THE SUSSEX VT1 as interpreted by Les Carpenter G4CNH

From an original design by Mike Rowe G8JVE

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The Controls:

1. Valve pin switches (SW1 to SW9), each pin of the valve holders is given an independent switch which may be set to the required supply. e.g., if pin 5 of the valve to be tested was its anode, then switch number 5 (pin 5) will be set to position 6 (Anode). The full range of selections for each switch are:-

Position 0 = open circuit
1 = Cathode
2 = Heater –
3 = Heater +
4 = Control Grid (G1)
5 = Screen Grid (G2)
6 = Anode 1 (A1)
7 = Anode 2 (A2)
8 = Diode 1 (D1)
9 = Diode 2 (D2)

2. Cathode/ Heater insulation indicator which should in normal circumstances remain extinguished unless there is a heater cathode leak in an indirectly heated valve. The only other time when it would illuminate is when testing directly heated valves; these must have their heaters connected to the Cathode line for Anode current to flow. When testing directly heated valves e.g. DF96, it is necessary to apply an external jumper between both Blue terminals.
3. Terminal posts for the application of external heater volts not provided internally by the Sussex VT1. Typical valve that would require this are the U series and octal valves like the 35L6. As mentioned in 2, the Blue terminal post must be linked to the Blue Top Cap (TC) terminal on the rare occasions when directly heated battery valves are being tested.
4. Heater Voltage switch SW10), giving the following options:-

Position 1 = External supply
2 = 1·4V
3 = 2V
4 = 4V
5 = 5V
6 = 6·3V
7 = 12·6V

5. The valve holder deck comprising of a B7G, B9A, B8A and International Octal. To cater for older valves having fewer pins, an Octal Plug adaptor is used to provide pin connection by way of miniature crocodile clips.
6. Top Cap connectors, by way of a plug/crocodile lead, allowing valve top caps to be connected to Anode (Red), Grid (Green) or Cathode (Blue).
7. Anode Voltage selector (SW11) giving the following Voltage options:-

Position 0 = 0V
1 = 50V **Note**: The 50Vposition was added later to provide extra protection when testing signal diodes.
2 = 75V
3 = 90V
4 = 100V
5 = 120V
6 = 150V
7 = 175V
8 = 200V
9 = 225V
10 = 250V
11 = 300V

8. Anode Current meter (mA) also doubles to show grid current during a Gas Test.
9. This is the Screen Grid Voltage selector (SW12) and gives the same ranges as the Anode switch (7).
10. Grid Voltage meter to indicate amount of negative bias being given to the valve under test.
11. Multi-turn Grid Voltage control giving 0 to -45V.
12. Heater continuity LED, should illuminate when the Function switch is at position 0 and a valve is inserted with the heaters correctly defined and set on the pin selector switches.
13. Inter-electrode short LED should remain extinguished throughout tests.
14. Function switch (SW14) whose actions are:-

Position 0 = Heater Continuity
1 = Anode to Screen Grid short circuit detection.
2 = Anode and Screen Grid short to Cathode detection.
3 = Test – Position for measuring Anode Current and Mutual Conductance (Gm)

15. Electrode switch (SW13) whose actions are:-

Position 1 = Anode 1
2 = Anode 2, mainly used for testing double Triodes.
3 = Diode 1 for testing diodes in multi-section valves or Rectifiers.
4 = Diode 2 for testing diodes in multi-section valves or Rectifiers.

16. Gm meter giving direct reading of Mutual Conductance as ma/V.
17. Gas test button (SW15) to check integrity of valves vacuum or internal presence of gas. In this case a meter indication of 1mA indicates a Grid current of 1µA.
18. 50mA Test button (SW16). When using D1 or D2 the current is limited to 5mA to protect signal diodes. However, when testing rectifiers used in power supplies, the button provides a limited current of 50mA.

Testing an EL34 valve:

Prior to testing a valve, ensure that the
FUNCTION switch is set to 0 (Heater continuity) and the
ELECTRODE switch is set to 1 (A1).
The remaining switches are set depending on the valve parameters.
The data for an EL34 is first found in the AVO Handbook for the CT160.

VALVE TYPE	VCM163 only		VCM.s Mk 1-4 incl and CT/VT 160		Vf	Vg1	Va	Vg2	Ia mA	gm mA/V †Ra MΩ	BASE	TYPE
	SELECTOR SWITCH	TOP CAP	SELECTOR SWITCH	TOP CAP								
EL34	128 740 310 0000	00	126 540 310		6	13.5	250	250	75	11	A08	P

Ignore the settings for the VCM163.

Set the selector switches on lower front panel to **126540310**

Set HEATER switch to position 6 (6·3V).
Set Grid voltage on top right hand meter to 13·5V using the G1V control.
Set Anode voltage switch (AV) to position 10 (250V)
Set G2 voltage switch (G2V) to position 10 (250V)

Insert valve to be tested into the octal socket and verify that the heater continuity LED above the Function switch is lit.
Check the Cathode/Heater leak LED is extinguished .
Set FUNCTION switch to positions 1and 2, checking that the Leak LED (13) remains extinguished.
IF THIS LED ILLUMINATES DO NOT CONTINUE – THE VALVE HAS AN INTERNAL SHORT!

Allow the valve to reach operating temperature, then set FUNCTION switch to position 3 (Test).
From the given AVO Handbook data figures, check the Anode current is approximately 75mA and the Gm meter shows approximately 11.

While the valve is hot, check using the Cathode/Heater leak LED remains extinguished

If required, a check for the presence of gas in the valve can be made by pressing the GAS button and noting the reading on the AI/GAS meter. As previously stated, 1mA indicates a Grid current of 1µA.

Set FUNCTION switch to 0 (Heater continuity) and allow valve to cool before removal.

Testing a double Triode valve such as the ECC83:

Ensure that the
FUNCTION switch is set to 0 (Heater continuity) and the
ELECTRODE switch is set to 1 (A1).

The remaining switches are set depending on the valve parameters.
The data for an ECC83 is first found in the AVO Handbook for the CT160.

VALVE TYPE	VCM163 only		VCM.s Mk 1-4 incl and CT/VT 160		Vf	Vg1	Va	Vg2	Ia mA	gm mA/V †Ra MΩ	BASE	TYPE
	SELECTOR SWITCH	TOP CAP	SELECTOR SWITCH	TOP CAP								
ECC82	851 228 413 0000	00	741 226 413		6	8.5	250		10.5	2.2	B9A	TT
ECC83	851 228 413 0000	00	741 226 413		6	2	250		1.2	1.6	B9A	TT

Once again, ignore the settings for the VCM163.

Set the selector switches on lower front panel to **741226413**

Set HEATER switch to position 6 (6·3V).
Set Grid voltage on top right hand meter to 2V using the G1V control.

Set Anode voltage switch (AV) to position 10 (250V)
Set G2 voltage switch (G2V) to position 0 (0V)

Insert valve to be tested into the B9A socket and verify that the heater continuity LED above the Function switch is lit. Check that the Cathode/Heater leak LED is extinguished.

Set FUNCTION switch to positions 1and 2, checking that the Leak LED (13) remains extinguished.
IF THIS LED ILLUMINATES DO NOT CONTINUE – THE VALVE HAS AN INTERNAL SHORT!

Allow the valve to reach operating temperature, then set FUNCTION switch to position 3 (Test).
From the given AVO Handbook data figures, check the Anode current is approximately 1·2mA and the Gm meter shows approximately 1·6.

While the valve is hot, check the Cathode/Heater leak LED remains extinguished

Set FUNCTION switch back to position 0 (Heater continuity).

Set ELECTRODE switch to position 2, which is the other half of the double Triode.

Set FUNCTION switch to positions 1and 2, checking that the Leak LED (13) remains extinguished.
IF THIS LED ILLUMINATES DO NOT CONTINUE – THE VALVE HAS AN INTERNAL SHORT!

Allow the valve to reach operating temperature, then set FUNCTION switch to position 3 (Test).
From the given AVO Handbook data figures, check the Anode current is approximately 1·2mA and the Gm meter shows approximately 1·6.

If required, a check for the presence of gas in the valve, in either ELECTRODE switch position 1 or 2, can be made by pressing the GAS button and noting the reading on the AI/GAS meter. As previously stated, 1mA indicates a Grid current of 1µA.

Set FUNCTION switch to 0 (Heater continuity) and allow valve to cool before removal.

COMMISSIONING

1. Isolate HT (TB1 – 7 and 8) and Grid Bias 35V (TB1 – 10 and 11) taps on mains transformer.
2. Set Pin selector switches to 000000000.
3. Apply mains to correct taps on mains transformer e.g. Live to 230V* (TB1-4) and Neutral to 0V (TB1-1).
   *This of course will be 115V for some other countries using a different transformer..

