

dCS Puccini U-Clock

Service Manual

September 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

Data Conversion Systems Ltd. accept no liability for any kind for loss, accident or injury resulting from service activities.

Confidentiality



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UNIT DESCRIPTION



The *dCS Puccini U-Clock* is a Grade 1 digital audio master clock combined with a USB to SPDIF converter. The unit is intended for use with a *Puccini Player*, but it is suitable for use with other products.

The *U-Clock* is deliberately simpler (and less expensive) than our other products. It does not have a Control Board, so it has no menu, it cannot be CD Updated, it has no remote control facility and the front panel is very simple.

The key features are as follows.

- 4 industry standard Word Clock outputs on BNC connectors.
- 44.1 or 48kHz output frequencies, accurate to better than 1ppm (typically 0.1ppm when shipped).
- Single oven-controlled crystal oscillator.
- "Dither" feature exercises the receiving device's PLL to improve lock accuracy.
- The USB input accepts PCM data up to 24 bits / 96kS/s (**PUU** version) or 192kS/s (**PUC** version) streamed from a PC (Windows XP, Vista or 7), Apple Mac (OSX) or a sound server.
- The USB interface operates in asynchronous mode and is clocked by the Clock section, breaking the link to the computer's jittery clock.
- The PCM data is converted to SPDIF format and output on each of two RCA connectors.
- Software may be updated (or the unit re-booted) from a ROM, this involves opening the case.
- All-aluminium case.

In May/June 2011, the U-Clock's USB interface hardware was upgraded to accept data sampled at 176.4 and 192kS/s. The new hardware requires software issue 2.00 or later to run. The serial number for v1 units starts with **PUU**, the serial number for v2 units starts with **PUC**.



A hardware upgrade is required to convert from PUU to PUC (see page 20.)
Do not load software issue 2.xx into a PUU unit.

HARDWARE AND SOFTWARE HISTORY

Hardware History & Configuration Code

The long version of the *U-Clock* serial number appears on the packaging label and is kept electronically at dCS. 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 *Puccini U-Clock* with serial number PUU-0S4-1B1-1A1-1B2-1A4-6309.

A typical serial number	This code group means:
PUU	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.
0S4	OPTIONS CODE. First character = product options. Second character: B = Black, S = Silver. Third character = voltage setting: 1 or 2 = 100-120V, 4 or 5 = 200-240V.
1B1	CLOCK MAIN BOARD CODE. The build standard of the Clock Main Board.
1A1	TOP BOARD CODE. This slot is used for the build standard of the USB Board.
1B2	DISPLAY BOARD CODE. This slot is used for the build standard of the Clock Connector Board Set.
1A4	CASE & BASE CODE. This covers the build standard of the case parts, mains transformer, back panel wiring and anything else.
6309	WORKS ORDER NUMBER. Each unit has a unique serial number.

Software History

PUC

The latest software issue should be loaded in all PUC units.

June 2011 v2.00 – USB interface upgraded to operate in either Audio Class 1 mode (sample rates up to 96kS/s without special drivers) or Audio Class 2 mode (sample rates up to 192kS/s, *dCS* drivers are required for Windows, no special drivers are required for Mac OSX 10.6).



PUU units are not compatible with software issue 2.0x.

PUC units are not compatible with software issue 1.0x.

The hardware may be permanently damaged if the wrong software is loaded.

PUU

- October 2010 v1.04 - Allows manual override of USB-defined clock frequency. Improved behaviour with WASAPI. Improved behaviour switching sample rates when used with Puccini Player V1.21. **This issue should be loaded in all PUU units.**
- February 2009 v1.03 - Corrects a bug found on a small number of units that causes the clock to drop out periodically.
- January 2009 v1.02 - Corrects a bug which causes locking problems on some units when Dither is On.
- October 2008 v1.01 – This is the first issue.

The current software issue can be read from the Windows Control Panel when the U-clock is connected to a PC via the USB interface.

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. (This does not apply when the U-Clock is used with the Player only.)

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).
- 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 unit fails to respond to the controls

- PUU units: While the USB interface is active, the Frequency button is disabled, the 44.1kHz AND 48kHz LEDs are on and the unit automatically selects the clock frequency to match the received PCM data. Update to issue 1.04 to correct this – it allows the Frequency button to override the automatic frequency setting..

Symptom: The USB interface in a PUC unit will not operate

- Make sure the computer is set up correctly and is running a streaming program. Please refer to the latest version of the *dCS Guide to Computer Audio*, which can be downloaded free from www.dcsLtd.co.uk/page/support.
- PUU units or PUC units set to Audio Class 1 will not accept data sampled at 176.4 or 192kS/s from the USB input.
- PUC units set to Audio Class 2 will not lock to Windows XP/Vista/7 PCs unless the *dCS* USB drivers have been installed. Note that PUC units are supplied set to Class 2.
- For Windows XP/Vista/7 PCs, make sure that the Windows version is up to date.
- For Mac OSX 10.5 PCs, USB Class 2 is not supported. Upgrade to OSX 10.6.
- If 176.4 or 192kS/s files cannot be played, make sure the U-Clock is set to Class 2 Mode.

Symptom: The Clock will not lock to an external reference source

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

Symptom: Other dCS DACs fail to lock to PUC receiving 176.4 or 192 data

- If a Scarlatti DAC or Paganini DAC cannot lock to these rates, update the DAC software to 1.20 or later.
- At the time of writing, the SPDIF inputs on the dCS Debussy DAC is limited to 96kS/s maximum.
- The SPDIF inputs on the Elgar, Elgar Plus and Delius DACs are limited to 96kS/s maximum.

