

Installation Instructions

Atari 400 48/52 KB RAM Card

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Introduction

Hi!

Thank you for your purchase of an Atari 400 48/52 KB RAM card. I hope you enjoy this piece of hardware for our beloved Atari 8-bit computer systems ☺

The Atari 400 48/52 KB RAM card is a replacement for the genuine, made-by-Atari CO61553 add-on card. This one was only offered by Atari Service facilities and uses 8 pieces of 4164 DRAM (= 64 KB total) and some TTL chips of the 74s series. Of course the upper 16 KB of 64 KB RAM can't be used.

The advantages of my card comparing to the original card are:

- Uses SRAM instead of DRAM (reducing power consumption, need just +5V, smaller PCB)
- Enables the usage of a very common "little memory expansion" up to 52 KB using the former unused area between \$C000 and \$CFFF
- Enables the usage of up to 4 different operating systems installed on an industry standard EPROM instead of the special Atari mask-ROMs found on the 400 mainboard
- Enables the usage of an operating system which uses the former unused area of \$C000-\$CFFF without modifications to the Atari 400 mainboard

Please read the whole manual completely at least once, even if you're a professional. The installation of the Atari 400 48/52 KB RAM card is very easy and only two wires must be soldered. These wires are needed for detecting an inserted cartridge – otherwise the computer will crash if a cart is inserted.

The Atari 400 48/52 KB RAM card works fine in any Atari 400 computer using PAL or NTSC.

Please check the parts included in the kit:

- The Atari 400 48/52 KB RAM card, populated with a 27C256 EPROM
- One ready-to-use crimped connection ribbon cable with 16 pin IDC header and DIL adapter

All installation instructions are suitable for PAL or NTSC systems.

The default settings of the jumpers on the Atari 400 48/52 KB RAM card are:

- 48 KB RAM mode
- Operating system chips on the 400 mainboard is used

Starting

It may sound silly, but before you attempt installation, test the functionality of the Atari 400 first. Connect your Atari 400 to a television or monitor, plug in the power supply and turn it on.

- Does it make a picture?
- Does "ATARI MEMO PAD" appear on the screen (if no cartridge is inserted)?
- Do the background and foreground colours change after approx 9 minutes of operation?

When **all** these simple tests are passed, go ahead. Otherwise please do troubleshooting first. If you think the original RAM card in your Atari 400 is faulty, you can try one from an Atari 800, too (you've to open the case, if there's any around the 16 KB RAM cartridge). If you haven't one and your Atari 400 starts with a red or brown picture, then maybe the RAM is the source of trouble. Also go ahead!

Now open your computer. If you don't know how to open your Atari 400 computer, refer to the Atari Field Service Manuals found at AtariMania and other sources on the web – just ask aunt Google 😊

Very short how-to:

- Unscrew all screws
- Remove plastic body housing (two shell parts) of the computer
- Remove power PCB (side PCB)
- Remove upper part of the metal cage
- Remove keyboard to prevent the thin cable from breaking
- Remove bottom ground plate

You must completely detach the mainboard. The two wires to solder will be soldered at the bottom (solder) side of the mainboard.

Installing the Atari 400 48/52 KB RAM card

The connector (slot) for the RAM card is located after the cartridge connector, when you placed the 400 mainboard pointing with the four joystick ports in front to you.

Remember the way the both cards (CPU card and RAM card) are plugged in!

