PROPHET64

SID MUSIC SOFTWARE

Getting Started with the Prophet64

Includes specs for peripherals

Mar 5, 2007

Introduction

Thank you for your excellent choice of software purchasing the Prophet64 Cartridge!

We hope it will become an invaluable tool for you and bring tons of fun for many hours to come.
By using the Prophet64 you help to keep the unique sound of the Commodore 64 SID circuit alive and kicking in the 21th century.

The idea that any musician can pick up the C64 and instantly grasp the software has been the philosophy behind the Prophet64 applications. To fully explore the heart of video game music shouldn't have to require skill levels on a scale next to brain surgery. Neither should a user interface of an application become a treshold for users instead of a quick way of mastering the software. The lack of the latter especially in past C64 music applications, is quite contradictive for a computer mostly remembered for its sound capabilities.
In 2006, Prophet64 defies the old software, being written directly for musicians.

Sales Terms

The buyer of the Prophet64 Cartridge and SID2SID circuit board is purchasing a product designed for a computer no longer manufactured nor carried by distributors.
The buyer is to be aware that though all Prophet64 units are carefully quality checked before shipping, the providing party cannot guarantee a proper functioning of its products due to the platform running it where errors because of age, malfunctioning circuits and/or other factors occur. Therefore, the merchandise available by 8bit ventures is provided as is without any kind of warranty. In order to run the software safely and not cause damage to the Prophet64 hardware the owner is required to use a C64 in good condition and able to run 256 kb cartridges.
8bit ventures shall in no event be liable for any loss of data or damage to either machine and/or the Prophet64 product after running the software.

The buyer is adviced to thoroughly read the handling instructions provided in this manual. It is important to know proper routines on how to insert and start up the cartridge without damaging the unit.

The Prophet64 Cartridge, the software and its contents are under copyright by 8bit ventures. 8bit ventures preserves the right to change these terms and/or the software provided at any given time without further notice.
The owner of the Prophet64 Cartridge must find the information needed on how to use the software him/herself. There are no support functions or training sessions. Manuals are available on the prophet64.com site.

Note:

Caution! This software is highly addictive. 8bit ventures does not take responsibility for loss of sleep, calling in sick for work or neglecting friends and relatives.

How to start up the cartridge

This section explains how to insert the cartridge and start it up.
Read this section thoroughly before you use the Prophet64 Cartridge. It contains information on how to handle the unit without causing damage to either cartridge or computer.

Inserting the cartridge

1: Make sure your computer is completely turned off

Note:

YOU MUST NEVER INSERT OR REMOVE THE CARTRIDGE WHILE THE POWER IS ON!

2: Make sure the *This Side Up* text is facing upwards

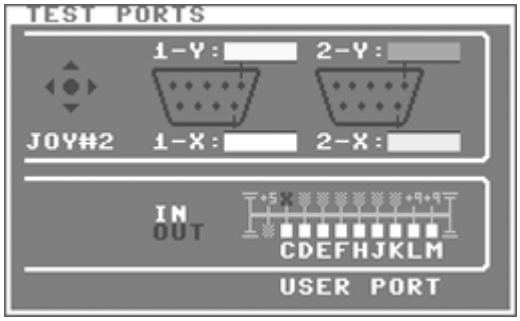
3: Insert the cartridge into the expansion port

Insert the cartridge carefully into the expansion port until it stops, then apply a little more pressure on the top side so that the cartridge fully connects into the female connector inside the expansion port and sits tightly.

4: Turn the power on

Your screen should now look like this

Press any key to enter the main menu.
From here you can select any of the Prophet64 applications to start up or test audio and user/controller ports.



To test the ports you choose the menu item *Test Ports*.
The upper part of the screen shows the Controller ports (joystick, potentiometers, mouse) and the lower part is a user port tester. With the CRSR keys you set the current mode of the port. IN displays input voltages on each pin and OUT toggles 0 and +5 volts at regular intervals so that you can read it with a volt meter.
The image on the screen gives you a quick view of the user port specs.

Note:

Be careful! The user port is a bidirectional port. Do not input signals while in output mode and vice versa!

Removal of the cartridge

Removal is opposite of insertion.

