Korg DSS-1 SCSI-USB-Memory Upgrade

Instruction Manual

Introduction

Thank you for purchasing the Korg DSS-1 upgrade kit. This kit will greatly expand the capabilities of your Korg DSS-1, adding SCSI and USB storage, allowing modern 1.44MB Floppy drives to be used, and making OS updates as easy as plugging in a USB flash drive.

Shortly after the DSS-1 was released in 1986, Korg realized that the DSS-1 was under-equipped in terms of memory and storage compared to competing instruments. They contracted Sound Logic, a company who had previously done work for them, to design an upgrade that would address these issues. The result was the DSS-MSRK (for Memory-SCSI-Retrofit-Kit). It included a new CPU (a NEC V40 running at 16MHz), a SCSI controller, a banked memory controller borrowed from the DSM-1 and Sampling Grand, and sockets for 7 additional banks of memory. Around 350 of these kits were manufactured, and then Korg moved on, as did Sound Logic.

Over the years, DSS-1's with the DSS-MSRK installed were rare and highly sought after. The upgrade kits were very difficult to find, and time consuming and difficult to install. Originally Korg had done much of the PC board modification itself due to the complexity, requiring the DSS-1 to be disassembled and have to board shipped to Korg.

In 2007, the task was undertaken to reverse-engineer the DSS-MSRK with the help of schematics and information available on the internet. A modified DSS-1 was disassembled and analyzed. As a first step, an exact clone of the DSS-MSRK PC board was created to verify the schematic against the PC layout. The second phase was doing the same with the KLM-780, which is the CPU-1 board from the DSS-1. Finally, these designs were merged together to create a new CPU board and separate memory board for the sample DRAM (which Korg refers to as Wave RAM).

Not having access to the documentation for the custom bank switching chip, its functions were analyzed with a digital logic analyzer, and its functions were recreated in a modern programmable logic device. This device was put back into the DSS-MSRK with an adapter PC board to verify its functionality.

After announcing the first run of boards, I was contacted by one of the Sound Logic engineers. Having kept the rights to the software, a new version was developed that added support (via a plug-in daughterboard) for a USB adapter that allowed for fast, DOS-based file storage and usage with USB flash drives. The daughterboard also increases the program RAM and uses flash memory instead of EPROMs, so that OS updates may be done by loading the new OS file onto a USB drive.

Tools required

- · medium and small philips screwdriver
- small needle-nose pliers
- · soldering iron (temperature controlled preferable)
- desoldering pump OR vacuum desoldering station (preferable)
- white masking tape for connector identification
- fine-tip permanent marker
- components organizer (for holding screws and parts during disassembly)
- digital multimeter (for checking voltage and continuity)

WARNING!!!!!

The DSS-1 contains lethal voltages once the lid is open! Always make sure to disconnect the AC cord when working on it!

General precautions

If you don't have any electronic experience, DO NOT attempt this modification!!! You run the risk of damaging the DSS-1 as well as harm to yourself!!! Enlist a competent service technician to do the job. Alternatively, you may send us the necessary components or the entire instrument for modification. The DSS-1 is not supported by Korg and repair components are difficult to obtain.

However, if you have experience soldering and working with electronic components, as well as a lot of patience, this modification is relatively straightforward. One of the design goals was to make installation as easy as possible given the nature of the modification.

Some hints to help during the process:

- · Use a clean, uncluttered work area
- Use a grounded wrist strap
- Use a component organizer when disassembling for keeping the hardware organized by type
- Label all wire harnesses that you disconnect with white tape and marker or write the connector identifier on the connector body itself
- When desoldering components, if the component does not come out easily, DO NOT force the removal. Re-flow the point and try to desolder again, or heat up the pin with the soldering iron.
- Document the stages of disassembly with a camera so you know how to put things back!
- If at first it doesn't work, don't panic! Retrace your steps, the problem is usually fairly easy to resolve.

Getting Started

Put the DSS-1 on a flat, clean work surface. Make sure the AC cord is disconnected.



