dCS Display Boards
Service Manual

March 2014

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Contents

SAFETY AND CONFIDENTIALITY

Safety Warnings

Servicing must be carried out by qualified service personnel only.

These products contain circuitry that operate at high voltages and/or currents. Removing safety covers can expose personnel to risk of electric shock or other injury.

Take special care when working on the Power Board, as much of the board is at high voltage.

These products contain static-sensitive devices which can be seriously damaged by incorrect handling. Observe standard anti-static precautions at all times.

This product is lead-free to comply with the RoHS directive. If soldering or de-soldering is required, SAC solder (tin / silver / copper) must be used to ensure reliable repairs.

Always use genuine replacement parts supplied by ***dCS***.

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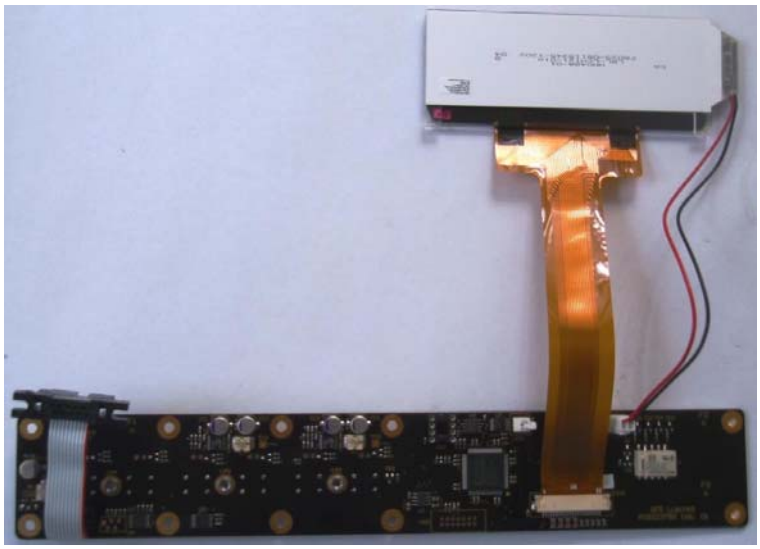
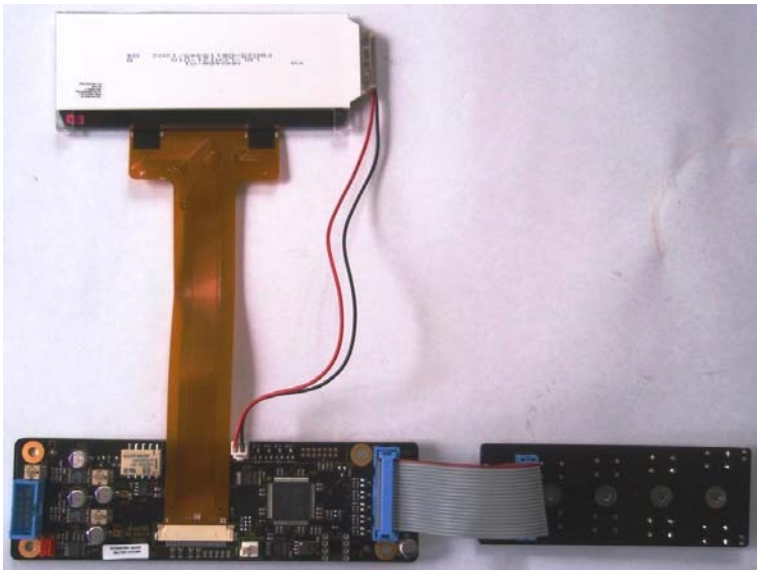
SCARLATTI / PAGANINI / PUCCINI DISPLAY BOARD

Assembly Description

Scarlatti DAC / Clock / Upsampler Display Board DCS222750



Scarlatti Transport Display Board DCS223750



Paganini / Puccini Player Display Board DCS300750 / DCS300755

The Display Boards used in Scarlatti / Paganini / Puccini use similar circuitry and the same LCD display module (MOD0160008). The Display Board drives the LCD module, carries the front panel switches, indicator LEDs, IR remote control receiver and the rotary encoder (fitted to DACs). Due to the shape of the Paganini / Puccini front panel, the switches and LEDs are mounted on a separate board (DCS300755) connected via CN8, but the circuitry is essentially the same.

