



Assembly Manual

For **REVISION-G** PCBs only!

Welcome to the Blasterboard assembly manual. This manual will guide you through the building and setup process of the Blasterboard ISA sound card. It consists of 5 steps:

1. Preparing necessary tools and components
2. Soldering the components to the PCB
3. Installing the mounting bracket
4. Programming* and installing the MCU (* for DIY Kit 0)
5. Preparing the card for the first use

1. PREPARING NECESSARY TOOLS AND COMPONENTS

To make the process of building as DIY-friendly as possible, I tried to reduce the component count to a minimum, not degrading the card's performance. All of the components are THT and require basic soldering tools and skills.

1.1. Prepare the necessary tools:

You will need a soldering iron, solder, a multimeter, wire cutters, PZ1 or PH1 screwdriver. IC programmer is also required if you acquired DIY Kit 0.

1.2. Check your kit contents:

Kit 0:

- 1x Blasterboard **REV: G** printed circuit board
- 1x custom made ISA metal bracket
- 2x white nylon mounts for the bracket
- 4x metal screws for mounting the bracket to the PCB
- 1x 3-pin 40cm wire for connecting optical drive's analog audio output to the Blasterboard
- 1x 2-pin 40cm wire for connecting PC-Speaker header on the motherboard to the Blasterboard









Kit 1:




- Everything that is included in Kit 0 (see above)
- 3x Alps RK09K1110AK4 mono potentiometers
- 1x Alps RK09K12A0A2K stereo potentiometer
- 1x 3.579545MHz active crystal oscillator in DIP8 package
- 1x resistor network (9 pins)
- 2x ferrite beads
- 1x stereo minijack socket
- 1x Pre-programmed Atmega MCU with the latest firmware
- 1x DIP28 plastic socket for the MCU
- 1x MCP4901 8-bit DAC
- 1x YM3812 (OPL2) FM synthesizer chip
- 1x Y3014B DAC

1.3. Check your PCB revision. It is printed on the PCB and should read “REV: G”

1.4. Prepare the components from the table below.

- Possible value substitutions are indicated in round brackets
- Components marked with ¹ are included in Kit 1

Value	Details	Qty	Parts
Resistors 			
All resistors are 2mm x 7mm or smaller, not less than 0.25W, either metal film or carbon film with 5% or better tolerance.			
15k		10	R7, R10, R13, R14, R15, R16, R17, R18, R23, R24
100k		9	R2, R4, R5, R6, R9, R12, R19, R27, R29
3.3k		4	R1, R3, R8, R20
22k		2	R21, R26
56k		2	R22, R25
560R		2	R28, R30
470k		1	R11
Resistor network 			
10k ¹ (4.7k-12k)	9P8R, ≤ 5%	1	RN1
Diodes 			
1N4001	1N400(1/2/3/4)	2	D1, D2
1N4148		1	D3
Ferrite bead 			
≥20Ω @ 25MHz ¹	ℓ=4mm..7mm, Ø=2mm..5mm	2	B1, B2
Ceramic caps 			
100nF	2.54mm pitch	22	C3, C4, C5, C10, C11, C12, C13, C14, C15, C18, C19, C21, C22, C25, C26, C27, C28, C31, C36, C37, C40, C41
22pF	2.54mm pitch	8	C1, C2, C29, C30, C32, C33, C42, C43
Film caps 			
3.3nF	Any film, 5mm pitch	2	C16, C17
Electrolytic caps 			
100uF/≥16v	Ø6.3mm, 2.5mm pitch	2	C44, C45
10uF/≥16v	Ø5mm, 2mm pitch	11	C6, C7, C8, C9, C20, C23, C24, C34, C35, C38, C39
IC socket 			
DIP28 ¹	socket for MCU	1	IC1

