SID2SID

Installation Guide

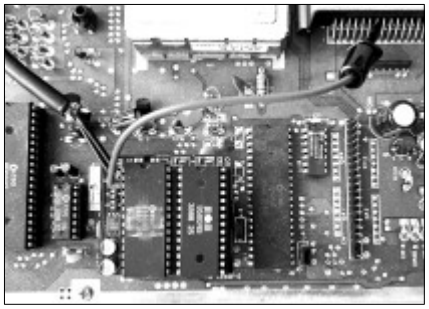
Concept

The SID2SID is a circuit board designed to house two SID audio chips doubling the Commodore 64's sound abilities. SID2SID is installed into the same socket as the computer's SID chip. The original SID and an additional one are then inserted into the SID2SID's internal sockets.

The SID2SID circuit board is only halfway assembled out of the box. The owner needs to solder connectors for sockets and motherboard as well as an audio jack of choice into place.

SID2SID is compatible with any software making use of an extra SID chip through the address DE00 or DF00. This manual suggests using address DE00 to work with the MSSIAH Cartridge but it can easily be switched to address DF00 by changing the access point physically. (The address required should be stated in the manual for the software in question).

When using SID2SID together with the MSSIAH Cartridge the Sequencer, Drummer and Wave-Player applications are extended with three extra voices/channels, the Mono Synthesizer and Bassline merely double the sound making a left-right stereo panning possible.



SID2SID is not designed to mix 6581 and 8580 SID revisions on the same board. It does not enable mouse/paddle input readings from SID no. 2. It works with both real SID chips as well as emulator chips as long as they are fully compatible.

SID2SID comes tested for 100% working parts from the factory. To make the final installation operational you need to assemble it correctly and test/make sure vital signal paths are fully functional.

Please read this whole document through before starting to install the SID2SID.

Disclaimer
This booklet aims at giving a well enough experienced reader sufficient information to assemble his or her SID2SID circuit board. Mssiah.com does not take responsibility for any errors, injuries or malfunctions caused by operations carried out while installing the product.
The product is provided as is without any kind of warranty as the user will need to physically modify it before installing and using it. A correct installation does not cause your computer to fail or misbehave.
This manual issues warnings to avoid serious pitfalls that may cause damage to the SID2SID or the computer if not dealt with properly. Apart from that, owner is required to have enough knowledge to safely assemble and install electric components and the concept therein.
Modifications such as on/off switches, mixing SID revisions or in-depth troubleshooting are out of scope for this manual.

SIDs are sensitive circuits that may be damaged by careless handling. User is advised to protect the SIDs from electrical discharges and use discretion whenever connecting and disconnecting audio equipment from the SID circuit. Even though SID2SID has protective diodes giving partial protection from back currents user is strongly advised to use discretion whenever connecting and disconnecting audio equipment from the SID circuit. Unplug the SID before turning off the mixer, amplifier or alike .

Motherboard Compatibility
This booklet explains how to install the SID2SID in a standard Commodore 64. Since it comes with various circuit board revisions it is up to the owner of the SID2SID board to find the information necessary for his or her specific motherboard.
As for compatibility with new motherboard replicas as well as available SID emulators, SID2SID works with any product with 100% chip compatibility and the same access points and chip timings available as the original C64's motherboard and expansion port.

Sockets on Motherboard
To install the SID2SID your C64 needs to have the SID circuit installed in a socket. Some C64s do not but instead have the SID soldered directly on to its motherboard. It is still possible to install the SID2SID but the SID needs to be desoldered first which is a bit trickier than just removing it from a socket.
This process is not addressed in this manual. Before you order a SID2SID you are advised to open your C64 computer and verify that you can carry through a full installation.

What You Need to Assemble and Install the SID2SID

Solder Iron

You need to solder the sockets, pin headers and wires

Solder

Use a solder that is not too thick. 0.7mm is recommended.

Multimeter

Optional but highly recommended!

The fastest way to verify all connections are ok.
A great tool when troubleshooting messed up solder joints.

You can use a magnifying tool (or smartphone) to analyze the solder joints but then it relies on your eyes to make the judgement
If you want to be 100% sure we recommend you to use a multimeter preferably with audible continuity test functionality.

