SAO Core4 Assembly Guide

INSTRUCTIONS TO ASSEMBLE SAO CORE4 KITS

SAO Core4 designed by Andy Geppert
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The latest version of this and related Core4 details at: https://github.com/ageppert/SAO_CORE4

Demo video on YouTube: https://www.youtube.com/watch?v=id1_PEvV3Vw

2. VERSION HISTORY OF THIS GUIDE

Revision	Description	Author	Date
A	First draft	Andy Geppert	2024-09-09
B	Add redlined schematic excerpt of V0.1.1 changes	Andy Geppert	2024-09-10

3. Important Cautions and Warnings

These caution symbols point out important things to help ensure your assembly goes smoothly!

Beware the ESD monster!

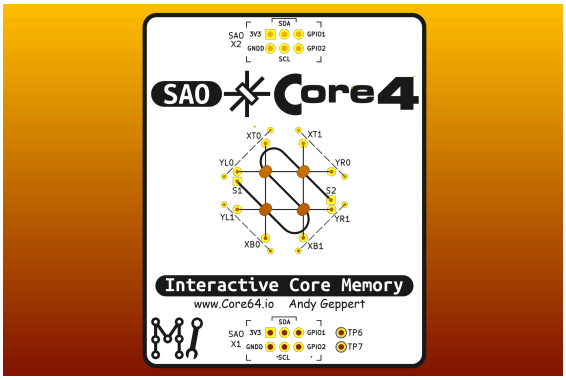
Core4 Maximum battery pack voltage: 5.5 VDC
All kits have minimum working voltage: 3 VDC

CORES are fragile! Don't crush them.

CORES are small! Don't lose them.

4. Introduction

Welcome to the assembly instructions for the SAO Core4 kit! This is a simple add-on kit for you to learn how to use core memory!



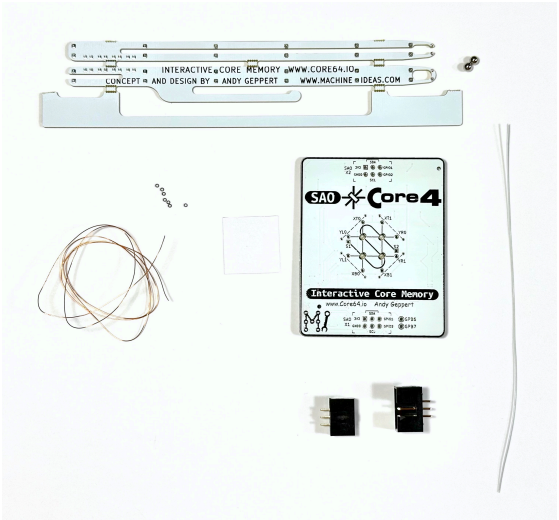
What does Core4 do?

A layer of core memory on top of an LED Matrix enables you to use a magnet to draw in core memory and see the effect in real-time! This is Interactive Core Memory and the opportunity to learn how to use core memory down to the transistor level.

What comes in the Core64 kit?

With this kit YOU get to make Core Memories! The baseline kit includes:

- 4 bits of core memory
- 4 LED pixels
- Enamel wire
- Screen Protector
- SAO socket for I2C + 2 GPIO connection to a host
- Magnetic Stylus
- [optional] SAO header in the prototype V0.1.x kits
- [optional] QWIIC socket in the prototype V0.1.x kits
- [optional] rework wire to go from V0.1.0 to V0.1.1



What is NOT in the CSAO Core4 kit?

Since this is an SAO, it is designed to run as a Simple Add On to some sort of host microcontroller. Usually an electronic badge. You need to provide:

- Power
- Logic

in order to access the cores and control the. LEDs through a combination of the I2C port and the GPIO pins.

There is sample code available at https://github.com/ageppert/SAO_CORE4

You must provide your own microcontroller and code logic!

What else can I do with Core64?

Learn how to use and misuse core memory! Blinks some LEDs! Make some interactive games!

