

dCS Paganini Clock

Service Manual

October 2011

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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.

Disclaimer

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Confidentiality



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UNIT DESCRIPTION



The *dCS Paganini Clock* is a Grade 1 digital audio master clock intended for use with a *Paganini Transport, DAC* and *Upsampler*. The unit is extensively configured by software stored in flash memory. The key features are as follows.

- 6 industry standard Word Clock outputs on BNC connectors.
- 44.1 or 48kHz output frequencies, accurate to better than 1ppm (typically 0.1ppm when shipped).
- Twin crystal oscillators – one for 44.1kHz, the other for 48kHz.
- “Dither” feature exercises the receiving device’s PLL to improve lock accuracy.
- Software may be updated by the user from a suitable CD-R, played on a standard CD Player or Transport. If the software has become corrupted, the unit may be re-booted from a ROM, fitted to a Programmer Board.
- All-aluminium case with laminated damping plates.

HARDWARE AND SOFTWARE HISTORY

Hardware History & Configuration Code

For products manufactured since early 2000, the long version of the *dCS* unit serial number may be read from the menu. This contains a great deal of information about the build standard of the unit, allowing *dCS* to advise on the suitability of software updates, whether a hardware update is advisable and (sometimes) the cause of a particular problem.

The example below is a *Paganini Clock* with serial number PCK-0S2-7G4--1C5-012-5832.

A typical serial number	This code group means:
PCK	PRODUCT CODE. SCK = Scarlatti Clock, SDC = Scarlatti DAC, STT = Scarlatti Transport, SUP = Scarlatti Upsampler, PPR = Puccini Player, PUU or PUC = Puccini U-Clock, PCK = Paganini Clock, PDC = Paganini DAC, PTT = Paganini Transport, PUP = Paganini Upsampler, DDC or DDP = Debussy DAC.
0S2	OPTIONS CODE. First character = product options. Second character: B = Black, S = Silver. Third character = voltage setting: 1 = 100V, 2 = 115/120V, 3 = 200V, 4 = 215/220V, 5 = 230/240V. Early versions have only 2 voltage settings: 1 = 100-120V, 4 = 200-240V.
7G4	CONTROL BOARD CODE. The build standard of the Control board.
-	TOP BOARD CODE. The Clock has no top board, so this slot is not used..
1C5	DISPLAY BOARD CODE. The build standard of the Display Board.
012	CASE & BASE CODE. This covers the build standard of the case parts, mains transformer, Power Board, back panel wiring and anything else.
5832	CONTROL BOARD SERIAL NUMBER. Each Control Board has a unique serial number.

Software History

August 2007 v1.00 – This is the first issue.

The latest software should be loaded in all units.

COMMON SET-UP ERRORS

GOLDEN RULE 1

The source *MUST* be locked to the Master Clock.

Locking the DAC (and possibly the Upsampler) to the Clock but leaving the CD Transport unlocked and running in Master mode results in either occasional clicks (which may not be noticed) or frequent clicks (which can make the system unusable), depending on the difference between the 2 clock frequencies.

GOLDEN RULE 2

The sample rates used in the system *MUST* be compatible with the Clock frequency.

Using an incompatible mixture of sample rates in a system generally results in the DAC being unable to lock, and so remains muted.

For example, upsampling CD data to 192kS/s while trying to lock the whole system to a Clock set to 44.1kHz results in the DAC locking to the Clock but being unable to decode the data, and so remains muted. The sample rates used *MUST* be exact multiples of the Clock frequency:

- With the Clock set to 44.1kHz, you can use 44.1, 88.2 or 176.4kS/s or DSD (2.822MS/s).
- With the Clock set to 48kHz, you can use 32, 48, 96 or 192kS/s.

Two exceptions to Golden Rule 2 are the *Scarlatti & Paganini Upsamplers*, which have been designed for a more flexible response to Clock frequency. They will accept Word Clock at 44.1 or 48kHz while decoding data at any standard rate. The Output Sample Rate should be set to a multiple of the clock frequency to ensure the DAC will accept the data.



Problems caused by ignorance or misunderstanding of these 2 rules are VERY common!

Symptom: The unit fails to power up

- Check that the rated supply voltage stated on the back panel matches the local supply voltage.
- Ensure there is power available on the power cable, connect it to the unit. Set the back panel power switch to the **I** position (ON), wait 10 seconds and press the **POWER** button.
- Check that the mains fuse under the mains inlet has not blown. If it has, correct any obvious cause then replace the fuse as described in the manual.

Symptom: The Display turns on when a control is operated, then turns off

- This happens when the Display Settings > Display On/Off menu page is set to OFF. Change the setting to ON to stop the Display blanking out.

Symptom: The unit fails to respond to the controls

- If the indicator beside the **POWER** button is illuminated, the unit is in sleep mode - press the **POWER** button once to return to normal operation.

Symptom: The Clock will not lock to an External Reference source

- This feature is present on the *Scarlatti Clock* but not the *Paganini Clock*.

Symptom: The Clock displays CAL

- CAL indicates that the calibration data has been corrupted. Contact *dCS* to arrange re-calibration.

DISMANTLING PROCEDURE

Bear in mind that you should not have to completely dismantle the unit to carry out the repair!

Tools required:

- Ratchet screwdriver handle.
- Screwdriver bits: Allen key 2, 2.5 & 3mm A/F, 6mm flat blade, No.1 PoziDriv.
- Nut spinners / socket spanners: 5.5mm, 7mm, 12.5mm (1/2"), 14mm (5/16") & 16mm (5/8") A/F.



Do not use ball-ended Allen keys, as these can damage the screw heads.

The design of the case has changed over time, the unit you are servicing may be slightly different from that shown.

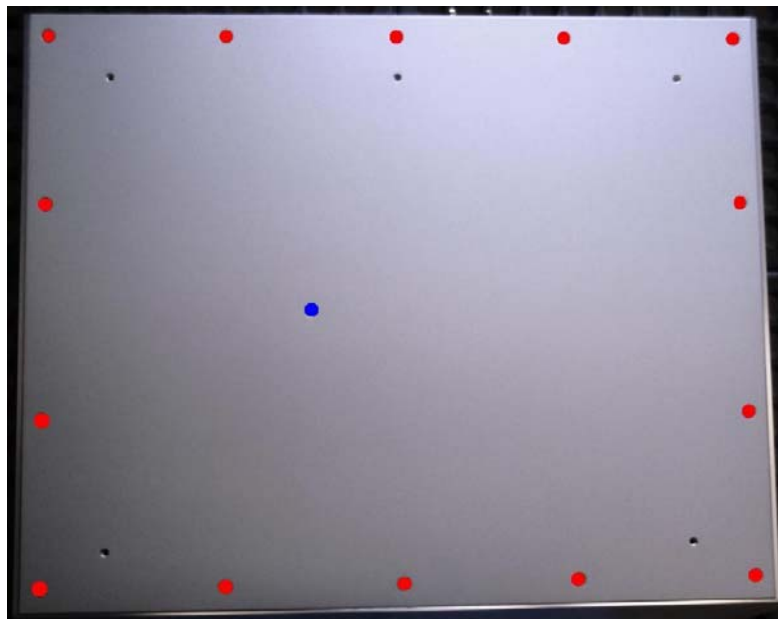


Remember to observe anti-static precautions when dismantling.

The *Paganini* metalwork has evolved since it was first designed, there are now 3 distinct versions in circulation, which we will describe as Mk1, Mk2 and Mk3. Disconnect all cables from the unit. Rest the unit on a soft anti-static surface to prevent damage to the finish.

Opening the case – Mk1 - units shipped from September 2007 to March 2008

Turn the unit upside-down and remove the 14 screws from the base plate, shown in red below. Also remove the screw near the middle of the plate marked in blue. Remove the base plate.



To detach the top cover, first remove the 2 screws in the middle of both side plates, shown in red below.



Inside the unit, remove the 5 screws in the well near the back panel, shown in red below.

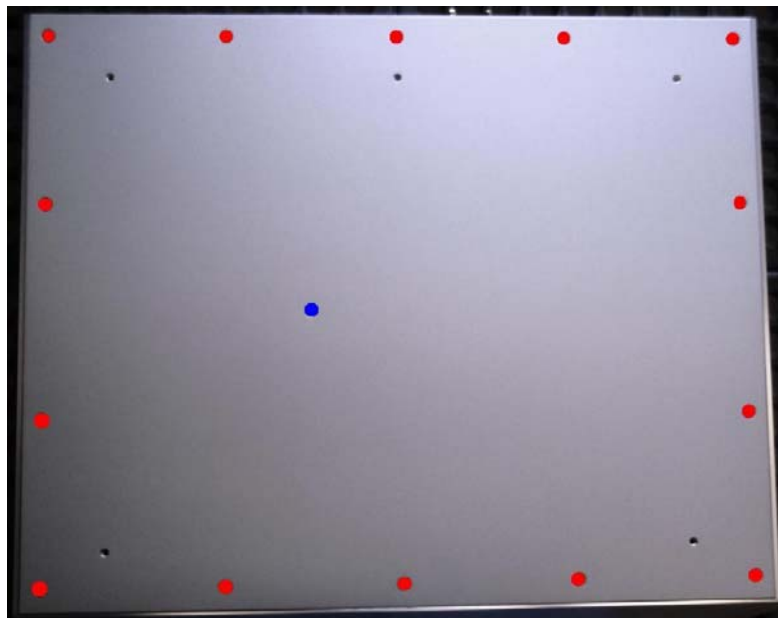


Turn the unit over and slide the top plate backwards about 10mm to clear the slot at the front of the case, then lift the top plate off, complete with 2 small brackets. This gives access to the Power Board and mains transformer.