Data is transferred to and from the Control board in serial form via ribbon cable CN2:

- **SDATA** carries data from the Control Board to the Display Board
- **RDATA** carries data from the Display Board to the Control Board
- **SCLK** & **STR** synchronise the data delivery / receipt.
- IR receiver data is sent to the Control Board via a dedicated **IR** line.

SYNCIN is required for correct FPGA operation, after it has configured.

Pressing the Power button shorts the POFF line CN2 pin 9 to ground, which turns the Power Board on, powering the unit up. The +5V DC supply from the Control Board connects via ribbon cable CN2. Regulators U2, U3 & U4 generate +3V, +1.2V and +2.5V power rails respectively.

At power up, FPGA U9 loads its configuration code from flash memory U8. The FPGA reads the “dCS” screen from flash and displays it on the LCD display, which connects via CN4. After a few seconds, communications with the Control Board are running and the “dCS” screen will be replaced by the “product” screen (e.g. Scarlatti DAC, Paganini Transport) as commanded by the Control Board, then the display will blank out. Once the Control Board has finished booting up, the normal operating screen for that product will be displayed.

If the Display Board FPGA fails to configure, the “dCS” screen will not appear and the display will remain blank. The FPGA configuration mode is set by R25-26, R28-33. If any of these are incorrectly fitted or the contents of flash chip U8 have been corrupted, the FPGA will not configure.

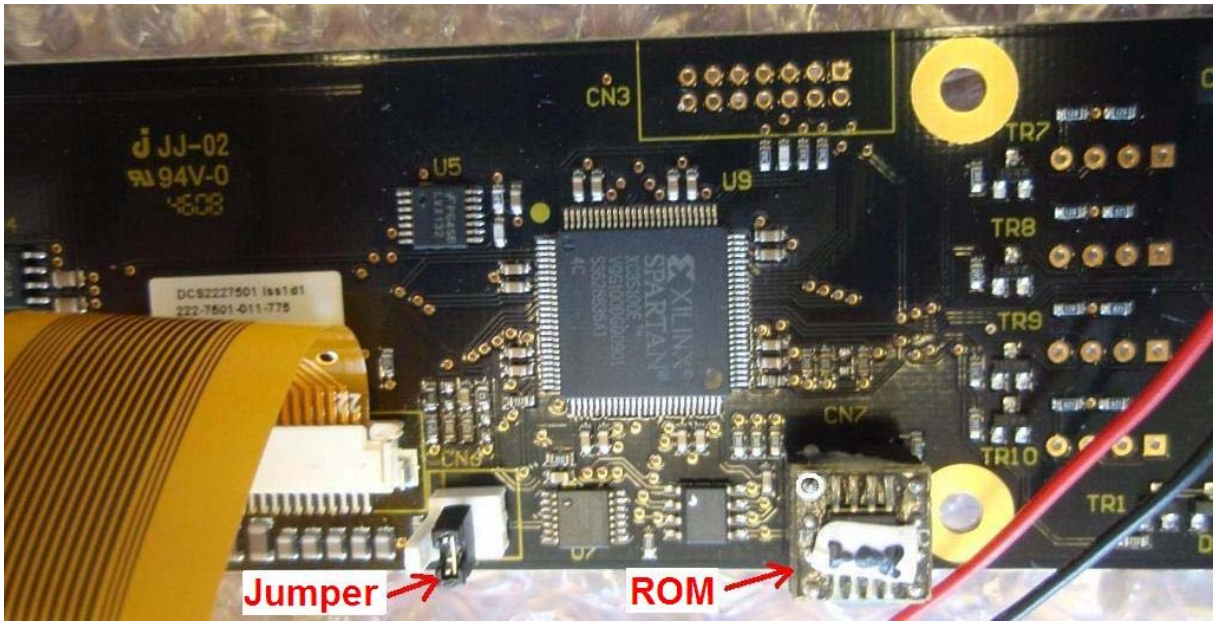
If communications with the Control Board cannot be established, the “dCS” screen will remain on the display.

The BL bus from the FPGA turns on a selection of transistors TR3 – 6, which supply current via CN5 to the backlight LED. The setting of the BL bus, and hence the LED current, is controlled by the Display Brightness menu. On Scarlatti Display Board version 1d1, the LCD contrast range is factory set by trimmer RV1, which adjusts for variations in the LCD module. It may be necessary to adjust the RV1 if the LCD module is replaced – this is described in the Hardware History section. The contrast setting is controlled by the Display Contrast menu.

