USER'S MANUAL

BFG9060

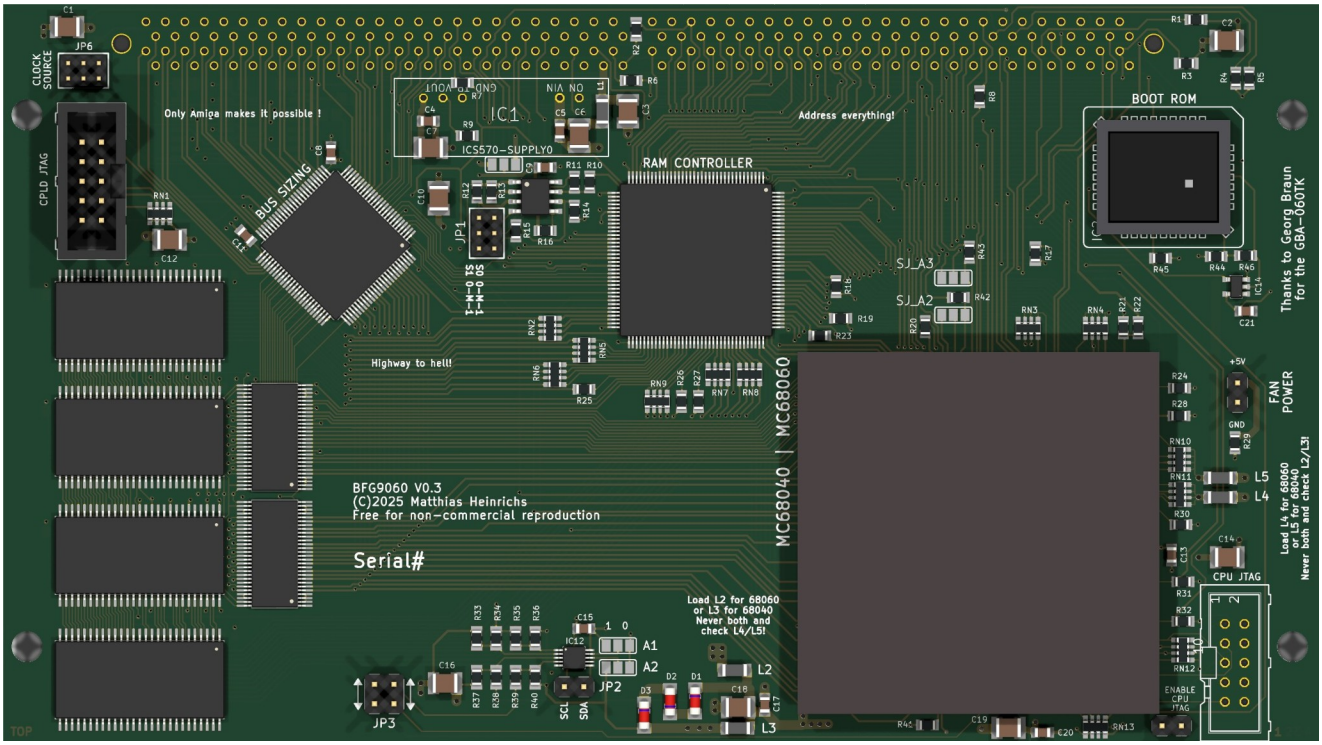
68040/68060 CPU Accelerator for Amiga 3000(T) and 4000(T)

The BFG9060 is a CPU accelerator for the CPU slot of the Amiga 3000(T) and 4000(T). It carries a Motorola 68040 or 68060 CPU and adds 128 MB of 32-bit Fast RAM, which is detected automatically at startup.

1 FEATURES

* 68040 CPU (25 MHz) or 68060 CPU (50, 75 or 100 MHz), including EC and LC versions
* 128 MB SDRAM as 32-bit Fast RAM, with MOVE16 bursts and Amiga DMA accesses
* Boot ROM with boot menu: hardware overview, memory test, test report and settings
* Selectable clock source: mainboard clock (INT) or on-board oscillator (EXT)
* Connector for a 5 V fan, JTAG connector for programming the CPLDs
* Optional: voltage and temperature monitoring via LTC2990 and I²C (68060 only), selectable when ordering. Reading out the voltage and temperature values requires a CPLDICY Zorro board.