The top edge of the front panel is attached to the chassis by 4 screws, the bottom edge is attached to a slim bracket by 4 screws. Remove the 8 screws to detach the front panel and access the Display & Switch Boards. Disconnect the ribbon cable from the Display Board.

Opening the case – Mk2 - units shipped from March 2008 to March 2009

Turn the unit upside-down and remove the 14 screws from the base plate, shown in red below. Remove the base plate. It should not be necessary to disturb the screw indicated by the blue dot.



To detach the top part of the case, first remove both side plates (each fixed by 6 screws).

Inside the unit, remove the 5 screws in the well near the back panel, shown in red below.

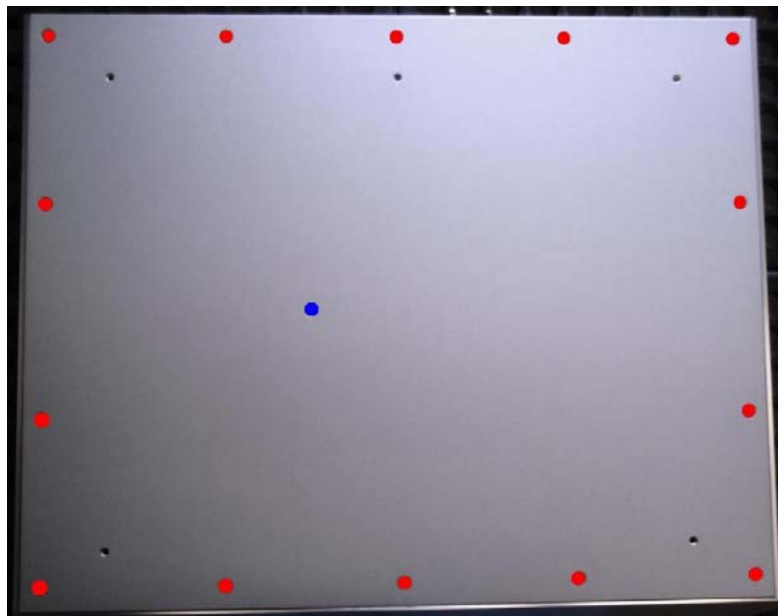


Remove the 2 nuts at the front of each side of the unit (the upper screws are accessed through slots in the side of the chassis) and a third nut near the bottom centre of the chassis. Disconnect the ribbon cable from the Display Board. Slide the upper section of the chassis back 10mm and lift it off.

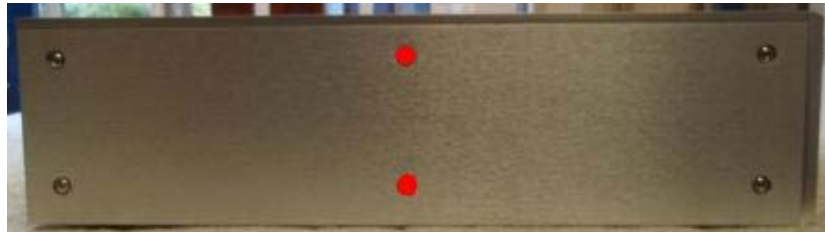
The front panel bracket & front panel are secured to the top cover by 2 screws on each side. The top and bottom edges of the front panel are attached to the chassis by 4 screws each. Remove the 8 screws to detach the front panel and access the Display & Switch Boards.

Opening the case – Mk3 - units shipped from March 2009 to present

Turn the unit upside-down and remove the 14 screws from the base plate, shown in red below. Remove the base plate.



To detach the top cover, first remove the 2 screws in the middle of both side plates, shown in red below.



Inside the unit, remove the 5 screws in the well near the back panel, shown in red below.



Turn the unit over and slide the top plate backwards about 10mm to clear the slot at the front of the case, then lift the top plate off, complete with 2 brackets. This gives access to the Power Board and mains transformer.

To remove the front panel, first remove both side plates. The front panel bracket is secured to the chassis by three M4 nuts on studs: one near the bottom centre and one near the top of each side. The two (Puccini) pictures below indicate the location of the nuts with red arrows.

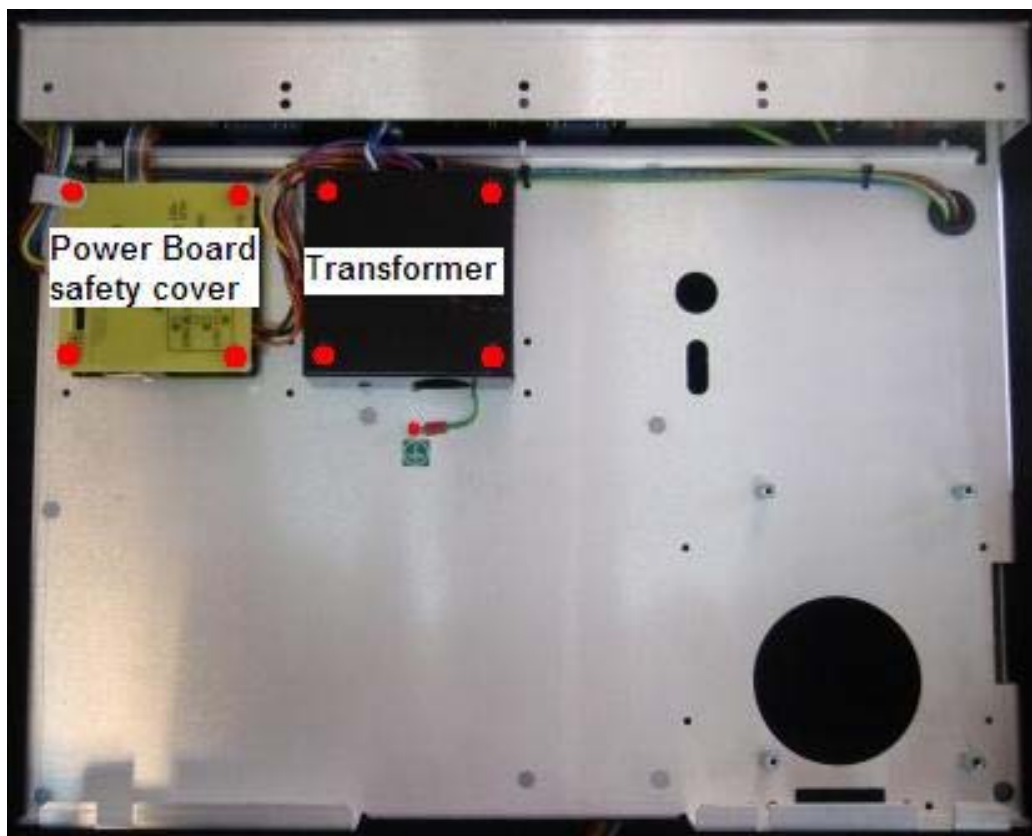
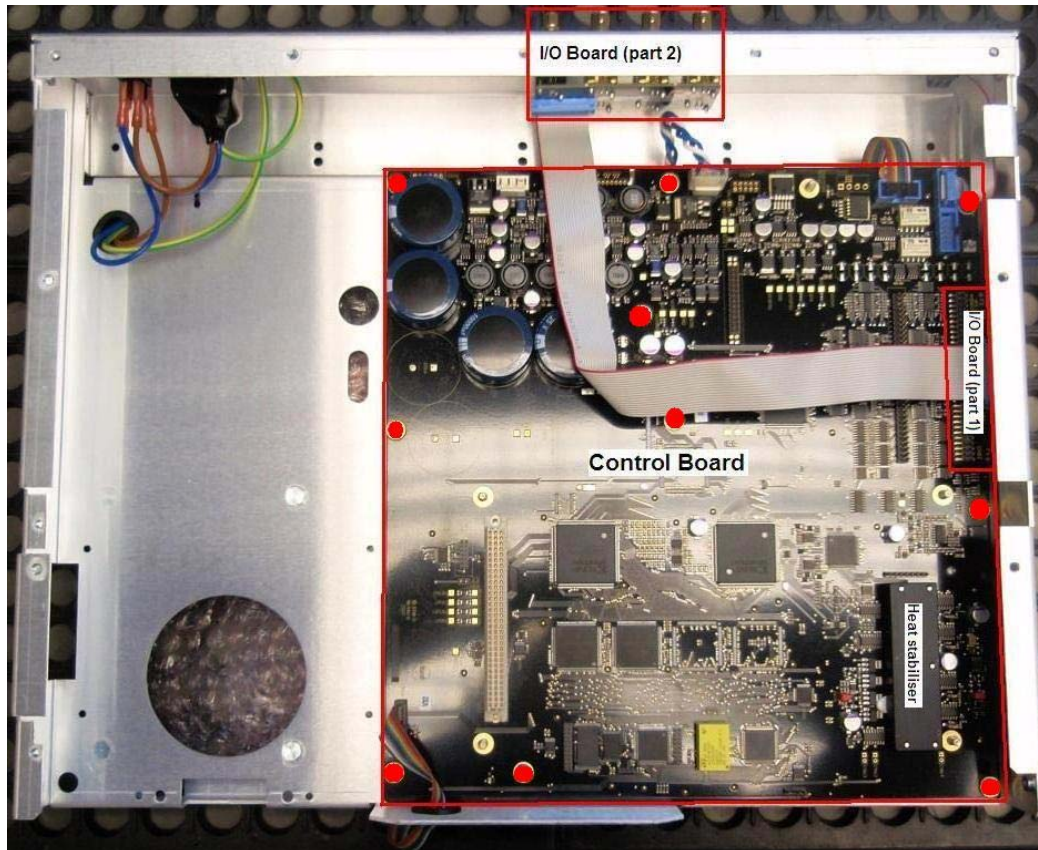


Remove the 3 nuts, then ease the front panel and its fixing bracket off the front of the unit. Carefully disconnect the ribbon linking the Display Board to the Control Board.