Pressing of front panel buttons SW0 – 9 is read by the FPGA via the SW bus, the data is serialised and sent to the Control Board via CN2. Relay RL1 operates briefly whenever a button is pressed to provide some tactile feedback. On DACs, pulses from the rotary encoder are connected via CN1 to the FPGA and serial commands are sent to the Control Board. The front panel LEDs are turned on/off by the Control Board via CN2, the FPGA and the ELG bus. Commands from the IR remote receiver U6 pass through the FPGA and CN2 to the Control Board.

Flash memory U8 is programmed at the production stage and does not normally require re-programming. If it becomes necessary to re-program U8 in the field, follow this procedure:

- Discuss the problem with dCS, request the current Display Board ROM and jumper.
- Switch off the unit and dismantle to gain access to the back of the Display Board.
- Fit the 8-pin ROM in socket CN7 and the jumper to CN6. **Make sure the ROM is fitted correctly** – the white ring indicates pin 1, which should be at the notched end of the socket, pointing away from the edge of the board.
- Power up and watch the display. “Copying...” should appear, then the unit should boot up and the normal display should appear. **Wait – do not switch off**.
- After 1.5 to 2 minutes, the display will darken because the back-light has turned off. Switch off using the back panel switch. Remove the ROM and jumper.
- Power up and check that the Display Board is working correctly.



Scarlatti Display Board with ROM and jumper fitted

Drawings

	Circuit diagram files	Component layout files
Scarlatti DAC, Clock & Upsampler	222750cd1d1.pdf	222750cl1d.pdf
Scarlatti Transport	223750cd1d1.pdf	223750cl1d.pdf
Paganini system & Puccini Player	300750cd1c1.pdf / 300755cd1a1.pdf	300750cl1c.pdf / 300755cl1a.pdf

Product-Specific Variants

The **Scarlatti Transport** uses the standard DCS223750 with a LED fitted in position D16.

The **Scarlatti DAC** uses the standard DCS222750 with LEDs fitted in positions D10, D14 & D16.

The **Scarlatti Clock** & **Upsampler** use the standard DCS222750 with LEDs fitted in positions D11 & D12. Zero-ohm resistor R87 is fitted (this relocates the power button function to SW2).

The **Paganini series / Puccini Player** Display Board DCS300750 is standard for all, Switch Board DCS300755 is fitted with switches and LEDs to suit the model as follows:

	SW0 SW1	SW2 SW3	SW4 SW5	SW6 SW7	SW8 SW9	D16	D10
Paganini Transport	✓	✓	✓	✓		✓	
Paganini DAC	✓	✓	✓			✓	✓
Paganini Clock	✓	✓				✓	
Paganini Upsampler	✓	✓				✓	
Puccini Player	✓	✓	✓	✓	✓	✓	✓

Hardware History

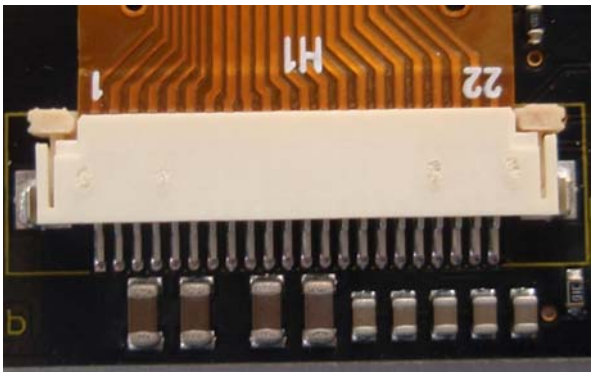
The various modification states are identified by a 3-character issue code such as **1c1**, each state is supported by a dCS Modification Note. The board's modification state will be noted on the board's serial number label.