The following tools will be needed: Medium and small philips screwdriver, small pliers, flush cutters, and straight razor



Remove the 2 screws from the end caps. There are 2 in each side for a total of 4.



Remove the screws from each side of the back plate (2 total)



Remove 4 machine screws from the bottom of the DSS-1 under the floppy/joystick housing. Remove 3 tapping screws from the top edge.



Remove the 3 larger screws from the bottom that hold in the keybed. The screws to be removed have the front metal plate cut out around them.

It's easiest to remove these screws by moving the DSS-1 so that it overhangs the table or work surface, and they can be accessed from below.

Don't forget to keep the screws organized, and make a note of what screws were removed from each part of the instrument.



Move the DSS-1 so it isn't overhanging the work surface anymore. The lid can be opened to expose the interior of the DSS-1.



Next, remove the 34-pin ribbon cable from the CPU board, and the power cable from the floppy drive.



Cut the cable tie holding the multi-colored wire harness from the joystick to the keybed assembly.



Remove connector CN27A. Mark the removed connector with a piece of tape or permanent marker 'CN27A'. Use this procedure for all connectors that you remove. The floppy drive/joystick housing can now be removed and set aside.



There are 3 screws holding the keybed to the base of the keyboard (2 shown). They fasten the 3 metal tabs that are attached to the keybed frame. Two of the screws also hold eyelets attached to ground wires. Make sure to put the fastening screws through the eyelets when re-installing the keybed.



Remove keyboard connectors CN23A, CN24A, and CN25A, marking them as you remove them. CN23A and CN24A are tied together. CN25A is bundled in with the power supply lines via a flexible metal cable strap. Bend the strap back to free CN25A's wires from the bundle.



Remove CN30A from the pressure sensor board that is attached to the keybed. Next, pull the wire harnesses that attach to the keybed free, as they are threaded under other harnesses and around the back of the CPU-2 board. Slide the keybed assembly slightly to the left, and carefully pull it up and remove it.



Remove CN10A, CN11A, CN12A, CN13A, CN7A, CN6A, CN5A, CN4B, CN8A from the KLM-780 CPU-1 board, labeling the wires as you go.



Remove 2 machine screws and 2 tapping screws from the top edge of the CPU-1 board. Remove and keep the metal clips from the PCB that the foil tabs were screwed to.

Use the pliers to squeeze the nylon board hinges and gently push them out of the PCB. The lower PCB nylon posts can be gently bent and the PCB lifted up.



At this point the CPU-1 board can be removed and set aside.



Under the KLM-780 (CPU-1) board is the KLM-782 board, where most of the modifications take place.

Remove the power connector CN14B and grey audio cable CN15B.



Remove connector CN16B on the KLM-781 board. The other end of the CN16 cable does not detach from the KLM-782 board.



Remove connectors CN51A and CN52A from the KLM-1061 board that sits on top of the KLM-782 board.



At this point the KLM-782 should look like the picture above. The connectors that have been removed are marked with arrows.





Remove the three tapping screws from the plastic PCB holder at the front of the KLM-782, and the three tapping screws from the metal bracket at the rear of the KLM-782.

Remove the one long tapping screw from the center of the KLM-782 (next to IC19).



Using the pliers, remove the hex threaded standoff that holds down two ground wires with eyelets from the bracket at the rear of the KLM-782 board.

The KLM-782 board can now be removed. At this point, if you are not modifying the PCB yourself, the KLM-782 assembly and KLM-780 can be packaged in an antistatic bag and shipped out for modifications.



If you are installing a new LED backlit LCD module, the inverter/contrast board must be removed and modified. Remove the inverter board by removing the two screws attaching it to the lid. Then remove the two connectors (CN40B and CN46), labeling them. They are both 4 pin connectors so take care to identify them correctly.



Remove the screws holding in the LCD module. The LCD cabling is tied in with other harnesses and will need to have the cable ties cut to free it. Make sure that you don't clip any wires when removing the cable ties!!!



The following items will be modified (or sent away for modification): The inverter board, LCD with cable harnesses, KLM-780 (CPU-1) board and KLM-782 board.