Measure heater voltages between TB2-2 and TB2-5 and check it is within expected tolerances. If necessary try different mains transformer taps to achieve best figure.

4. Check that all three panel meters are lit and the internal fan is running.

Disconnect mains supply from the Valve Tester.

5. With a Multimeter connected to the Blue Cathode Top Cap 4mm socket, verify that it measures infinity resistance on all pins of the valve holders.
6. Set Pin selector switches to 100000000 and verify Multimeter indicates continuity only on Pin 1 of all valve holders.
7. Set Pin selector switches to 010000000 and verify Multimeter indicates continuity only on Pin 2 of all valve holders.
8. Set Pin selector switches to 001000000 and verify Multimeter indicates continuity only on Pin 3 of all valve holders.
9. Set Pin selector switches to 000100000 and verify Multimeter indicates continuity only on Pin 4 of all valve holders.
10. Set Pin selector switches to 000010000 and verify Multimeter indicates continuity only on Pin 5 of all valve holders.
11. Set Pin selector switches to 000001000 and verify Multimeter indicates continuity only on Pin 6 of all valve holders.
12. Set Pin selector switches to 000000100 and verify Multimeter indicates continuity only on Pin 7 of all valve holders.
13. Set Pin selector switches to 000000010 and verify Multimeter indicates continuity only on Pin 8 of all valve holders.
14. Set Pin selector switches to 000000001 and verify Multimeter indicates continuity only on Pin 9 of the B9A valve holder.
15. Connect the Grid Bias 30V taps on mains transformer to (TB1 – 10 and 11).

16. Apply mains to the valve tester and verify that the Grid Voltage control can be set to provide 0 to -45V on the Grid Voltage Panel Meter.
17. Set Pin selector switches to 400000000, Function switch to 1 and verify this negative voltage is available at Pin 1 of each valve holder.
18. Set Pin selector switches to 200000030 and connect the Multimeter between Pins 1 and 8 of the Octal valve holder. Verify that the heater voltages obtained agree with the setting of the Heater Volts switch, bearing in mind that the 1·4V and 2V settings will be DC as opposed to AC for the other settings and may appear high due to no loading.

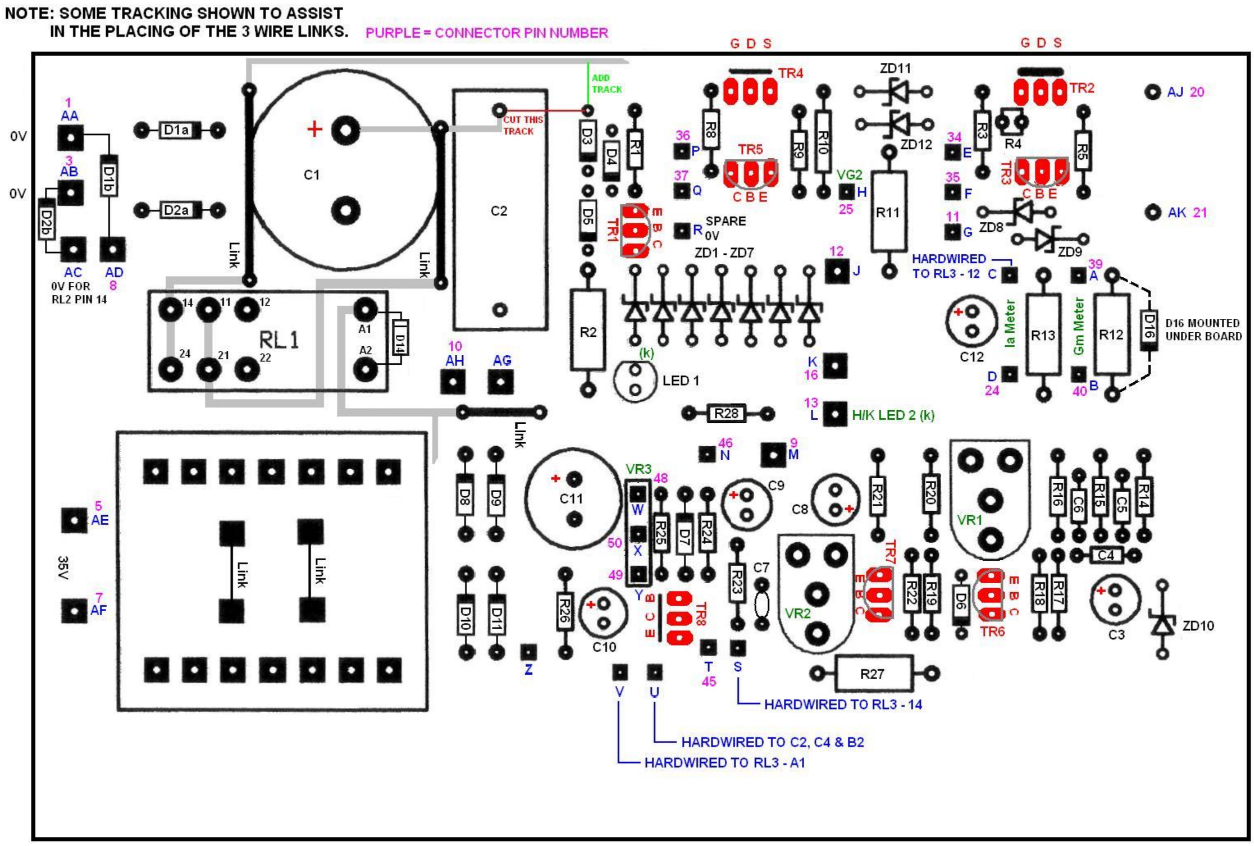
Disconnect mains supply from the Valve Tester.

19. Connect the HT taps on mains transformer to (TB1 – 7 and 8).
20. Connect a Multimeter to the input side of either the Anode or Screen Voltage selector switch with respect to the Blue Cathode Top Cap 4mm Terminal.
21. Slowly apply mains supply via a Variac and confirm that the voltage rises but stabilises at approximately 300V and rises no further.

Disconnect mains supply from the Valve Tester.

22. Transfer Multimeter from the Voltage selector switch chosen in step 20 and connect it to Pin 1 of the Octal Valve holder. Set the Pin selector switches to 500000000.
23. Apply mains supply to the Valve Tester, set Function switch to 3 and check the Multimeter shows the voltage as selected by the Screen Grid (G2/V) switch from 0 to 300V.
24. Set the Pin selector switches to 600000000 and check the Multimeter shows the voltage as selected by the Anode (A/V) switch from 0 to 300V only when the Electrode switch is set to A1.
25. Set the Pin selector switches to 700000000 and check the Multimeter shows the voltage as selected by the Anode (A/V) switch from 0 to 300V only when the Electrode switch is set to A2.
26. Set the Pin selector switches to 800000000 and check the Multimeter shows the voltage as selected by the Anode (A/V) switch from 0 to 300V only when the Electrode switch is set to D1.
27. Set the Pin selector switches to 900000000 and check the Multimeter shows the voltage as selected by the Anode (A/V) switch from 0 to 300V only when the Electrode switch is set to D2.
28. Connect an rms Meter between the Green Top Cap Grid 4mm terminal and the Blue Top Cap Cathode 4mm terminal. The rms Meter should read 100mV and may be adjusted if required by VR2 on the main board. If the rms Meter does not indicate anything then it may be necessary to adjust VR1 to ensure good oscillator start up and best waveform.

