

# ***dCS* Power Board**

## **Service Manual**

**December 2014**

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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.



Always use genuine replacement parts supplied by *dCS*.

### 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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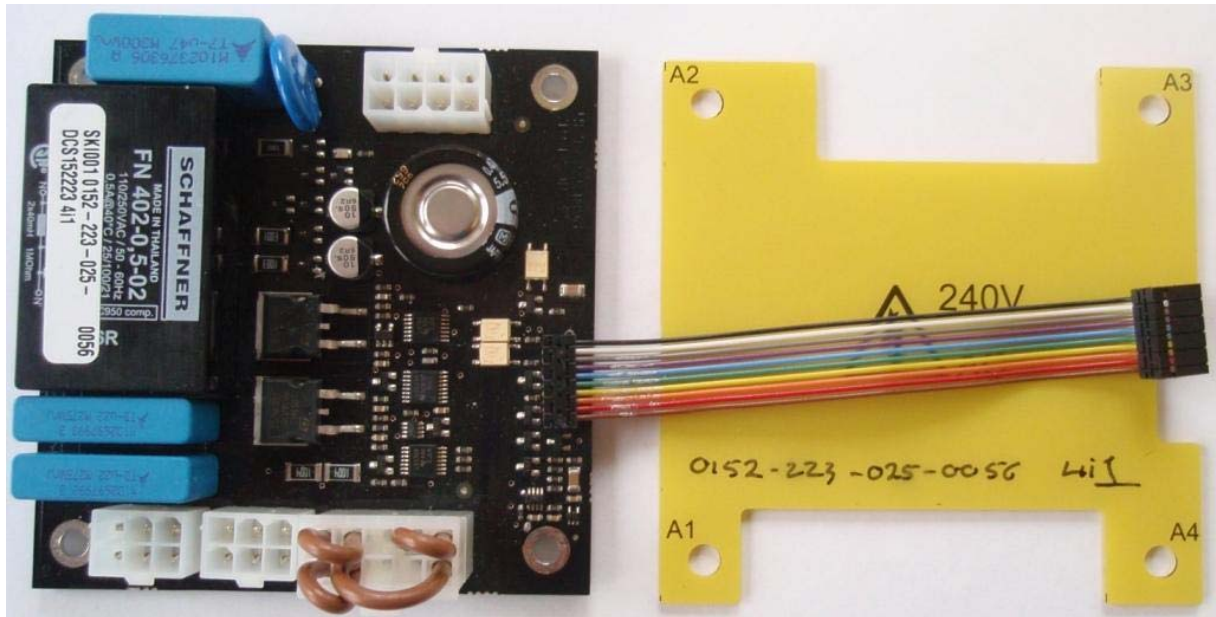
If you have received this Service Manual in error, please destroy it and inform Data Conversion Systems Ltd.

## HARDWARE HISTORY

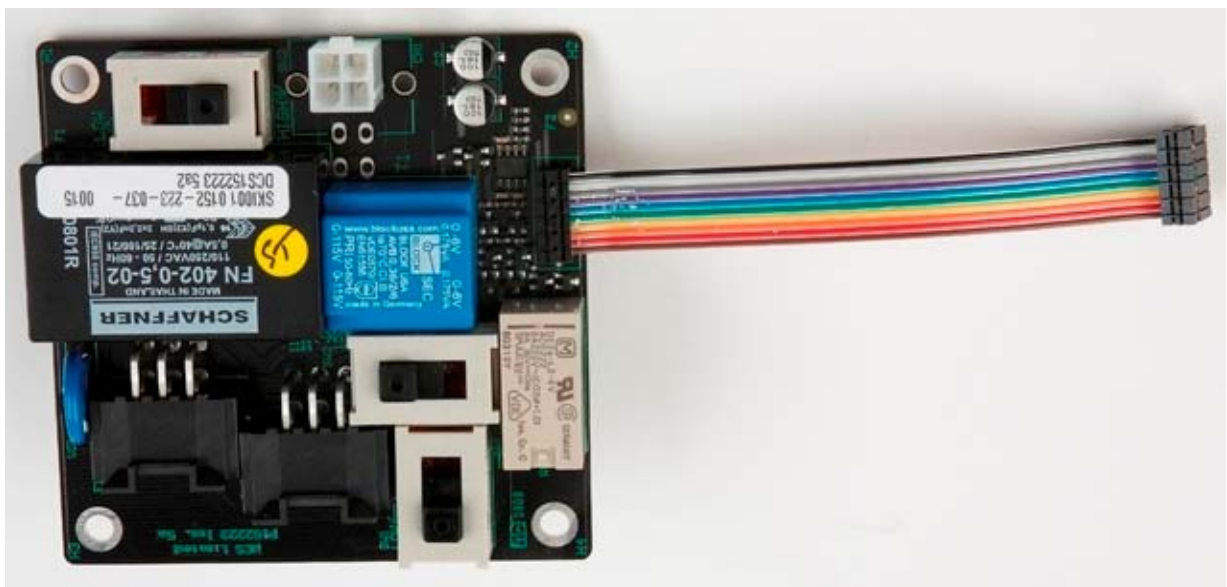
The Power Board was originally designed for the Delius DAC, it was subsequently used on Elgar Plus, Purcell, Verdi, Verdi La Scala, Verdi Encore, Verona, P8i and the Professional 9x5 range. These early versions (1a to 4i) used a pair of power MOSFETs in place of the latching relay and the mains voltage was set by changing a jumper.