Detach the front panel from the bracket to expose the Display & Switch Boards.

Identification of the sub-assemblies

The fixings are indicated by red dots.



Removing sub-assemblies

Top section:

The **Power Board** is protected by a yellow safety cover, fixed by a screw at each corner. The Power Board underneath is fixed by a hex pillar at each corner. Disconnect the cables and lift the board off the 4 studs.

The mains **Transformer** is fixed by a screw in each corner. Disconnect the cables from the Power Board and Control Board, then detach the green/yellow screen wire from the base plate.

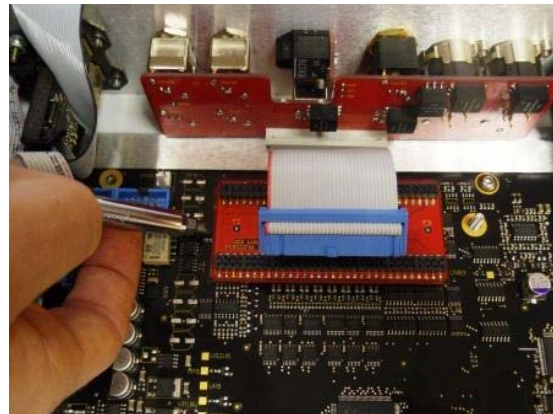
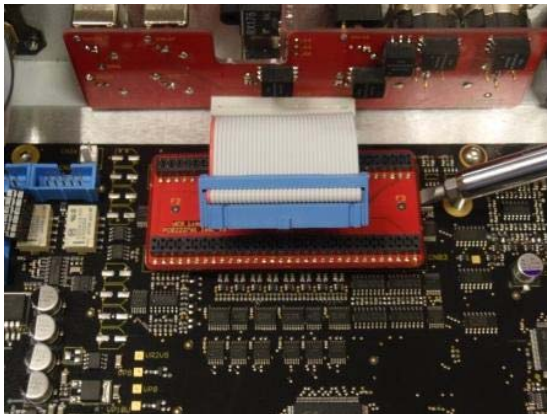
Bottom section:

The **I/O Board (part 1)** is a **very tight press-fit** onto Control Board headers CN82/83.



This board is difficult to remove! Careless use of tools can cause serious (and expensive) damage to the Control Board, **for which dCS shall not be liable**. If you really need to remove it and you are not confident you can do so safely, refer servicing to dCS.

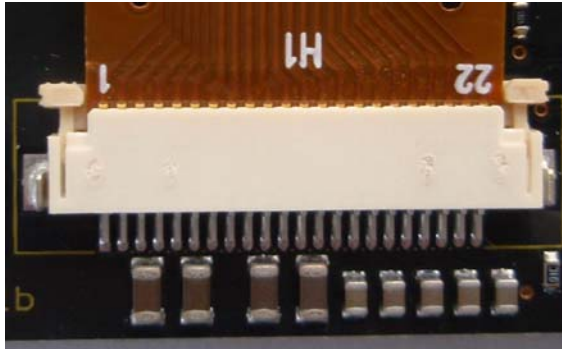
First disconnect the cable to the Connector Panel Board. Use a 6mm flat-blade screwdriver to lever the right side of the board up a few mm, pivoting on the top of the stud. Carefully lever up the left side of the I/O Board in the same way, protecting the Control board with your fingers. When the I/O board has been loosened, lift it off.



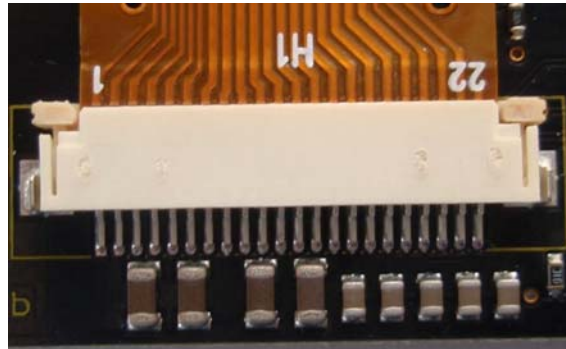
The **Control Board** is secured to the chassis by 10 screws. Disconnect all cables, remove the fixings and lift the Control Board out of the chassis.

The **I/O Board (part 2)** is fixed to the back panel by the nuts and screws on the connectors themselves.

The **Display Board** is secured to the back face of the front panel by 4 screws and washers. Release the clamps on CN4 by gently pulling them out of the connector by a few mm. Disconnect the cable from the rotary encoder. When reassembling, take care to ensure the flat flex cable is fully engaged inside CN4 and the clamps are pushed back in.



ZIF clamp open



ZIF clamp closed

The **Switch Board** is secured to the front panel by 5 screws and washers.

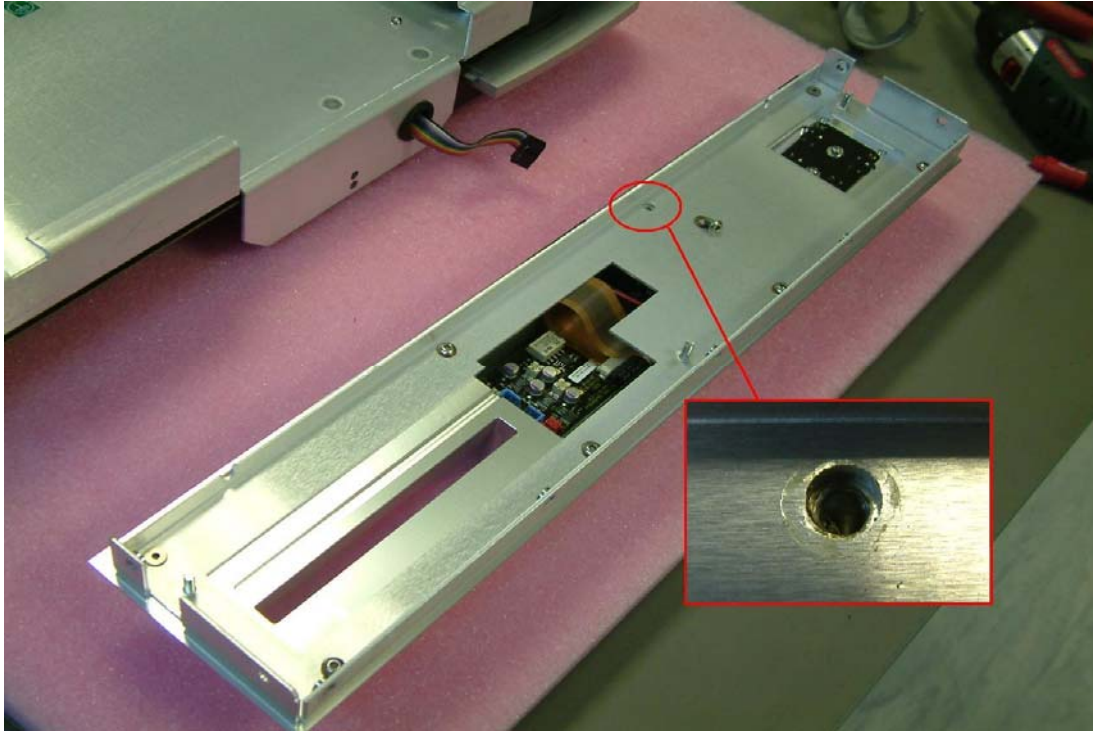
The **LCD module** is clamped in place by foam pads fitted to the back of the **Display Board**. When re-fitting the LCD module, make sure it is correctly located in its machined recess before fitting the Display Board on top.