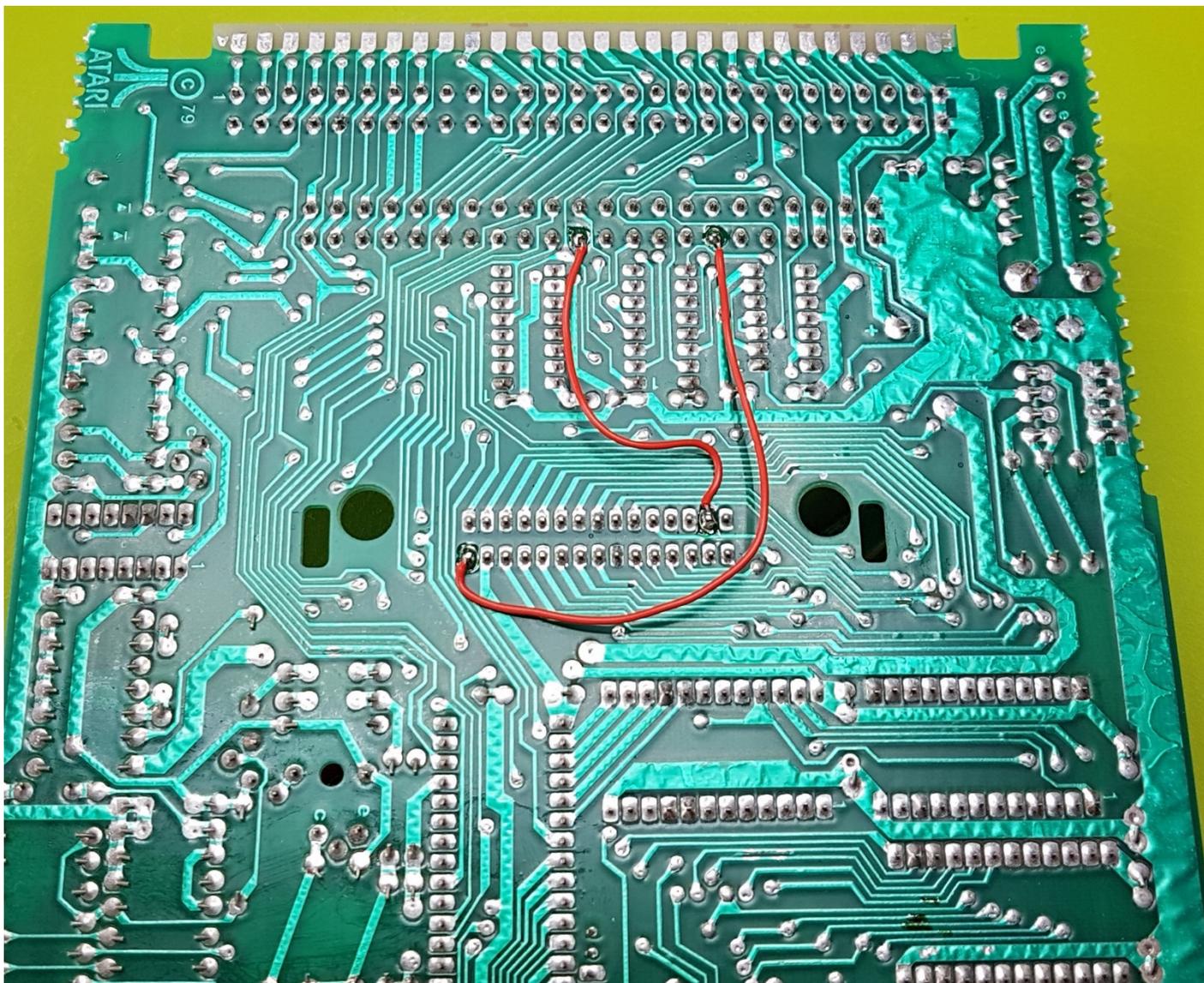
All components on both cards face away from the mainboard's centre. The connectors doesn't have any protection tab or something similar against wrong insertion, so be careful. **Because there are +12V, +5V and -5V voltages at the RAM card connector, a wrong insertion immediately will kill your RAM card!**

Remove the existing RAM card and the CPU card, too – for turning the whole mainboard upside-down this is much easier. Also remove the grey cartridge guide shell.