Power Board version 1a was only used on early Delius units, up to serial number D04488.

A v4i board fitted with a 115/120V (brown) jumper is shown below.



The board was redesigned for Scarlatti / Paganini / Puccini / Debussy in 2006/7 to use a miniature isolating transformer and a latching relay. This approach reduces the power consumed when switched off to <1W to comply with EU legislation. Version 5a is shown below.

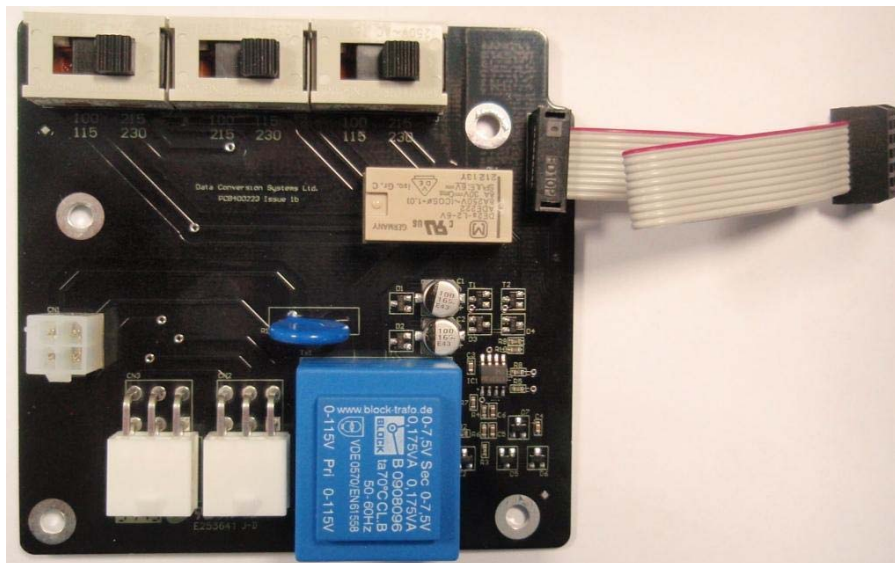


The board was updated in 2010 to version 5b, to further reduce the off-state power consumption to <0.5W. The version 5a & 5b board can be retrofitted to Classic units.

The Scarlatti Power Board design was re-arranged to suit Vivaldi in 2012.

## VIVALDI POWER BOARD

### Assembly Description



The circuitry on the Vivaldi Power is nearly identical to the Scarlatti version (see page 7), the R.F. filter is now part of the main inlet block. The board has been rearranged with the switches in a line at the back edge, so that they can be re-set from the back panel by removing the power legend plate. This version does not have a yellow safety cover.



**WARNING! Most of the circuitry on this board is directly connected to the mains inlet and constitutes an ELECTRIC SHOCK HAZARD. Disconnect the power cable from the unit before attempting repairs.**

### Drawings

Circuit diagram file: 400223cd1b1.pdf

Component layout file: 400223cl1b.pdf

### Changing the voltage setting

Please contact dCS for re-tapping details. You will need to order a new power legend plate, showing the serial number and the new voltage setting.



To avoid serious damage to the unit, make sure that all 3 switches are correctly set.