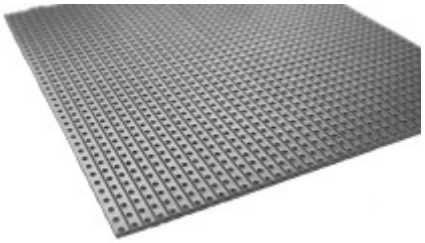
Audio Jack

One way of routing the audio signal from SID2 is to install an audio jack in your C64's casing. Using a stereo jack you can even include the audio from SID1.

A simpler alternative is to mount an audio cable with a plug and pull it out from any of the C64's openings. Then you need an audio cable instead.

Prototype Board

Optional.



Helps aligning the pin headers when soldering.
Should be perforated with a hole distance of 0,100 inches (2,54 mm).

IC Extractor Tool

Optional.

Removes SIDs out of the C64's or SID2SID's sockets.

You can also use a flat screwdriver.

IC Pin Straightener Tool

Optional.

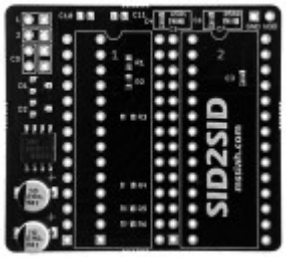
Quickly salvage a bent pin or simply straighten a misaligned row of pins.

(Also good when trying to get a brand new IC into a socket for the first time. If you do lots of prototyping this will be the best $10 you ever spent!)

Putting the Pieces Together

What's in the bag?

PCB	Circuit Board with all almost components attached.
Sockets (x2)	Attach the SIDs. Require soldering.
Pin headers (x2)	Attach SID2SID to the C64. Require soldering.
Hook	Connects the Chip Select signal. Requires soldering.



Not Included

Wires	SID 2 audio out and attaches to the hook.
Audio jack/plug	Audio out from SID2.

Before installation, check the contents in the bag and that the legs of the sockets are ok. Sometimes these tiny pins can bend a little but it's ok, just carefully bend them back to a straight position (here an IC pin straightener tool comes in handy).
Also check the circuit board so that the two large capacitors are in place. If not, solder them back into place.

If you prefer to use other components than the ones included, like a fancier socket or a shorter/longer pin header that is fine. Just make sure they fit.

The size and colors of included components may vary.

Precautions

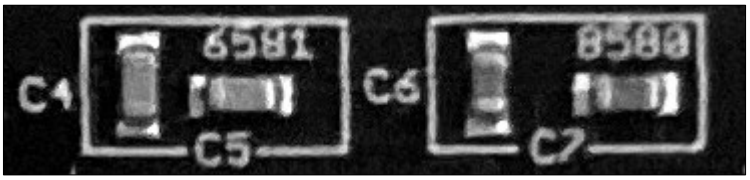
Avoid touching components and pads on the circuit board. If it cannot be avoided, like during installation, make sure you are wearing an antistatic bracelet.
Grip the circuit board on its sides when moving or lifting and installing it into the computer.

It's recommended that you ground yourself with a wrist band when working with the SID2SID installation.

So let's begin the assembly..

Step 1. Remove filter capacitors

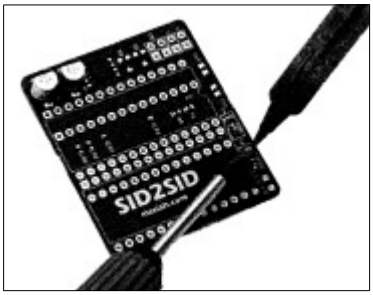
Getting started to finalize the SID2SID circuit board for use you first need to adjust for the SID version you intend to use.
The SID circuit's two different versions 6581 and 8580 use different external capacitors for their filters. To accomodate for this SID2SID comes pre-installed with a setup of both capacitors. You simply remove the ones you don't need. It's easier to take care of this first when there is still space to move around before the sockets are mounted.