Locate the pins for the cartridge connector and the RAM card connector. You've to solder two wires to the shown points. Take any wires you have, as long they have an insulation 😊

Hint: If your Atari 400 was equipped before with an Atari factory 48K RAM update card (CO61553), then you don't need to solder anything! Your 400 computer has already the needed modification (it uses four wires, but only two of them are needed for the new Atari 400 48/52 KB RAM card – you can leave the other two at their places without problems).

See where to solder the both wires on next page.



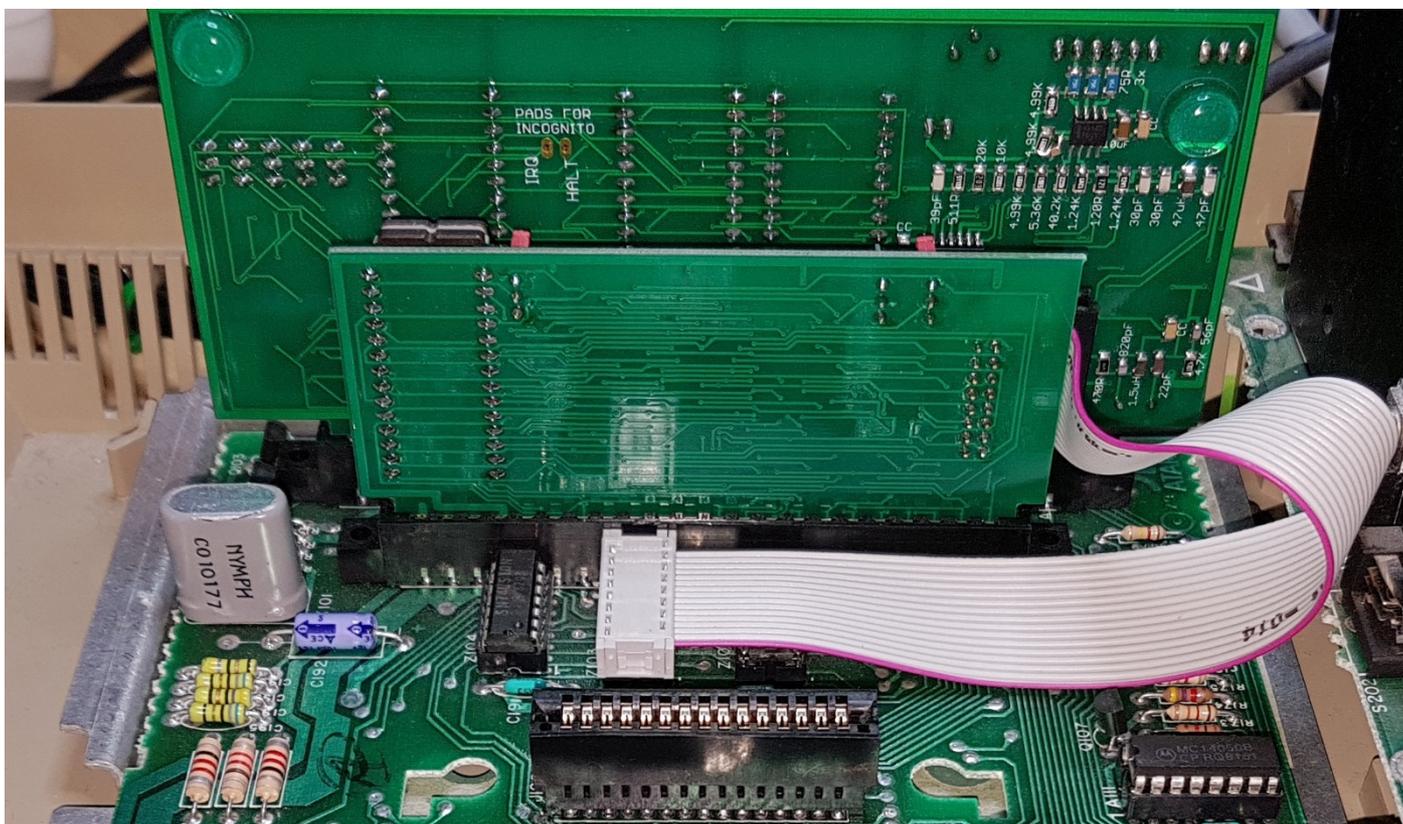
(In the manual's archive you will find the high resolution version in the file "Atari 400 RAM card wires.jpg")

Remove the 74LS42 chip. It's the one in the middle between cartridge connector and RAM card connector. Keep the 74LS42 in your drawer if you ever want to return to the original state. The soldered wires can remain also when a genuine Atari 16 KB RAM card is used.