To reduce the risk of mistakes, please be sure to label the back panel with the new voltage setting.

## Known Faults & Fixes

The Vivaldi Power Board used on current products has proven to be very reliable, there have been no field faults reported since its introduction.

In the event of a power-up problem, check that all 3 switches are correctly set and that they match the voltage stated on the serial number label.



Damage caused by operation at an incorrect voltage is NOT covered by the dCS warranty.

### **Symptom: The unit switches off for no apparent reason.**

A small number of Vivaldi units built before December 2014, fitted with v1b1 Power Boards, have been seen to switch themselves off during a routine production soak test. They could be switched on again from the front panel Power button. This has not been reported from the field, but if it is suspected, modify the Power Board to v1b2 as follows:

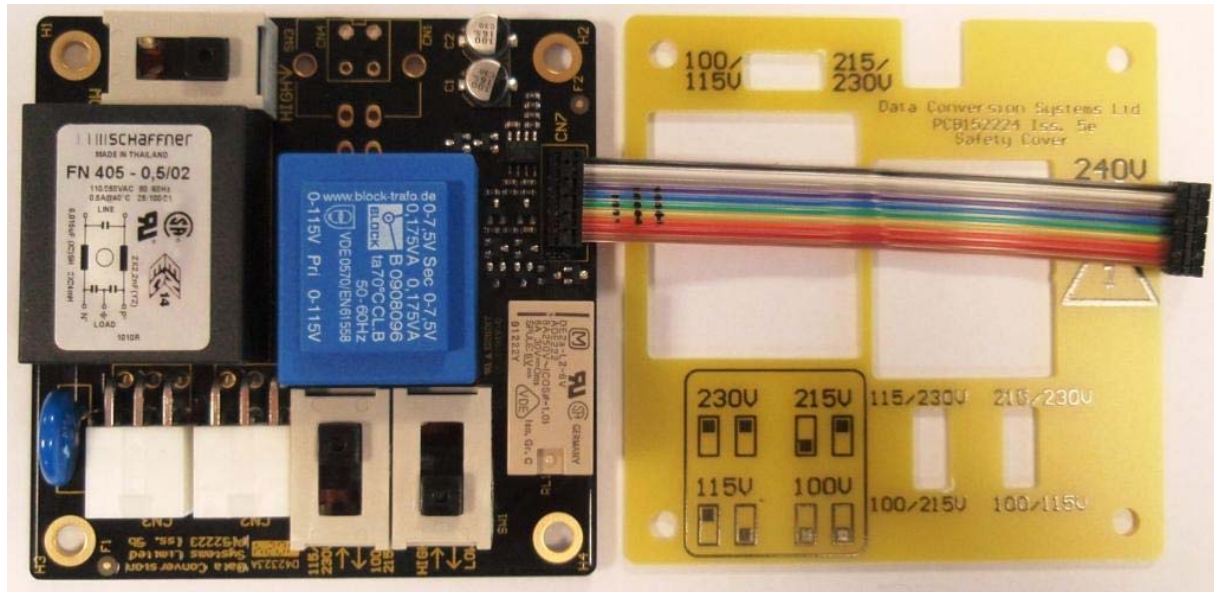
Change 0603-size chip resistors R8 and R9 from 100k $\Omega$  to 470k $\Omega$ , the part number is RES0285470.

This increases the “switch off” threshold voltage from 0.3V to 1.4V, improving the immunity to interference. This change is incorporated in version 1b2.



## SCARLATTI / PAGANINI / PUCCINI / DEBUSSY POWER BOARD

### Assembly Description



The Power Board carries mains in & out connectors CN1-4, the R.F. filter F1, mains switching relay RL1, voltage setting switches SW1-3, an isolated control circuit and a ribbon cable CN7.

The mains supply is applied via CN1 (or CN4), passes through filter F1 to surge arrestor VD1 to the latching power relay RL1 and isolating transformer T1. When the relay is on, power is applied via mains voltage selector switches SW1 & 2 to connectors CN2 & 3, which connect to one or two mains transformers to power the unit.

The primary windings of the isolating transformer are set for 220-240V or 100-120V by switch SW3. AC from the secondary windings is converted to approximately +12V DC by D1, D2, C1 & C2 to power the latching relay RL1 and the control circuit U1 (a dual comparator).