1: First turn the power off!

Note:

YOU MUST NEVER REMOVE OR INSERT THE CARTRIDGE WITH THE POWER STILL ON!

2: Pull the cartridge out
Grip the cartridge firmly on the top side and pull it out of the computer. Don't wiggle it, just pull it straight out.

3: Store the cartridge in a safe place
Take good care of the cartridge, don't store it in excessive heat, cold or humidity.
Don't expose the terminals on the bottom side to grease or electrostatic discharges. Do not open the cartridge case, there are no user repairable parts inside.

Troubleshooting

Be aware of that the Commodore 64 is more or less 20 years old. Cartridges are tested and quality checked before shipped but if the unit does not work it is most likely related to your computer. 8bit ventures does not take responsibility for any loss of hardware caused by failing machines. The product should start up fine on a flawless Commodore computer.

-Cartridge won't start, black screen
-Cartridge won't start, standard blue C64 startup screen

- The cartridge is not properly inserted in the expansion port.
  Make sure it sits tightly so that the terminals make good contact with the connector inside the expansion port. Being an old computer it's not unlikely that it has been exposed to a large amount of grease and dust that degrades electric connectivity.

- The cartridge is inserted upside down
  Be absolutely sure that the *This Side Up* text is facing upwards when inserted into the expansion port. When reversed, not only subject to damage, there is no way the software will start up.

- The terminals are greasy why electric connection fails
  If there is grease on the terminals they don't make as good connection as they ought to in order to exchange data with the computer.

- The Commodore 64 expansion port and/or computer address bus is defective
  Either way, this suggests that your computer is unable to read cartridges. If you have another *identical* cartridge you can test it and see what happens.

Note:

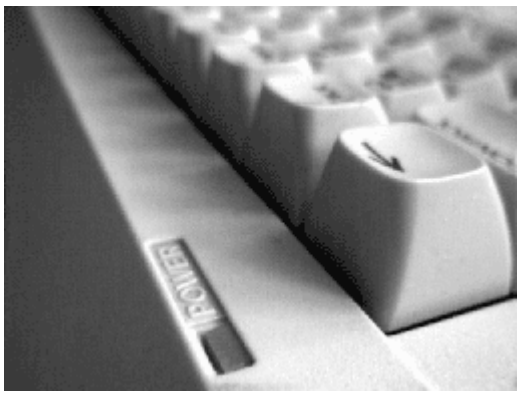
Even though an expansion port fails to provide electric connections on all lines, it may still be able to run some older cartridges with a simpler configuration (8Kb or 16Kb).

The Commodore 64

In a long forgotten time and place where internet was a subject of sci-fi movies, Hollywood special effects were not CGI but hand crafted models, car design was boxy, drum sounds were big, shoulder pads were big and hair was..well, er, big also.. the number one console people had in their homes was the Commodore 64.

With a total of 17 million units sold it still holds the world record in home computer sales.
That's a good thing because it means there are still lots of used C64s out there ready to be picked up at a fair price.

There is plenty of information about the C64 on the net so instead of a deep look into its history and tech specs we just take a quick peek at it to refresh our minds.



CPU: 1 MHz
Memory: 64 Kb RAM
8 Kb Kernal ROM
8 Kb Basic interpretor
ROM had to be switched off to fully access the 64 Kb RAM.

Graphics: Hires
320 x 200 16 colors
2 colors for every 8 x 8 area
Multicolor
160 x 200 16 colors
2-4 colors for every 8 x 8 area
Text mode
320 x 200, 40 x 25 characters
16 colors, 2 colors per 8 x 8 area
Useless border

Audio: SID Sound Interface Device.
3 oscillators w/ 4 waveforms .
VCA envelopes for every oscillator.
1 resonant low/band/high-pass filter.

Different versions for NTSC and PAL TV systems. NTSC running a little faster.

The Commodore 64 operating system is nothing like a modern MS-Windows computer. On the retro looking blue screen, the user enters commands or writes simple basic programs.
Unlike MS-DOS, you can navigate the screen window with the cursor keys, up, down, sideways, you name it.