Remember, it's the opposite of what you're using that should go:

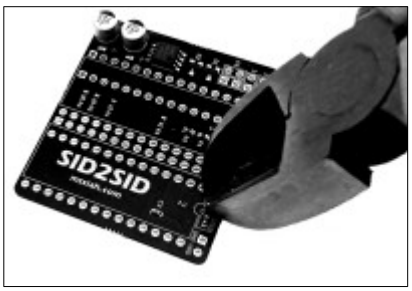
If your SIDs are version 6581 then you should remove the 8580 ones (C6 and C7)
If your SIDs are version 8580 then you should remove the 6581 ones (C4 and C5)

There are two ways you can remove these capacitors.



Method 1 (recommended)

- Put the solder iron onto one edge of the capacitor.
- When the solder melts and the capacitor loosens up, gently lift it up a little using a screwdriver or the solder tip.
- Now heat up the opposite side and do the same.



Method 2

Use a pair of pliers directly on the middle of the capacitor cutting it in half. Then you can either leave it as is or use tweezers to remove the residues.
Use a magnifying tool to see what you are doing.

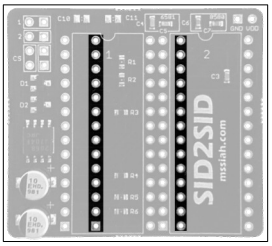
Be aware: This is more of a brute force method with the risk of damaging the board!

Either method used, you need to check the pads (multimeter or magnifyer) afterwards so there is no residue causing a connection between them. This is especially important when using method 2.
If you went for the first alternative and did it carefully the pads can be used again in the future should you wish to re-install the capacitors to use a different SID version with your SID2SID. Meanwhile save those tiny capacitors in a ziplock bag.

Step 2. Solder the pin headers

Now it's time to attach the first components.

You must start with the pin headers, i.e., the pins sticking out of the bottom of SID2SID to connect with the C64's empty SID socket. The right one will be impossible to mount if the sockets are soldered first.



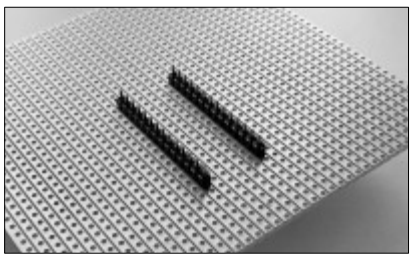
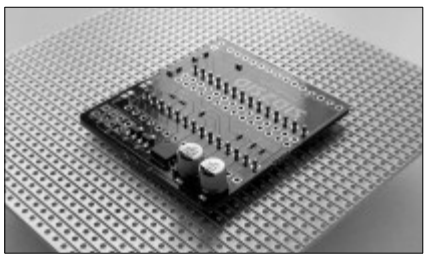
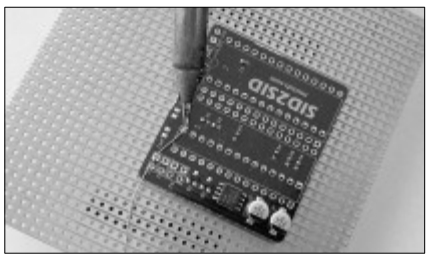
Looking at SID2SID from the top, the pin headers are installed into the second and fifth row of vertical holes.

The headers are inserted from SID2SID's bottom side and soldered on its top side where the short side of the pins will stick out.

How to get the header straight

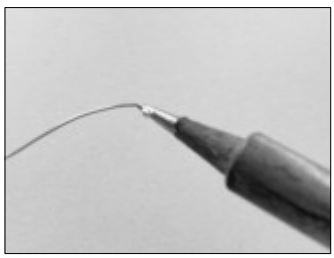
The pin header must be mounted completely straight pointing out 180 degrees from the board. Not paying attention to this detail might result in the SID2SID becoming hard or even impossible to insert into the C64 later.
If you're familiar with attaching pin headers to circuit boards you probably already know how to deal with this and even have your own trick how to get the job done correctly. If not, we suggest you use any of these methods:

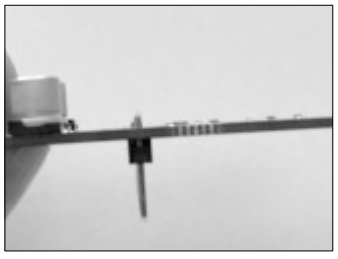
Option 1

- The first and simplest option requires a prototype board with holes 0.1 inches (2.54 mm) apart. Elevate the board so that the pins do not touch ground. You can use the included IC sockets as stands if you flip them 90 degrees.
- Align the pin headers in the prototype board keeping five holes between them and place the SID2SID on top of the pin headers, left one goes into the second vertical row and the right one into the fifth row.
- Solder all the pins together.