R9 & D3 provide a +3V reference to the control circuit. With the unit switched off, U1 pin 3 is biased to +0.1V, U1 pin 2 is biased to about +0.3V, so output U1 pin 1 is close to +12V. U1 pin 5 is biased positive with respect to U1 pin 6, so output U1 pin 7 is also close to +12V. POFF line CN7 pin 5 connects via the Control Board to the POWER button on the Display Board. When the POWER button is pressed briefly, POFF falls to 0V, TR1 turns on and the relay RL1 flips to the ON state. The POFF line is driven high while the unit is powered up.

Once the unit has booted up, holding down the POWER button for about 5 seconds instructs the microcontroller to drive CN7 pin 7 low and pin 10 high, TR2 turns on briefly and the relay RL1 flips to the OFF state, shutting off power to the unit.

The latching relay RL1 retains the OFF/ON setting during power failures and disconnections.

A yellow safety cover fits over the board to reduce the risk of electric shock.



**WARNING! Most of the circuitry on this board is directly connected to the mains inlet and constitutes an ELECTRIC SHOCK HAZARD. Disconnect the power cable from the unit before attempting repairs.**

### Drawings


Circuit diagram file (current): 152223cd5b1.pdf

Component layout file (current): 152223cl5b.pdf

## Changing the voltage setting

### Current version 5b

The mains voltage setting may be changed by opening the unit and re-setting the 3 slide switches on the Power Board. The switches are accessible without removing the yellow safety cover.

The switch positions are shown as  in the 4 pictures below.



**100V**



**115V (115-120V)**



**215V (215-220V)**



**230V (230-240V)**



To avoid serious damage to the unit, make sure that all 3 switches are correctly set.

To reduce the risk of mistakes, please be sure to label the back panel with the new voltage setting.




### Previous version 5a

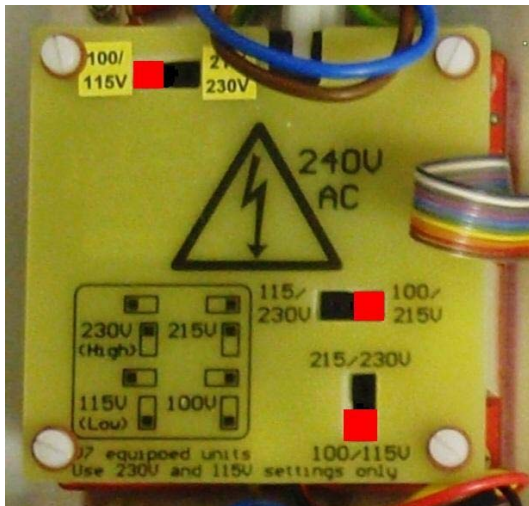
The mains voltage setting may be changed by opening the unit and re-setting the 3 slide switches on the Power Board. The switches are accessible without removing the yellow safety cover.



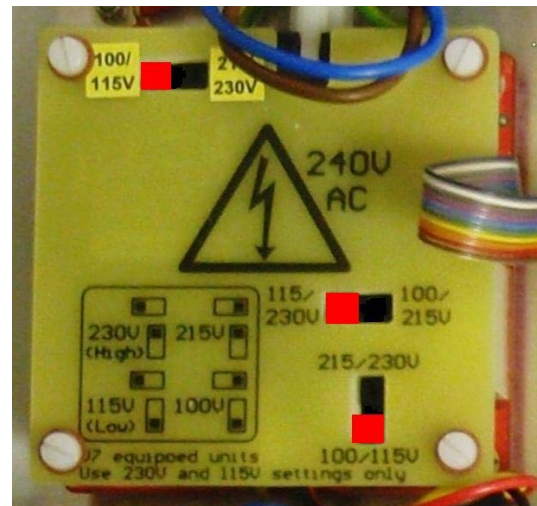
Early versions of Scarlatti, Paganini and Puccini (up to February 2008) were fitted with mains transformers with FOUR primary wires instead of SIX. This version has only 2 settings: 230V for 200-240V operation or 115V for 100-120V operation.