ICs 			
NOTE: 74HCT-series ICs can also be used			
74HC125	DIP14	1	IC2
74HC74	DIP14	2	IC5, IC6
74HC245	DIP20	1	IC10
74HC08	DIP14	1	IC8
74HC32	DIP14	2	IC9, IC11
74HC14	DIP14	1	IC12
74HC574	DIP20	3	IC13, IC15, IC18
74HC138	DIP16	3	IC14, IC16, IC17
TL074 (LF347)	DIP14	3	U1, U2, U3
MCP4901-E/P ¹	DIP8 (8-bit DAC)	1	IC4
YM3812 ¹	DIP24W (OPL2)	1	IC3
Y3014B ¹	DIP8 (DAC for OPL2)	1	IC7
ATMEGA88* ¹	DIP28 (MCU)	1	IC1
* For the list of all supported MCUs please refer to section 4: “Programming and installing the MCU”			
Crystal resonator 			
20MHz	HC-49/S	1	Q1
Crystal oscillator 			
3.579545MHz ¹	DIP8 or DIP14	1	Q2
Voltage regulators 			
78L05	TO-92 package	1	V1
79L05	TO-92 package	1	V2
Potentiometers 			
RK09K1110AK4 ¹	B10k mono	3	VR1, VR2, VR3
RK09K12A0A2K ¹	B10k, stereo	1	VR4
Pin headers 			
double row 2 pins	2.54mm pitch, straight	2	H4, H5
double row 8 pins	2.54mm pitch, straight	1	H6
double row 3 pins	2.54mm pitch, straight	1	H7
single row 3 pins	2.54mm pitch, straight	1	H8
single row 2 pins, 90°	2.54mm pitch, angled	2	H0 (optional), H1
single row 3 pins, 90°	2.54mm pitch, angled	1	H2
Jumpers 			
n/a	2.54mm pitch	5	n/a
Audio connector 			
PJ-306M ¹	3.5mm stereo socket	1	J1

2. SOLDERING THE COMPONENTS TO THE PCB

LIABILITY ISSUES

I will have no responsibility or liability in relation to any loss or damage that you incur, including damage to your hardware or software, arising from incorrect assembling or other misuse of the Blasterboard.

While getting familiar with the PCB please notice that components are numbered in reading order for faster search.

Note that the Atmega MCU (IC1) should not be soldered onto PCB directly. A 28-pin IC socket should be soldered first and then the programmed MCU with the latest firmware must be inserted into that socket. This is done so the MCU could be updated with future firmware releases.

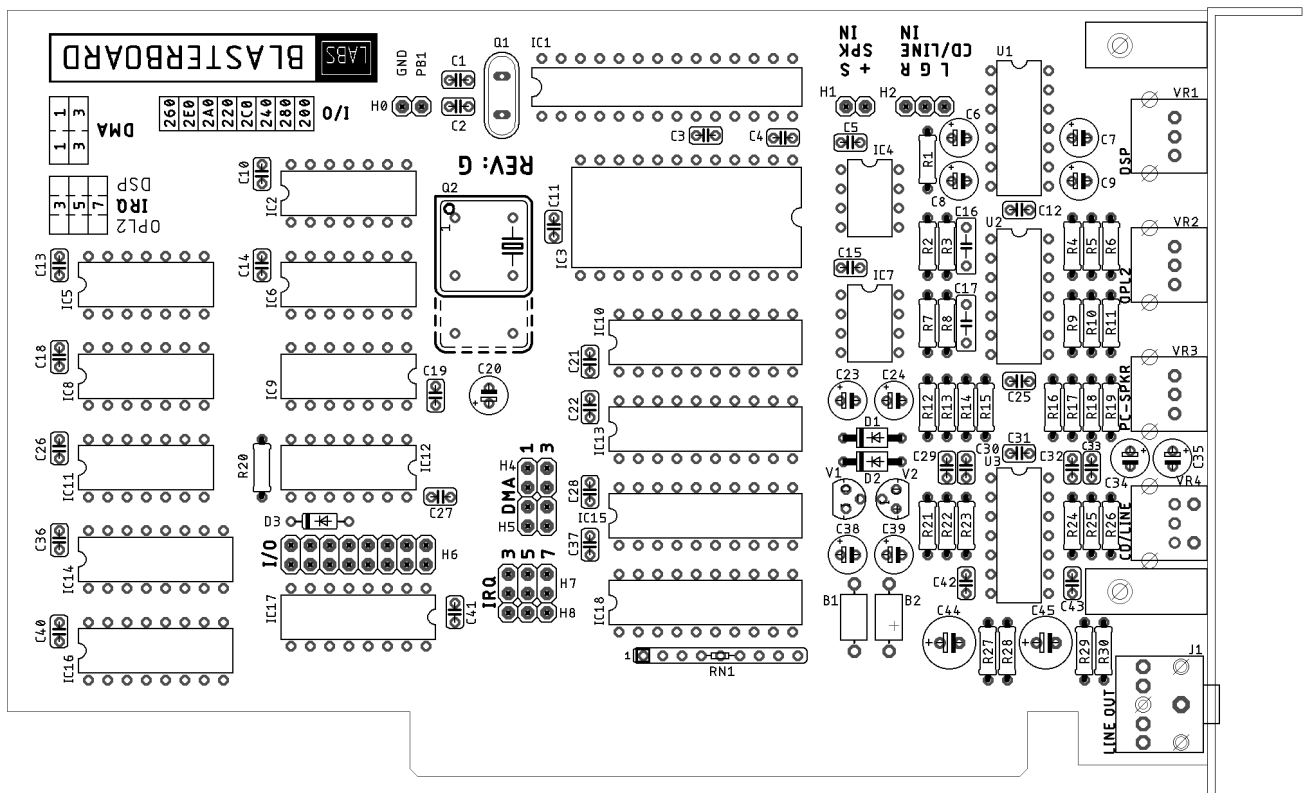
When inserting VR1-VR4 potentiometers, push them into place until click, so they sit well into position.