Main Board Components:

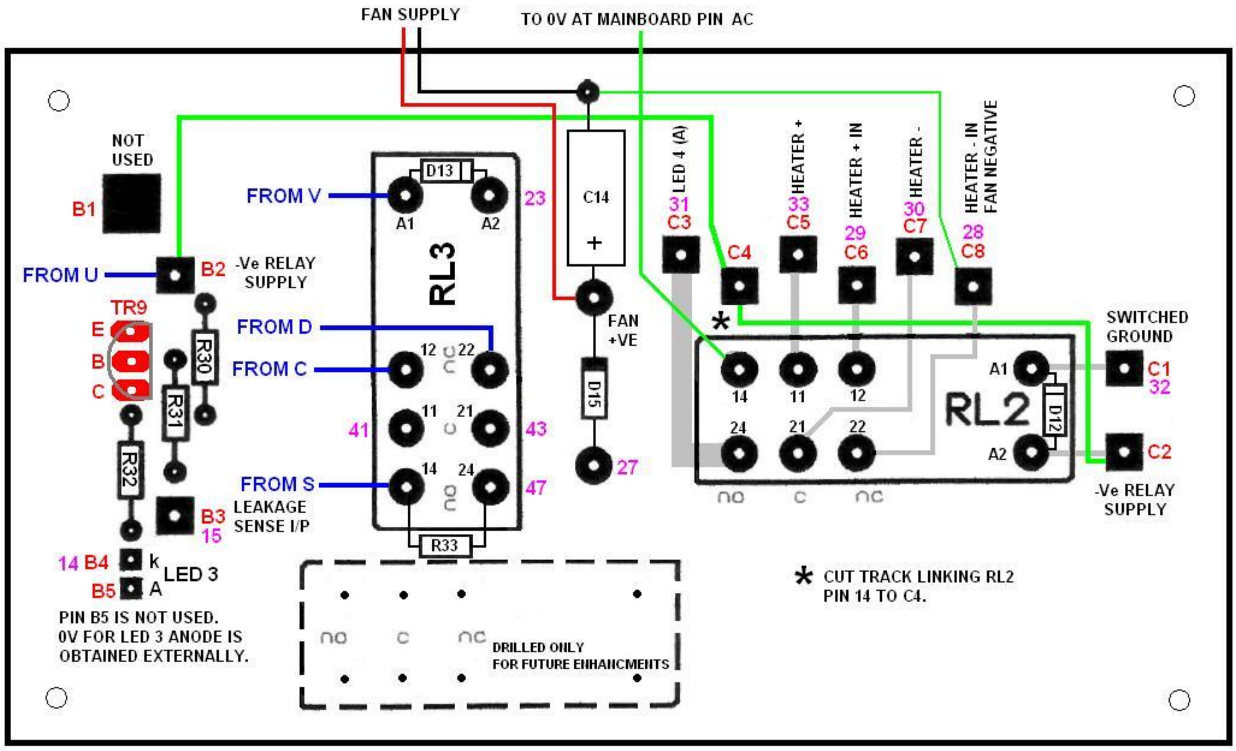


NOTES: The link connecting RL1 pin 14 to the Drains of TR2 and TR4 has been replaced with an open type of fuse holder which takes a 20mm 250mA Quick Blow Fuse (See Page 12). This Fuse could also be re-sited (if desired) to a dedicated Panel Mount Fuse Holder.

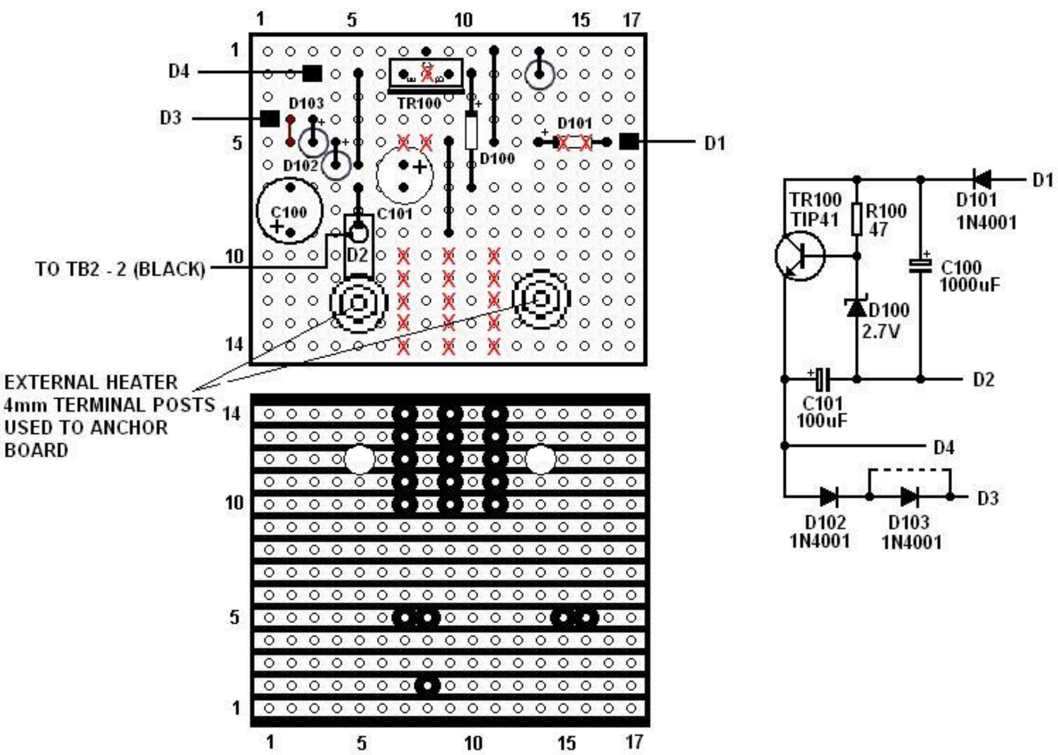
A circuit board Tracking Error exists which connects the Anode of D3 to C2 (+) and which negates the power control provided by RL1. To correct for this, the Track should be cut linking D3 to C2. A new Track connection for D3 Anode should be made by using a short wire link, thus connecting D3 Anode to the main HT+ line that feed the Drains of TR2 and TR4. This error has been corrected on later boards.

A diode has been placed across R12 in an attempt to protect the AC mV meter in the event of a mal-function in the voltage control circuits (See Page 11).

Relay Daughter Board:

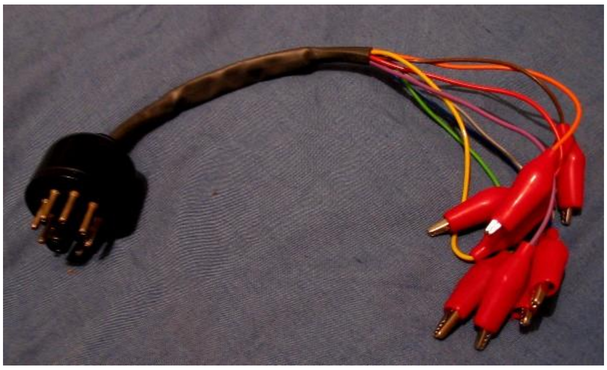


Low Voltage Heater Board:



Top Cap connecting lead:

Valve Adaptor lead:



Coloured wires indicate pin numbers according to the resistor colour code.

Brown	Pin 1
Red	Pin 2
Orange	Pin 3
Yellow	Pin 4
Green	Pin 5
Blue	Pin 6
Violet	Pin 7
Grey	Pin 8

Technical Notes:

Power Input:

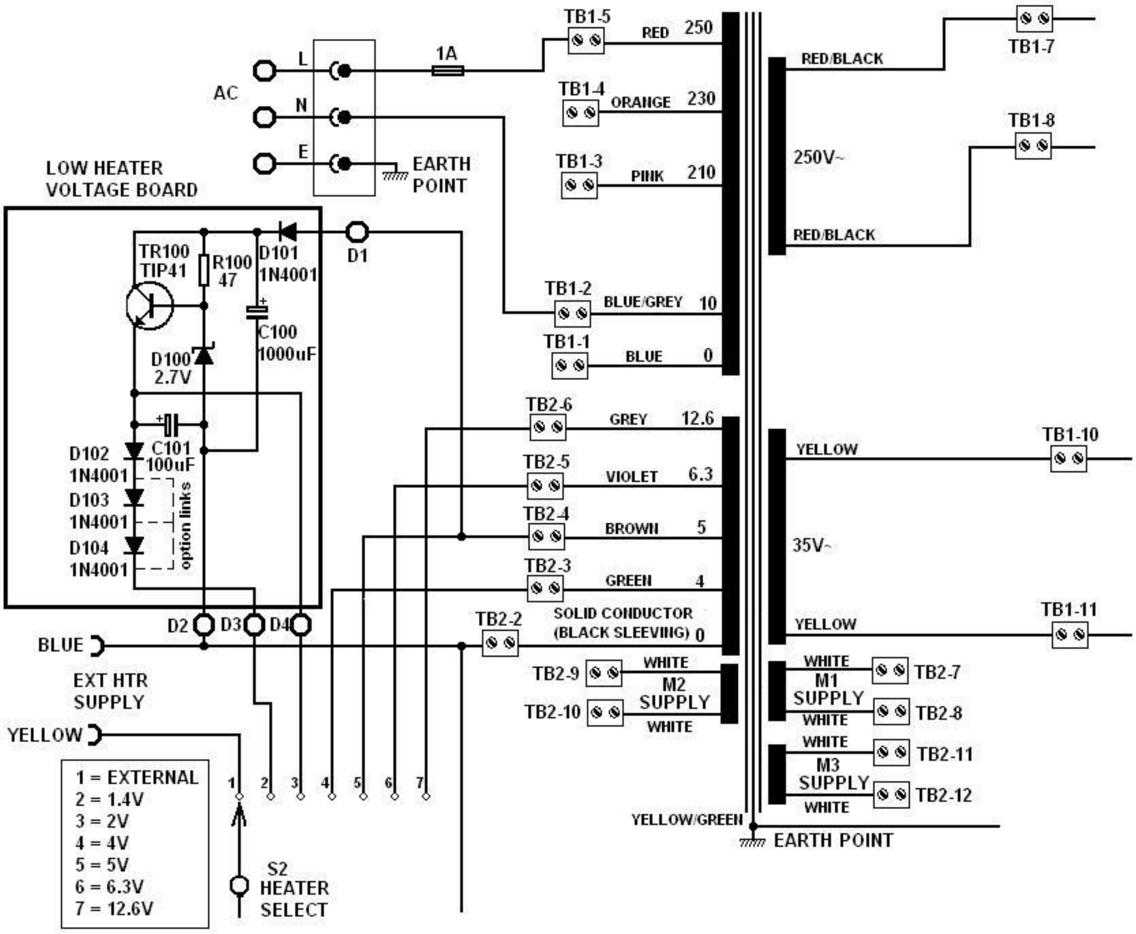
Mains power is applied to the transformer via the 1 Amp slow blow fuse. The wires of the transformer are colour coded as shown, the 240V primary taps proving to be the best option for UK power supplies so the input is applied to the Red and Blue/Grey wires. Because the custom made transformer has no tags for connections, use is made of two 12-way terminal blocks. Terminal block one (TB1) carries the mains input and also the HT and Relay supplies which are both bridge rectified on the main board. Terminal Block two (TB2) carries the heater and meter supplies.