2 BOARD LAYOUT



Component side of the BFG9060 with 68060 (without fan)

Part	Function
JP6	Clock source INT/EXT («CLOCK SOURCE»)
JP1	CPU frequency (S0/S1)
SV1	JTAG of the CPLDs («CPLD JTAG»)
JP2, A1/A2, JP3	I²C connector, I²C address and temperature signals of the LTC2990
FAN POWER	Fan connector +5 V/GND
IC2 / IC9	Flash ROM (Boot ROM) / CPU socket
L2-L5	Selection of the CPU supply voltage (ferrite beads)

3 INSTALLATION

CAUTION: Electrostatic discharge can damage the board and the Amiga. Grounding is required before touching the components, e.g. on a radiator. Install and remove the board only with the Amiga switched off and disconnected from mains power.

1) Boot the Amiga with the current hardware and install the libraries for the new processor in LIBS:. AmigaOS 3.2 includes everything needed: the AmigaOS 3.2 installer installs the 68040 and 68060 libraries as an option. With older AmigaOS versions, install MMULib by Thomas Richter instead (Aminet: util/libs/MMULib, also on the floppy disk supplied). Copy the file MMU-Configuration to ENVARC:.
2) Switch the Amiga off, disconnect it from mains power and open the case. Remove any existing CPU card.
3) Set the clock source with JP6 and the CPU frequency with JP1, then set the mainboard jumpers to match the clock source.
4) Press the board evenly and firmly into the CPU slot over the full length of the connector and check that it is fully seated.
5) Close the Amiga and switch it on. At startup, the Boot ROM displays colour bars. Holding down the F1 key at power-on opens the BFG9060 boot menu.

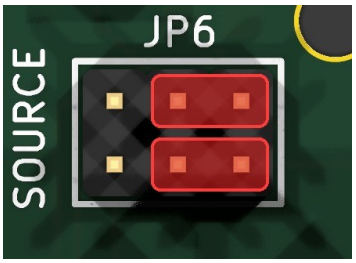
4 BFG9060 JUMPERS

4.1 JP6 – Clock Source

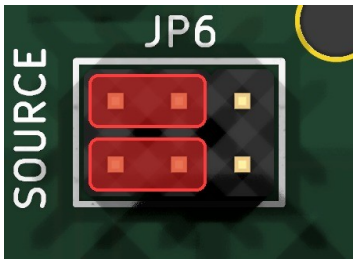
JP6 selects between the mainboard clock (INT, JP6 open) and the on-board oscillator (EXT). The position of the two jumpers is marked in red. If stability problems occur with EXT, EXT +5 ns can be tried. Boards without JP6 run on the mainboard clock.



INT – mainboard clock



EXT – on-board oscillator



EXT +5 ns – fine tuning

4.2 JP1 – CPU Frequency

JP1 has two rows S0 and S1, each with three contacts «0 – M – 1» (2 mm pitch). The jumper connects M to 0 or 1; «open» means no jumper. The default setting is recommended. LC and EC versions of the 68060 are to be operated at 50 MHz, the 68040 always at 25 MHz.

S0	S1	Clock	Use
1	0	100 MHz	68060 (active CPU cooling!)
open	0	75 MHz	68060 (active CPU cooling!)
1	1	50 MHz	68060 (default), also LC and EC
0	1	25 MHz	68040 (default)

4.3 Monitoring and JTAG

Voltage and temperature monitoring with the LTC2990 (IC12) is an option that must be selected when ordering. It is read out via I²C, e.g. with the CPLDICY Zorro board, an I²C controller for the Amiga. This allows, for example, the CPU temperature to be shown on the Workbench.

Part	Function and setting
JP2	I²C connector (SCL/SDA) of the LTC2990 for an external I²C controller, e.g. the CPLDICY Zorro board.
A1/A2	I²C address; both solder jumpers closed to the left (1) at the factory = 0x9E, supported e.g. by Sensei (Aminet: driver/other/Sensei).
JP3	Forwards THERM0/THERM1 of the CPU to the LTC2990. Fit only with a 68060 and a populated LTC2990 (IC12).
SV1	JTAG of the CPLDs, for programming and updating the logic (Xilinx iMPACT with JTAG adapter).