REASSEMBLY OVERVIEW

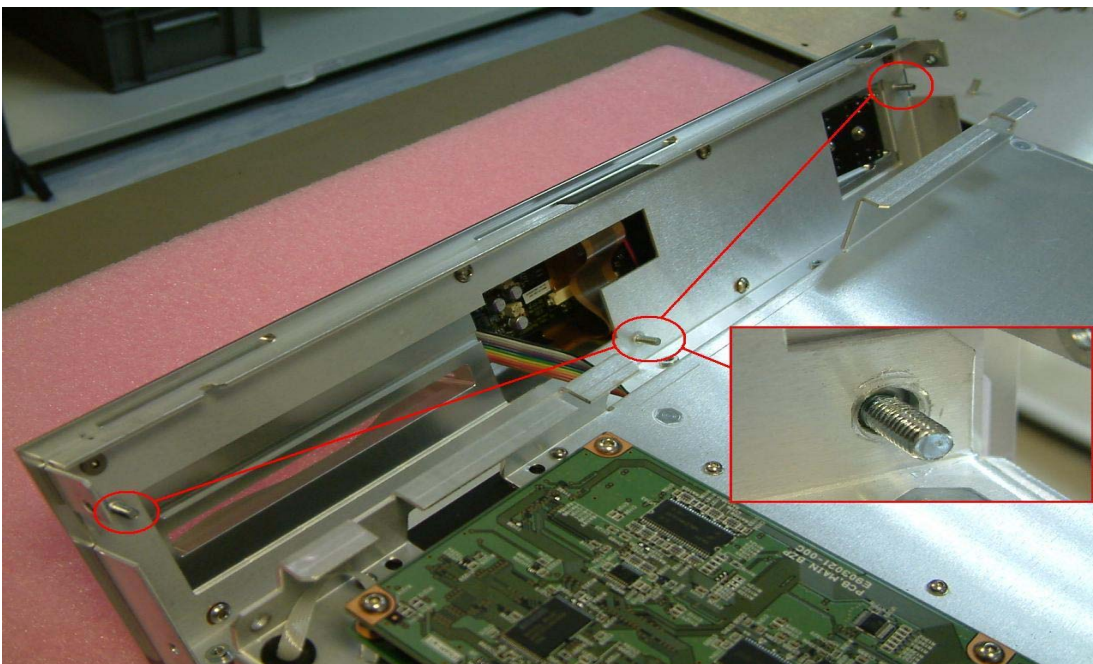
This section deals with squaring and aligning the case parts for when a high degree of dismantling has been necessary. These instructions were written primarily for the Mk3 case (units shipped from March 2009 onwards). (The pictures show a Puccini Player, but the case design is the same.)

Front panel

Secure the front panel to the front bracket using M4x6 button head screws. As shown below, align the front panel screw holes to the holes in the bracket before tightening.

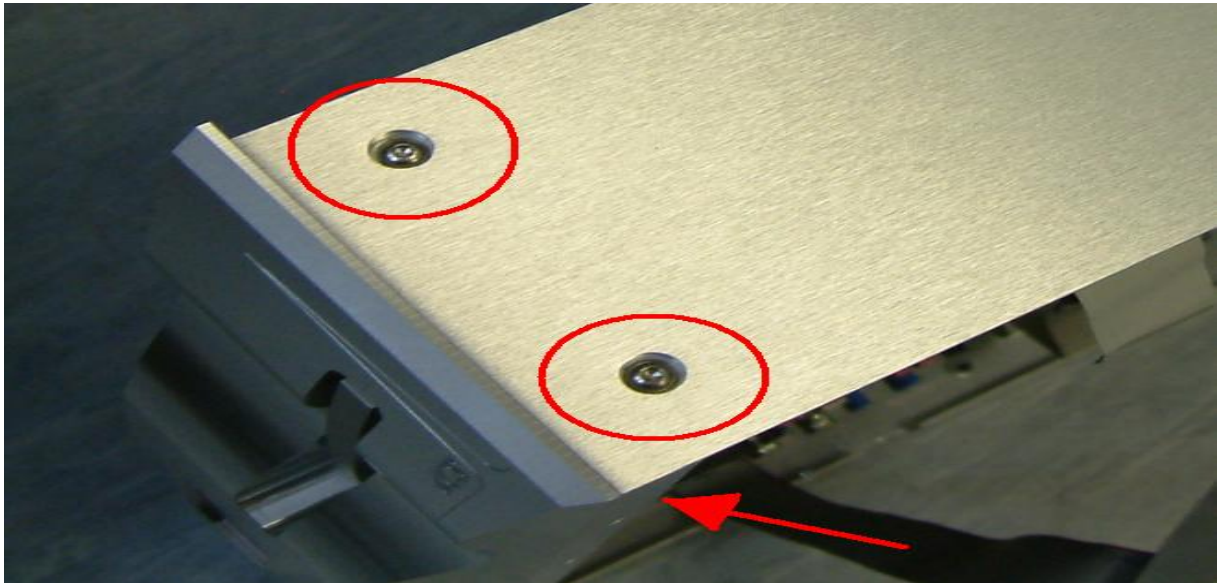


Align the 3 front panel assembly securing studs centrally through the chassis holes and secure with M4 nuts.

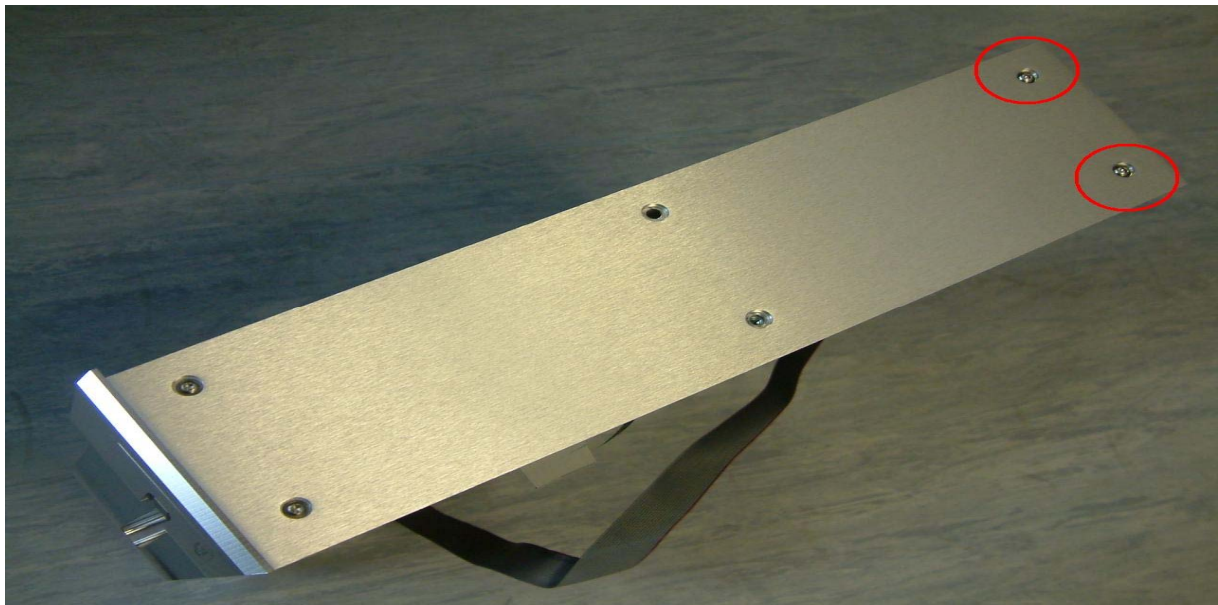


Side cheeks

Align a side cheek to the front panel, keeping the bottom corner of the side cheek flush with the bottom corner of the front panel, secure using the two front screws only.



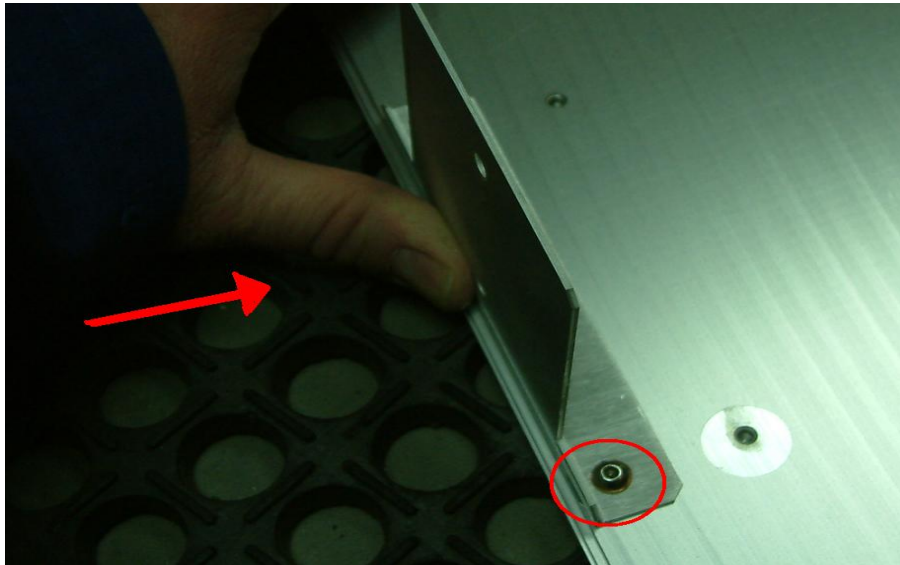
Align the rear chassis holes with the side cheek and secure using two M4 screws.