Symptom: The Puccini Player will not lock to the U-Clock's SPDIF outputs at 176.4 or 192kS/s

- *Puccini Players* loaded with software issues up to 1.21 have SPDIF inputs limited to 96kS/s. Compatibility with 176.4 and 192kS/s data is added in *Puccini Player* software issue 1.30.

Symptom: Playing a 24-bit file, the Player or DAC reports 16 bits

- Make sure the computer is set to output 16-bit data. If so, the Player or DAC is almost certainly correct.
- If the file is in the iTunes library, select it, click on **File > Get Info** and check that the word length is actually 24 bits. Most other streamer programs can be set to display Bit Depth. There have been many instances of files sold as 24-bit actually containing only 16-bit data. If the file has been mis-sold, contact the file supplier.

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.
- Nut spinners / socket spanners: 5.5mm A/F.



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



Remember to observe anti-static precautions when dismantling.

Opening the case

Remove the 2 large screws from the back panel, indicated by red blobs below.



Remove the screw on each side plate that is nearest to the back panel.

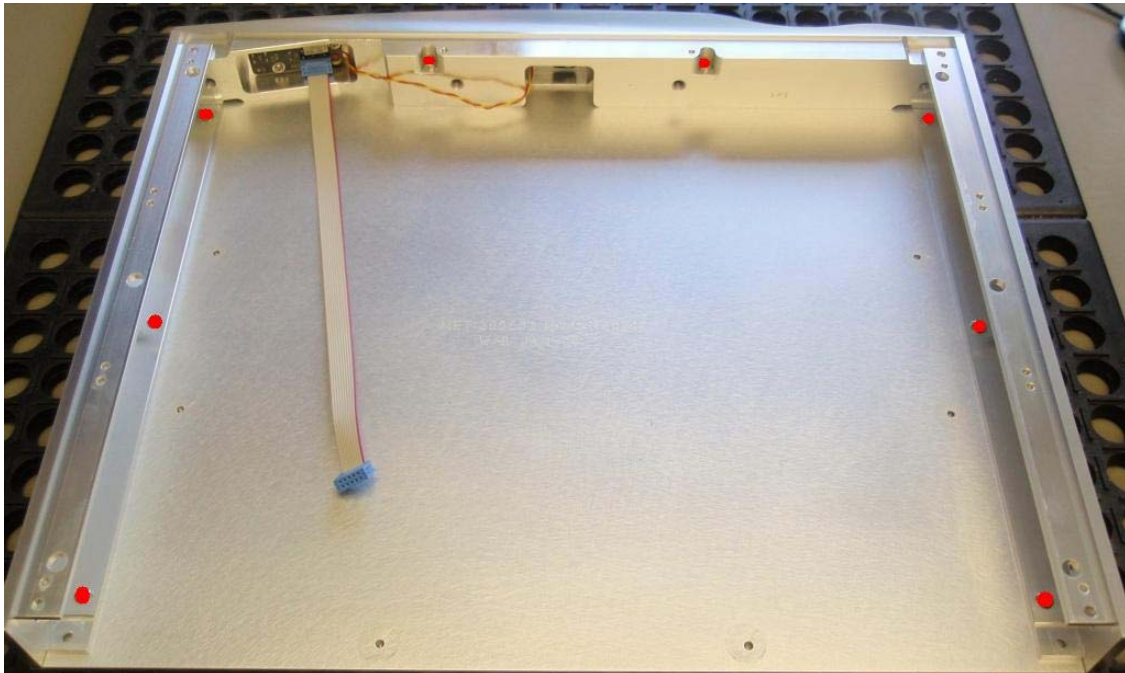


Turn the unit over. Remove the 10 screws indicated by red blobs in the picture below.



Slide the base plate backwards, disconnect the ribbon cable linking the front panel to the base plate and lift the base plate clear.

To detach the top panel, remove the 3 screws at each side and the 2 screws at the front as shown by red blobs below. Slide the top plate back to disengage the "tongue" from the front panel and lift it clear.