Option 2





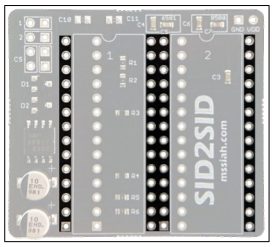
- Heat up and put some solder on your soldering tip
- Insert the pin header into SID2SID's second row from the left
- With one hand, hold the SID2SID and pin header in place, try to hold it absolutely straight.
- Grab your soldering iron with your other hand and put the tip on one end of the pin header.
- When the solder is melted, check that the pin header is straight. If so, go ahead and do the same thing

on the other end of the pin header. When you're sure it's 180 degrees, finish off soldering all the rest of the 12 pins.

- If the pins are not straight after soldering the first pin, heat the pin up again so that the header comes loose and adjust it with your finger as you let go of the solder joint.
  This trick is a lot easier than it sounds but as you only have two hands you need to keep up with your motor skills. You may need to try again a couple of times but as long as you have only one pin soldered you can easily re-heat it to adjust. Once you solder more pins you would need to desolder the whole row.
- Do the same with the other pin header

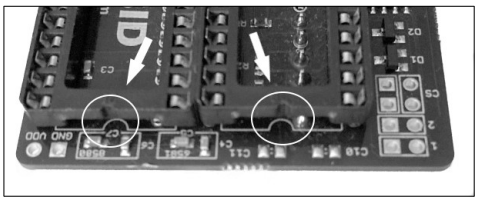
Before proceeding, please check your connections. Use a multimeter or magnifyer tool to assure that no two adjacent joints are accidentally connected with solder and also that all solder joints are filled with solder. Since these parts will be covered by the sockets you will not be able to go back and adjust this later.

Step 3. Solder the sockets

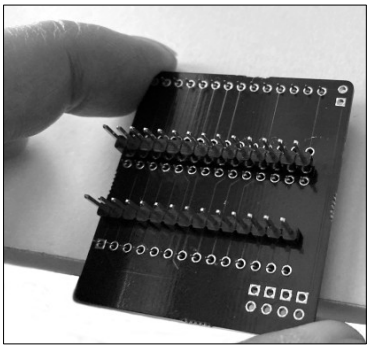


The sockets are inserted from the top side into the remaining rows. They are soldered on the bottom side.

Sockets should be aligned so that the notch on the socket matches SID2SID's printing. They should both point upwards when looking top down on SID2SID.



Since there are other components on the SID2SID sticking out you need to elevate and support the sockets as you flip the SID2SID upside down.



Easiest method is to rest the SID2SID upside down against the edge of your desk. That makes the other components facing down outside the desk and gives the sockets support.

You can now solder all the pins for the two sockets, 56 in total.
The tricky part is the tight space in between them next to the header pins but if you are patient and careful it should not be a problem. A magnifying glass can however be highly useful.

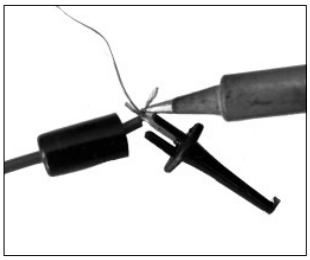
When you're done, please go through all the solder joints with a multimeter or magnifyer tool to make sure there are no adjacent connections made by accident. And of course, at the same time making sure the solder joints look fine filled up with solder and actually making a connection where they should.

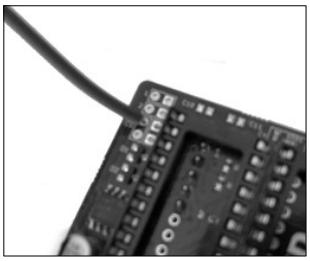
Step 4. Solder the chip select hook

The second SID needs to know when the computer addresses it and for that you will hook up the Chip Select signal (CS).