Carefully package the boards in antistatic packaging and ship them to your service center.

Preparing and modifying the PC boards

Before proceeding with the following modification, make sure your work area is clean, organized, and take anti-static precautions if possible. It is very easy to damage the PC boards, and many of the components are difficult or impossible to replace. Therefore, if you don't have any electronic repair experience you should have a service center do the work.



Remove the foil shield from the KLM-782 assembly by removing the 3 tapping screws that attach the foil to the mounting bracket.

Remove the 4 screws holding the KLM-1061 board to the KLM-782. The two screws on the left have washers underneath them.

Remove and label connectors CN47B, CN48B, and CN53B (along the top), CN49B and CN50B (along the side). De-solder the ground wire and put the KLM-1061 aside.



Next to IC11, between IC11 and IC12, there are five solder vias which will be used to attach the 6-pin FFC connector included in the kit. Using a desoldering device (solder wick, hand desoldering pump, desoldering station), remove solder from the holes marked by the violet circles in the photo above. The white line next to the violet circles indicates a track that must be scraped down so that the copper is exposed. Once the copper has been exposed it needs to be tinned.

Note: the track is NOT to be cut!! It is just to be used as an attachment point!!





Once the PCB has been prepared, insert the connector as pictured above. The modified connector leg should rest above the bare copper area that was scraped and tinned. The connector can be soldered in, and the scraped area with its connecting leg soldered together. The arrow shows the soldered pin above the trace.



The next, and most time consuming part, is removing the twelve DRAM chips and installing the sockets for the new memory board.

Using a good desoldering device, do a chip at a time. After removal of the solder, GENTLY rock the device back and forth. You will be able to see some (or all) of the pins moving from the underside which indicates that they are unattached. If a pin doesn't move, try heating the pin while moving the chip back and forth. If that doesn't work you may have to re-solder and de-solder the pad again.

In some cases the chip may have been inserted at an angle (like above). These tend to attract more solder to the bent part of the DRAM leg.

If all else fails, the legs of the DRAM chip can be carefully cut and the pins manually removed one at a time. The DRAM chips are not re-used so it doesn't matter if they are destroyed. The main objective is to make sure the PCB is intact.



Once all chips have been removed, check all the holes where the DRAM pins were. Remove any remaining solder with a desoldering device. Reflow with solder any holes that won't clean out completely.



Install the provided 8-pin SIP sockets in the areas previously occupied by the DRAM chips. These sockets are a very tight fit and the solder holes must be very clean. If prepared correctly, the socket will 'snap' into place. Solder in the sockets, making sure they are installed evenly and straight.

It may be easier to 'tack' all socket strips in by soldering only a couple of pins on each socket, then turning the board over and soldering the remainder of the pins.

Note: it is only necessary to do both rows of a DRAM chip location on the FIRST and LAST locations (IC25 and IC36). The rest (IC26 to IC35) only need the right-hand socket strip installed (as in the picture above). If you want the option of going back to the original DRAM chips, all of the sockets must be installed for IC25-36.



Next, insert one end of the provided 6-conductor FFC cable into the connector that was just added next to IC11. The contacts should be facing UP.



Next, take the memory board, with the Xilinx chip up and the small brown FFC connector towards you, and insert the other end of the 6 pin cable, contacts DOWN (towards the PCB).



Flip the memory board over and carefully insert it into the sockets. Check the pins by looking at the alignment from the sides.



Make a 'Z' fold in the cable, with the one fold just barely touching the memory board. The actual positioning isn't critical.



Reinstall the KLM-1061 board, re-soldering the ground wire if necessary. Reattach all connectors except for CN51A and CN52A



Reattach the foil shield with the 3 tapping screws.



Reinstall the modified KLM-782 assembly. Secure the board to the base with the 7 wood tapping screws (6 short front and back, 1 long in center). Re-attach the hex threaded standoff, attaching it through the ground eyelets to the bracket. Attach connectors CN14B, CN15B, and the wire from CN16A to CN16B on the KLM-781 board. Connect CN51A and CN52A (harnesses with the grey wires)to the KLM-1061 board.