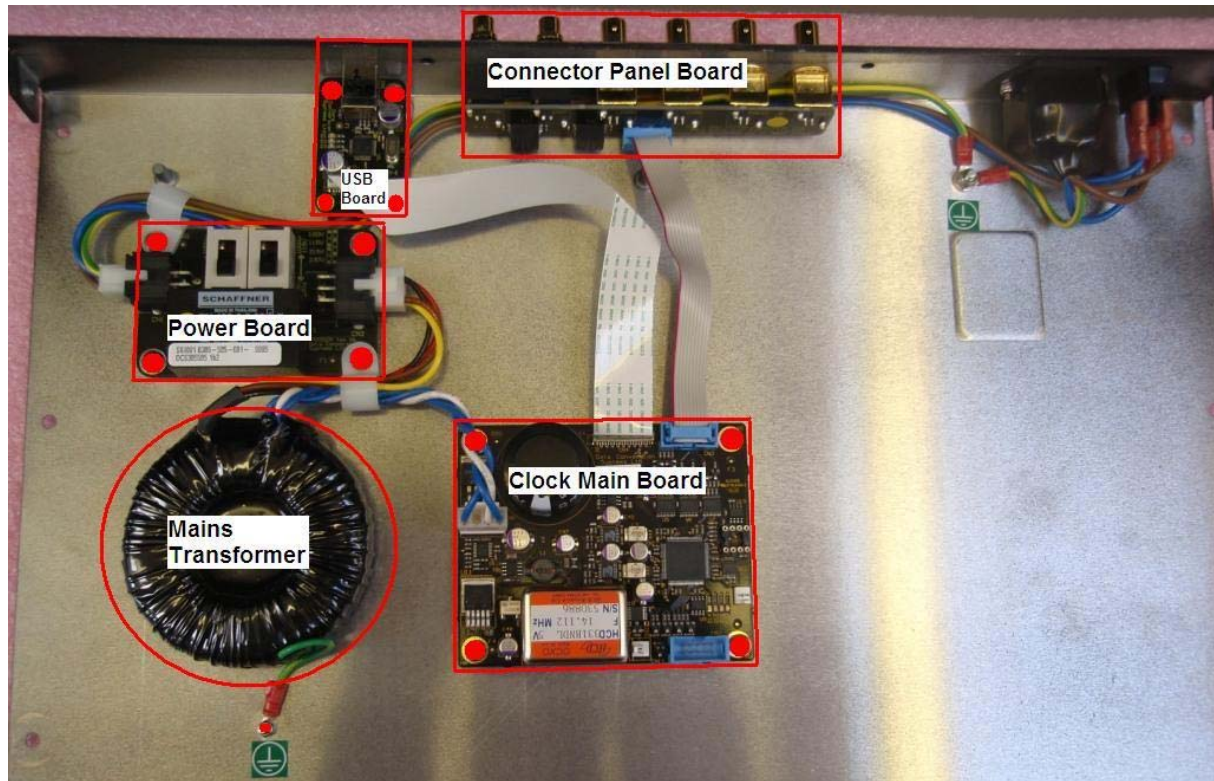


To detach the front panel from the side plates, remove the screws from the top corners of the front panel.

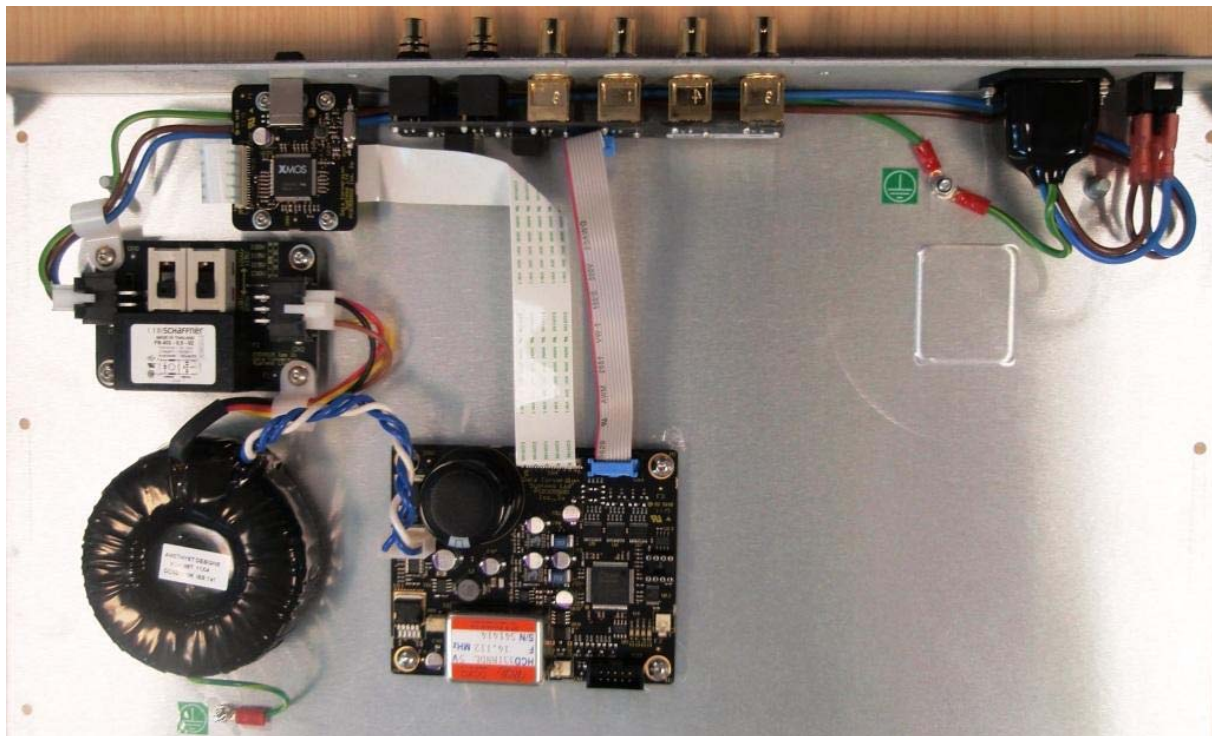
Identification of the sub-assemblies

The fixings are indicated by red dots.

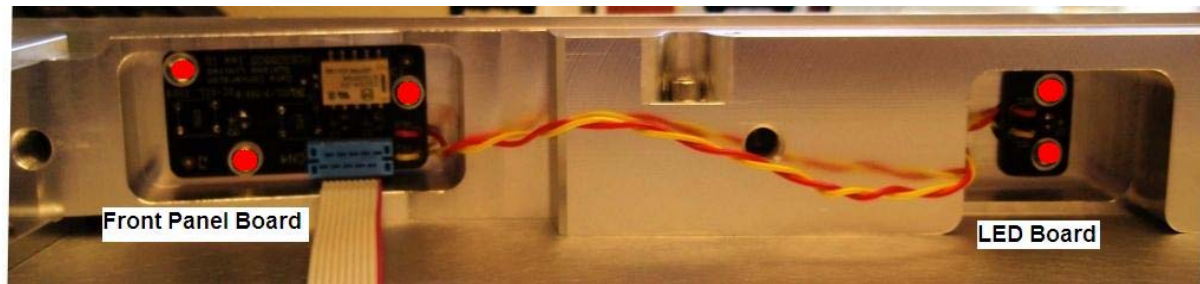
PUU chassis



PUC chassis



Front panel boards



Removing sub-assemblies

The **Power Board** is fixed by a screw at each corner. Disconnect the two cables first.

The mains **Transformer** is fixed from the underside by a single screw. Disconnect the cables from the Power Board and Clock Main Board, then detach the green/yellow screen wire from the base plate.