The package includes a hook that goes to the back side of the expansion port.

First you need to solder a wire to it and solder the other end of the wire to one of SID2SID's CS holes. It's the round ones in the picture to the right. They are duplicates so you can pick any of them to attach the wire to.



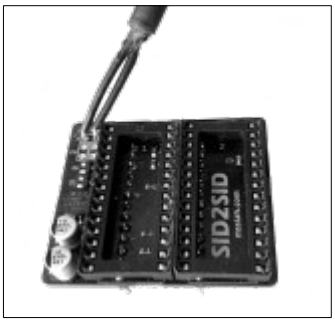


Open the hook, solder a wire to it. Insert the other end of the wire to one of the CS holes from the top down. Solder it from the bottom side.

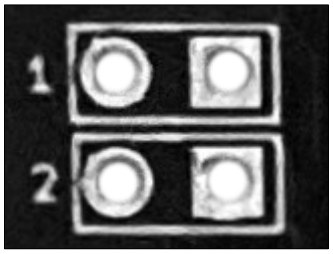
Last, do a continuity test with your multimeter between the empty CS hole and the end of the hook.

Step 5. Attach an audio jack/plug

There are two ways you can get audio out of the second SID chip:
- Solder wires between SID2SID and an audio jack and drill a hole in the side to mount the plug. Pretty neat but requires some extra work and makes an irreversible hole in your C64's case.
- Cut off an existing audio cable with a plug and solder the two wires to SID2SID and route the side with the plug out of the computer.



Solder the wires to the top holes on SID2SID marked "2". These are for SID no. 2's output. The ones marked "1" are for SID no. 1's output. Those are there in case you want to create a separate output for SID no. 1 instead of the internal audio/video output.

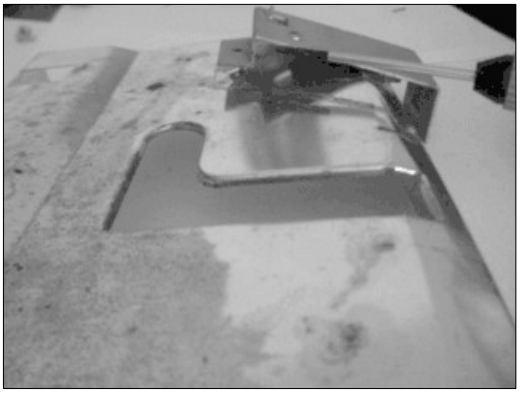


The wire for the tip of the audio plug/jack connects to the round hole and the sleeve goes to the square hole.

Don't forget to do a continuity check with a multimeter so that your solderings are ok.

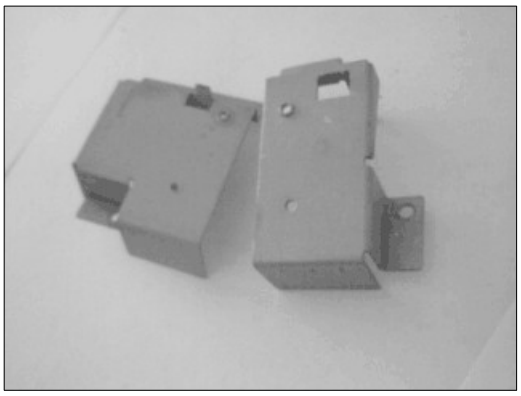
Installing SID2SID in the C64

Step 1. Open the C64



Remove the screws and lift the top of the case. What you will encounter depends on the model and year of your computer. Your objective is to remove anything that may block your way to access the motherboard. You do not have to dismount the board, just make sure you can reach the components inside.

Most C64s/C128s had covers made of cardboard paper or metal installed directly under the casing. Main reason was to function as heat shields to keep temperatures down. SID2SID will not fit into your computer if you keep this cover on. You therefore have two options: Cut a hole big enough for the SID2SID in the cardboard/metal cover or Remove it completely.
If you want to keep the cover intact go for the latter. A good advice is then to install heat sinks on each chips instead, they come cheap and are available from any supplier of electronics.