The modifications applied to date mainly relate to setting the contrast range to suit the LCD module. This will only be relevant in the field if an LCD module is replaced. If the module is replaced in a Scarlatti unit fitted with a Display Board version 1d1 or later (a board with a contrast trimmer), before replacing the Display Board set the trimmer as follows:

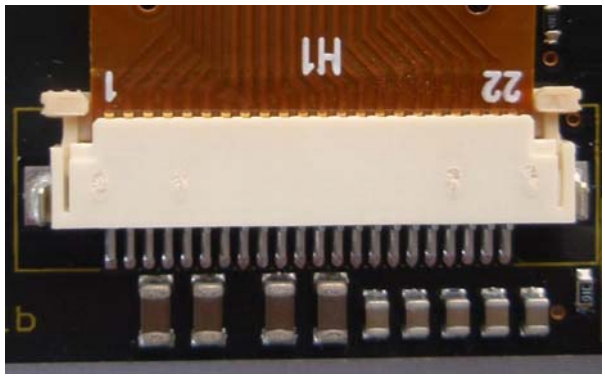
- Lay the Display Board and LCD module on an insulating sheet (such as paper) on top of the Control Board and connect it up.
- Power up the unit and set the **Display / Contrast** menu page to maximum.
- Locate RV1 – it is close to LCD connector CN4.
- Use a trim tool to adjust RV1 clockwise until a yellow grid shows on the LCD.
- Turn RV1 counter-clockwise until the yellow grid is only just visible.
- Run the **Settings / Factory Reset** routine – this will set the Contrast to 60%.
- Power down for 10 seconds, then power up and check that the dCS boot-up screen does not appear yellow or grey.

If you have replaced the LCD in a unit that does not have a contrast trimmer and the contrast needs to be adjusted, note the display board issue and the appearance of the LCD at maximum contrast then contact dCS for advice.

The LCD module connects via a flexi-PCB which fits into a ZIF socket (Zero Insertion Force). Before removing the old display, release the ZIF clamp by gently prising the 2 lugs at the side of the connector out by a few millimetres. Remove the old LCD module, fit the cable for the new module fully into the ZIF socket and close the clamp.
Forcing the cable into the connector without opening the clamp WILL damage the cable.
A connector with an open clamp or a missing clamp WILL make very poor contact.



ZIF clamp closed



ZIF clamp open

Known Faults & Fixes

Symptom: Scarlatti - some front panel buttons stop working.

- This can be caused by corrosion of the switches on the Display Board, only 2 cases of this fault have been seen in 2 years. Switches are difficult to remove, so the solution is to replace the Display Board.

Symptom: Pressing the front panel buttons causes unexpected changes.

- This can be caused by a short-circuited switch, pressing that switch will have no effect. This fault is rare. Switches are difficult to remove, so the solution is to replace the Display Board.

Symptom: The LCD display has bright patches.

- The LCD module is clamped to the front panel by 2 metal clips. If one of these is over-tightened, is distorted or has burrs on the edge, this will squeeze the LCD panel in that area, resulting in areas in which the liquid crystal is transparent. Depending on the actual cause, the solution is to slightly loosen the clip fixings, file any burrs of the clip or replace a distorted clip. We do not expect units to be shipped with this fault.

Symptom: One LED does not illuminate when it should, possibly intermittently.

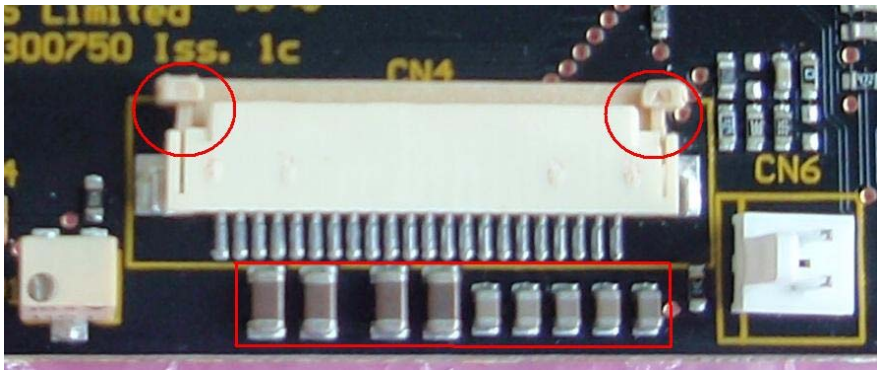
- If the LED behaves correctly when the Display Board is detached from the front panel, the cause is probably an LED terminal shorting to the front panel. Insulate the terminals, reassemble and check that the LED is behaving correctly. This has been seen on early Debussy DACs and early Puccini U-Clocks (Power LED only).

Symptom: The unit fails to power up or crashes.

- If the fault is cleared by detaching the Display Board from the front panel, the cause is probably an LED terminal shorting to the front panel, pulling down a power rail. Insulate the terminals, reassemble and check that the unit is behaving correctly. This has been seen on early Debussy DACs and early Puccini U-Clocks (Power LED only).