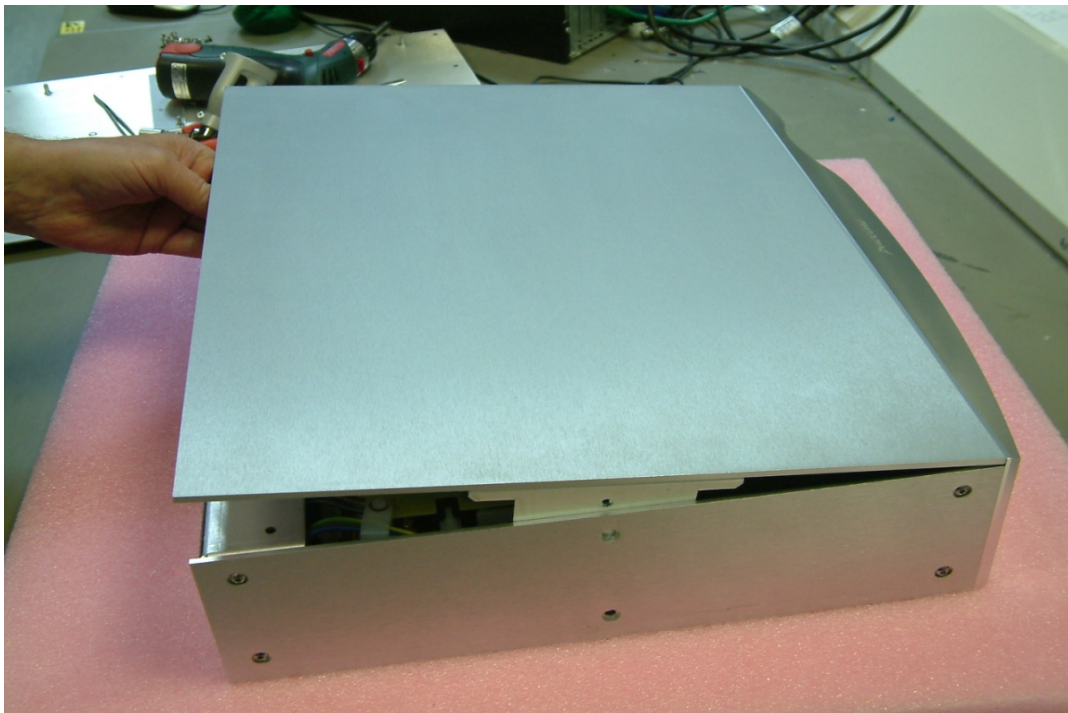
Repeat for the other side cheek.

Top plate

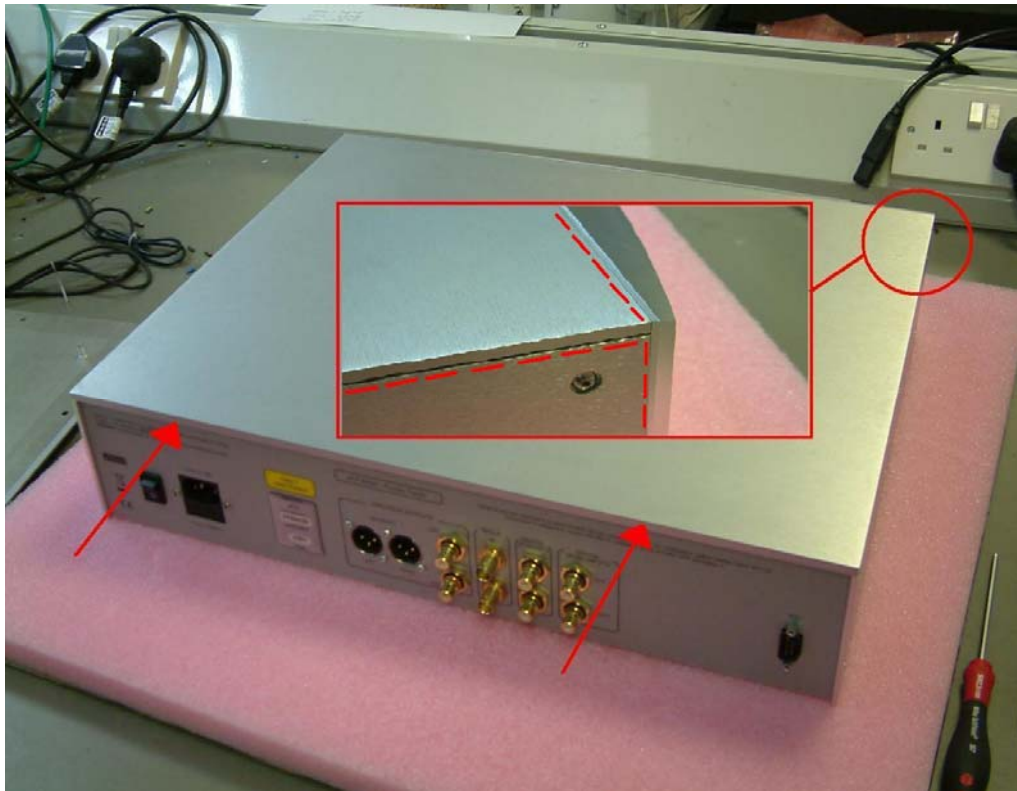
Fit the top plate brackets using M4x6 screws and flat washers. Push the bracket inwards towards the centre of the plate as the screws are tightened.



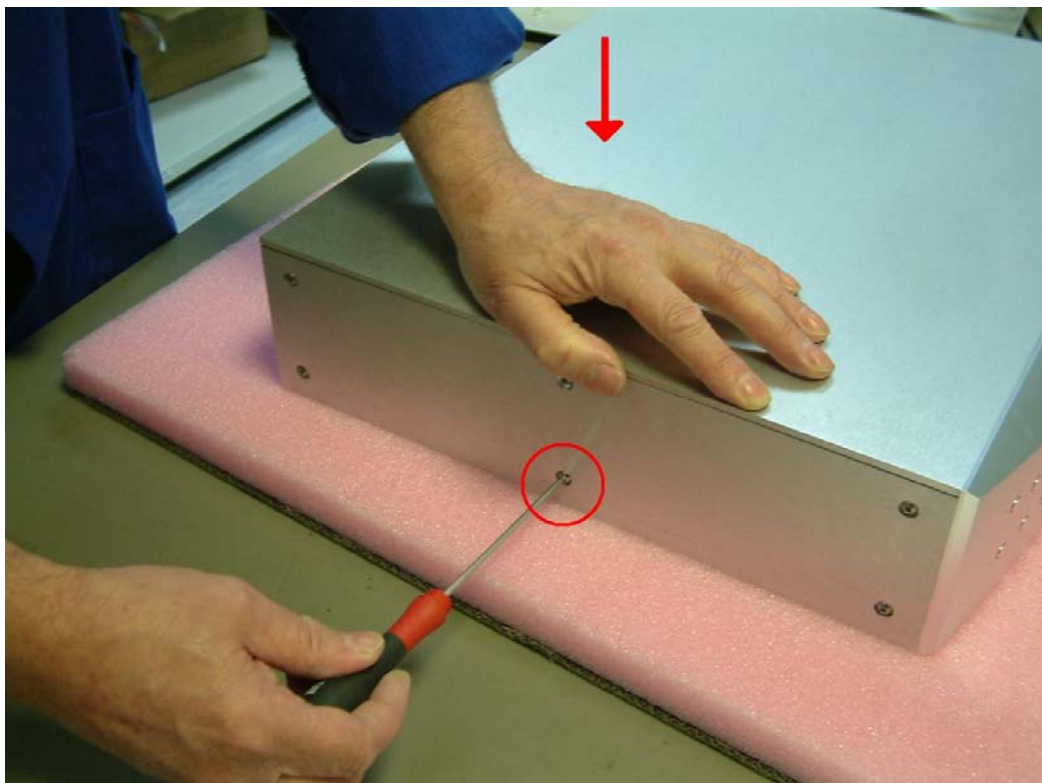
Fit the top plate to the unit, taking care that the top plate brackets do not scratch the outer faces of the side cheeks. Locate the tabs at the front edge of the top plate into the slots in the front panel – this is easier if the panel is inserted at a shallow angle rather than slid in flat.



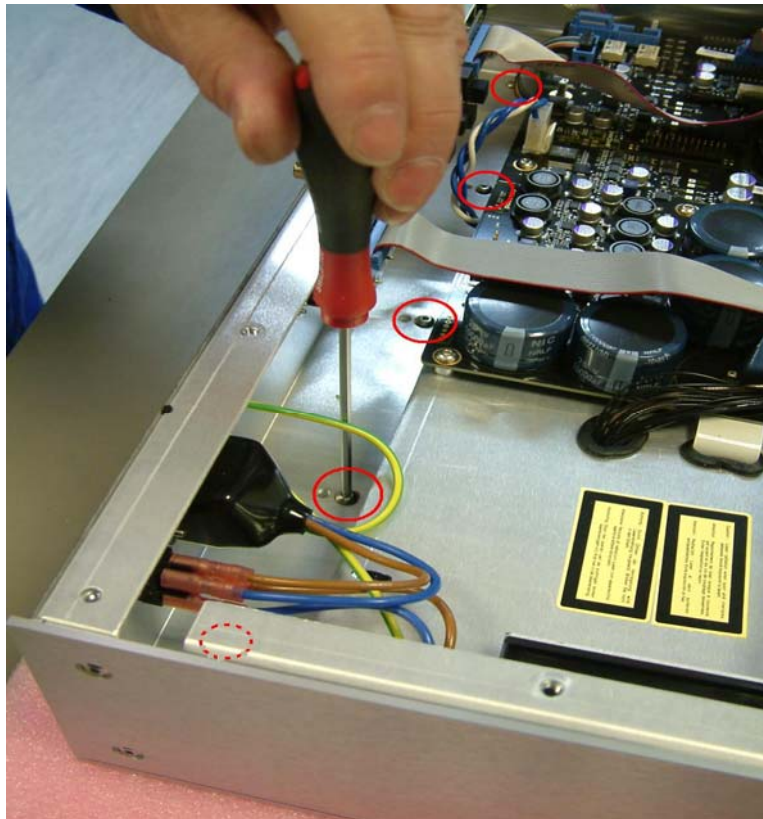
Move the top plate into position by pushing from the rear edge, ensuring that there are no visible gaps where the top plate meets the front panel. Check that the joins between the top plate and side cheeks are tight as shown in the inset below.