TB1		TB2	
1	Primary 0V	1	Not Used
2	Primary 10V	2	Heater 0V common
3	Primary 210V	3	4V Heater Tap
4	Primary 230V	4	5V Heater Tap
5	Primary 250V	5	6·3V Heater Tap
6	Not Used (Guard)	6	12·6V Heater Tap
7	250V HT Winding	7	6V Winding for Meter 1
8	250V HT Winding	8	6V Winding for Meter 1
9	Not Used (Guard)	9	6V Winding for Meter 2
10	35V Relay/Bias Winding	10	6V Winding for Meter 2
11	35V Relay/Bias Winding	11	6V Winding for Meter 3
12	Not Used	12	6V Winding for Meter 3

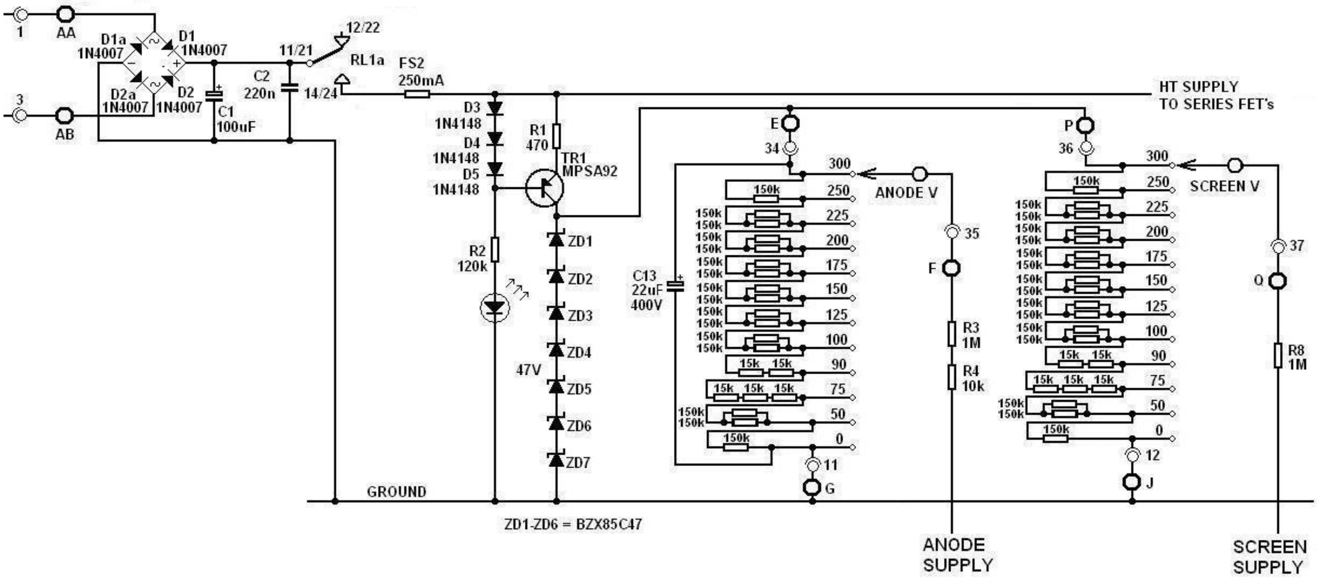
The use of AC supplies for the three panel meters is acceptable as these will operate on either AC or DC supplies. Note that by supplying each meter with its own isolated supply, it allows the meters to be freely allocated to any task, especially for current measurement of the high voltage supply.

The heater supplies are fed to selector switch S2, position 1 of this switch being reserved for accepting an external supply via the Yellow and Blue terminal posts mounted on the front panel. Thus valves with heater voltages outside of the range of the more common ones provided, e.g. the 50C5 with a 50V heater, can be supplied externally.
The 5V AC Heater supply is additionally routed to a Low Heater Voltage Board comprising of TR100 (TIP41) controlled by zener diode D100. This circuit provides a DC smoothed 2V or 1·4V for testing directly heated battery valves. The diode string D102-D104 was initially provided in case the 1·4V supply was too high but in practice only one diode was required.

The Fan supply is derived from the 12V AC Valve Heater supply, half wave rectified by D15 and smoothed by C14.



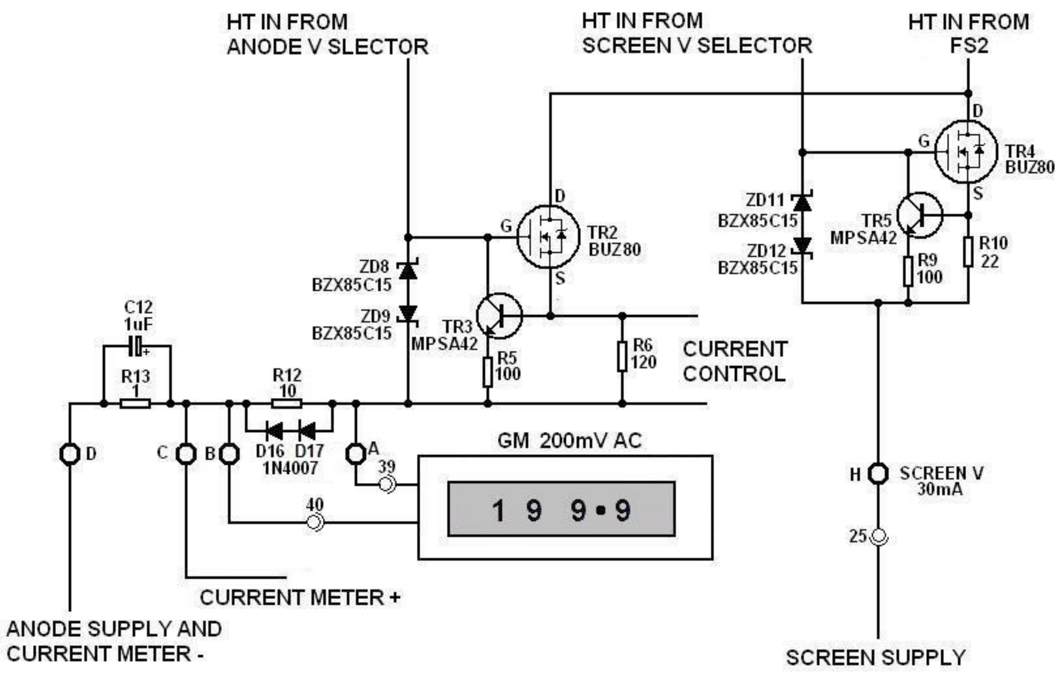
HT Supply - Rectification and pre-regulation:



The 250V HT winding of the mains transformer is bridge rectified by diodes D1, D1a, D2 and D2a before being smoothed by C1. The relay RL1 isolates the HT until the Function switch is set to position 3 (TEST). Un-regulated HT is fed to the Drains of the power FET's TR2 and TR4 (shown on next section). The circuit built around TR1 is a pre-regulator designed to produce +300V for the Anode and Screen voltage selector switches. Tr1 is a constant current source of approximately 1mA for the Zener diode chain ZD1 to ZD7 which are 6 x 47V + 15V = 297V. This supply is feed to each selector switch that operates at high impedance, each resistor chain adding up to 900kΩ and drawing 333µA.