Now take the short ribbon cable you got with your Atari 400 48/52 KB RAM card. There's an IDC header on one end, this one will fit into the IDC connector at the Atari 400 48/52 KB RAM card. The other side has a 16 pin DIL plug. Remove the protection foam off the pins and push the DIL plug into the empty socket where the 74LS42 was installed before. The ribbon cable must point to the right (having the mainboard in front of you, the joystick ports in front pointing to you). The space between the RAM card connector and the I.C. socket is a tenth millimeter too less – but it works! Just place the DIL plug into the socket and press – with a little force – until it fits into the socket.

Insert the Atari 400 48/52 KB RAM card in the RAM card connector now. The components on the Atari 400 48/52 KB RAM card must point to the rear of the 400 mainboard, where the CPU card will be found. The ribbon cable is too short to insert the RAM card the wrong way... normally.

That's all! Just re-insert the CPU card and the grey cartridge guide shell. Maybe you've to press a little bit more to insert it, but it will fit. Your Atari 400 computer should look like the picture at the next page.



(Picture shows the pre-final version of the Atari 400 48/52 KB RAM card!)

Setup your Atari 400 48/52 KB RAM card and use the extended features

When you plug the Atari 400 48/52 KB RAM card into your computer leaving all jumper bridges at their default positions, the Atari 400 48/52 KB RAM card acts like a 48 KB RAM solution only. For most users this is already fine. But you can do more... let's show you how to use the extended features.

You will find three jumper fields on your Atari 400 48/52 KB RAM card. The most left one is named **"Memory Mode Selection"**. Here are the possible settings:

- Bridge (Jumper block) between 1-2: 52 KB RAM is enabled
- Bridge (Jumper block) between 2-3: 48 KB RAM is enabled

When the 52 KB RAM mode is selected, the O.S. ROM space (when using the EPROM as O.S. source on the Atari 400 48/52 KB RAM card) is mapped between \$D800 and \$FFFF (10 KByte) only. The first 6 KByte in every "16 KB slot" of the EPROM (if larger than 16 KB, of course) are unused.

If the 48 KB RAM mode is selected AND usage of the EPROM as O.S. source (see next), then \$C000-\$CFFF contains the first 4 KByte of the EPROM's 16 KB slot. The next 2 KB are always not accessible, the rest of 10 KB is math pack and the O.S. itself.

Hint: The 52 KB RAM won't be detected, if a BASIC or any other cartridge is inserted. The Atari O.S. checks the amount of memory from the beginning (\$0000) in page-sizes (\$0100). When reaching ROM (because a cartridge is inserted), the search for memory is ended and dependent on the cartridge size the system pointers (MEMHI etc.) in the zeropage are set to "32 KB RAM" or "40 KB RAM". But without a cartridge inserted the O.S. will detect 52 KB RAM and well programmed software can use it.

Of course the new RAM (\$C000-\$CFFF) remains accessible by BASIC or any other application, but not seen. Typing in Atari-BASIC a "? FRE(0)" never shows more than 37902 bytes (without DOS loaded!).

The jumper field in the middle is called **“ROM Mode Selection”** and the options are:

- Bridge (Jumper block) between 1-2: Use the EPROM on the Atari 400 48/52 KB RAM card as source for the operating system. When using this mode, you can leave the three ROM chips on your 400 mainboard or remove them – as you like it
- Bridge (Jumper block) between 2-3: The chips on the Atari 400 mainboard are used for the operating system. The EPROM on your Atari 400 48/52 KB RAM card is not used.