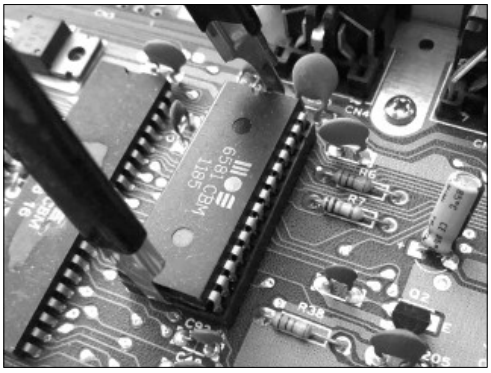


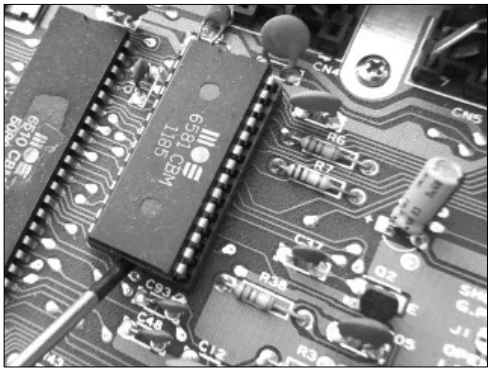
If you remove the metal cover you will still need to keep the side clamps to attach the keyboard. Pry them off the cover with a screwdriver.

CAUTION

The edges of the metal covers are razor sharp. It does not take much pressure to make deep cuts into your fingers!

Step 2. Remove the SID circuit





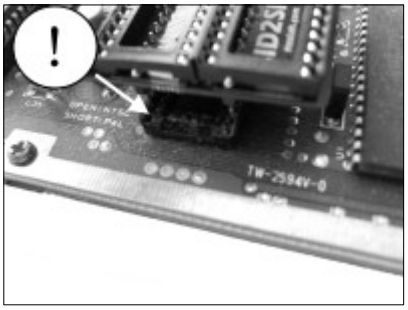
Locate the SID chip and gently remove it. If you have an IC extractor tool, use it and pull the chip straight up, otherwise the pins might be bent.

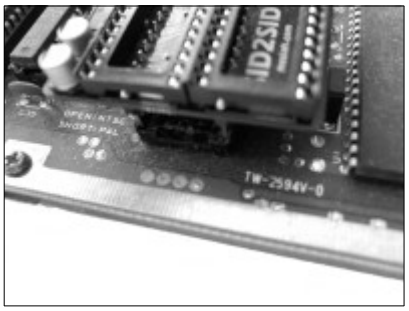
If you don't have such a tool you can use a small flat screwdriver instead, in fact many people find this method easier: Insert the screwdriver under one side of the SID and turn it slightly. Then switch to the opposite side and do the same. Go back and forth alternating sides gently raising the chip little by little and eventually it comes off.
To minimize the risk of the SID popping out too far you can put a finger on the top of the IC on the opposite side of the screwdriver. Push the chip back just a little while turning the screwdriver. Make sure you don't touch the pins, stick to the black area. To be on the safe side and prevent electrostatic discharges it's always a good idea to wire your wrist to ground when working near electronic components.

When you have taken the SID out of the socket, put it in a safe place (like an IC pin straightener tool if you have one). Don’t insert it into the SID2SID just yet.

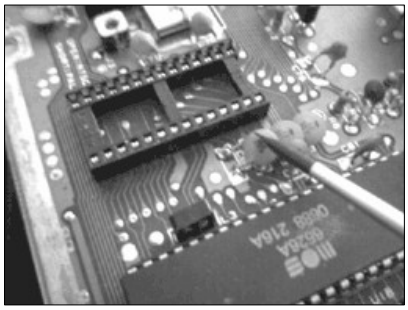
Step 3. Insert the SID2SID into the SID socket

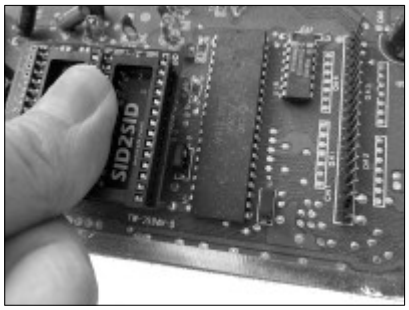
Place the SID2SID in the SID socket facing the same way (look at the socket notches to match them).