Storage Media

Storage media includes the ”datasette” tape cassette recorder and 5 1/25” floppy disks each side carrying 170 kb of data.
The tape recorder became notoriously slow, mainly due to its backward compatibility with the VIC-20 (C64 predecessor). The idea behind tape saves is in fact quite good, modulating data into audio signals.

A media primarily made for game distribution was the ROM cartridge that goes into the expansion port of the computer. Modern game consoles and handheld devices still make use of the cartridge concept so does the The Prophet64 Cartridge.
A cartridge is basically a circuit board with ROM circuits containing the software. The whole thing is wrapped up in a plastic case that fits well into a special input port on the computer. A direct bus allows the computer to access the software that starts instantly.

SDR

The Prophet64 Cartridge applications all have an optional way of saving/loading called SDR. The acronym is short for Serial Data Register, a built in C64 feature never used by any factory media nor third party hardware/software aside from modern “burst fast loaders” on the internet.
Prophet64 wakes up the hidden feature and allows external hardware to save the data stream onto a modern device. This requires a special unit though, the third party MIDI controller hardware showcased on the Prophet64 site handles SDR and saves the data onto audio devices such as mp3-players etc. Pretty neat!

Inputs and outputs of the C64

What seems to be missing on the net is a close up look on the back of the Commodore 64, that is its input and output ports. Lets have a look, starting from left:

Controller ports
9 pin DSub connectors for old time joysticks, game paddles (potentiometers), mice and even light pens. The one to the left is port #1, the one on the right is #2.

Peripherals connected into these ports, especially #1, causes major conflicts with the keyboard. That is why most programs run the joystick in port #2.

Expansion port
Here is where you put the Prophet64 Cartridge.

This port was also used for a variety of hardware: external RAM expansions, MIDI interfaces etc.

RF out
Direct connect to your TV-set.

Now, you don't have this on your brand new PC, do you?

Video/Audio out
An eight pin DIN input/output for Audio out, Video out and Audio in.

Even though it's got eight pins, a standard five pin DIN fits right into it. Good to know when building an audio cable to hook up the C64 to your Euphonix..

Serial port (”IEC”)
This is where to connect the disk drive.
Some printers used this port too.

The C64 can have multiple drives each with a different device number. In that case, they are chained together still using this output only.

Cassette port
Here is where the to connect the ”datasette” cassette recorder.

User Port
Similar to the cassette port only bigger.

This 24 pin output is a bi-directional parallel communication port.
It is mostly used for printers and modems.

The Prophet64 uses this port for synchronization etc (via the s24-64II interface).

The SID – Sound Interface Device

The first thing for which people recognize the Commodore 64 today (besides the vast amount of classic games) is its remarkable sound. A sound created by a special chip, the infamous SID.

The SID has been claimed to be one of the best synthesizer circuits built. Technically this is not true, anyone into vintage analog synthesizers will tell you why.
What is true is that the SID is probably the most beloved audio circuit of all time.
Its unique sound, much due to the software controlling it, certainly comes with a lot of soul.

During the years in production the SID got altogether five upgrades.
Ranging from 6581 Revision 1 (that allegedly never made it onto the production line) to 8580 Revision 5.
On the 8580 the designers overhauled the filters, the biggest flaw in the SID since the start. 6581s were very inconsistent in filter response, R4 being an exception.
Do a search on the net and you will find people telling you that the 6581 R4 has the best filters of *all* the SIDs. There is really no right and wrong in that saying, it's all a matter of taste. However, Prophet64 advocates the use of the 8580 R5.
Its filter response is more versatile and has a much wider cutoff slope than the R4 thereby sounding more like a "real" synthesizer. The Bassline edition is in fact tailor made for the 8580 R5.
If you can't find an 8580, the 6581 will do quite well with the rest of the applications. As for the Drummer edition either SID version will do, it does not make use of the filters at all.

Other differences between the 6581 and 8580 are the 8580's somewhat (very subtle) tighter VCA envelopes and its capability to mix waveforms. If you add two waveforms on the 6581, the result is a silent oscillator.

Voices or oscillators?