For your comfort I recommend to print out the component table above and mark your soldering progress on paper, so you don't miss anything.

WARNING!

During assembly carefully check position and polarity of the components before soldering! Incorrectly placed, they can be damaged and cause your computer's hardware to malfunction!

Solder components according to the table above - filling positions from column "Parts" with respective "Values". It is recommended to start with resistors and go on as component's height increases.



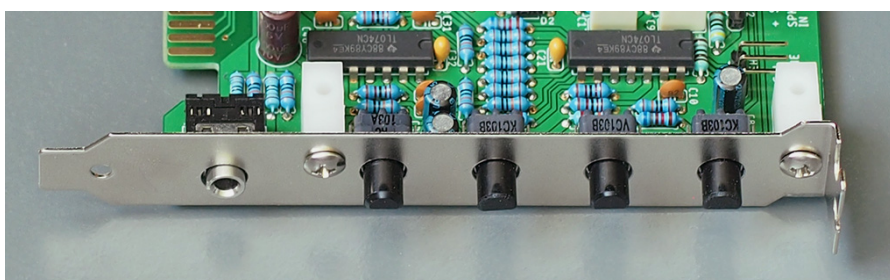
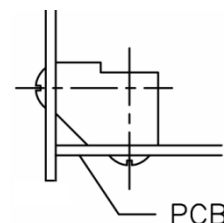
Pic. 1. REV: G board layout for additional reference.

After soldering is completed, thoroughly clean the solder side of the PCB with solvent to remove flux, solder bits and other leftovers. Also carefully clean ISA contacts with a piece of cloth soaked in solvent until there is no dissolved flux left and the contacts don't stick when dry. Thoroughly inspect your work eliminating any possible problems. Bad soldering and other inaccuracies can cause shorting or bad contacts.

3. INSTALLING THE MOUNTING BRACKET

Install the metal bracket using 2 nylon mounts and 4 screws as shown →

Make sure all potentiometers rotate freely.
Otherwise slightly adjust the bracket.



Pic. 2. Correctly installed mounting bracket.

4. PROGRAMMING AND INSTALLING THE MCU

Blasterboard **Kit 1** comes with a pre-programmed Atmega88 MCU. If this is your case - insert the MCU into IC1 socket according to the key position and skip to section 5: "Preparing the card for the first use".

The process of programming the MCU assumes that you have an appropriate hardware IC programmer, programming software and knowledge how to use them properly.

4.1. Downloading the firmware

Blasterboard's firmware comes in 2 flavours to support wider range of MCUs. This is the same firmware, but compiled for 2 groups of Atmega MCUs in 28-pin DIP package:

- 1) With $\geq 16k$ of program memory, can be burned to:
 - ATmega168-20PU
 - ATmega168A-PU
 - ATmega168PA-PU
 - ATmega168PA-PN
 - ATmega328-PU
 - ATmega328P-PU
 - ATmega328P-PN
- 2) With less than 16k of program memory, can be burned to:
 - ATmega48-20PU

- ATmega48A-PU
- ATmega48PA-PU
- ATmega48PA-PN
- ATmega88-20PU
- ATmega88A-PU
- ATmega88PA-PU
- ATmega88PA-PN

To download the latest firmware go to the official Blasterboard repository:

<https://github.com/labs-lv/blasterboard/tree/master/Firmware>

A folder with a ‘-current’ suffix contains the latest firmware.