Where can I get a kit?

These kits will be available at https://www.Core64.io/

5. Tools Needed for Assembly

This kit requires some basic electronics tools. It is helpful to have a clear and bright workspace, and perhaps some magnification for your eyes. The cores are small, and you don't want to lose them!

TOOLS: Soldering pencil, fume extractor, tip cleaner, tweezers, small flush-cut wire cutter, sharp hobby knife, continuity tester

SUPPLIES: Solder (1/32 or 1/16"), flux pen, isopropyl alcohol, Q-tips, Kimwipes or similar lint-free towel

If you are not already in the habit of using flux when soldering, you are missing one of the best tricks of the trade! Not just flux core solder, but a flux pen or flux paste. It's the secret to shiny solder joints that "just flow." But don't breathe it. Get a fume extractor and solder in a well-ventilated area.

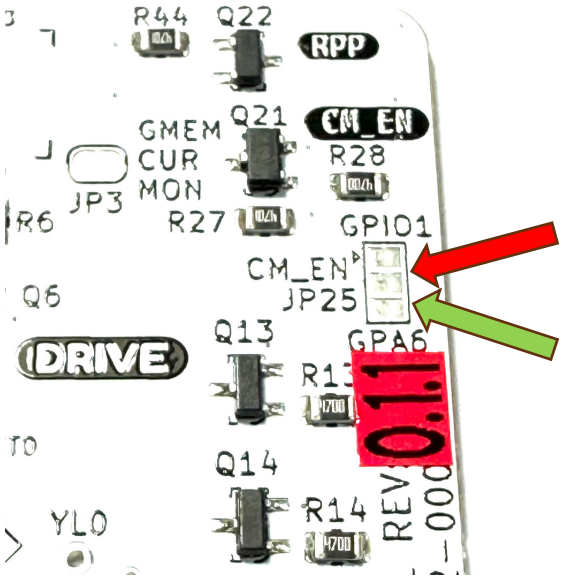
OPTIONAL: Magnifier, flux remover, more light

Be patient and gentle with the cores and wires. You'll be very happy with the results.

6. [OPTIONAL] Update the PCBA from V0.1.0 to V0.1.1

STEP 1: Cut top of Jumper JP25

The top two pads needs to be cut at the red arrow. Do not cut adjacent traces! Verify there is no continuity.

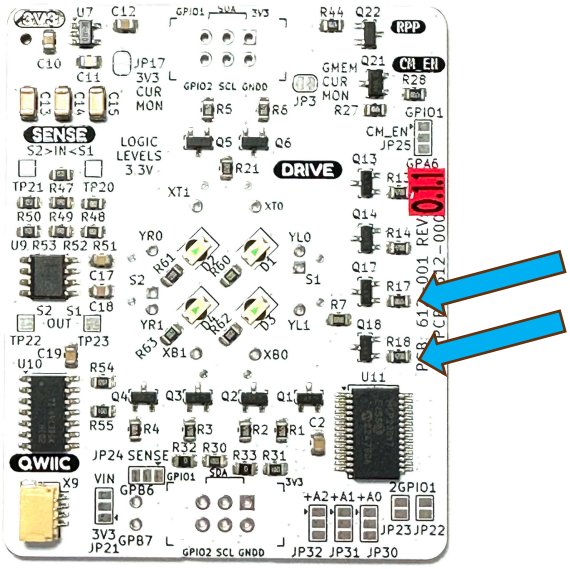


STEP 2: Cut bottom of Jumper JP25

The bottom two pads need to be solder closed at the green arrow.