Make sure the header pins are not misaligned in the socket. It's an easy miss but do pay attention, worst case scenario is that your SIDs are ruined by 9 or 12 volts inserted into the wrong pins



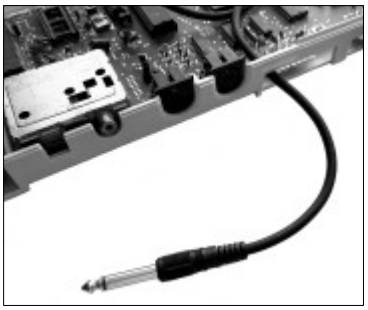


If any components, such as capacitors, on the C64's motherboard block the way you need to bend them down so they are laying flat. Just be careful so you don't break the legs of the cap.

To insert the SID2SID into the C64's SID socket use your thumb touching both sockets and push it downwards. Apply pressure with just enough force not to break anything. When the header pins' legs reach the bottom of the socket the SID2SID should not come loose if you grab the sides and try to (gently!) rock it.

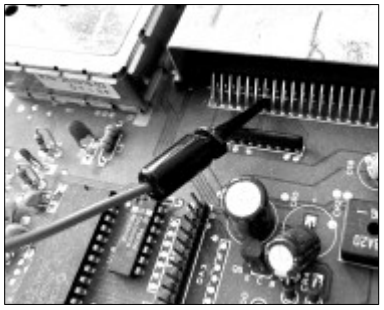
Step 4. Route the audio cable

When it comes to routing the audio out of your second SID you have multiple options.
You can either use an old audio cable with a plug, cut it in one end and solder its two wires to the SID2SID audio out or you can be more sophisticated and drill a hole in your C64's casing to mount a real audio jack. In that case it's a good idea to first test the SID2SID installation so that everything works before start making holes in the case.



Step 5. Attach the CS hook

Click to extract the tiny hook in its front end and attach it to the 7th pin from the left on the expansion port. Release and the hook snaps to the pin.

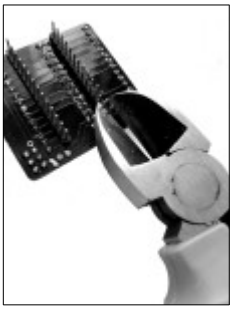


Step 5. Install the SIDs into the SID2SID's sockets

Make sure the SIDs are aligned correctly facing up. Match the ICs' notches to the SID2SID's sockets.

Never mix SID versions 6581 and 8580 on your board. Never insert a 6581 into a 8580 board or vice versa. The chips use different voltages and will be damaged if you do so.

Step 6. Make Sure You Can Close the Lid



On some motherboards the SID sockets are located further down making less space for the keyboard with the extra height provided with a SID2SID. If this is the case then you will need to cut the length of the header pins. Measure carefully and make sure you don't cut away too much!

Affected motherboards are mainly the 250407 and 250469.

Step 7. Audio Test

To test the SID2SID installation fire up your MSSIAH Cartridge and run the audio test in the startup menu.

If you don't have a MSSIAH then enter these pokes on the C64 basic screen:

Audio Test Program C64

```
POKE 54296,15

POKE 54272,0
POKE 54273,5
POKE 54277,0
POKE 54278,240
POKE 54276,33

POKE 56856,15
POKE 56832,0
POKE 56833,10
POKE 56837,0
POKE 56838,240
POKE 56836,33
```

This plays one tone on SID1 and another tone one octave up on SID 2. To stop enter these pokes or simply press RUN/STOP key and hit RESTORE key simultaneously:

Stop Audio

```
POKE 54276,32
POKE 56836,32
```

Troubleshooting

Every SID2SID unit is thoroughly quality checked prior to shipping to assure that the components onboard are fully functioning and so that you should get sound out of your SID2SID if everything is installed and used correctly. So if you're consulting this chapter it means something went wrong during the installation.

