complex HTML pages for example) with RADEON graphics cards. This problem was resolved in the latest revisions of the driver.
- Problems linked to Articia S. These problems were partly corrected by the chip modifications; April 1 then April 2. Pegasos II has a different Northbridge and do not have these problems.
- The VIA8231 blocked the IDE under certain conditions, in particular with the use of peripherals on two IDE ports. This problem is corrected in a software way in MorphOS.
- Non recognition of USB keyboards under Openfirmware 1.1 and less
- Inability of putting a TV Tuner card in a Pegasos I if it has a video card in the AGP port

5 SmartFirmware

5.1 Presentation

Smartfirmware is the command prompt shell which can be first seen when the Pegasos starts. It looks like white text prompt on a black background on your monitor.

The provided BIOS is an implementation of Openfirmware (cf http://www.openfirmware.org/) with a few differences. Smartfirmware is based on a Forth engine (http://www.forth.org/) which is a command interpreter, in which the instructions are executed immediately when "Enter" key is pressed. Smartfirmware amongst other things makes it possible to list the peripherals available and their properties, to modify their parameters and to initialize boot commands on a peripheral or the network.

For a detailed guide of all the commands available, refer to the online handbook: Smartfirmware User's manual:
http://www.pegasosppc.com/files/SFUserManual.pdf.

This document is also available on the MorphOS CD, in the "Docs" directory.

5.2 Firmware versions

To obtain the firmware version, type the following commands in the OpenFirmware prompt :

```
cd /openprom
.properties
```

Here is a non-exhaustive list of the known version listed by several users :

Machine	Proc	Board	CPU	CX	SF	Rev
Pegasos I Pre-april	G3	0.1b73	750	1.0	1.1	20020814
Pegasos I	G3	1A1 (0.1b112)	750	1.0	1.1	20021203121657
Pegasos I	G3	1A1 (0.1b114)	750	1.0	1.1	20030317114750
Pegasos II	G4	1.1	744X	1.1	1.2	20040224
Pegasos II	G3	1.1 (0.2b1)	750	1.0	1.2	20040402193939
Pegasos II	G4	???	744X	1.1	1.1	20040405
Pegasos II	G4	1.2	744X	1.2	1.1	20040505
Pegasos II	G4	1.0	744X	1.0	1.2	20040810112413
Pegasos II	G4	1.2	744X	1.1	1.2	20040810112413
Pegasos II	G3	1.2	750	1.0	1.2	20040810112413
Pegasos II	G4	1.2	744X	1.2	1.2	20040810112413
Pegasos II	G4	1.2	744X	1.2	1.2	20050602111451
Pegasos II	G4	1.2	744X	1.2	1.2	20050808153840
Pegasos II	G4	1.2	744X	1.2	1.2	20051216161829

5.3 Firmware's update

Here is the procedure to be followed to update the firmware of the Pegasos. This works both for Pegasos I and Pegasos II.

Warning: incorrect handling procedures during the update of the firmware can cause serious damage to your computer (it might not start any more !). If you're not sure of your skills, have it done by an experienced person !

Under MorphOS, copy the update file in the partition "Boot:" (where your boot.img file is) under the name of "update".

Reset the hardware and press the "Esc" key to get to the firmware prompt of your machine.
Enter « `boot update` » to launch update
Wait until the machine starts again and arrives at the new firmware.
The new firmware destroyed your preceding settings. They should be remade. The following example is used to start automatically on the first partition of your first hard disk (unit 0), with a countdown of 3 seconds:

```
setenv boot-file boot.img ramdebug
setenv boot-device /pci/ide/disk@0,0:0
setenv auto-boot-timeout 3000
setenv auto-boot? True
```

Note: "boot.img" is the name of the MorphOS boot file, "3000" indicates a 3 seconds countdown before the starting of OS. You can modify these values as you desire.

6 Where to buy a Pegasos

6.1 New

The Pegasos motherboard and related products are now sold out and discontinued.

Genesi used to sell the motherboard (415 Euros) and the G4@1GHz processor card (199 Euros) on its website. The sale of a separate or customized configuration was not possible from Genesi but could be done from other retailers throughout the world. The Open Desktop Workstation (650 Euros) was sold as a complete configuration.

In addition, MorphOS was delivered with each Pegasos and it was not possible to buy it separately (without speaking about the PowerUp version).

The last Pegasos (motherboards but also customized configurations) are still on sale on various retailers websites throughout the world. The prices vary between 600 and 1900 Euros according to the configuration.

For example :
- Relec/Pegasos Suisse - Swiss - http://www.pegasos-suisse.com/
- Axe Z Informatique - France - http://www.axe-z.fr/
- FL Computer - Luxembourg and France - http://www.flcomputer.com/

6.2 Second hand

Pegasos I are available as second hand between 150 to 400 Euros.
For Pegasos II, the price generally varies from 400 to 700 Euros.

7 Websites about the Pegasos

- Genesi, finance and distribution of Pegasos: http://www.genesi.lu/
- Bplan (Genesi), manufacturer of the Pegasos : http://www.bplan-gmbh.de/
- PegasosPPC (Genesi), official site of Pegasos computers: http://www.pegasosppc.com/
- PPC Zone (Genesi), site PPC : http://www.ppczone.org/
- Pegasos org : http://www.pegasos.org
- Freescale, PowerPC processors : http://www.freescale.com/
- Power org, PowerPC architecture technology development: http://www.power.org
- Powercollaboration org (Genesi), PowerPC collaboration website : http://www.powercollaboration.org