**If a unit of this type is set to 215V or 100V, it will not power up.**

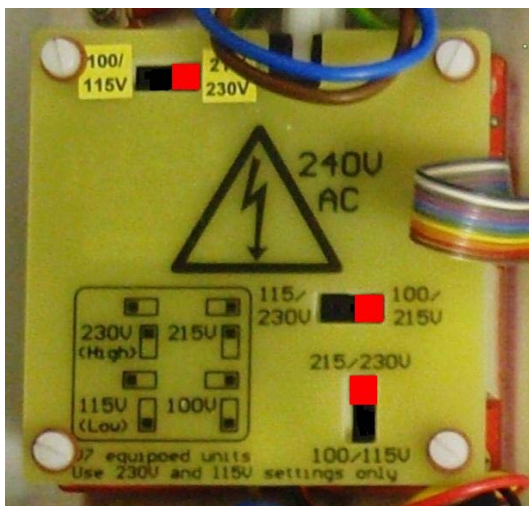
The switch positions are shown as  in the 4 pictures below.



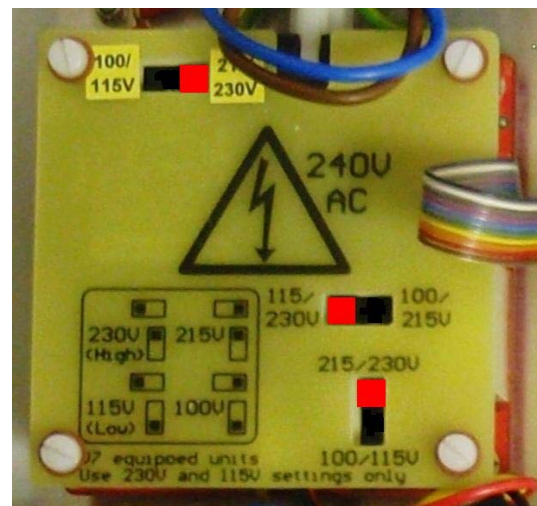
**100V**



**115V (115-120V)**



**215V (215-220V)**



**230V (230-240V)**



To avoid serious damage to the unit, make sure that all 3 switches are correctly set.

To reduce the risk of mistakes, please be sure to label the back panel with the new voltage setting.

## Known Faults & Fixes

The v5b / 5a Power Board used on current products has proven to be very reliable, there have been no field faults reported since its introduction.

In the event of a power-up problem:

- Check that all 3 switches are correctly set and that they match the voltage stated on the serial number label.
- **v5a only:** Check the that the top of the isolating transformer T1 is flat. If it has a bulge and/or turns brown, this indicates it has been connected to high voltage while set for low voltage (SW3) - the whole board must be replaced to maintain safe operation.



Damage caused by operation at an incorrect voltage is NOT covered by the dCS warranty.

## CLASSIC SERIES POWER BOARD

### Assembly Description

There are 12 different versions of the Power Board used on the Classic products, all do basically the same job. In brief:

- The mains connects to a surge arrestor and passes through an R.F. filter.
- Safe, low voltage DC for the sensing circuit is derived from one or two photovoltaic isolators, supplied from the mains via a capacitor.
- The sensing circuit uses an opto-isolator to drive the switching circuit.
- +12V DC for the switching circuit is derived from the mains via resistors and a zener diode.  
**Note that this part of the circuit is connected to the mains and is still a shock hazard.**
- The switching circuit turns a pair of power MOSFETs on/off, controlling power to the mains transformer(s).
- The rated supply voltage (i.e. the transformer tapplings) is set by a 10-way jumper, wired with coloured cable to identify the voltage range. Some versions require component changes also.
- Versions 1a (1999) to 4a (2001) connect to the Control Board via a 6-way Molex connector. Later versions use a 10-way ribbon cable.



**WARNING!** Most of the circuitry on this board is directly connected to the mains inlet and constitutes an **ELECTRIC SHOCK HAZARD**. Disconnect the power cable from the unit before attempting repairs.