Symptom: The LCD contrast becomes very poor and cannot be improved.

- A possible cause is corrosion of the FFC cable connecting the LCD module. Lift the connector clamps (as indicated by the red rings in the picture below), remove the cable and check for a black film or blue-green crystals on the contacts. If you see these signs of corrosion, clean the contacts with a clean cloth soaked in iso-propyl alcohol. Reconnect the cable, close the clamps and check to see if the contrast has returned to normal.
- The most common cause of loss of contrast is the failure of one of the 9 small capacitors near the LCD connector CN4.To check this, lift the connector clamps, remove the cable and measure the capacitance of the 9 capacitors shown in the red box below.



The 4 large capacitors (10uF, C23-C26, CAP2057100) should be in the range 8.0 – 12.0uF.
The 5 small capacitors (1uF, C27-C31, CAP2256100) should be in the range 0.9 – 1.1uF.
If any of these parts are out of range (usually one or two), please contact dCS for a set of replacement capacitors. After replacing the capacitors, reconnect the cable, close the clamps and confirm that the contrast has returned to normal.

Modification to fit wide-angle LEDs

Some customers have reported that they find the blue LEDs to be too bright and the viewing angle is too narrow. We have developed a modification to change to wider angle LEDs with a more even intensity. The time required varies by model, the worst case being a Scarlatti Transport which takes around 2 hours. Note that the Debussy DAC has always been fitted with the wide-angle LED.

A kit of parts required to modify Scarlatti/Paganini/Puccini Display Boards can be purchased from dCS as "**KT LED HILO 1**". Each kit is sufficient to change 5 LEDs, so you will need either 1 or 2 kits per system. The kit will contain some spare resistors – do not worry about this.

- Disconnect and remove the Display Board from the unit.
- Remove the original LEDs from the board and clear the holes of solder.
- Remove the specified chip resistors from the board and replace with the new values. These are listed below as they vary by model. Refer to the component layout files specified on page **6**.

Changes for Scarlatti DAC

Fit 120k 0603 chip resistors (marked 124) in positions R68 R76 & R83. (Was 1k6.)
Fit 180k 0603 chip resistors (marked 184) in positions R69 R77 & R84. (Was 1k6.)
Fit 330k 0603 chip resistors (marked 334) in positions R88 R92 & R94. (Was 10k.)
Change LEDs D16 D10 & D14.

Changes for Scarlatti Clock / Upsampler

Fit 120k 0603 chip resistors (marked 124) in positions R70 & R72. (Was 1k6.)
Fit 180k 0603 chip resistors (marked 184) in positions R71 & R73. (Was 1k6.)
Fit 330k 0603 chip resistors (marked 334) in positions R89 & R90. (Was 10k.)
Change LEDs D11 & D12.

Changes for Scarlatti Transport

Fit 120k 0603 chip resistors (marked 124) in position R83. (Was 1k6.)
Fit 180k 0603 chip resistors (marked 184) in position R84. (Was 1k6.)
Fit 330k 0603 chip resistors (marked 334) in position R94. (Was 10k.)
Change LED D16.

Changes for Paganini DAC & Puccini Player

Fit 120k 0603 chip resistors (marked 124) in positions R68 R78 & R83. (Was 1k6.)
Fit 180k 0603 chip resistors (marked 184) in positions R69 R79 & R84. (Was 1k6.)
Fit 330k 0603 chip resistors (marked 334) in positions R88 R93 & R94. (Was 10k.)
Change LEDs D15 (on 300750), D16 & D10 (on 300755).

Changes for Paganini Transport / Upsampler / Clock

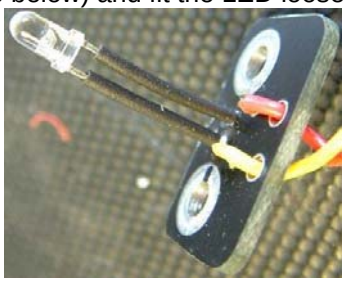
Fit 120k 0603 chip resistors (marked 124) in positions R78 & R83. (Was 1k6.)
Fit 180k 0603 chip resistors (marked 184) in positions R79 & R84. (Was 1k6.)
Fit 330k 0603 chip resistors (marked 334) in positions R93 & R94. (Was 10k.)
Change LEDs D15 (on 300750) & D16 (on 300755).