The supplies thus available (from zero to 300V) are fed to the gates of the FET's which act as source followers.

Anode and screen current limiters:



Both current limiters work in the same manner by having a transistor sensing the voltage drop across a feed resistor in the source of each FET. When this voltage reaches approximately 0·6V, the transistor turns on and lowers the voltage applied to the protected FET's Gate. The Screen supply current is fixed by R10 and will be approximately 0·6/22 = 27mA. The Anode supply has its resistor value switched by the Electrode Switch. In the A1 and A2 positions there is a total resistor combination of 6·316Ω (R7, R35 and R39) placed across R6 (120Ω) and gives an Anode current of 95mA maximum. In the D1 and D2 positions, the resistance is removed except for the 120Ω R6, which now limits the available current to 5mA thus protecting small signal diodes. When testing power rectifiers, there is a boost button provided that increases the Anode current to 50mA by placing 13·34Ω (R36,R37 and R38) across R6 when pressed.

It was felt that a bit more A1/A2 anode current would be beneficial when testing some valves so R39 was deleted and R35 changed from 27Ω to 11Ω which with R6 gives approximately 120mA. To avoid

having three resistors in parallel for the diode current, R38 was deleted and R36 and R37 made 27Ω each.

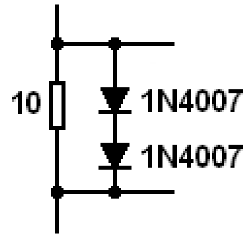
R12 is the sense resistor for the gm meter and R13 the sense for the Anode current meter.

Gm Measurement:

Gm is a measurement of gain and is in fact the change in Anode current (mA) from a change in Grid voltage (V).

In the Sussex we apply 0.1V to the grid of the valve under test and measure the change in Anode current across a 10 Ohm resistor R12. Let us assume a valve under test has a gain of 25, if we were using 1V as a grid voltage we would expect a change in Anode current of 25mA and therefore there would be 250mV developed across R12. But as we are using 0.1V signal then the voltage developed will be a tenth of this i.e. 25.0mV. This figure is what will be displayed on the front panel Gm meter.

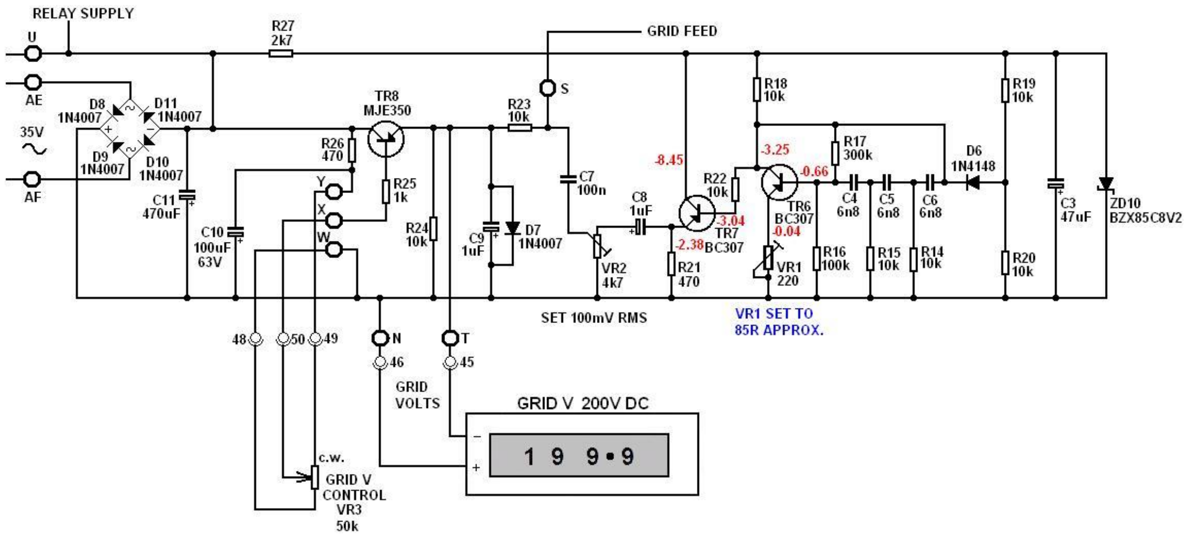
Due to failures encountered with this meter under fault conditions, for example if the Anode supply FET goes short circuit, protection diodes placed across R12 has been tried and seems to help.



The diodes have a combined forward turn on voltage of 1.2V approximately so should not affect the 1V max (100mA) expected in normal use.

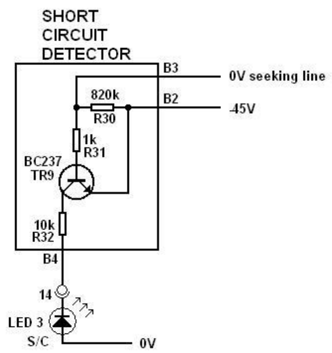
Whether simple diodes fitted on their own will be sufficient has yet

Relay and Bias supply:



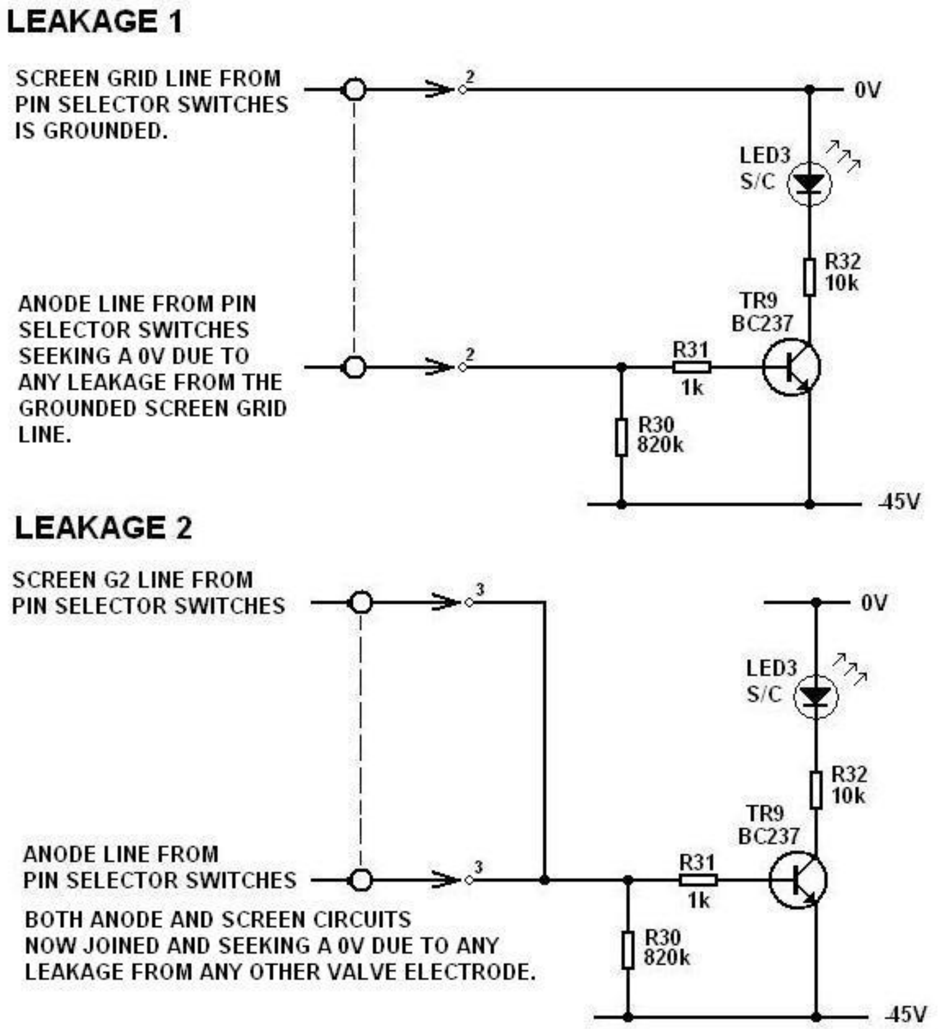
The 35V AC input is bridge rectified by D8, D9, D10 and D11, smoothed by C11 and provides the supply for all relays. The supply is also fed via R27 to Zener diode ZD10 to provide a stabilised 8V supply for the phase shift oscillator built around TR6. VR1 is adjusted for best waveform, normally just before oscillation ceases and the sine wave is passed to driver TR7. After passing C8 the sine wave is applied to VR2 which is adjusted to give 100mV RMS at the grid feed point. Here it is being superimposed on the grid bias as set by the series regulator TR8 and which is monitored by the grid voltage meter.