Apply hand pressure to keep the joints closed, insert an M4 screw into the lower hole of each side cheek.



Check the unit to ensure all joins are square, then fit M4 screws in the remaining hole in each side cheek. Turn the unit over and fit the five M4x6 screws and washers into the inside face of the chassis to secure the top plate.



Base Plate

Finally, fit the base plate using twelve M4x8 countersunk screws and two M4x12 countersunk screws where shown below.



SUBASSEMBLY DETAILS

Subassemblies which are common to other products are detailed in separate Service Manuals.

Common Subassemblies

Control Board DCS156541 v7



The Control Board carries out all the digital processing and provides regulated DC to the unit. This board is common to most other current *dCS* products, it is configured by software. To date, the 7G or 7J versions of this board have been used on all *Paganini Clocks*.

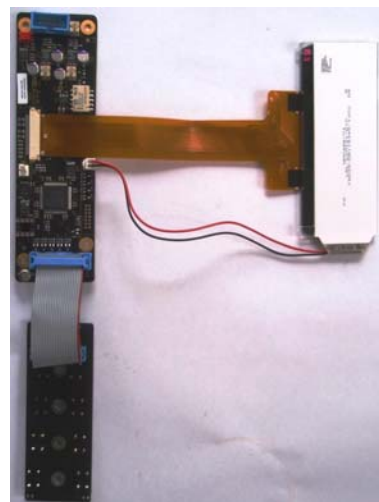
The circuit diagram file is 156540cd7g4.pdf.

The component layout file is 156540cl7g.pdf.

Earlier versions of this board were used on the Classic range.

This board is detailed in the separate **Control Board v7 Service Manual**.

Display Board DCS300750 / Switch Board DCS300755



The Display Board drives the LCD display module MOD0160008 (shown at the right side of the picture) and carries the IR receiver. The Switch Board (shown at the lower left side) carries the switches and LEDs, it connects to the Display Board. Switches and LEDs are fitted to the Switch Board to suit the product. The same boards are used on the *Paganini* series and *Puccini Player*.

To date, the 1A or 1B versions of the Display Board (version 1D will be introduced soon) and the 1A version of the Switch Board have been used on all *Paganini Clocks*. The differences between these versions are minor.

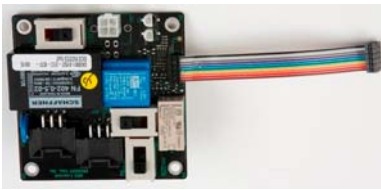
CN2 connects to Control Board CN16. This carries power (+5V / 0V), data, clock, IR remote control and power on/off signals.
CN4 & CN5 connect to the LCD display module.
CN8 connects to the Switch Board.

The circuit diagram files are 300750cd1c1.pdf & 3007551a1.pdf.

The component layout files are 300750cl1c.pdf & 3007551a.pdf.

These boards are detailed in the separate **Display Board Service Manual**.

Power Board DCS152223



This board filters the mains supply and allows the power to be switched on/off safely from the front panel POWER button. The connection of the mains supply to the Mains Transformer primaries is set by 3 slide switches. It is common to most current products. The Power Board is covered by a yellow insulator board for safety. Several earlier versions of this board were used on the Classic range.

The circuit diagram file is 152223cd5a1.pdf (current version).

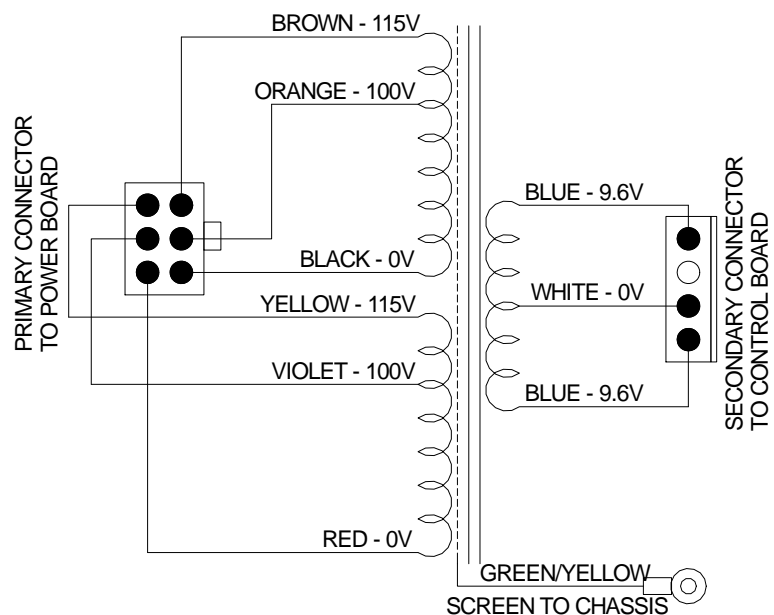
The component layout file is 152223cl5a.pdf (current version).

This board is detailed in the separate **Power Board Service Manual**.

Mains Transformer DCS002896



This transformer is common to all current products except the *Puccini U-Clock*. The twin primaries allow the transformer to be configured for 100, 115/120, 200, 215/220 or 230/240V.



Early versions of this transformer had four primary wires instead of six and offered two ranges: 100-120V and 200-240V. The Power Board used with this early type should be set to 115/120V or 230/240V ONLY (not 100V or 215/220V – otherwise the unit will not power up).

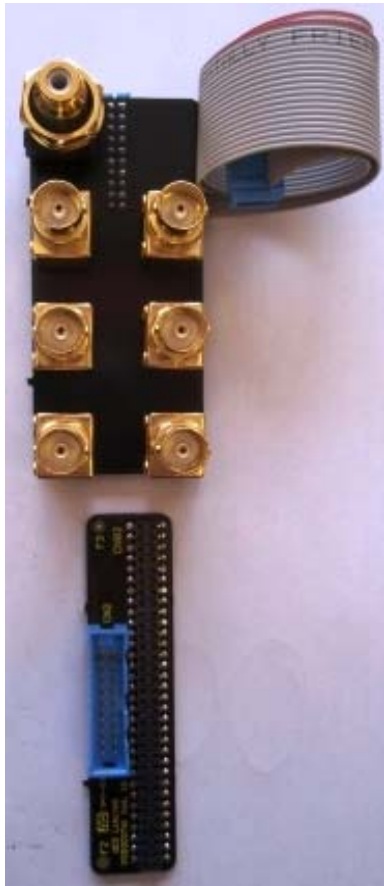
TYPICAL winding resistances are:

- Black to Orange or Red to Violet: 22 ohms
- Black to Brown or Red to Yellow: 25 ohms
- Blue to White: 0.15 ohms

Note that there is a considerable resistance variation from one transformer to another.

Unique Subassemblies

Paganini Clock I/O Board DCS302761



This board is in two sections.

The connector panel section (at the top of the picture) fixes to the back panel, it carries the Word Clock output connectors, the SPDIF input (for calibration only) and a ribbon cable, CN3, which connects to CN2 on the lower section.

The I/O section fits onto the I/O header CN82 on the Control Board.

The retention force of CN82 is VERY high. Take great care to avoid damage if it is necessary to detach this board from the Control Board.

The circuit diagram file is 302761cd1b1.pdf.

The component layout file is 302761cl1b.pdf.

FAULT-FINDING

Known Faults and Solutions

Make sure the latest software is loaded.

At this time, there are no known systematic faults with the *Paganini Clock*.

Fault Finding Guide

Symptom: The mains fuse blows

This can be caused by a brief mains voltage surge. Check that the voltage setting is correct, then fit a new fuse of the correct type (20x5mm T0.5A L). If the new fuse does not blow, soak for 24 hours to verify the fix.

If the new fuse blows, the most likely causes are:

- Incorrect voltage setting. See the Power Board Service Manual for details.
- A damaged surge arrestor on the Power Board. See the Power Board Service Manual.
- The mains transformer short-circuits. This is VERY RARE, so please do not make assumptions! Test the transformer against the circuit diagram on page **20**, checking for short-circuits. Note that the secondary windings (Blue and White wires) have a very low resistance.

To date, we have never seen a fault in the rest of the unit that causes the mains fuse to blow.

Symptom: The unit fails to power up

- Is AC reaching the Power Board? If not, check the mains wiring and mains fuse.
- Is the full mains voltage AC passing through the Power Board to the mains transformers? If not, make sure the Power Board is turned on and find the point at which the circuit is broken.
- Is low voltage AC reaching Control Board at connector CN17? With nominal mains voltage, the AC voltage (referred to the base plate) at pins 1 & 4 (blue wires) should be 10V and at pin 2 (white wire) should be 0V. If the voltage is substantially different, check the transformer for signs of overheating.
- To check the Control Board Power Supply circuitry, measure the DC voltages between GND (or the base plate) and the various square test point pads around the board. You will have to lift the 1394 main board clear to do this (switch off the power first!). Typical measurements are:

Name	DC Voltage
VR2V5	+2.500V
VP5	+5.0V
VP9	+8.5V
VP18U	+18.0V

Name	DC Voltage
VP5PSU	+5.0V
VP3PSU	+3.3V
VP3	+3.3V
V1P8	+1.8V

Name	DC Voltage
VN18U	0V *
VP6U	+6.8V
VN8X	-5.9V

* Note that VN18U remains disabled on this model.