For example:

/2.1-current

You will need 2 files from this folder:

1) **fuses.bin** – fuse settings for Atmega MCU in binary format (*fuses-pic.png* in the same folder shows the fuse settings as well)

2) **bb-<?_?>--<mcu>.hex** – compiled firmware in Intel HEX format

<?_?> - indicates the firmware version

<mcu> - indicates Atmega MCU group:

m88 – for MCUs with less than 16k of program memory

m328 – for MCUs with 16k or more of program memory

For example if you want to burn Blasterboard firmware of version 2.1 to Atmega48-20PU chip (4k of program memory) use:

bb-2_1--m88.hex

For the same firmware version and Atmega168A-PU chip (16k of program memory) use:

bb-2_1--m328.hex

4.2. Programming the MCU

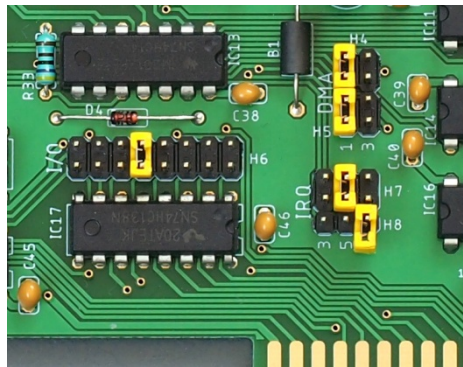
The process of programming the Atmega MCU is explained in its datasheet, which can be downloaded from the Microchip website. It also fully depends on your platform and tools you use, so cannot be covered in this document. Please refer to your hardware programmer’s documentation about programming the Atmega MCU’s fuses and firmware in Intel HEX format.

After successful programming insert the MCU into IC2 socket on the Blasterboard PCB.

5. PREPARING THE CARD FOR THE FIRST USE

First of all you need to select hardware settings using jumpers. Value tables are printed on the PCB near the logo. Blasterboard has an ability to select IRQ for OPL2 chip (H8 header), which adds 2 hardware timers to a system. But since this option was absent on the original SB card, there is no software (at least to my knowledge) that uses this functionality. So it is here only for experimental reasons and should not be used during normal operation of Blasterboard leaving IRQ line free for other hardware.

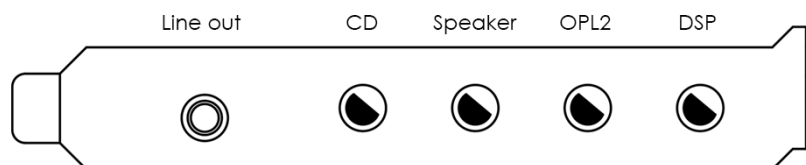
DMA number is selected by setting 2 jumpers together on H4 and H5.



*Pic. 3. Hardware settings for I/O port 220, DMA 1, IRQ 5.
Jumper on H8 is left floating and not connecting any pins.*

After installing the Blasterboard into 8-bit or 16-bit ISA slot, use 3-pin wire to connect analog output of your optical drive (R–G–L pins) to the corresponding pins of Blasterboard’s “CD/LINE IN” header. Then use 2-pin wire to connect PC Speaker’s VCC pin to “+” and the other pin to “S” pin on the card’s “SPK IN” header. You can also use “CD/LINE IN” header to connect stereo output of any other audio hardware (for example MIDI sound module) and feed it through internal mixer to Blasterboard’s output.

Blasterboard’s output is unbalanced stereo 3.5mm jack. Individual volume levels can be set for each sound source using corresponding potentiometers.



Pic. 4. Blasterboard controls.

Do not forget to set up a BLASTER variable for your DOS environment by adding corresponding line to C:\AUTOEXEC.BAT. For hardware settings on picture 3 the line should look like this:

SET BLASTER = A220 D1 I5 T3

Axxx – I/O address (200/220/240/260/280/2A0/2C0/2E0)

Dx – 8-bit DMA setting (1/3)

Ix – IRQ number (3/5/7)

Tx – Sound Blaster model: 3 is for SB 2.0, so is for the Blasterboard

Congratulations! Enjoy your Blasterboard!

If something is not working as it should, please follow these steps:

- Check jumper settings
- Thoroughly clean ISA contacts of the PCB with solvent. Even a little bit of flux or dirt can create bad contact with ISA slot of the motherboard
- Check components placement using PCB layout on picture 1
- Walk around all contacts with hot soldering iron, there might be bad connections left