Leakage Detector



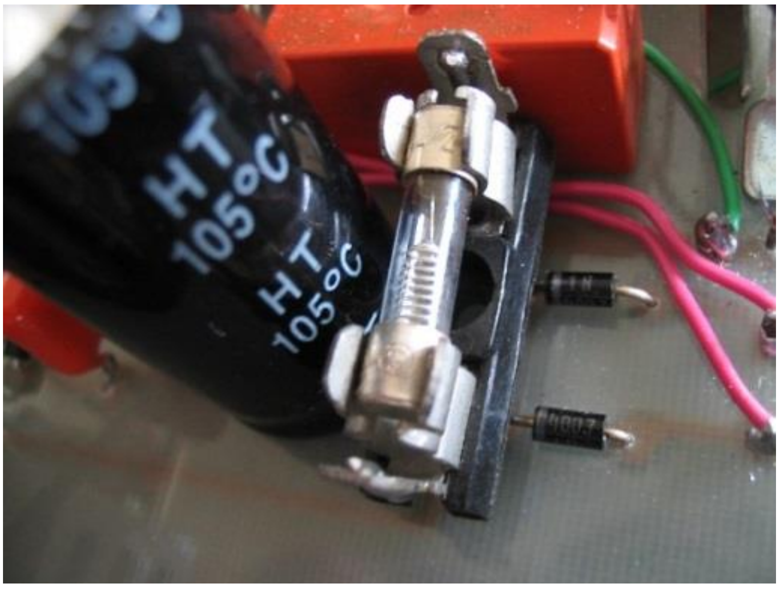
The BC237 emitter is at -ve voltage, and the base is tied to –ve through the high value resistor R30. In this condition the transistor is cut off and the LED is extinguished. If either the anode or G2 has a leak to ground, (+ve with respect to emitter & base) a positive voltage will appear at the base and the transistor will conduct thus illuminating the LED. The higher the +ve voltage caused by a lower leakage resistance, then the brighter the LED will shine.

Leakage 1 Places a 0V on G2 whilst looking at the Anode circuit to detect a leak between the two.
Leakage 2 Connects the Anode and G2 lines together to detect a leak between them and other electrodes in the valve under test.



HT Fuse:

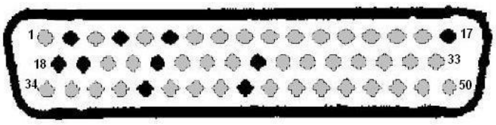
Later addition comprising of FS2 (20mm 250mA Quick Blow) and open Fuse Holder.



This is mounted in place of previous wire link but could also be panel mounted if preferred..

50 Way Connector:

For ease of maintenance, the stacked circuit boards are wired to a 50 way Canon D connector. Any required replacement of semiconductors or modifications is greatly assisted by being able to withdraw all of the active circuitry as one module.



The grey shaded pins are those that are used in the Sussex.

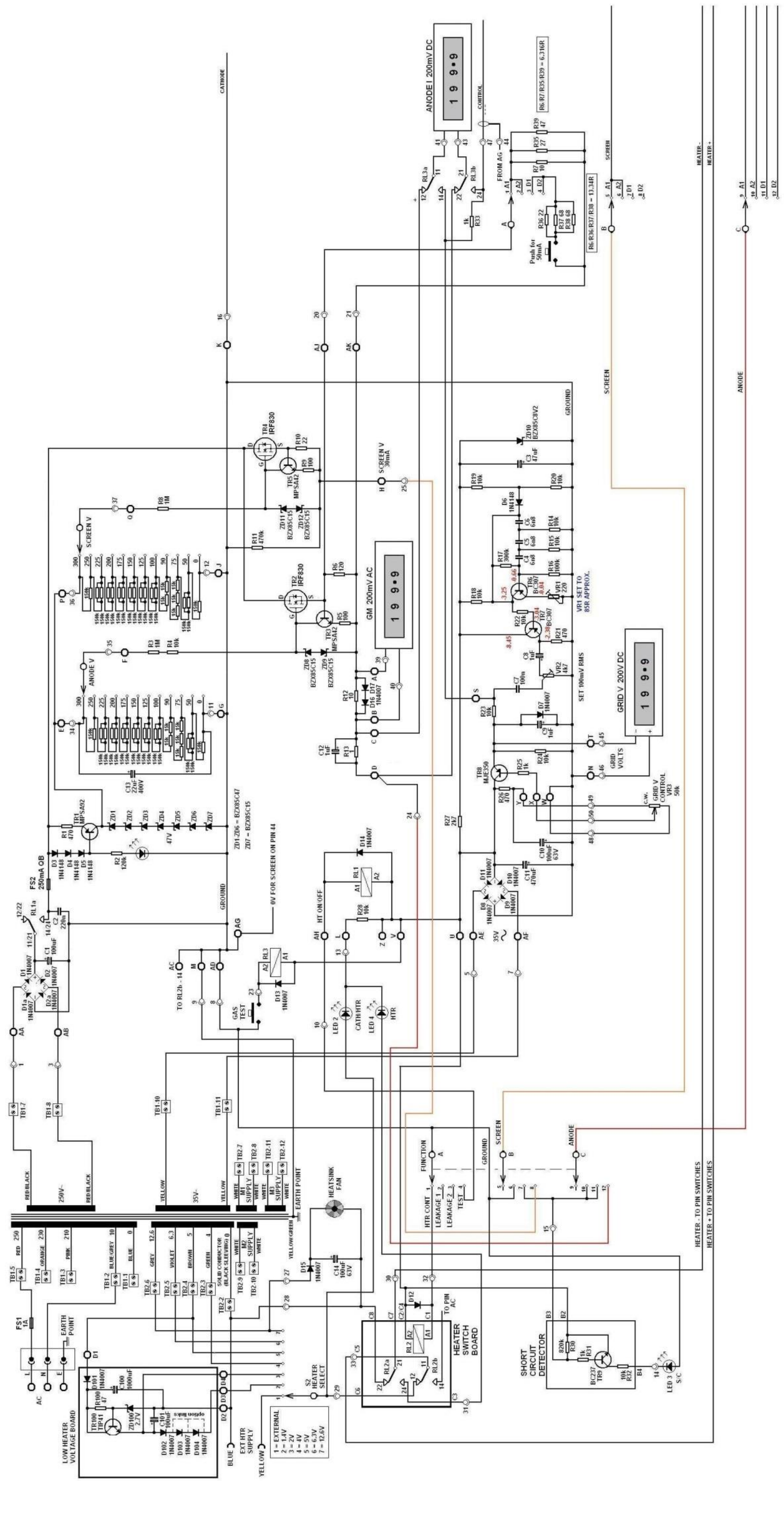
50 Way connector Pin details;

Pin	Colour	Remarks	Board Ident
1	Red	HT Input from Transformer TB1-7	AA
2	N.U.		
3	Red	HT Input from Transformer TB1-8	AB
4	N.U.		
5	Red	35V AC Input from transformer TB1-10	AE
6	N.U.		
7	Red	35V AC Input from transformer TB1-11	AF
8	Green	0V to gas test and function switches	AD
9	Green	Ground Connection	M
10	Red	TEST Enable from Function Switch	AH
11	Green	0V to Anode Volts Selector Switch	G
12	Green	0V to G2 Volts Selector Switch	J
13	Green	To Cathode/Heater LED Cathode	L
14	Green	To Short Circuit LED Cathode	B4
15	Red	Short Circuit Detector to Function Switch	B3
16	Red	Cathode to Pin Selector Switches (1)	K
17,18 & 19	N.U.		
20	Red	Anode Current Limit control	AJ
21	Red	Anode Current Limit control	AK
22	N.U.		
23	Red	Input from Gas Test Switch	RL3 - A2
24	Red	Anode Voltage to Function Switch	D
25	Red	Screen Voltage to Function Switch	H
26	N.U.		
27	Red	12V AC to Fan Rectifier from TB2-6	D15 ANODE
28	Green	Heater Return from TB2-2	C8 & FAN 0V
29	Red	Heater Volts IN from Selector Switch	C6
30	Green	Heater Return to Pin Selector Switches (2)	C7
31	Green	To Heater LED Cathode	C3
32	Red	To Heater LED Anode and Function Switch	C1
33	Red	Heater Volts OUT to Pin Selector Switches (3)	C5
34	Red	HT to Anode Volts Selector Switch	E
35	Red	HT from Anode Volts Selector Switch	F
36	Red	HT to G2 Volts Selector Switch	P
37	Red	HT from G2 Volts Selector Switch	Q
38	N.U.		
39	Red	To Gm Meter	A
40	Red	To Gm Meter	B
41	Red	To Anode Current Meter (+)	RL3 - PIN 11
42	N.U.		
43	Red	To Anode Current Meter (-)	RL3 - PIN 21
44	Green	0V (screen leads) from AG	AG
45	Blue	Voltage to Grid Voltage Meter	T
46	Green	0V to Grid Voltage Meter	N
47	Green	Control Voltage to Pin Selector Switches (4)	RL3 - PIN 24
48	Green	0V to Grid Voltage Control	W
49	Blue	Voltage to Grid Voltage Control	Y
50	Blue	Voltage from Grid Voltage Control	X