An oscillator is the frequency generator that creates the basic timbre in a subtractive synthesizer. A synthesizer voice however is the whole package of oscillators, VCA, envelopes and filters for one voice in a polyphonic system. Old analog synthesizers built up their polyphony by adding as many audio circuits as there were voices.
The SID, a one voice chip per se, has only one filter yet three oscillators w/ one VCA envelope each and thereby becomes somewhat of a hybrid. Even though MOS technologies (designers of the SID) saw prospective clients in the synthesizer industry, the main purpose of the SID was as the audio source within a game computer. The three oscillators then became "voices" playing computer game music and sound effects.
One filter per oscillator would have made a huge improvement but due to interviews with designer Bob Yannes, lack of space inside the chip as well as time seem to have been the contributing factors to why it wasn't done.

VCA Envelope bug

The SID VCA envelopes have an annoying bug where triggering fails every eight notes or so. This occurrs whenever decay or release values are applied limiting the SIDs versatility.
Luckily people came up with a technique to get around this bug and make the SID envelopes work acceptable.
The idea behind the tehnique named *Hard Restart*, is to reset the SID a certain amount of time before the trigger occurs. By learning to deal with hard restart and how the envelopes behave, you learn how to get the most out of the SID and becomes a true SID musician.

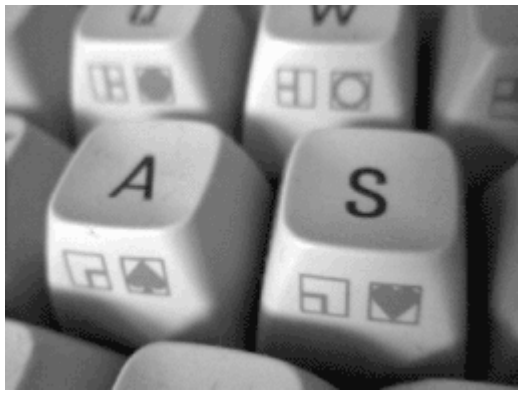
What to look for when shopping for C64s

Besides being in nearly mint condition (keyboard, ins and outs, nice picture etc) you want it to sound great, after all we are going to use the C64 as a synthesizer.

Don't believe the myth that older C64s sound better than newer ones.
Yes, they might sound grittier due to either old SIDs or poor components along the audio chain and yet a good thing when listening to old game music it's less attractive when using the C64 in your synthesizer setup. Prophet64 musicians are adviced to look for late model C64s with the R4 or R5 chips instead.
It's always a special feeling getting one's hands on a late model C64 with either the 6581 R4 or the 8580 R5 inside. If you already have a stockpile of good SIDs, it does not matter as much.

So, where does it say what SID is inside the computer? Well, the answer is nowhere, you will have to find out yourself:

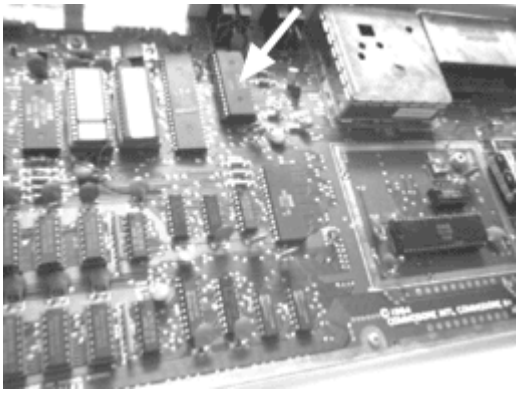
1. Look at the keyboard
Late model SIDs were housed in late model Commodores.

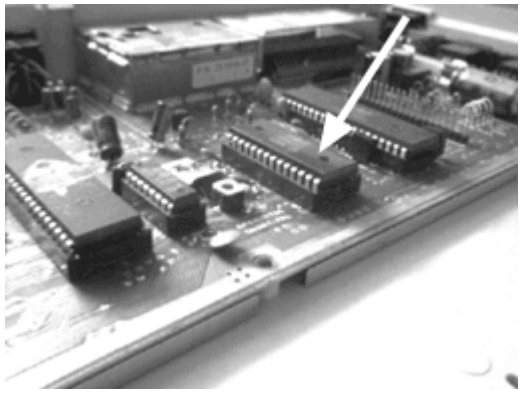


These are are recognized by the symbol letters printed on the top side of the keys (left image) as opposed to old C64s where symbol letters were printed on the vertical side instead (right image). Don't trust this method though, keyboards as well as audio circuits in the computer might have been switched. It's a first notice of what might be a nice purchase when looking at an ad for a used C64.