With the KLM-782 reinstalled, the keybed can be replaced. Replace the three internal screws first, making sure to hook through the 2 ground eyelets on the left and center screws. Thread the connector harnesses back to their original positions and reconnect them to the KLM-781 board. (CN23A, CN24A, CN25A)



Take the new KLM-780-II board and install the metal clips where the foil shield will attach. It is the third hole from the end on each side.



Install the KLM-780-II board in the position of the old KLM-780 board. All the mounting holes and connector positions of the ORIGINAL cables are the same. First, insert the locking tab of the nylon hinges into the rear of the board, then lower the board and secure it with the front locking tabs. Finally, reattach the foil shield with the tapping screws, and secure the board to the standoffs in the back with the machine screws.



Install the included 14-pin FFC cable into the connector on the front of the memory board, contacts facing DOWN.



Take the 14-pin cable and insert it into the connector on the daughterboard, contacts facing UP. The smaller connector labeled 'TO RAM EXPANSION' on the main part of the CPU board is NOT used. It is a different size connector and will not fit the 14 pin cable.



Make a 'Z' fold in the cable similar to the other FFC cable.

Installing a USB combo drive

If you're installing the combo USB drive, this is where you start. You will need the floppy drive housing, new USB drive, and original floppy drive cable.





Place the floppy housing upside down, with the joystick hanging over the edge of the work surface. Remove the 4 mounting screws.



Remove the old floppy drive. Insert the new combo drive in the same position. The mounting holes should be the same. Attach the new drive with the existing mounting screws.



Attach the power cable and ribbon cables to the combo drive. The power cable may have to be re-routed from its original path. Re-install the multi-conductor joystick harness in its original position.



Reinstall the floppy ribbon cable, re-routing it to avoid the new USB connector.



Cable tie the excess USB cabling, and insert the USB cable into the USB connector on the new CPU board.



If necessary, use an extra cable tie to fold back the USB cabling so it doesn't interfere with the floppy drive housing.

Finally, secure the floppy housing with the 4 machine screws and 3 black tapping screws underneath. Make sure that no wires are caught between the floppy drive bracket and the base of the DSS-1.

LCD Modification

The LCD modification replaces the original LCD which has an EL backlight with a longer-life LCD backlight. The inverter board must be modified to provide the proper power for the backlight.



Remove TR1, Q1, and R3. Install a new current limiting resistor from the center pin of Q1 to the pin of TR1 closest to CN46 (purple line).

The value of the current limiting resistor will depend on the display used. For the blue-white display, the value is 35 ohms. For the yellow/green display, the value is 5.6 ohms. If using a different display, the value is calculated using Ohm's law.

For example, the blue/white LCD (Crystalfontz CFAH2002ATM), requires a backlight supply of 40mA (0.04 Amps) at 3.6V. The resistor will be dropping the power supply (5V) down to 3.6V, a voltage drop of 1.4 V

R=V/I, in this case R = 1.4V / 0.04 A = 35 ohms.



Install a jumper wire from the pad of the contrast potentiometer VR1 (closest to J1) to the center pin of Q1 (now occupied by one lead of the new current limiting resistor).



Remove both wire harnesses from the old LCD. Solder the harnesses to the new LCD, making sure that the wiring position is the same. For the smaller backlight power connector, the yellow wire connects to the Anode (A), the brown connects to the Cathode (K), and the orange connects to pin 3 of the data connector.

In some cases, the new LCD may have extra pins (16 instead of 14). Pins 15 and 16 are left unconnected.

If you are not installing the SCSI option, you can install the LCD and KLM-1013 board back into the DSS-1. The new LCD is thicker than the original EL backlit LCD, and must be attached to the lid using plastic spacers (included). The LCD is installed first, then the KLM-1013 board. Connect CN40B and CN46 to the KLM-1013 board before attaching it. Make sure the connectors are in the proper positions. The LCD power cable with the brown, yellow, and orange wires goes to CN46. The other cable harness goes to CN40B.