The **Clock Main Board** is fixed by a screw at each corner. Disconnect all cables first.

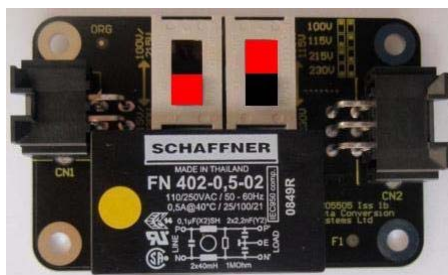
The **Connector Panel Board** is fixed to the back panel by the nuts on the connectors themselves.

The **Front Panel Board** is secured to the back face of the front panel by 3 screws and washers, the small LED board by 2 screws and washers. The 2 boards are joined together by 2 wires.

The **USB Board** is mounted on 4 pillars (possibly 3 pillars on some versions). Disconnect the Flat Flex Cable (FFC) first.

Changing the voltage setting

The supply voltage is set by 2 slide switches on the Power Board.



100-120V setting



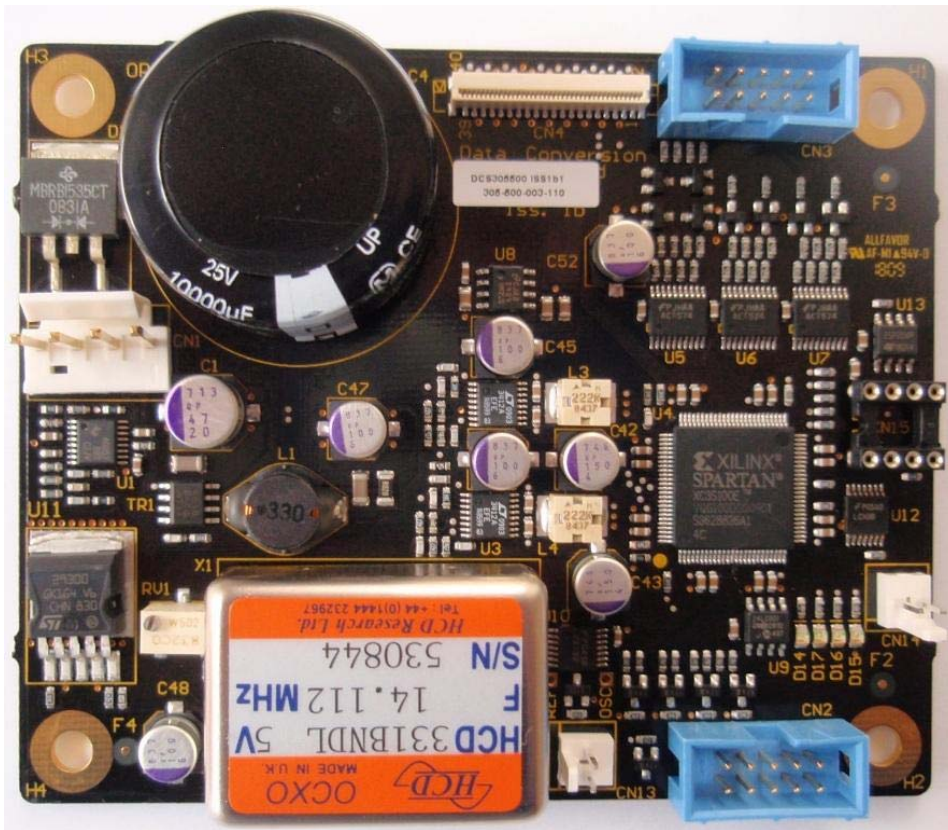
200-240V setting



Severe damage will result if the unit is set for 100-120V but supplied with 200-240V. The unit will not operate correctly if it is set for 200-240V but supplied with 100-120V. Make sure the voltage setting is correct.

SUBASSEMBLY DETAILS

Clock Main Board DCS305500



The Clock Main Board is the heart of the unit.

AC from the mains transformer connects via CN1 and is converted to approximately +12V DC by D1/C4. Switch-mode regulators U1, U2 & U3 convert this to +5.5V (VP6), +3.3V (VP3) & +1.2V (V1P2). Linear regulators U8 and U11 convert VP3 to +2.5V (V2P5) and VP6 to +5.0V (VP5).

At power up, FPGA U4 downloads configuration code from the flash memory U13. OCXO X1 warms up to running temperature and generates a stable 14.112MHz signal, which is divided down to either 44.1 or 48kHz by the FPGA as required. EEPROM U9 stores the last frequency setting – this frequency is re-loaded at power up. CN13 is the reference input, used during calibration at *dCS* only.



The OCXO is manually calibrated at the factory by adjusting trimmer RV1.
Do not interfere with RV1 as this will spoil the accuracy of the clock.

The FPGA drives the front panel LEDs and reads the switches via CN2. The FPGA controls the USB Board, accepts data from it via FFC connector CN4 and converts the data to SPDIF format. Ensure the FFC is fitted with the metal contacts away from the board edge. SPDIF outputs & Word Clock outputs are buffered/re-clocked by U5 & U6/U7, then conveyed to the Connector Panel Board via CN1.

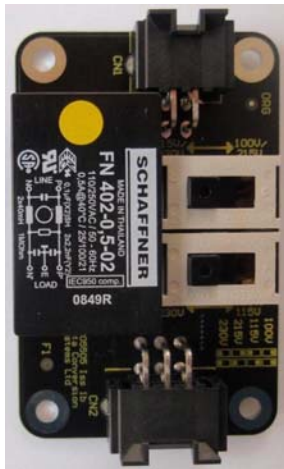
The flash chip U13 may be re-programmed by temporarily fitting a suitable ROM in socket CN15 and fitting a jumper to CN14. See page 19 for details.