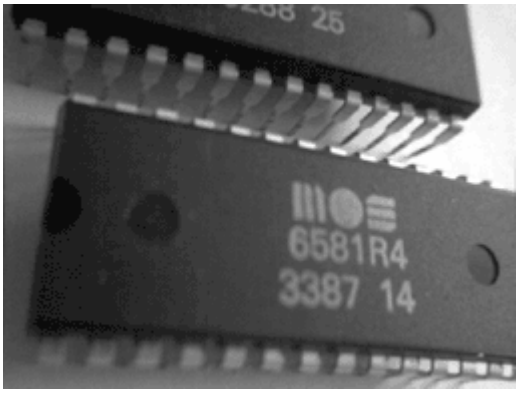
2. Use the Prophet64 Cartridge
Plug in the Prophet64 Cartridge, turn the power on and see what it says.
The startup menu tells you what system is running and the SID version. Be aware of that this function fails to detect the correct SID version approximately one out of thirty times. Start it up a couple of times to be sure.
This will still not tell you the revision in case of a 6581 (R4 being the most attractive) though. For that, you will need to go for the third option:

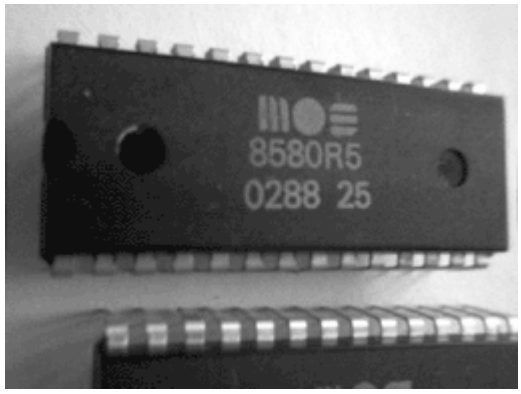
3. Look at the SID
This calls for opening up the Commodore 64 to look at the motherboard and the SID chip.





6581s are located to the left of the "RF modulator" (TV output) as seen in the left picture where as 8580s are located just below it (right picture).





The 6581s have a printing on the top saying *6581*. If it says *R3* or *R4* that means Revision 3 or Revision 4. On the left picture above, the SID in question is a 6581 Revision 4 (good!). The right picture shows an 8580.

Check the filters
When you have found the C64 of choice it's time to test the filters. Insert the Prophet64 Cartridge and switch the power on. Start up any of the Prophet64 editions (preferably the Mono Synthesizer or Bassline) and try out the filter. How does it sound? Is the chip ok? Does all three oscillators work? Does it trigger well (test with Drummer edition).

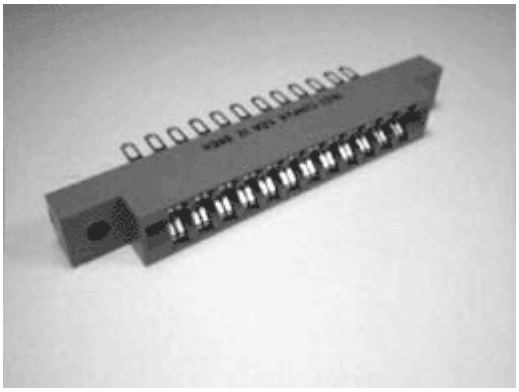
If you are at the seller's house maybe it might not be such a good idea to show him or her the Prophet64 software. Maybe he suddenly sees the computer's potential and ends up not selling it to you, at least not for a bargain!
When testing, maybe you should ask the seller to go and make some coffee (or at least leave the room)? On a serious note, do take that extra time when looking for at C64. It will pay back later.