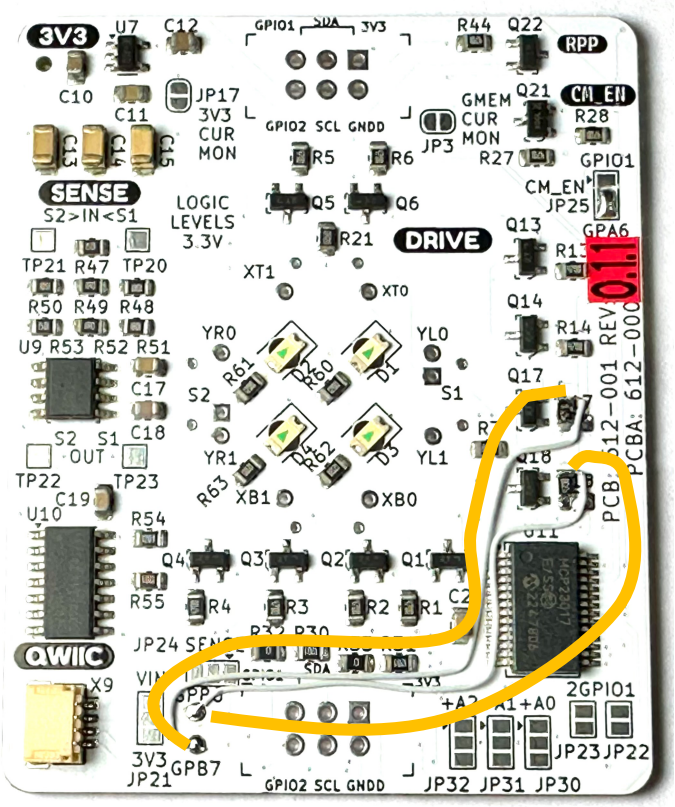
STEP 3: Remove and rotate R17 and R18

The two resistors which connect to the bases of Q17 and Q18 need to be removed, rotated, and reinstalled on the left pad. See blue arrows.