The circuit diagram file is 305500cd1b1.pdf for **PUU** units or 305500cd2a1 for **PUC** units.

The component layout file is 305500cl1b.pdf for **PUU** units or 305500cl2a for **PUC** units.

The 2 versions are not compatible and must be matched with the correct USB Board.

Clock Connector Board Set DCS305505

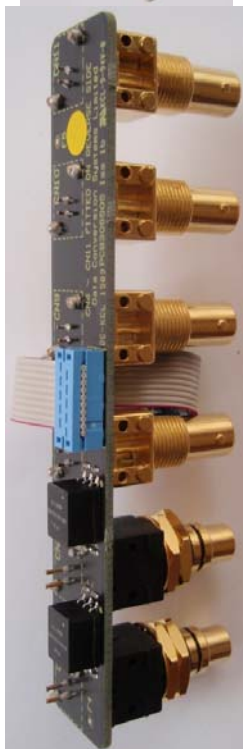


This board splits into four sections.

The **Power Board** section accepts mains on CN1, which is filtered by F1 and connects to the mains transformer via CN2 and voltage selector switches SW1 & SW2. The board makes provision for 4 voltage settings, but the transformer used has only 2 settings. See page 12 for voltage setting details.



The larger **Front Panel** section carries the 2 switches, 3 LEDs and the relay (which gives the user tactile feedback when a switch is pressed). Ribbon cable CN4 connects to CN2 on the Clock Main Board.



The smaller **Front Panel** section carries the LED in the centre of the front panel. It connects to the larger section by 2 soldered wires.

The **Connector Panel** section carries the four Word Clock Output BNC connectors, the two SPDIF Output RCA connectors and the SPDIF interfacing components. Ribbon cable CN3 connects to CN3 on the Clock Main Board.

The circuit diagram file is 305505cd1b2.pdf.

The component layout file is 305505cl1b.pdf.

PUU - USB Board DCS305502 1



This is the original 24/96 version, fitted to **PUU** units.

CN1 on the USB Board accepts PCM data streamed from a computer or sound server. The interface is driven by USB chip U1, which is clocked by a 6MHz crystal oscillator, X1. The data buffer in U1 limits the data format to a maximum of 24/96. FFC connector CN2 connects to CN4 on the Clock Main Board, it connects power, control and data lines. Ensure the FFC is fitted the right way around, with the metal contacts towards U1.

The circuit diagram files are 305502cd1a1

The component layout files are 305502cl1a.pdf.

PUC - USB Board DCS305502 2



This is the later 24/192 version, fitted to **PUC** units.

CN102 on the USB Board accepts PCM data streamed from a computer or sound server. After power up, the –RESET line goes high, releasing XMOS microcontroller U103, which loads itself from the Main Clock Board via the SP interface. The interface is driven by USB chip U101, under the control of U103. Both are clocked by a 13MHz crystal oscillator, X101. FFC connector CN101 connects to CN4 on the Clock Main Board, it connects power, control and data lines. Regulator U104 generates a +1.8V rail. Ensure the FFC is fitted the right way around, with the metal contacts towards U103.

The circuit diagram files are 305502cd2b2

The component layout files are 305502cl2b.pdf.

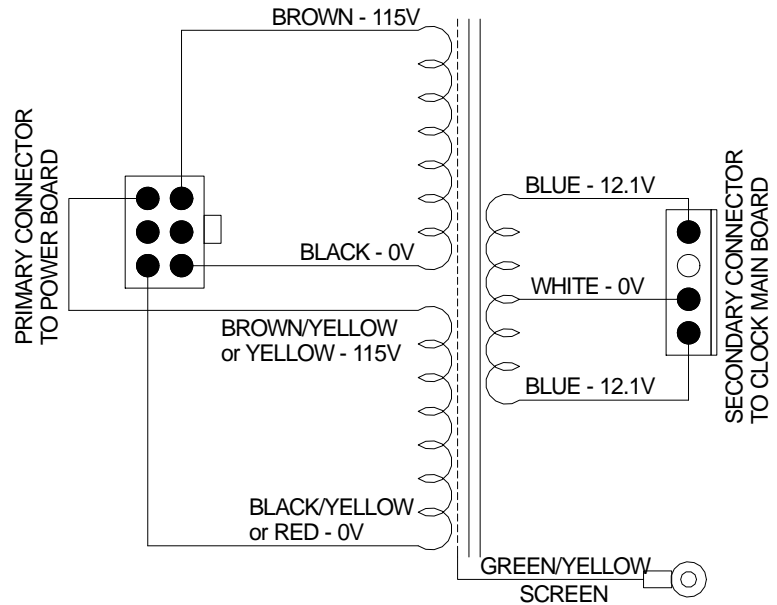
The 2 versions are not compatible and must be matched with the correct Clock Main Board.

Mains Transformer DCS305896



This transformer is used on the *Puccini U-Clock* only.

The twin primaries allow the transformer to be configured for 100-120 or 200-240V.



TYPICAL winding resistances are:

- Black to Brown or Black/Yellow to Brown/Yellow: 48 ohms
- Blue to White: 0.3 ohms

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

FAULT-FINDING

Known Faults and Solutions

Make sure the latest software is loaded.