5 MAINBOARD JUMPERS

The mainboard jumpers must match the JP6 setting.

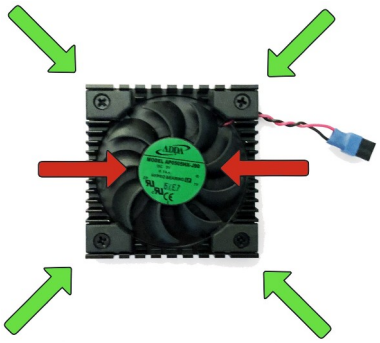
Mainboard	Jumper	INT CLK	EXT CLK
A3000(T)	J100 (QUADCLK)	1-2 (25 MHz)	3-4 (EXT)
	J102 (BRDCLK)	2-3 (INT)	2-3 (INT)
	J103 (FPU)	3-4 (ON)	1-2 (OFF)
	J104 (CPUCLK)	1-2 (INT)	2-3 (EXT)
	J151, J152 (ROMSPEED)	1-2 (25 MHz)	1-2 (25 MHz)
	J851 (CPUSPEED)	2-3 (25 MHz)	2-3 (25 MHz)
A4000(T)	J100 (CLK90)	1-2 (INT)	2-3 (EXT)
	J104 (CPUCLK)	1-2 (INT)	2-3 (EXT)

6 CPU NOTES

* Low-cost models of the MC68040/MC68060 CPUs:
  - 68LC060: MMU but no FPU.
  - 68EC060: neither MMU nor FPU; mmu.library cannot be used with it.
* AmigaOS and most programs do not require an FPU. For a CPU without FPU, select 68020/68030 in installers; the program still runs at full 060 speed.
* LC and EC versions as well as MC68060 CPUs below revision 6 cannot be overclocked. At 50 MHz they normally stay cool and usually need no fan.

CAUTION: The CPU supply voltage is selected with L2-L5: 68060 (3.3 V) with L2 and L4, 68040 (5 V) with L3 and L5, never both at the same time. Changing between 68040 and 68060 also requires a different CPLD firmware. A wrong voltage can destroy the CPU!

7 FAN MODULE



Green: press here. Red: never press here.

* Press the fan module onto the CPU at the four corners only, never on the centre (bearing).
* Connection to FAN POWER: red wire to +5 V, black wire to GND.
* In the A3000, the fan height is critical; the ADDA AP4505MX-G90 (5 V) is recommended.

8 BOOT ROM AND BOOT MENU

The flash ROM (IC2) contains the Boot ROM from the factory. It disables the FPU of a full 68060 at startup (required for Kickstart 3.0 to 3.9) and displays colour bars. In addition, it provides a boot menu with a hardware overview, memory test and settings. The menu runs before Kickstart starts and does not access hard disks or floppies.

Hold at power-on	Effect
F1 key	BFG9060 boot menu
Right + left mouse button	Amiga Kickstart boot menu (Early Startup Control)
Middle mouse button / joystick fire	Start without the Kickstart modules in the flash

The main page shows the CPU (type, revision, clock, FPU/MMU), chipset, PAL/NTSC, Chip and Fast RAM, Kickstart version with checksum, and the CPLD firmware of the board. Operation via function keys or mouse click:

Key	Function
F1	Memory test of Chip, board and accelerator RAM, runs until ESC; the power LED flashes on errors
F2	Read and write speed of the memory areas in MB/s
F3	Leave the menu and boot normally
F4	Kickstart modules in the flash, flash type and space used
F5	Settings: Kickstart modules on/off, menu at every power-on (5 s); F10 saves
F6	Test report via the serial port (null modem cable, 9600 baud, 8N1)
F10 / ESC	Save settings and reboot / cold start

Settings can only be saved on an SST39SF010/020/040 flash. Since the menu uses Chip RAM, the Amiga always performs a cold start when leaving it, to free the Chip RAM again.