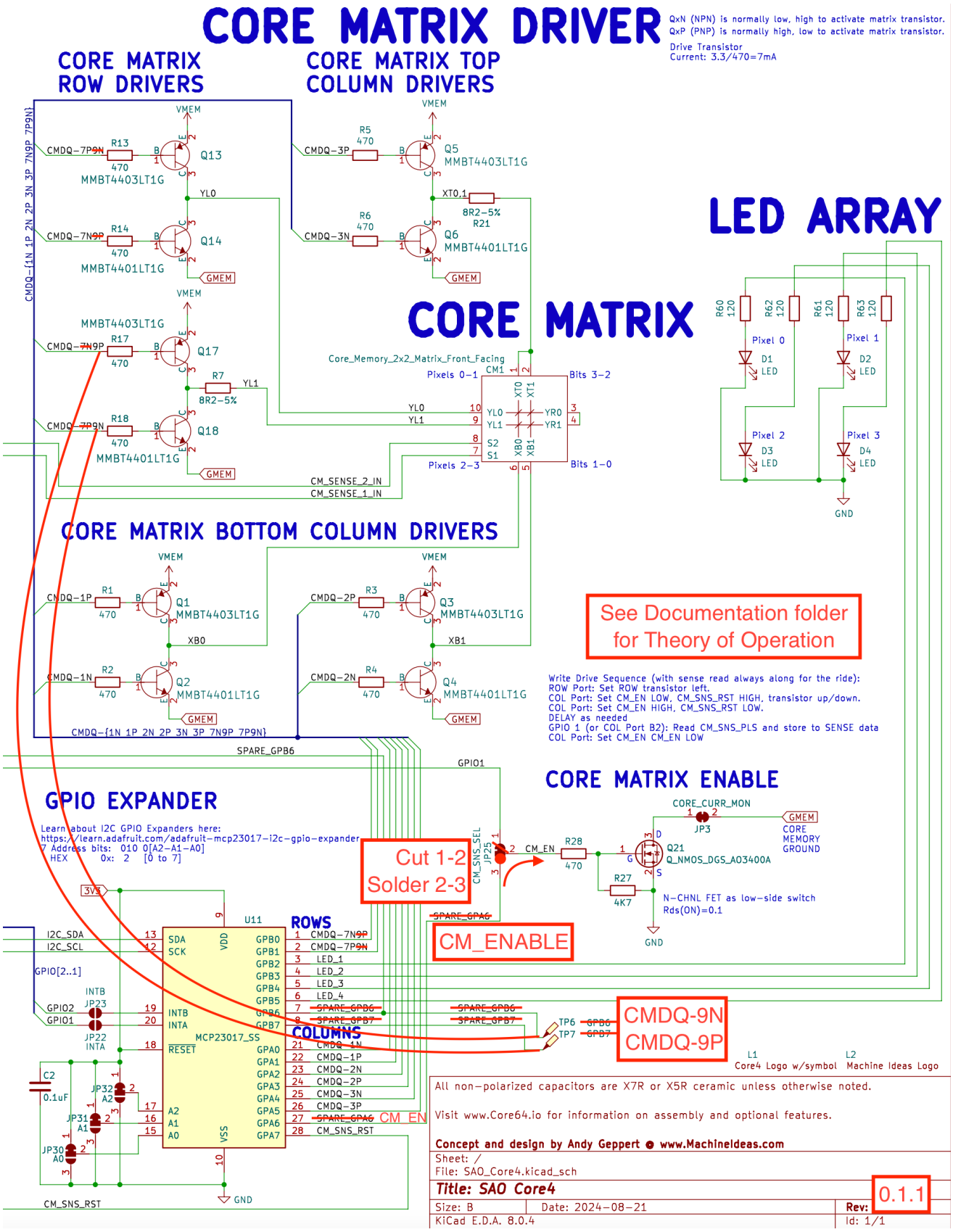


STEP 4: Add jumper wires R17 & R18 to GPB7 & GPB6

The free end of each resistor must be routed to the GPB6 & 7 solder points. See orange lines:

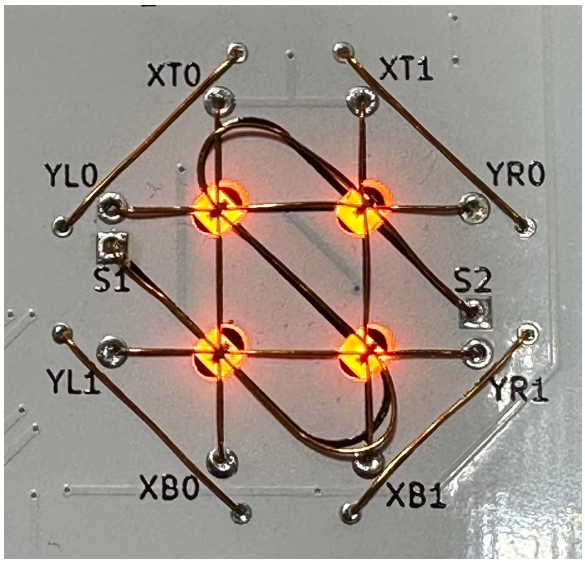


Schematic Redlines of V0.1 to V0.1.1 changes:



7. Weave the Matrix wires with the Core Memory

Weaving follows the pattern shown on the front of the SAO Core4. When complete, there are four matrix wires, a sense wire, and optional diagonal outer wires to secure the screen protector. Each core will be in the same diagonal orientation at the four LED cut-outs. The finished result looks like this:



Leaving a ½" to 1" of wire extended out the back side during the weaving process makes it easier to gently pull the wires straight with a tweezers in the final assembly steps.

STEP 1: Insert horizontal wire at YL1, solder on bottom side to anchor it, with a ½" extended out the bottom.

STEP 2: Slide two cores on the open end of the wire.

STEP 3: Insert horizontal wire down through YR1.

STEP 4: Leave 1 inch loop on the backside and route wire up through YR0.

STEP 5: Slide two cores on the open end of the wire.

STEP 6: Insert the wire down through YL0.

STEP 7: Leave a ½" of wire extended out the back side and cut of the remaining wire.

STEP 8: Solder the wire on the back side at YL0, YR0, and YR1 to anchor it. Keep the wires running straight and down close to the board on the front side, with the cores in the LED openings.