At this time, there are no known systematic faults with the *Puccini U-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 page **12** for voltage setting details.
- The mains transformer short-circuits. This is VERY RARE, so please do not make assumptions! Test the transformer against the circuit diagram on page **15**, 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 transformer? If not, find the point at which the circuit is broken.
- Is low voltage AC reaching the Clock Main Board at connector CN1? With nominal mains voltage (230 or 115V as appropriate), the AC voltage (referred to the base plate) at pins 1 & 4 (blue wires) should be 12V rms 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 Clock Main Board Power Supply circuitry, measure the DC voltages between GND (or the base plate) and the following points around the board. Typical measurements are:

Location	DC Voltage
D1 tab	+12 to +18V
L1	+5.5V
L3	+3.3V

Location	DC Voltage
L4	+1.2V
C48+	+5.0V
U8 pin 5/6	+2.5V

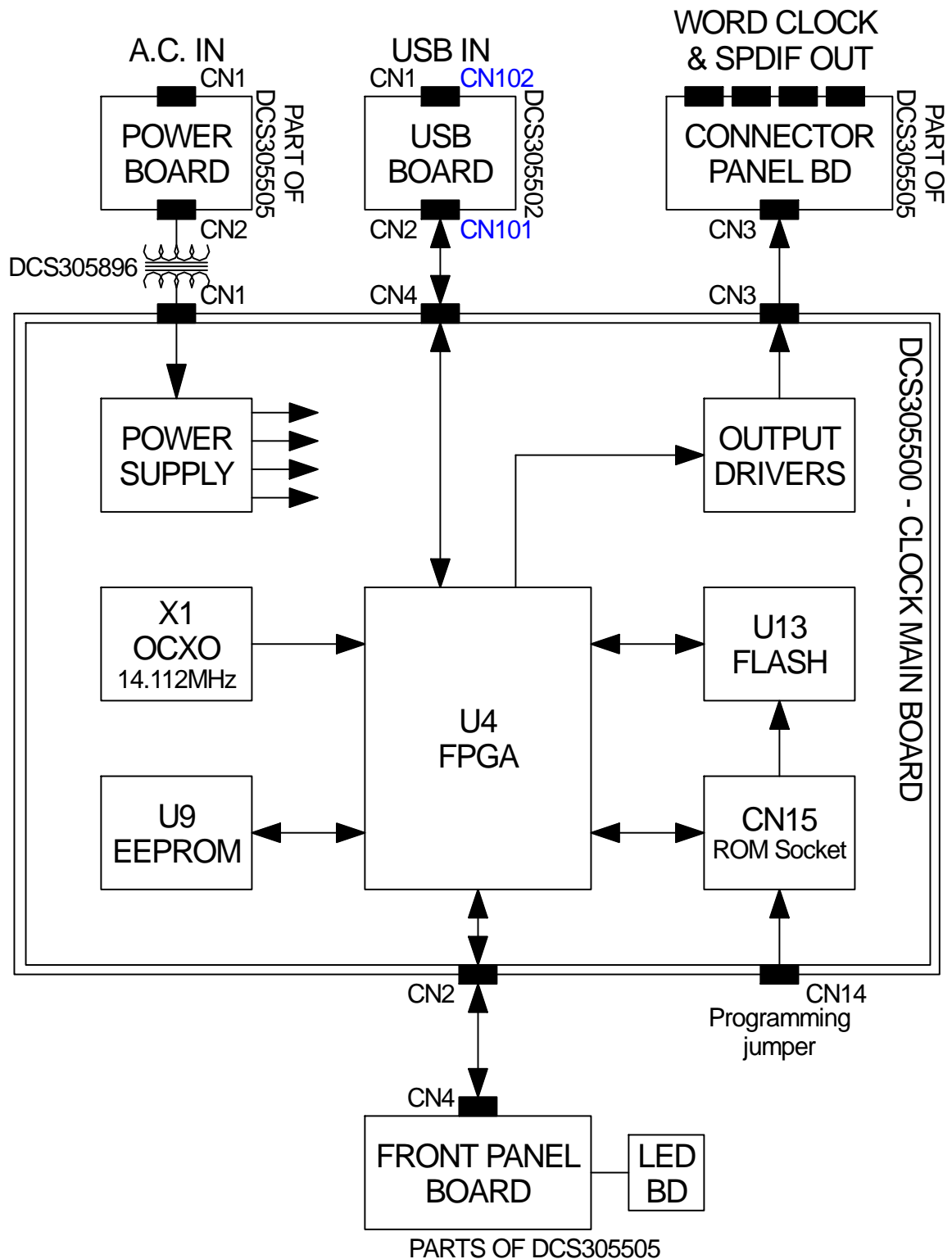
If any of these measurements are different by more than 5%, this indicates a fault in the power supply or that the power supply is being overloaded by the circuitry it is supplying. Power down, disconnect the Front Panel and USB Boards, then check to see if this has corrected the voltages.

- If power is reaching the Clock Main Board, the 4 red LEDs should be on. If this does not happen, check that a 14.1MHz clock is present at the OSC test point. If it is not, contact dCS for advice.
- If all else is well, but the unit is not operating, try reloading the software from ROM, as described on page **19**.

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 Clock Main Board – which is normally dealt with at dCS.