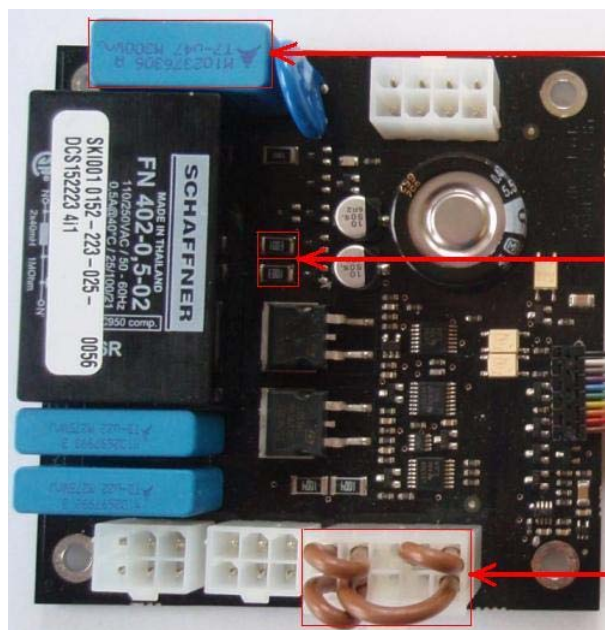
### Drawings

Circuit diagram file (final version): 152223cd4h4.pdf

Component layout file (final version): 152223cl4h.pdf

### Changing the voltage setting

Power Board versions 4f to 4i require some component changes when re-tapping between 100-120V and 200-240V:



100-120V	200-240V
Change C56 to 470nF X2 grade capacitor, part No CAP0205470.	Change C56 to 220nF X2 grade capacitor, part No CAP0205220.
Change R62 & R71 to 100kΩ 2010 chip resistors, part No. RES0685100.	Change R62 & R71 to 330kΩ 2010 chip resistors, part No. RES0685330.
Change jumper: Orange for 100V Brown for 115-120V	Change jumper: Yellow for 200V Black for 215/220V Red for 230-240V

We recommend replacing older Power Boards with version 5b, note that this requires replacing the 8-way mains input connector with a similar 4-way part (part No. CON0180420 + 3x CON0180000 crimps). Please tell us the version of the original Power Board when requesting new replacements.

To re-tap versions 2a, 3a or 4a-4d, change the jumper (part No. DCS152331 2a – state voltage).



To reduce the risk of mistakes, please be sure to label the back panel with the new voltage setting.

**Please do not try to re-wire an existing jumper, as this is difficult to do safely.**

The 100V and 115/120V jumpers designed for v1a Power Board are not compatible with later Power Boards. All v1a Power Boards should be replaced with version 5b.

Please contact dCS for advice and parts when re-tapping older versions.

## Known Faults & Fixes

Power Board versions 2a - 4i may be repaired if there is no sign that the board has been burned, but it is often more cost-effective to replace it with the current version.

### Symptom: The mains fuse blows, a replacement fuse also blows.

- Check that the voltage setting matches the local mains voltage.
- The unit may have been subjected to too high a voltage (more than 265V rms) for an extended period, causing the surge arrestor to short circuit. The surge arrestor is R66 on versions 4f-4i or R16 on earlier versions. Remove the surge arrestor and (if it is not obviously damaged) measure its resistance - a damaged part will measure less than 500kΩ. If it has failed but the Power Board is not damaged, replace the part with a new one (part No. RES2012250) and check that the unit powers up correctly. Advise the customer to check the local mains voltage and ensure this matches the voltage for which the unit is set.
- If the 2 MOSFETs TR1 & 2 show signs of overheating, replace the Power Board.
- Discharge any electrolytic capacitors on the Power Board. Check that the 3 terminals of each MOSFET are high resistance (more than 100kΩ) with respect to the others (i.e. check between terminals 1-2, 2-3, 1-3). A low resistance indicates the part has failed. If the board is intact, both transistors may be replaced (part number TRN0140002).
- Check the mains transformer for short circuits – transformer failure is very rare, so please make sure.
- There are other possible reasons for the fuse blowing that are not related to the mains voltage, the Power Board or the transformer, but these are rare and usually result in obviously burned parts.

### Symptom: The unit fails to power up, the red LED on the Power Board is off.

- Check that the fuse is intact and that power is reaching the board at CN8.
- For board versions 2a – 4d, check that the 1kΩ LED protection resistor R10 is not damaged. Usually, a damaged resistor is burned or even missing from the board. If it appears intact, disconnect power and check that its resistance is correct.
- Other possibilities are an open circuit at red LED D14 or at the LED in opto-isolator U13 (pins 2 & 3 for versions 2a – 4b, pins 1 & 3 for versions 4c & 4d).

### Symptom: The unit fails to power up, the red LED on the Power Board is on.

- Check that the Power Board, Control Board and Display Board are connected correctly.
- For versions 4f – 4i running at 100-120V, check that the board has been modified as described on page 11.
- Symptom: The unit fails to power up, the red LED on the Power Board is dim.
- Check for damage to C56 (low value) or R63.