Changes for Puccini U-Clock

Fit 82k 0603 chip resistors (marked 823) in positions R22 R24 R26 & R28. (Was 56k.)
Fit 51k 0603 chip resistors (marked 513) in positions R23 R25 R27 & R29. (Was 36k.)
Fit 330k 0603 chip resistors (marked 334) in positions R5 R6 R7 & R8. (Was 10k.)
Change LEDs D2 D3 D4 & D5 (on two sections of 305505).

- Orient the new LEDs with the LONG terminal to the SQUARE hole (see the picture below) and fit loosely to the board, do not solder at this time.

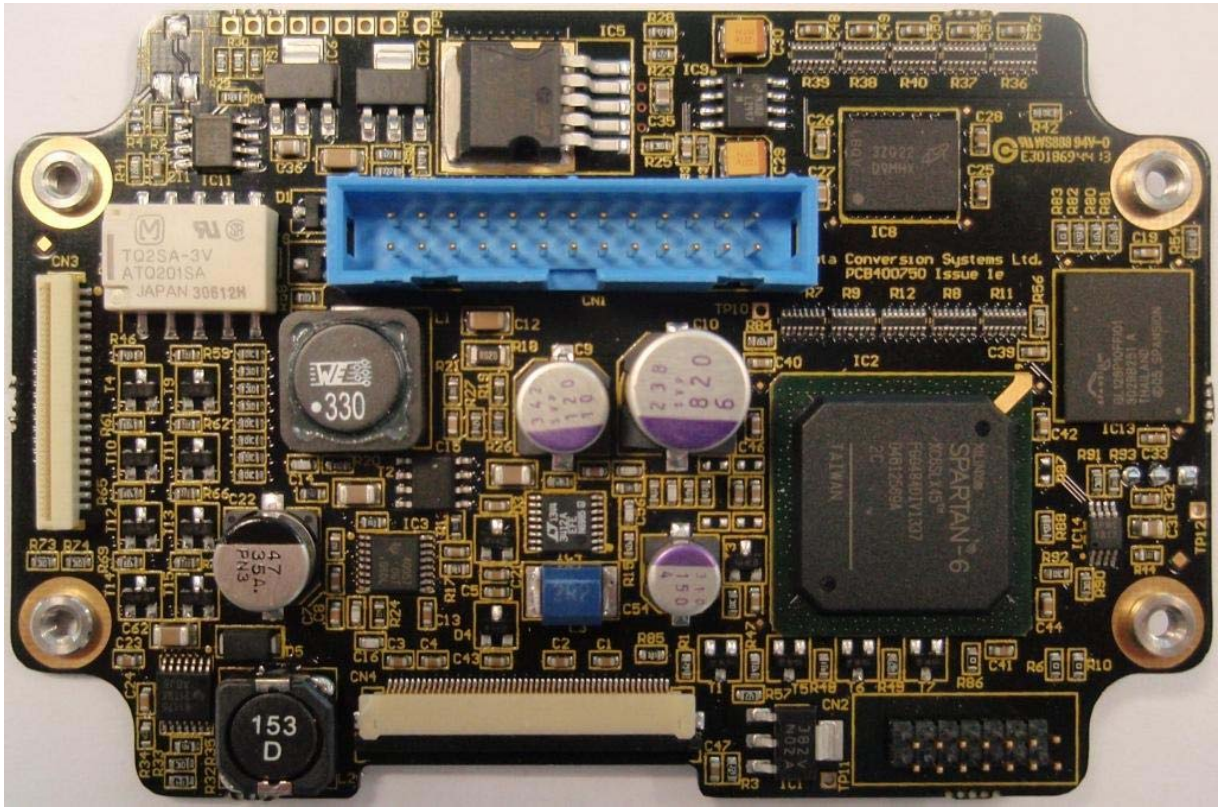
- For the Puccini U-Clock's power LED only, insulate both terminals with two 14mm lengths of thin insulating sleeve (see the picture below) and fit the LED loosely to the board.



- Carefully fit the board back to the front panel and secure it.
- Move each LED around until it locates in the front panel recess and can be seen from the front. Solder the terminals to the board and cut off any excess wire.
- Reassemble the unit and check that all LEDs illuminate correctly.

VIVALDI DISPLAY BOARD

Assembly Description



All four Vivaldi units use the same Display Board DCS400750, LCD display module (MOD0160013) and Switch Board DCS400751. The Display Board drives the LCD module, drives the Switch Board, communicates with the Control Board and carries the IR remote control receiver IC10. The Switch Board carries the front panel switches, indicator LED and connects to the rotary encoder (fitted to DACs).