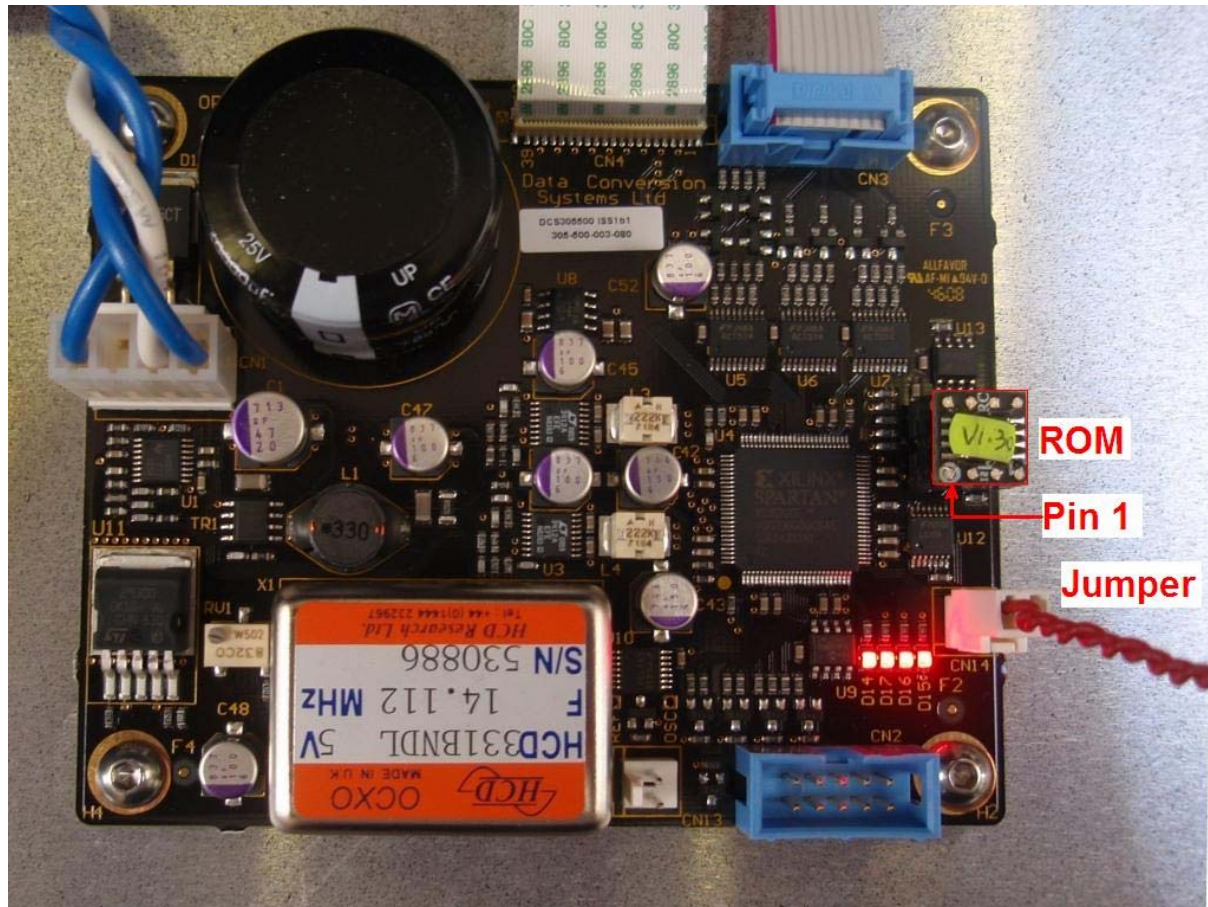
BLOCK DIAGRAM



RE-LOADING SOFTWARE FROM ROM

If the software needs to be updated or has become corrupt, it is necessary to reload the unit from a ROM. To do this, you will need a small ROM module which is loaded with the *Puccini U-Clock* software. It should be labelled with the software issue (e.g. v1.04 for **PUU** units, v2.00 for **PUC** units).

- Disconnect all cables from the unit.
- Open the case.
- Locate the main clock board in the centre of the base plate.
- Fit the update ROM to the socket as shown below, making sure the ROM is correctly oriented - pin 1 of the ROM is identified by a white ring. Fit the jumper to CN14.



- Connect the power cable and switch on.
- The 4 red LEDs near CN14 should illuminate, remain on for about 90 seconds and then turn off. The update is complete.



If the 4 LEDs remain on for longer than 2 minutes, something is wrong. Check that the ROM is correctly inserted into the socket. Note that the ROM may be permanently damaged if it has been fitted the wrong way around.

- Switch off, disconnect the power cable. Remove the update ROM and jumper, place them in anti-static packaging for later use.
- Turn the base plate over and locate it partway into the case.
- Reconnect the ribbon cable from the front panel to CN2 on the main clock board.
- Slide the base plate fully into the case.
- Replace the 10 screws on the base plate and the 2 screws on the back panel.
- Label the back panel with the new software issue as written on the ROM label (1.30 in this example).
- Check the unit for correct operation.

UPGRADING PUU TO PUC

Existing PUU units can be upgraded to PUC to extend the USB capability to 24/192. The upgrade involves replacing 2 boards, it can be carried out by dCS distributors. A kit is available from dCS for a modest charge, please quote order code **KT PUU-PUC** and state the serial number of the unit to be upgraded.

Each kit contains:

- USB Board v2 (tested)
- Clock Main Board v2 (tested)
- FFC cable
- A PUC serial number label for that unit
- dCS USB Audio Class 2 Driver disc
- Puccini Player update disc v1.30 (or later)

You will also need:

- 2mm & 2.5mm A/F Allen keys

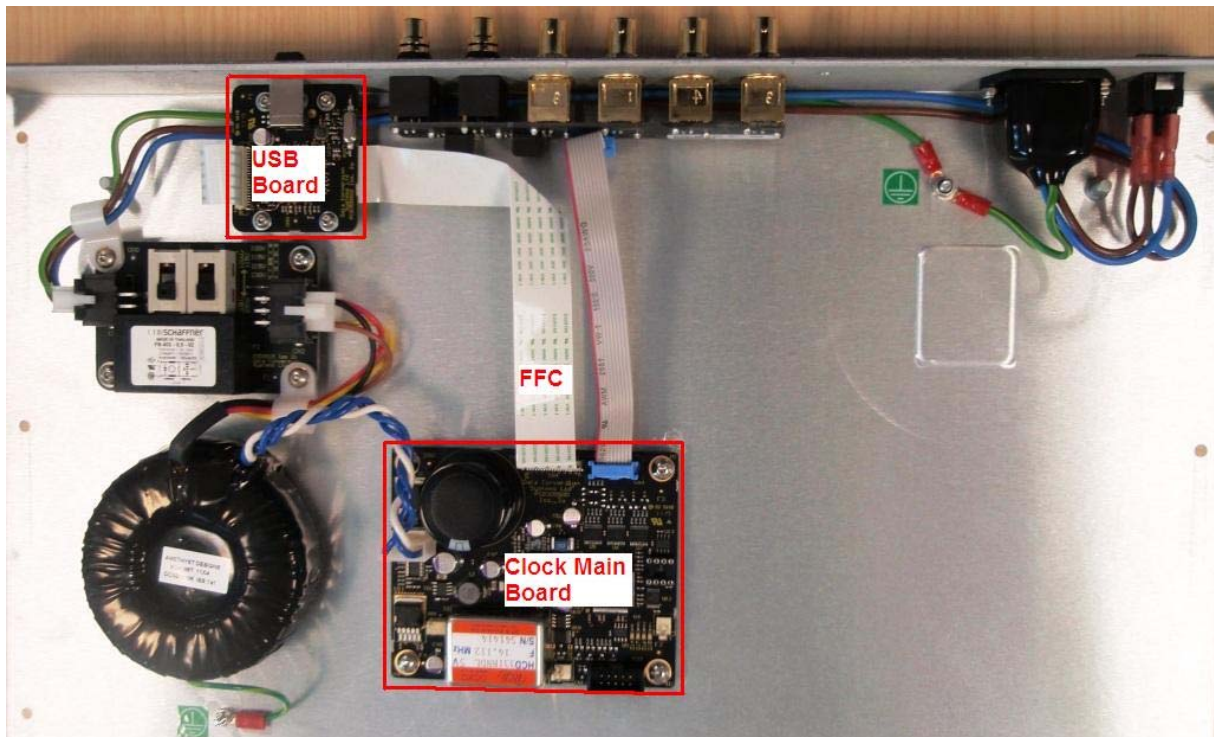


Electronic products contain static-sensitive devices which can be seriously damaged by incorrect handling. Observe standard anti-static precautions at all times.

Upgrade Procedure

Disconnect all cables and open the case as described on page 9.

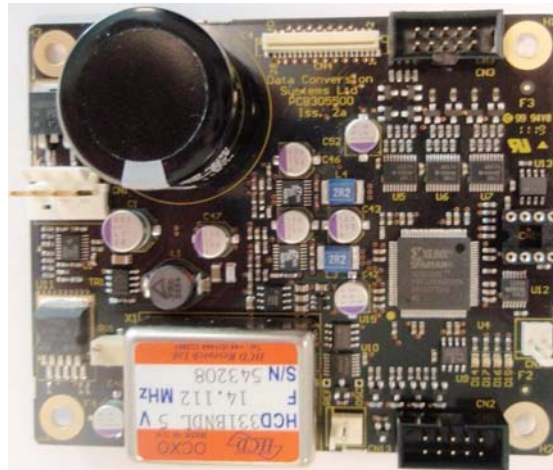
Disconnect the cables from the Clock Main Board and the USB Board then remove the 2 boards from the chassis. Pack the old boards in antistatic packaging and return them to dCS by ordinary airmail, declaring a value of GBP10.



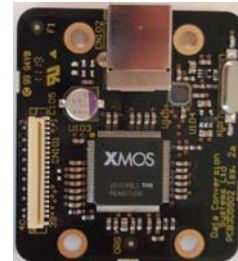
The upgrade kit has been assembled to match a particular unit. We need to keep records of which PUU units have been upgraded, so please make sure the PUC serial number label in the kit matches the unit (e.g. PUU7890 becomes PUC7890).

Please do not mix up the boards from 2 or more kits, as we log the board serial numbers against each unit.

Fit the new Clock Main Board (DCS30550 issue 2) and USB Board (DCS305502 issue 2) along with the new FFC.



Clock Main Board issue 2



USB Board issue 2

Make sure that the FFC is the right way around with the metal contacts away from the board edge. To avoid damaging the FFC, push it STRAIGHT into the connector, not at an angle.

Close the unit, remembering to re-connect the cable to the front panel.

Prise the plastic serial number from the underside of the unit, taking care not to damage the chassis. If necessary, remove any blobs of glue or pieces of paper from the chassis. Remove the backing paper from the new PUC serial number label (the number must match the original PUU serial number!), locate it on the chassis and press it down firmly.



Updating the serial number is important. Failure to do so **WILL** cause confusion and mistakes when supporting or updating the unit so **PLEASE TAKE THIS SERIOUSLY!**

The new Clock Board is supplied set for USB Class 2, so the USB interface will now operate at up to 192kS/s.

When connected to a Mac running OSX 10.6 or later, no special drivers are needed. Early versions of OSX (e.g. 10.5) do not support USB Audio Class 2 mode.



Before the U-Clock can be used with a Windows XP/Vista/7 PC, the *dCS* drivers must be loaded onto the PC from the driver disc provided. Follow the instructions provided with the disc.

Make sure that the drivers disc (with instructions) is given to the customer along with the upgraded U-Clock.

Puccini Player update

Puccini Players loaded with software issues 1.21 or early will accept single wire SPDIF data at up to 96kS/s only. To upgrade the digital inputs to accept 176.4 and 192kS/s, load the unit with software issue 1.30 or later from the Player update disc provided, following the instructions supplied with the disc.

If you do not have the Player, give the Player update disc and instructions to the customer.

If you want to set the unit to USB Audio Class 1 mode (96kS/s maximum):

Switch off the unit, wait 10 seconds then hold down the **DITHER** button while powering up. Keep the button pressed until the **DITHER** LED flashes continually, then release it. Wait until the Power LED in the middle of the panel flashes continually, switch off, wait 10 seconds, then switch on. The U-Clock is now in Class 1 mode.

You can select Class 2 again at any time by repeating this process but holding down the **FREQUENCY** button instead of the **DITHER** button.