9 MMU CONFIGURATION

At startup, mmu.library reads ENVARC:MMU-Configuration. For full performance, the Fast RAM of the board must be entered as cacheable:

```
SetCacheMode from 0x08000000 size 0x08000000 Valid CopyBack
```

Zorro III memory cards can be cached per card with For <manufacturer ID> <product ID> SetCacheMode ... Valid CopyBack; Zorro III cards with I/O functions must not be cached. The complete file is reproduced in the appendix and is also included on the floppy disk supplied with the BFG9060.

10 TROUBLESHOOTING

Symptom	Remedy
No start, no colour bars	Check that the board is fully seated. Compare the mainboard jumpers with JP6. With a full 68060 and Kickstart 3.0 to 3.9, the Boot ROM must be programmed.
Crashes with clock EXT	Try EXT +5 ns or select INT; set JP1 to the default.
Hangs with Zorro II memory	In MMU-Configuration, activate the two lines for the Zorro II area (remove the semicolon).
Program reports missing FPU	With 68LC060/68EC060, install the program version for 68020/68030.

11 SOURCES AND LICENSE

Documentation: gitlab.com/tkurbad/amiga-hardware-info (BFG9060) · Sources: gitlab.com/MHeinrichs/a4000-tk · Forum: a1k.org, thread 73349

Design: Matthias Heinrichs. Non-commercial reproduction is permitted with attribution. Thanks to Georg Braun (GBA-060TK), Henryk Richter (Boot ROM) and Thomas Richter (MMULib).

APPENDIX A - MMU-CONFIGURATION

```
;************************************************************************
;** MMU Configuration file               **
;**                          **
;** this file is read on startup by the mmu.library and used to modify  **
;** the pre-calculated or scanned MMU table          **
;**                          **
;** @ 1999-2018 THOR Software, Thomas Richter           **
;************************************************************************


; the current version of the MMU library knows six commands that can
; be used in this file:
; CLEARTTX clears all or parts of the transparent translation registers
; ADDMEM   adds memory to the exec free list pool. BE WARNED, this command
;     does NOT modify the MMU tables, this must be done by yourself
; SETCACHEMODE defines the MMU tables.
; DESCRIPTORCACHEINHIBIT defines whether the data cache should be disabled
;          for the MMU descriptors. It's usually OFF meaning the cache will
;     remain enabled. This is fine for the mmu.library, but certain
;     hacks might require a ON argument here. Note that this means more
;     work for the library.
; FOR    executes a command only for a specific hardware expansion which is
;     given by the manufacturer and product ID.
; CLEARMMU overrides the MMU configuration found by the library for selected
;     parts of the configuration.
;
; All other commands are currently "external". The library will scan for
; these commands in "LIB$:mmu" and execute them on startup. These *are not*
; standard shell commands. They cannot be run from the shell, and shell
; commands cannot be started from this file.
;


ClearTTx ;ignore all TTX registers if any. We don't need them.
      ;this will speed up the system for some machines.

ClearMMU Memory Blank Motherboard
      ;re-initialize some resources
;Turbo-RAM
SetCacheMode from 0x08000000 size 0x08000000 Valid CopyBack
;Motherboard FastRam
SetCacheMode from 0x07000000 size 0x01000000 Valid CopyBack
;Regular Kickstart ROM
SetCacheMode from 0x00F80000 size 0x00080000 ROM
; Debug/F0-ROM
SetCacheMode from 0x00F00000 size 0x00080000 ROM

;This improves Chipram a bit as MUFast Chip does
SetCacheMode from 0x00000000 size 0x00200000 NonSerial Imprecise


; Remove the semicolon in the line below if you have to live with other MMU
; hacks that expect the MMU descriptors in non-cacheable memory. This is by
; default OFF, i.e. descriptors will be cachable.
; The library will work fine and will take all precautions for descriptors
; in the cache, but some third-party hacks might not.

;DescriptorCacheInhibit ON


; Remove the semicolon in the two lines below in case you encounter hangs or
; crashes with Zorro-II 16-Bit memory. It will disable caching for the Z-II
; area. Clearly, this is slower, but it will work, at least.

;SetCacheMode from 0x00200000 size 0x00800000 CacheInhibit NonSerial Imprecise
;ClearMMU Expansion
```