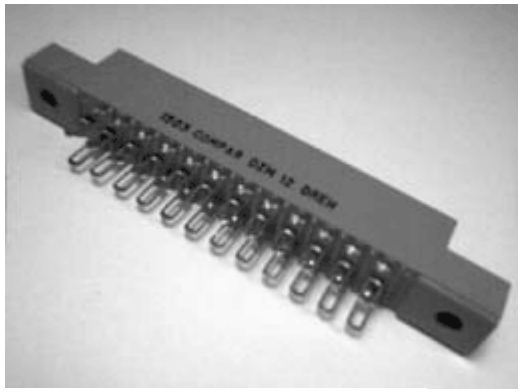
Second SID

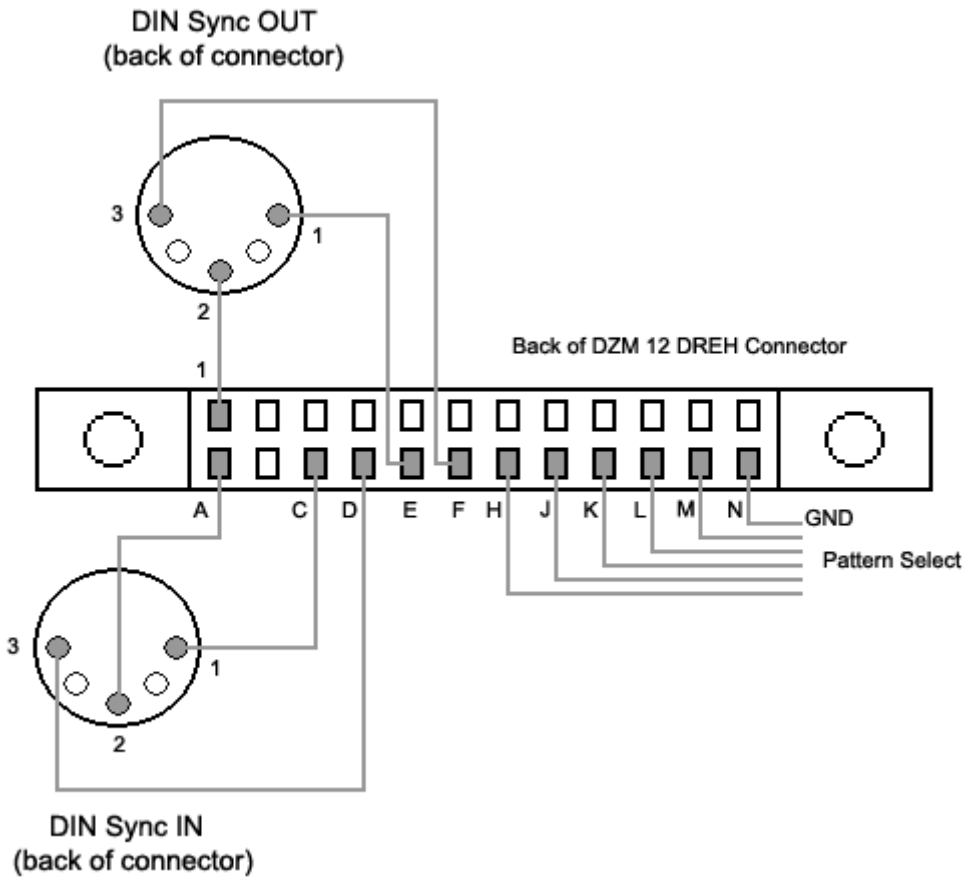
For years people have been piggy-backing a second SID on top of the old one to gain six oscillators or a stereo sound in their C64s. The Prophet64 SID2SID circuit board is based on the same idea but gives you a neat installation and you don't have to jeopardize the SIDs by direct soldering.
There haven't been many programs around capable of handling a second SID though, Prophet64 Cartridge edition now changes that.
A full description on how to assemble the SID2SID board is provided in the SID2SID installation guide downloadable on the Prophet64 site.

Peripherals

s24-64II







This is the s24-64II interface specs for the Prophet64 Cartridge.
The connector is a 12/24 pin edge board connector w/ .156" (3,96 mm) spacing. These are available from a number of manufacturers such as Sullins, Compar etc.
Use a 5 pin male DIN connector for the sync IN. Though depicted as a male connector you might want to use a female one for sync OUT. In that case, remember that pin 1 and 3 are mirrored. Sync OUT is optional, you do not need it to slave the Prophet64 to your Sync 24 equipment.