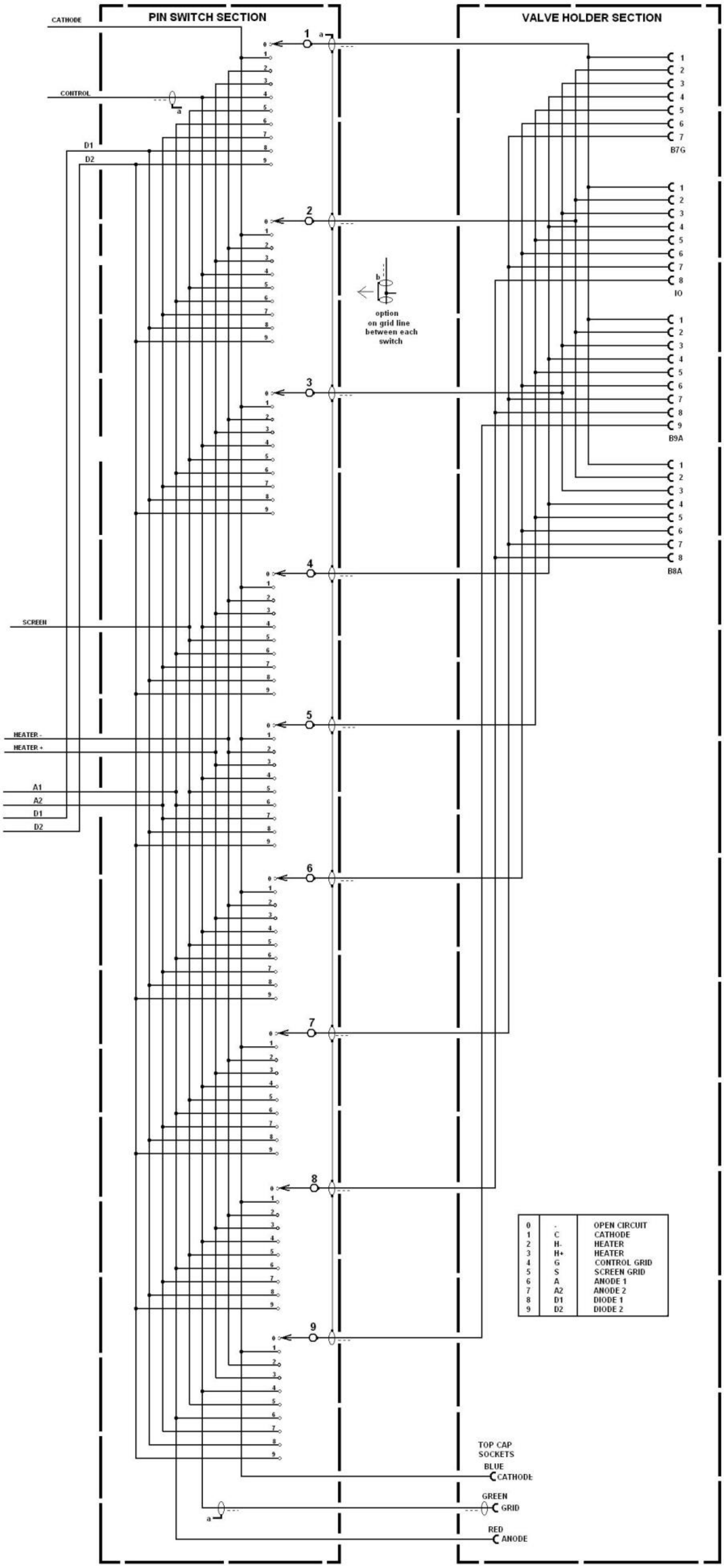
NOTE: REF PIN SELECTOR SWITCHES, as an example, look above at Pin 33; this indicates **Pin Selector Switches (3)**. The figure (3) in this example refers to its front panel marking position.
The switches actual physical position will be +1 due to the fact that position 1 is open circuit (0).

Circuit Diagrams

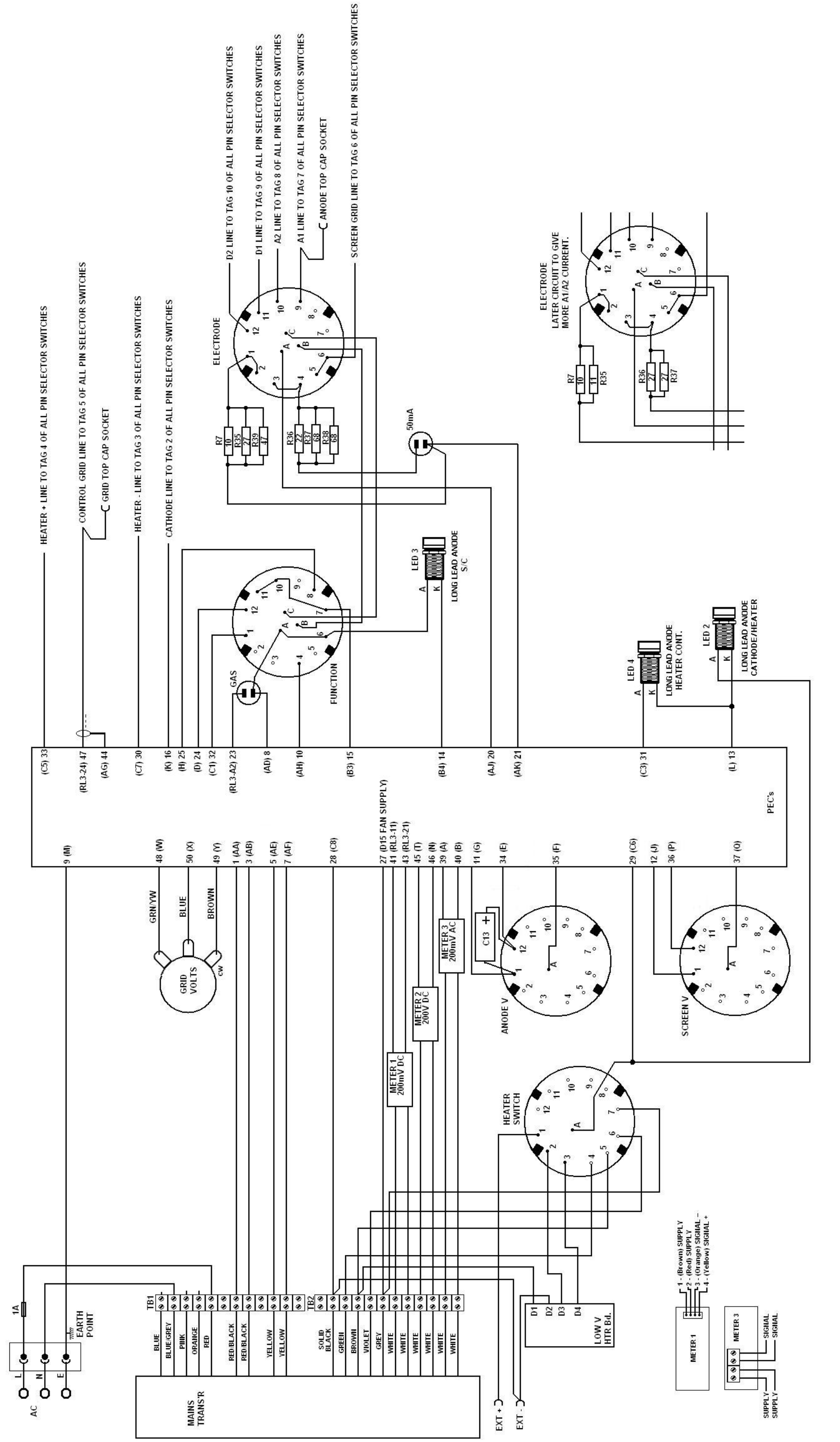
Pre-switching circuit.