If any of these measurements are different by more than 5%, this indicates a fault in the power supply or that the power supply is being overloaded by the circuitry it is supplying. Power down, disconnect the Display Board, then check to see if this has corrected the voltages.

- If power is reaching the Control Board, check the behaviour of the red diagnostic LED, located near the front right corner of the Control Board. When power is applied, the LED should flash once and then flash twice a few seconds later. It should remain off for about 20 seconds while the board boots up, then turn on. If this does not happen but there is some LED activity, the microcontroller is not running. Try reloading the software from ROM, as described on page **27**.

- At the rear right corner of the Control Board, you will see a black aluminium block, which covers metal-cased crystal oscillators X01 & X02. There is provision for 4 crystals on the board, a red LED behind each turns on when the crystal is powered. At power up, the LED behind X02 should turn on and stay on. During boot-up, the LEDs behind the other 3 crystals should flash together on 2 occasions, then the LEDs behind X01 and X02 should stay on. Check that a 22.6MHz clock appears at U626 pins 3 & 4. If not, X02 or U613 may be faulty.
- If the Control Board microcontroller is running, CN12 may be connected to a PC running Hyperterminal to extract diagnostic information from the Control Board. Please see the **Service Manual for the Control Board v7** for more information.

Symptom: The DAC does not un-mute

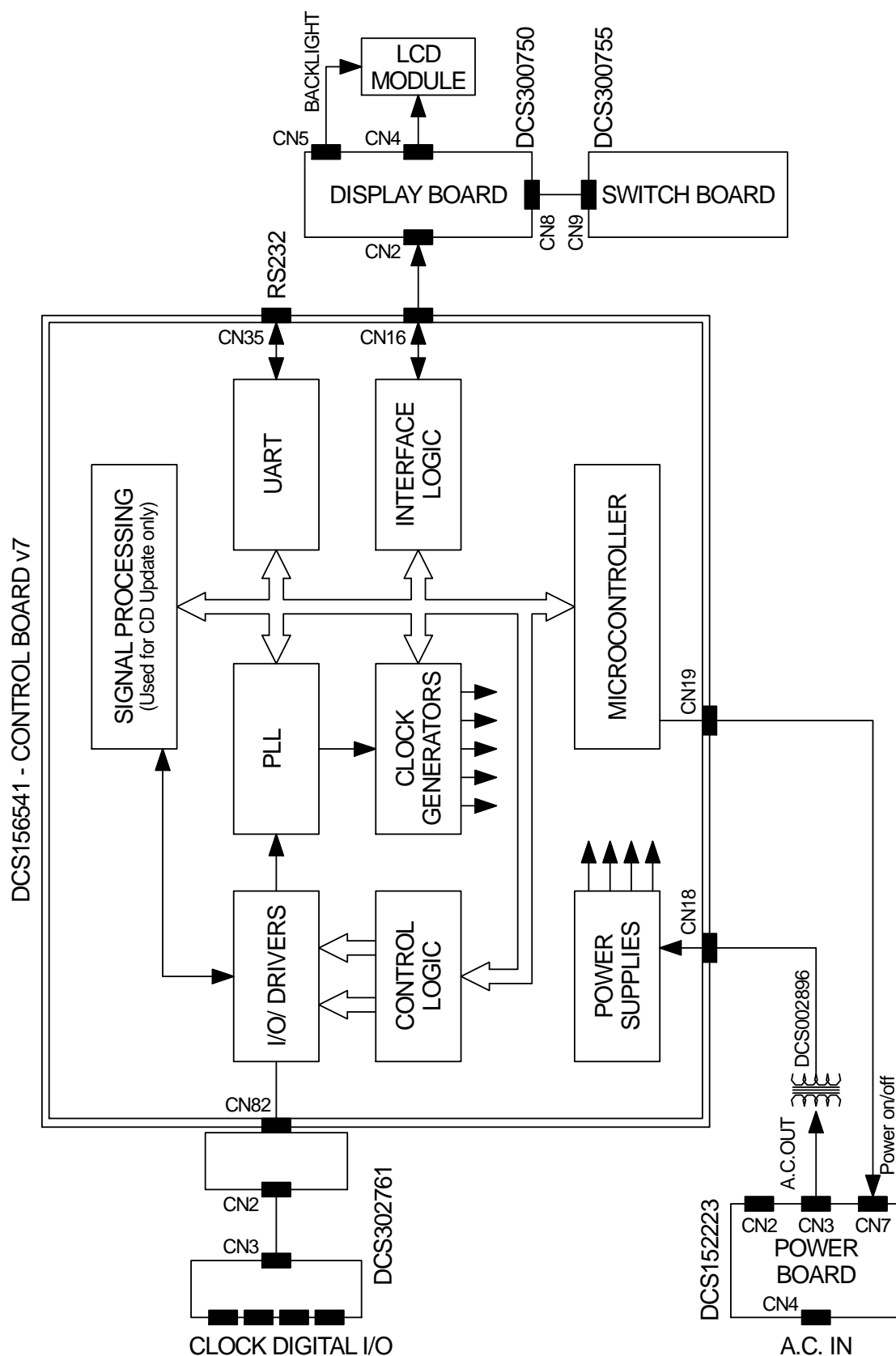
- Check that the clocking arrangements are consistent with the data rate (Golden Rule 2).

Further tests

In most cases, the above information will be sufficient to get an unresponsive unit up and running, or indicate a serious fault on the Control Board – which is normally dealt with at *dCS*.

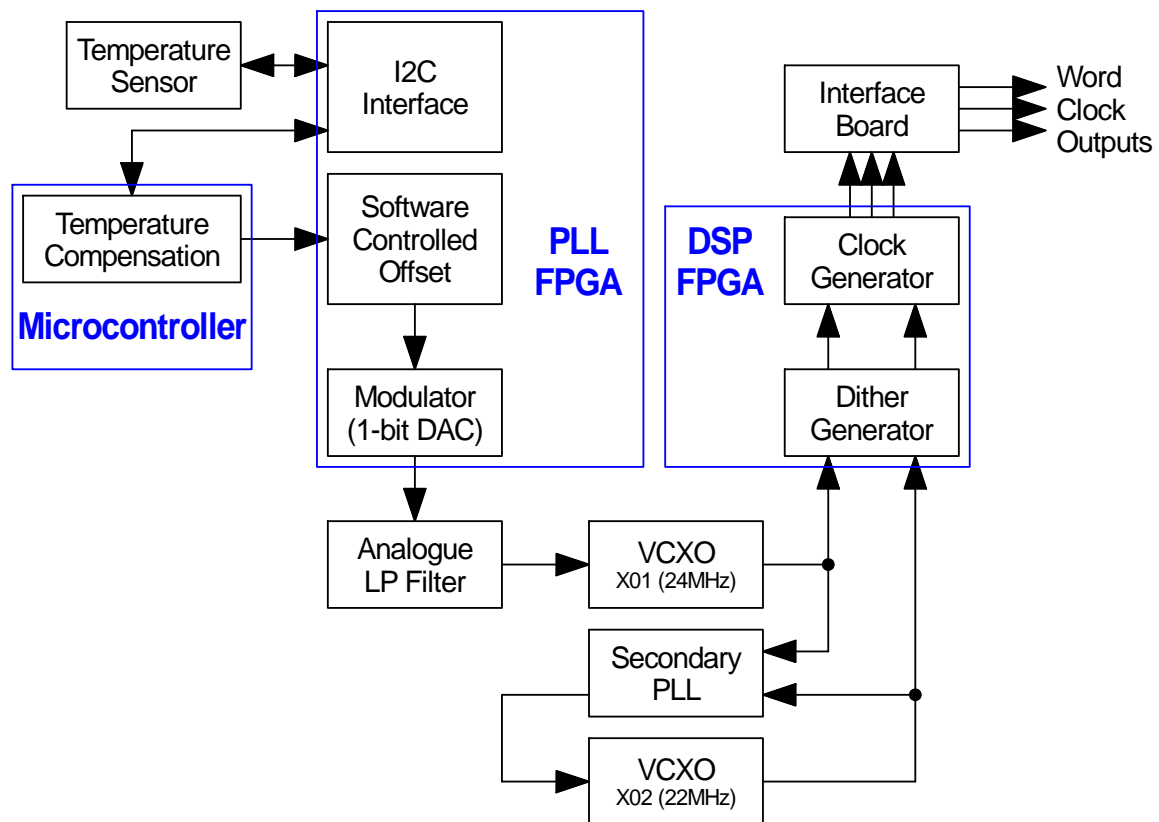
If the Display Board is not working correctly but the unit is still working correctly as a Transport, please refer to the **Display Board Service Manual**. Note that an intermittent ribbon cable connection to the Control Board is a fairly common cause of Display Board problems.