We do not provide support services for SID2SID assembly nor do we troubleshoot faulty installations for our customers. To correctly assemble and install the SID2SID into the computer and make sure audio gets out of it, including any possible troubleshooting that comes with it, is the buyer's responsibility.
However, to help you on your way we have listed some errors below and what to look for that may have caused the problem.

Some quick, easy and most obvious ones to rule out first:

- Try out each SID in the C64 socket before installing the SID2SID. Then you can quickly rule out whether any of these single chips are broken.
- Do continuity tests continously during the assembly to make sure your solder joints are fine and there are no short cuts or missing connections.
- Make sure you get the audio connector right and which wire goes to what part of it.

Error	**Cause / Remedy**
Black screen when starting up computer	▸ Black screen is most likely caused by a short circuit or faulty SID. This is a tough one since it means you need to start from the beginning to find that short. ✔ Continuity test ALL connections/solder joints Check adjacent solder joints for overlaps, ever so tiny yet causing big problems. ✔ Check that the SID2SID is inserted correctly in the C64's SID socket. The pins should be aligned with the socket. ✔ Remove SIDs to see if they are the problem (Startup with SID2SID inserted but no SIDs, then insert one SID at a time into each socket) ✔ Any wire/part touching something else inside the computer? (metal parts from your audio jack nudging the leg of an IC?)
No audio from SID no. 2	✔ Check so that VCC and VDD are present ✔ Check GND ✔ Check and test signal chain to tip and sleeve of the audio jack/plug ✔ Check and test hook connection ✔ Hook attached to wrong pin on expansion port? ✔ Try SID 1 in SID 2's socket. SID 2 broken? ✔ Any components come loose? Check big capacitors and ICs. ✔ Thoroughly examine your solder joints so they actually make connection.

Expanding/Modifying the SID2SID

Here are some tips and tricks for a neater installation or to add some functionality to the SID2SID.

Audio Out Jack

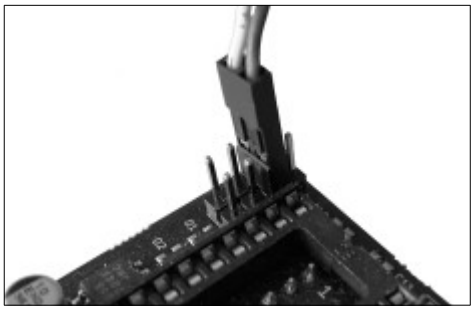
Drill a hole in the side and connect a mono out for SID2.

Adding Audio Out for SID 1

Drill a hole for another audio jack for SID1's audio. You can cut pin #27 (second from the top right side) on the header pin attaching SID2SID to the C64's socket to prevent any audio going out from C64's audio/video DIN. Then you're 100% relying on your installed audio outputs instead.

Removable Audio Out and CS

Install header pins on the top left holes on the SID2SID and use Dupont connectors for your connections. Makes it much quicker and easier if you need to install/re-install the board.
If the space in your C64 is really tight then this might not be an option.



Adding your own capacitors for SID 1

You can solder your own capacitors for the SID 1's filter putting two 1206 sized surface mounted caps on the SID2SID's empty pads C10 and C11. For this to work you need to cut off the header pins for pins 1-4 (four top pins to the left) going to the caps on the C64's motherboard.
The correct capacitor values for each SID version are:

6581: 470 pF
8580: 22 uF

Changing Hardware Address

With the hook attached to pin 7 on the back of the expansion port SID 2 responds to any writes done to address DE00. If you want to use SID2SID with software requiring a SID 2 on address DF00 instead just move the hook to pin 5 from the left.
Note that this will prevent SID2SID to work with the MSSIAH Cartridge!

Use a Different SID Version

SID2SID cannot mix SID versions but the opposite version of the motherboard's SID can be used providing it's correct VDD and cutting off SID2SID's VDD pin.
More info is out of scope for this manual and is left for owners with a lot more knowledge. Do it at your own risk.