The last and most right jumper field called **“O.S. Slot Select”** contains two bridges for up to four different selections. These options are only valid when the “ROM Mode Selection” option is set to use the EPROM on your Atari 400 48/52 KB RAM card as O.S. source, of course:

- When using a 27128 (16 KB) EPROM, the settings of these both bridges are negligible
- When using a 27256 (32 KB) EPROM, only the LEFT of both bridges is used
- When using a 27512 (64 KB) EPROM, both bridges are used to gain four combinations

Setting if using a 27256 EPROM (this type is already installed on your Atari 400 48/52 KB RAM card!):

- LEFT bridge set to 1-2: First 16 KB of 32 KB are selected (EPROM’s offset \$0000-\$3FFF)
- LEFT bridge set to 2-3: Last 16 KB of 32 KB are selected (EPROM’s offset \$4000-\$7FFF)

The ST M27C256B EPROM found on your Atari 400 48/52 KB RAM card is already programmed with the common, unmodified Atari O.S. versions. The first 16 KB (Offset \$0000-\$3FFF) contains the NTSC OS version “B”, the last 16 KB (Offset \$4000-\$7FFF) contains the PAL OS version “A” (because until today there’s no PAL version “B” ever found!).

If you install an EPROM type 27512, please use at the following matrix:

LEFT	RIGHT	EPROM’s offset selected
1-2	1-2	\$0000-\$3FFF
2-3	1-2	\$4000-\$7FFF
1-2	2-3	\$8000-\$BFFF
2-3	2-3	\$C000-\$FFFF

Connecting the jumper field inputs to other electronic devices, PCBs, expansions etc.

If you have create or own any other expansion, device, electronic switch or whatever, you can easily connect the outputs to drive the modes on your Atari 400 48/52 KB RAM card. Remove the desired jumper bridges completely to do that. Use always the middle pin of each jumper field – this is the input which drives the correspondent function. Each input is connected using a 6.8k resistor as pull-up resistor to +5 volt. So you can use open collector circuits, too. To switch the input to the non-default setting, it must just be pull down to low (0V). The high value of 6.8k is also compatible to 5V tolerant devices like the Xilinx CPLD XC95xx-XL series.

Addendum V1.1 (2017-09-02): Re-adjust of color pot on the CPU card may needed

Due a good information in the AtariAge forum I would mention the fact, that maybe a re-adjustment of your color pot located on the CPU card of your Atari 400 is needed.

The reason why is the change of current load at the 12V rail. The genuine RAM cards made by Atari uses 16 KBit DRAMs which require +12, +5 and -5 volts. Your new Atari 400 48/52 KB RAM card needs only +5 volts, so the voltage on the 12V rail increase a little bit (less than 0.3 volts). This is enough the change the colors – the color pot circuit is fed by the 12V rail and remains now typically as the one and only user of the 12V rail.

So before you complete rebuild your Atari 400 into it's case, check the colors and adjust it, if needed, using the color pot at the CPU card.

Addendum V1.3 (2018-05-18): Technical information – please read!

Dependent on my personal stock and availability of GAL chips I also purchase the one from Cypress. Cypress PALce22V10 will get much warmer than the one from Lattice or other companies. But they work flawless, I've tested it in over 20 different circuits for up to 72 hours of constant usage in a closed case. So don't be scared about some "hot" chips on my PCB!

Last words

Each Atari 400 48/52 KB RAM card is fully tested, so you get a fully working and tested device. If anything strange occurs, please first check all components, cables and so on. Read the manual again or, when in doubt, contact me.

Wistedt, Germany in September 2017 - Jürgen van Radecke alias tf_hh (AtariAge nickname)

Contact: tf_hh@gmx.de or jvradecke@gmail.com

You will find the latest version always here:

<http://www.van-radecke.de/Atari400RAMCard/Manual.zip>

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