BLOCK DIAGRAM

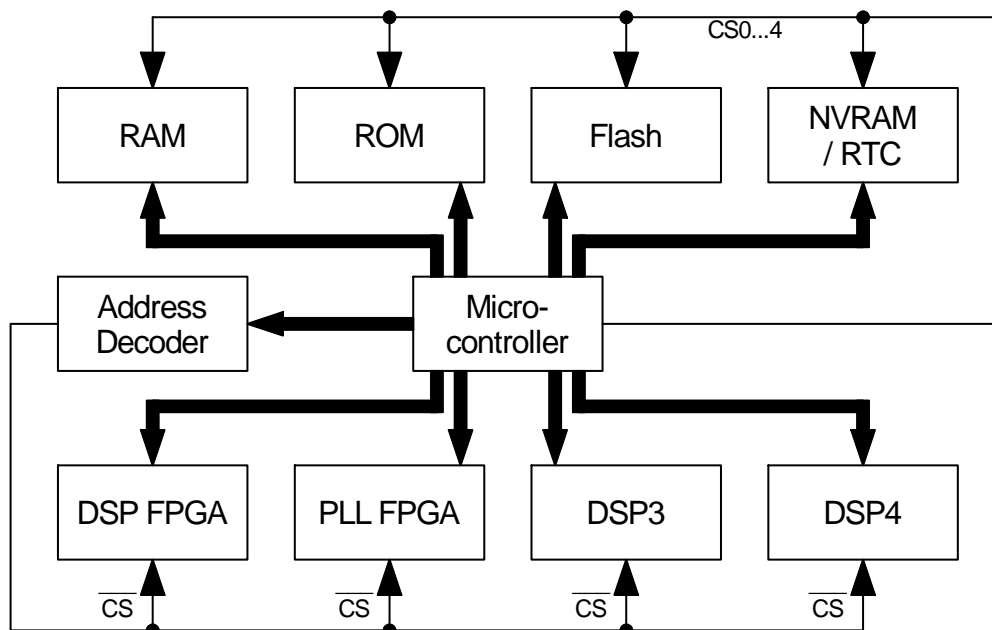


SIGNAL PROCESSING PATH

Internal Reference Generator



UA & UD



CD UPDATE PROCEDURE



The *Paganini Clock* software is still at version 1.00 at the time of writing, so no update CDs have been issued. When an update is issued, follow the instructions provided with the disc. The procedure below is given for reference only.

Please read these instructions through fully at least once before attempting the update.

Update Procedure

- Mute your power amplifier.
- Load the dCS Update CD into the Transport, **PLAY** the disc for about 10 seconds and then press **STOP**. The disc must **not** be playing at this point.
- If necessary, disconnect the cable to the Transport's Word Clock Input.
- Connect the Transport's RCA output to the *Paganini Clock's* SPDIF Input. The Clock should lock and display **00/44.1**.
- Open the *Paganini Clock's* menu by pressing the **Menu** button on the front panel. Press the **Menu** button again to select the **Information** menu. Press the **→** button 3 times to highlight the **CD Update** page and press the **Menu** button to start the update. The display sequence is shown below, with approximate times.

00:00 **Please wait - Please start CD** are displayed in sequence.

Press the Transport's **Play** button. The update is largely automatic from this point.

00:15 **Scanning – OK** are displayed in sequence.

If there is anything wrong with the dCS CD that has been loaded, or it does not match the product, or the new software will not run without a hardware update, the unit will display **Wrong Disc!** and revert to normal operation. Don't worry – the internal software is unchanged. If either of the above cases occur contact your dCS distributor or dCS.

00:35	Ver 1.00	(or later)
01:25	1/32	The first block of data is read from the disc.
02:25	2/32	The second block of data is read ...
...		
33:25	32/32	The last block of data is read.
34:15	Please wait	DO NOT switch off. The unit reboots.
34:20	Paganini Clock	DO NOT switch off.
35:50		The unit reboots.
36:00	00/44.1	The unit finishes uploading the new software.

- Switch the *Paganini Clock* off (NOT just to sleep mode), wait 10 seconds, then switch on again. Disconnect the cable to the Clock's SPDIF Input. Your *Paganini Clock* is now ready for use.

Problems?

- If the display does not change for more than 5 minutes or there is a power failure, switch off the unit at the rear panel switch, wait 10 seconds, then switch on and start the update again.
- If the disc skips or you accidentally advance the transport, the unit will display **Skipped!** Switch off the unit at the rear panel switch, wait 10 seconds, then switch on and start the update again.
- If the **Non Seq** message appears on the display, the most likely cause is that the CD is faulty. There is no cause to worry as the original software is backed up inside the unit. Check the disc for dirt or damage. If the disc appears to be dirty, wipe it gently from the centre outwards with a dry soft cloth. If the disc is damaged, contact your local dCS distributor or dCS for a replacement. If it appears to be OK, run the **CD Update** routine again (once only) to load the new software.



If the *Paganini Clock* starts up correctly but has a problem of some kind, do not repeatedly CD Update as this cannot solve the problem.

RE-LOADING SOFTWARE FROM ROM

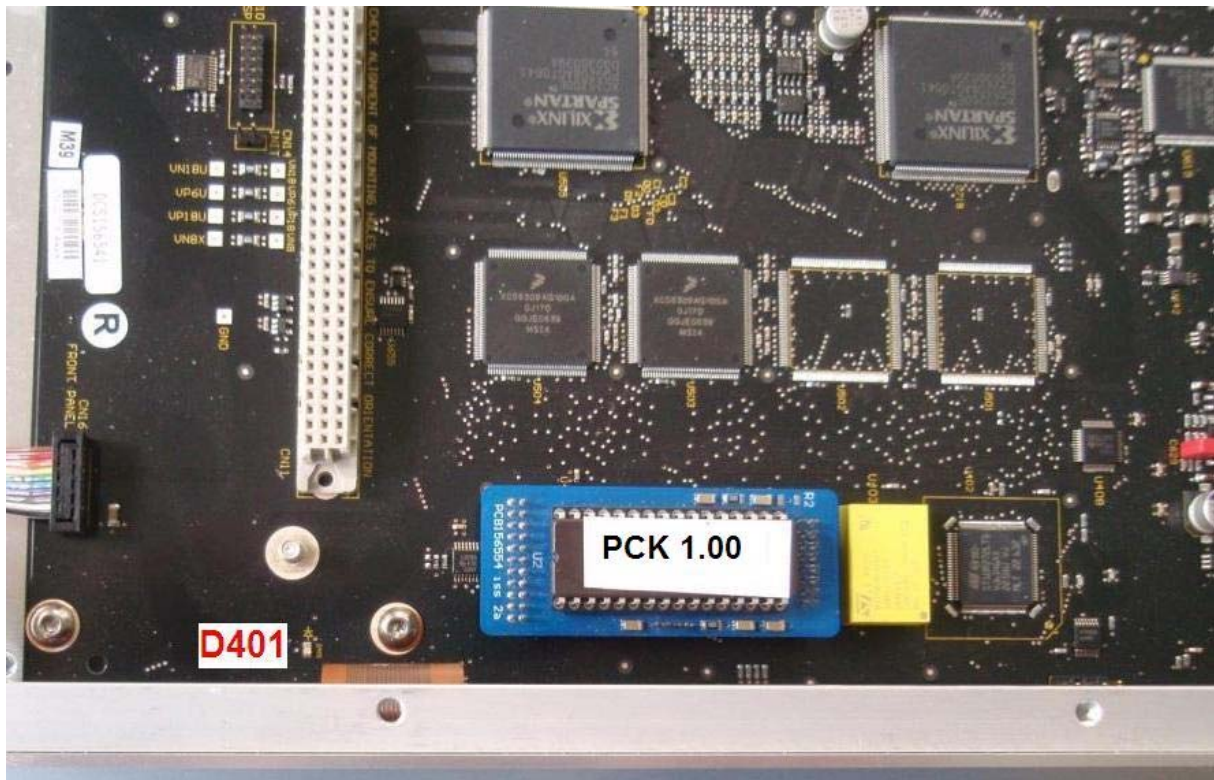
Normally, software can be updated from CD without opening the case, provided the unit boots up and runs correctly.

Occasionally, the software stored in the flash memory becomes corrupt, usually as a result of a power failure or user error while CD Updating. There is also some evidence that nearby electrical storms can do this. If the software has become corrupt, it is necessary to reload the unit from a ROM. To do this, you will need a DCS156554 programmer board and a ROM labelled "**PCK**" which is loaded with the *Paganini Clock* software. You can load an older version from ROM and then CD Update to the current version if necessary.

- Power the unit up and then pull out the power cable.
- Open the case, disconnect the Display Board ribbon cable and remove the top cover.
- Fit the **PCK** ROM to the socket in the programmer board, ensuring that the notched end is beside the "U2" label.



- Fit the programmer board onto the 3 headers near the edge of the Control Board, as shown below, making sure all pins fit into the sockets on the underside of the programmer board.



- Connect the power cable.

The Control Board will power up, red LED D401 will flash once and LEDs elsewhere on the board will turn on.

The loading process takes several minutes, please be patient. When it is complete, the red LED D401 will start flashing steadily.



If D401 is still off after more than 10 minutes, the software has failed to load for some reason. Pull out the power cable, make quite sure the programmer board and ROM are correctly seated and repeat the process.

- Disconnect the power cable.
- Remove the programmer board and ROM, put them somewhere safe in anti-static packaging.
- Reassemble the unit, remembering to connect the Display Board cable.
- Open the menu and check that on the **Information / Version Information** page, the **Control version** matches the ROM issue. It may be necessary to CD Update the unit.
- Check that the unit is operating correctly.