- CN1 connects to Control Board CN16. This carries power (+5V / +12V unregulated / 0V), data, clock, serial interface, IR remote control and power on/off signals. SYNCIN is required for correct FPGA operation, after it has configured.
- CN2 is a JTAG interface used for the initial loading of software or re-booting.
- CN3 connects to Switch Board CN1 by Flat Flex Cable.
- CN4 connects to the TFT display module by Flat Flex Cable.

Regulators IC1, IC3, IC4, IC5, IC6, IC7 & IC12 generate the VGL, +3.3V, +1.2V, +18V, VDH, +24V & VGH power rails respectively.

The DDR RAM is supplied from the V1P8 rail (+1.8V). The connections to the RAM are terminated with resistor packs to the termination regulator IC9, which generates a half-rail reference SD_VTT. The terminations control pulse reflections.

At power up, FPGA IC2 loads its configuration code from flash memory IC13. After a few seconds, the FPGA copies the contents of the flash memory to the lower section of the DDR RAM for faster access. The “Vivaldi Product” screen (e.g. Vivaldi DAC, Vivaldi Transport) appears on the LCD display, which connects via CN4. Once the Control Board has finished booting up, the normal operating screen for that product will be displayed.

The colour LCD display is driven from the FPGA with:

- Three 6-bit pixel buses Red[0..5], Green[0..5] and Blue[0..5]
- Hsync, Vsync and DotClock
- Backlight[0..3] which controls the current to the LED backlight strings via current sources T1/T5/T6/T7.

The LCD does not require contrast adjustment.

CN3 connects to the Switch Board:

- Button 1 – 11 commands are passed to the FPGA.
- Pressing the Power button shorts the POFF line CN1 pin 9 to ground, which turns the Power Board on, powering the unit up.
- 2 outputs from the DAC's rotary encoder.
- LED drivers T4, T9-15, driven by FPGA's LED1_0 to LED4_1 lines. Only LED1_0 & T4 are used for Vivaldi's Power LED.

Relay RL1 operates briefly whenever a button is pressed to provide some tactile feedback.

The IR remote receiver IC10 is mounted on the back of the board.

Commands from the Switch Board and IR receiver pass through the FPGA and CN1 to the Control Board.

Watchdog chip IC14 resets the board if the logic power rails are lower then normal.

Flash memory IC13 is programmed at the production stage and does not normally require re-programming. If it becomes necessary to re-boot the Display Board in the field, follow the procedure in the Service Manual for that unit.

During software updating, the upper half of the DDR RAM is cleared, the display code is downloaded from disc or file to the Control Board, checked and stored in the Display Board's DDR RAM. When the download is complete, the software image is copied to flash memory. The unit switches off at the end of the update so that when the unit is powered up again, the new software is active.

Drawings

Display Board	The circuit diagram file is 400750cd1e1.pdf. The component layout file is 400750cl1e.pdf.
Switch Board	The circuit diagram file is 400751cd1c1.pdf. The component layout file is 400751cl1c.pdf.

Product-Specific Variants

The switches fitted to the Switch Board vary by model:

	SW1	SW5 SW6 SW7	SW8	SW2 SW3 SW4 SW9 SW10 SW11
Vivaldi Transport	✓			✓
Vivaldi DAC	✓	✓	✓	
Vivaldi Clock	✓	✓		
Vivaldi Upsampler	✓	✓	✓	

Hardware History

The various modification states are identified by a 3-character issue code such as **1D1**, each state is supported by a dCS Modification Note. The board's modification state will be noted on the board's serial number label.

The Modification Notes listed below describe these build states, they are available on request. Versions earlier than 1D1 were not used in Production.

400750mn04 Updates version 1D1 to 1E1
Modifications: Increases the drive to the tactile feedback relay (change R58 from 10k to 2.7k).
Reduces local clock jitter (remove R89 & C60).
Prevents the display flashing at switch on (remove R87).
These changes are considered to be essential.