The Pattern Select is used for input only on Mono Synthesizer, Bassline and Drummer editions. Sequencer edition uses the same pins for output only.

Because the user port is bidirectional you risk damaging your computer if connecting two s24-64IIs before the programs are fully started up.
Since you are adviced not to insert anything into the user port with the computer's power turned on, a good idea is to solder the Pattern Select wires to a 6 pin male DIN connector for the Sequencer edition. Then use a female DIN for the other editions and you can safely leave the Pattern Selects disconnected until both applications are up and running.

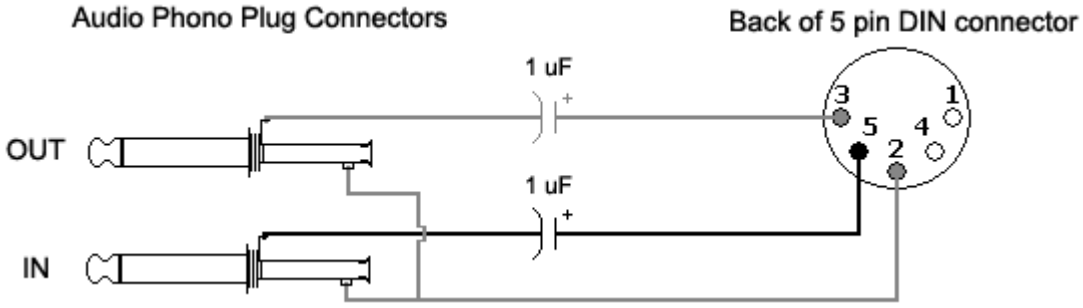
Note:

Caution! Never insert or remove the s24-64II interface connector while the computer's power is turned on!

The s24-64II and the user port can be tested with the Test Port function in the start up menu on the Prophet64 Cartridge.

The s24-64II is fully backward compatible with the s24-64. That means you can run the Prophet64 Cartridge editions with an old s24-64 interface still being able to DIN-sync the software as well as running the free trial software with a new s24-64II.
Of course the free trial editions wont be able to handle the extended functionality of the s24-64II (Sync Out, Pattern Select etc).

Audio out (in)

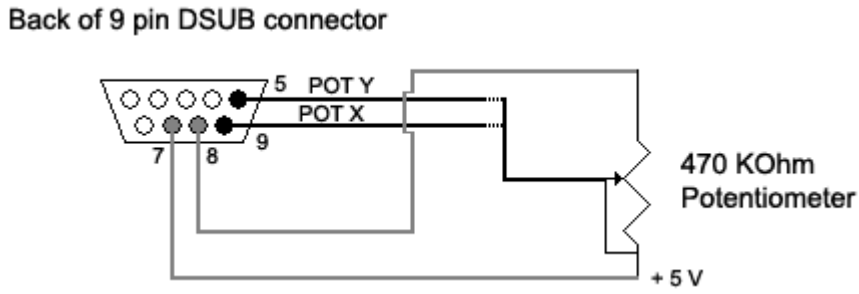


The 1 uF capacitors are from the SID specs. Their purpose is to improve the sound quality. With a fairly high S/N ratio and ground noise level, the caps do not really make any noticeable difference to the SID's audio output.

Note:

Caution! SIDs have been observed failing after being connected to mixing devices when mixer power has been turned off. Whether this is due to back current or any other spikes on the connection is not known. User is adviced to first carefully remove the audio connection to the SID before external unit is turned off.

Potentiometers



The Prophet64 Mono Synthesizer and Bassline editions are both capable of handling four potentiometers connected simultaneously.
The C64 connects two pots in every controller port (X and Y).
Drummer edition lets you choose either X and Y of controller port #2 if using pots.

Note:

Caution! Connecting a potentiometer into a controller port while power is on may cause a cold start (reset) of the computer. It is advisable not to insert/remove pots into the controller ports while power is on.

Second SID installation

There's a complete guide on how to install the SID2SID board in a separate booklet available for download on http://www.prophet64.com.