STEP 9: Repeat a similar process with the vertical wires, but weave the wire through the cores that are already installed on the horizontal wires. Make sure all of the cores are oriented in the same diagonal pattern as the LED openings.

8. Weave the Sense wire with the Core Memory

STEP 1: Insert the remaining wire from the front through S1, leave a 1/2" on the back, solder it.

STEP 2: Carefully weave the sense wire through all four cores and insert the free end through S2. Leave a ½"

9. Solder and continuity check

Flip the SAO Core4 on its face, and gently tension each wire on the back side as you go around the perimeter, heating each joint. Rub the solder pencil on the enamel wire at the base of the joint to help remove the enamel. A little extra heat helps too.

Continuity check each wire, by measuring from the solder joint at each end of each wire. These must be good solder joints, and this is the most frequent issue with these kits.

10. SCREEN PROTECTOR INSTALLATION

You can install the screen protector now or leave it off until you are sure the system is working.

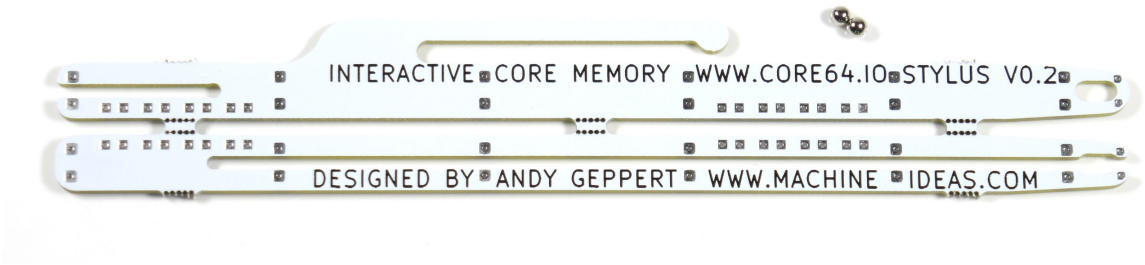
Be careful working with the Core Board so you don't damage the weaving. The Screen Protector will prevent damage from the stylus.

Solder in the four outer diagonal wires, which serve to hold the edges of the screen protector.

Slide each corner under the wires.

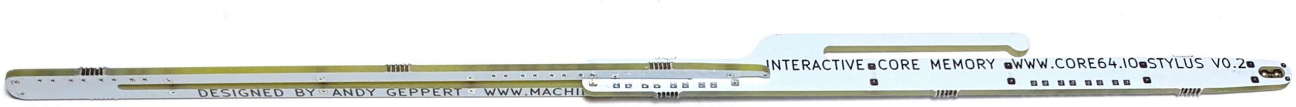
11. Stylus Assembly

The stylus assembly is easy - be careful separating the two boards. It is easy to accidentally break the stylus clip arm or the long thin strips that make up one half of the stylus. Don't let the little magnets get away from you either.



> ⚠ Be very careful separating the two stylus components. They are very thin and fragile. When breaking the pieces apart, use flat face pliers or similar on each side to ensure the break happens across the mouse bite holes.

Separate the two halves of the stylus. Slide the two stylus halves into each other held at 90° to each other. Place the magnets into the small opening at the tip. In some versions of the stylus (V0.3 RED) you may have to gently tap the magnets into the opening because the fit is tight.



Align the two halves of the stylus (hold with tape) and solder them together at the square pads which are adjacent to each other. You can skip every other set, and solder as much as you want, or a bare minimum to keep the assembly rigid and prevent the magnets from escaping.

File or sand away the sharp edges. Take extra care to sand/polish the tip of the stylus so there are no sharp edges that will scratch up the screen protector.

The final stylus assembly looks like this:

If you think the magnet strength is too weak you can carefully sand away more material at the tip so the magnet will be closer to the cores.

Thus completes the magnetic stylus.

12. Troubleshooting

Make sure the continuity is good on all of the enamel wires!

More support is available at https://www.core64.io/support