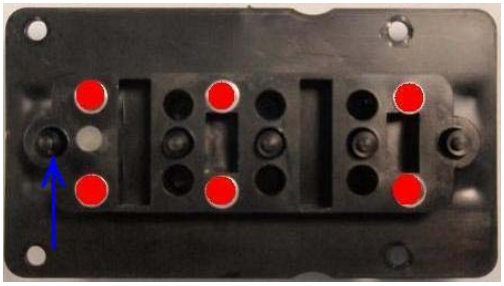
Known Faults & Fixes

Symptom: Following a software update, the unit powers up but the display is blank.

- This can be caused by the unit losing power during the last few minutes of an update, after the upload phase is complete. The solution is to re-boot the display from a PC as described in the service manual for the product. We have seen 3 cases of this to date.

Symptom: The unit suddenly switches to Sleep mode for no reason.

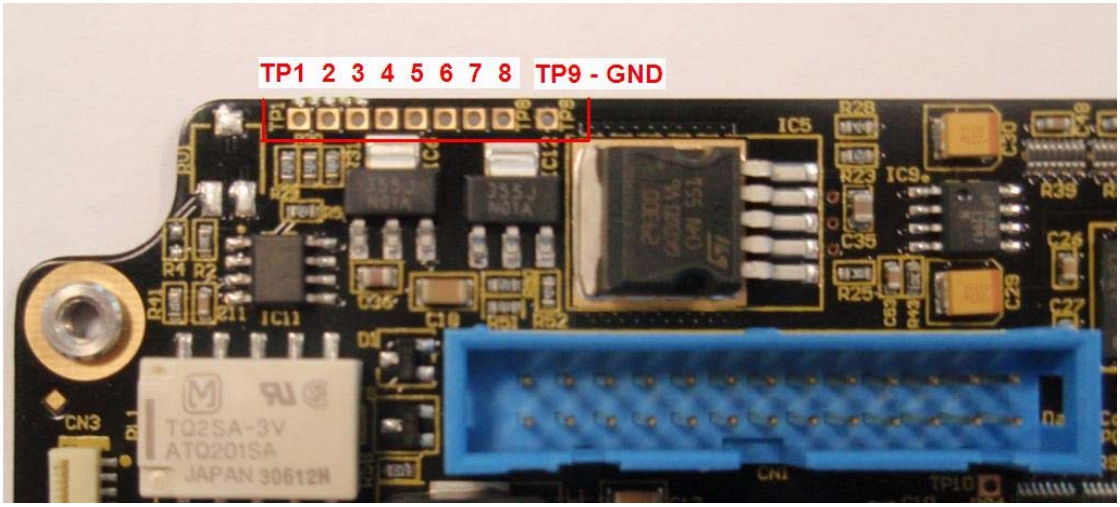
- Units made in 2012 - The clearance between the switch plunger and the switch is very small. Expansion / contraction due to temperature changes can be enough to close the switch with no pressure applied. This is most commonly seen with the Power switch, but it can happen with other switches too.



The solution is to remove the front panel and use a fine needle file to trim down the dome on the end of the plastic plunger (indicated by the blue arrow).
2 – 3 passes with the file should be enough to remove about half the height of the dome. If other switches are affected, trim their plungers also.

Symptom: The Control Board powers up but the display remains completely dark.

- At the rear of the Display Board you will see a row of test points in the top corner. Measure the voltage between each of these and ground (or the base plate).



You will need to drop the front panel of the Transport to gain access to the test points. Typical measurements are:

Test Point	Name	Function	Typical Voltage
TP1	+12V	Unregulated supply from Control Board	+12.2V
TP2	+24V	LED backlight supply	+23.5V
TP3	VGL	-8.05V for LCD module	-8.2V
TP4	VDH	+8.45V for LCD module	+8.5V
TP5	VGH	+16.5V for LCD module	+16.4V
TP6	+3.3V	FPGA I/O supply	+3.1V
TP7	+1.2V	DDR RAM supply	+1.2V
TP8	+1.8V	FPGA core supply	+1.8V

If any of these measurements are different by more than 5% (10% for the +12V supply), this indicates a fault in the regulator for that rail or that the power supply is being overloaded by the circuitry it is supplying.

Symptom: The "Vivaldi Product" screen does not clear 30 seconds after power up.

- Communications with the Control Board cannot be established. Check that the Control Board has booted up and is correctly connected.

Symptom: At switch on, the display remains blank.

- If the contents of flash memory IC13 have been corrupted for any reason (e.g. an electrical storm), the Display Board FPGA will not configure and the board will not run. Re-boot the Display Board from a PC as described in the Service Manual for that product.

Block Diagram