SCSI Installation (Optional)

The SCSI port was a feature on the original DSS-MSRK modification. At the time, SCSI hard drives were the only way other than floppy disks to store large amounts of information. There were no Zip, Jaz, or flash drives, and the largest hard drives available were less than 1 Gigabyte. The DSS-1 came on the market before DOS was in common usage, so a custom filesystem was used for the floppy drive. For the SCSI port, the floppy filesystem was expanded and modified. The limitations of the floppy filesystem also apply to SCSI. There are only 99 slots for Systems, 512 slots for Multisounds, 512 slots for Sounds, and 1 slot for MIDI parameters. The filesystem is flat, meaning there is one level to the directory (no folders or subdirectories) Originally the DSS-MSRK only supported drives up to 400 MB. After firmware version 3.2, this was expanded to 1 GB. Support was also added for CF drives with a SCSI interface.

When this new modification was originally designed, it was a functional clone of the DSS-MSRK. The SCSI port was intended to be the default mass storage option. However, since the implementation of USB, the SCSI port is only included as an option for backward compatibility, for those users who may already have DSS-1 sounds on a SCSI drive.

STEP 1 - DISASSEMBLY

- 1. Remove the slider caps from the Master Volume, Master Tune, Data Entry A and Data Entry B sliders and put them aside.
- 2. Remove the two power connectors from the power inlet PCB.



3. Remove the LCD and KLM-1013 boards from the lid. This may have already been done in a previous step. You may have to cut some cable ties to separate the LCD harness from the other wire harnesses. Make sure you don't clip the wires!!

4. Remove the slider board, KLM-784-1, by removing the 8 screws holding it to the cover. Put the foil shield aside and let the board rest on top of the KLM780 and KLM-781 boards.



5. Remove the main switch board, KLM-785-1, by removing 7 screws holding it to the cover. Let it rest on top of the KLM-781 board and power supply.



6. Remove the KLM-1012 board (small switch board) by removing its 4 screws.



7. Close the lid gently, making sure no internal components are getting crushed. Remove the 3 screws holding the audio jack board (KLM-788B). Open the lid, and remove the board from the back of the lid.



- 8. The only PC boards left on the lid should be the two DDL boards (KLM-1050. Remove the three connectors from each board and mark them.
- 9. Close the lid again, and remove the 8 screws holding the lid to the hinges. The lid should be able to be taken off and set aside.



10. Remove the 4 screws from each KLM-1050 board and set them aside, noting their orientation.

STEP 2 - MAKING THE DB25 CUTOUT

At this point the only thing attached to the lid of the DSS-1 should be the plastic switch caps. You will need the following tools:

- DB25 Punch
- Drill set
- Machining oil



There are a few types of DB25 punch available, so the actual usage may be a bit different than described.

1. Mark the center of the DB25 connector location with a pencil. The actual location is up to you, but must be as close to the main CPU board as possible. The supplied cable has been made to reach a cutout that has its center 390mm from the LEFT edge of the case, and inline with the screws that hold the audio jack board to the case (20mm from the bottom edge).



2. The SPC DSP-25P punch comes with a set of stickers with the hole centers printed on them. Using a center punch, punch the three locations as accurately as possible.

3. Drill a pilot hole for each location.



4. Drill the required 1/4" holes.



- 5. Place the DB25 punch base on the inside of the lid, and thread the hex screws through the punch top and the lid, into the base. Finger tighten the screws and make sure the punch is aligned correctly.
- 6. Put some machine oil on the sharp edge of the punch. A drop or two should be sufficient.
- 7. Carefully tighten the punch, doing a quarter turn at a time, first the center screw, then the outside screws.
- 8. Once the metal is punched through, tighten the hex screws that will make a mark for the jack screw holes.
- 9. Remove the punch and use a file to remove any burrs inside the case. Drill the jackscrew holes with a 1/8" drill and remove any burrs.
- 10. At this point it may be a good idea to clean the entire case lid with a mild detergent to remove any dirt, oil, etc.