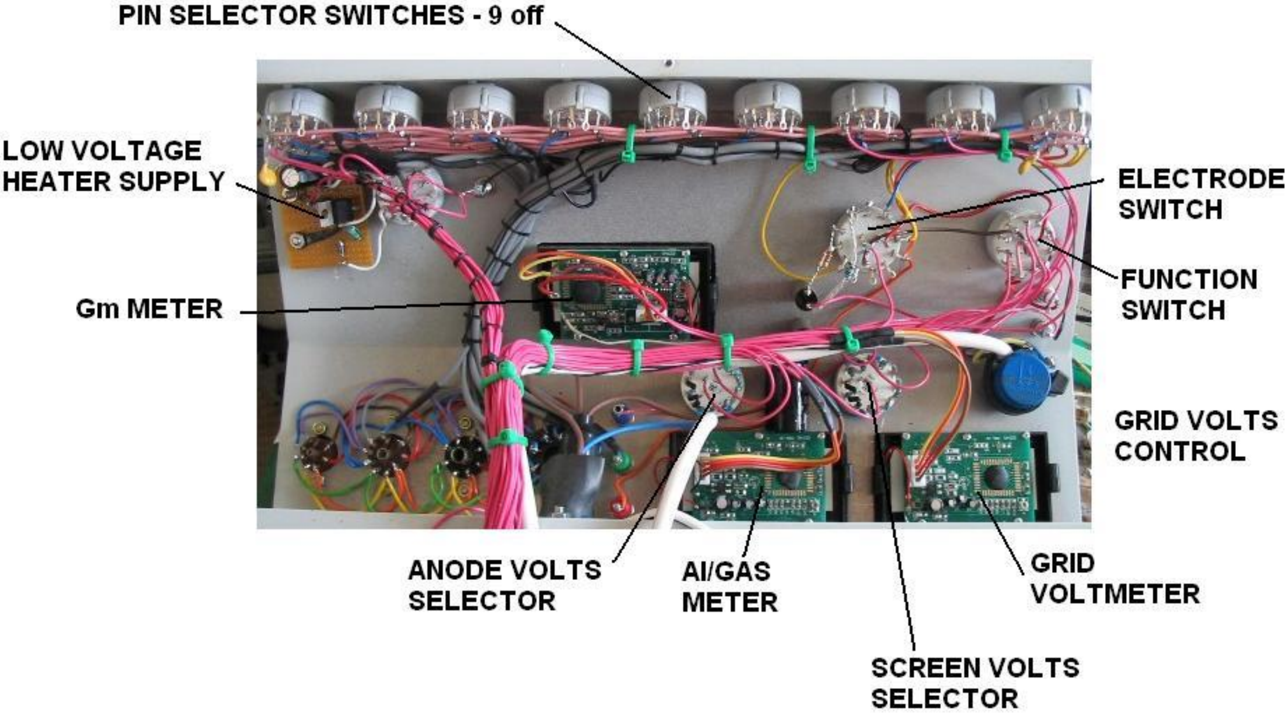
Switching circuit



Physical wiring

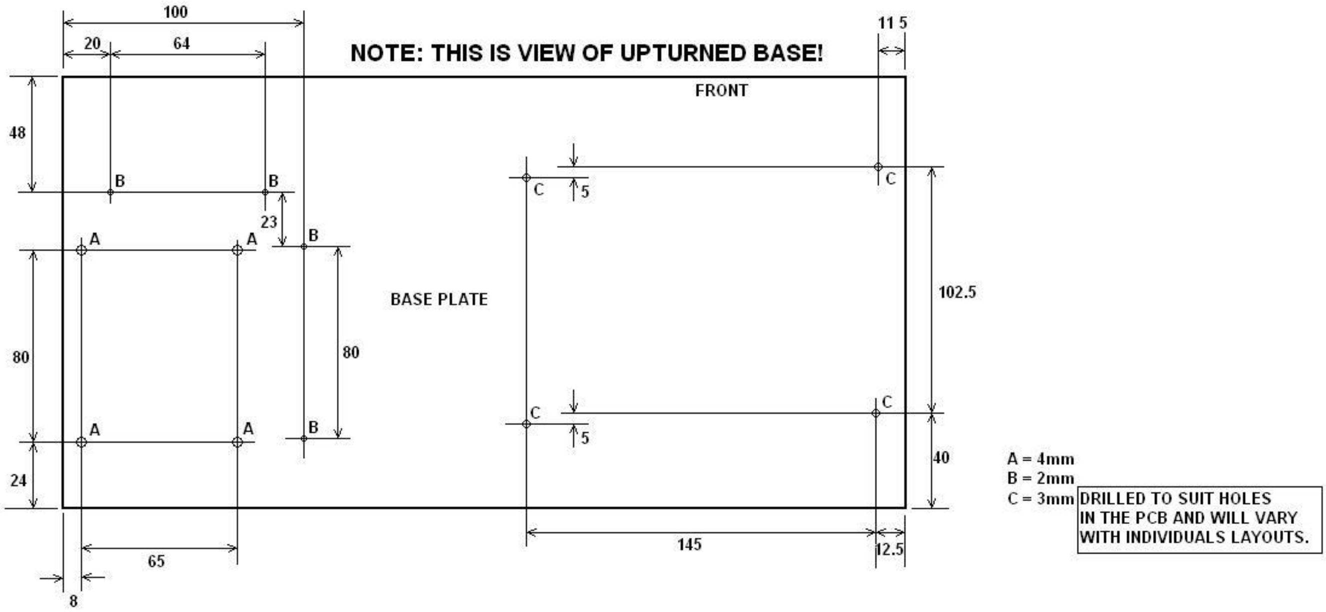


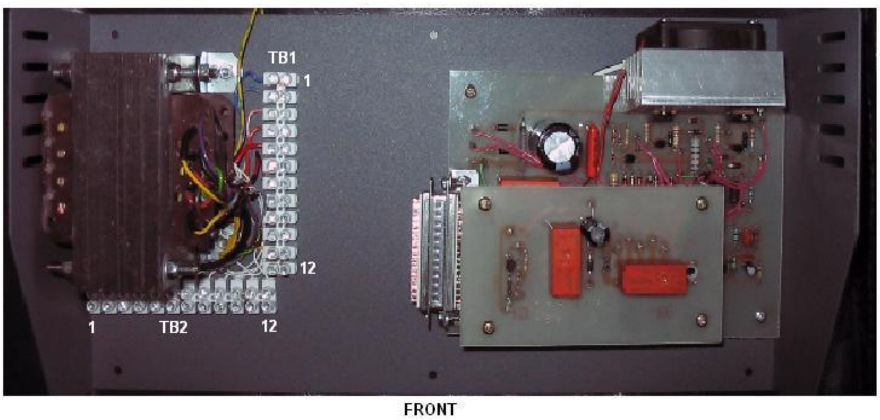
Interior Wiring:



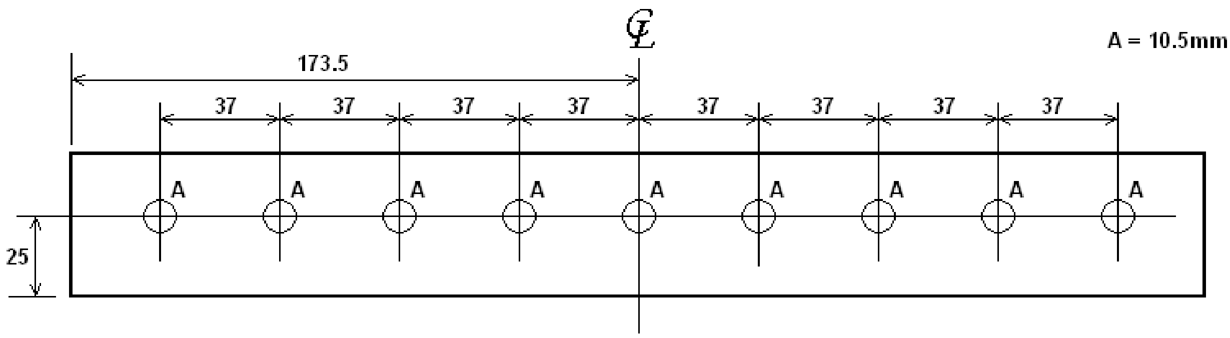
Drill drawings:

Base Plate:

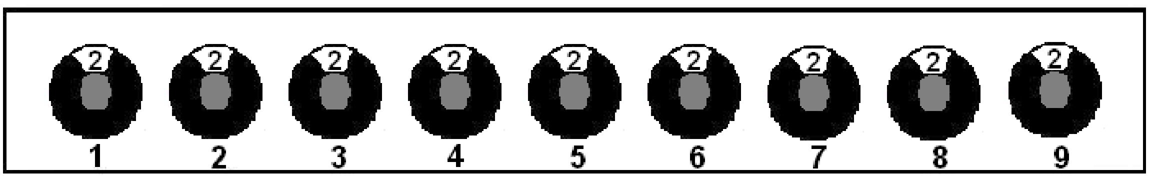




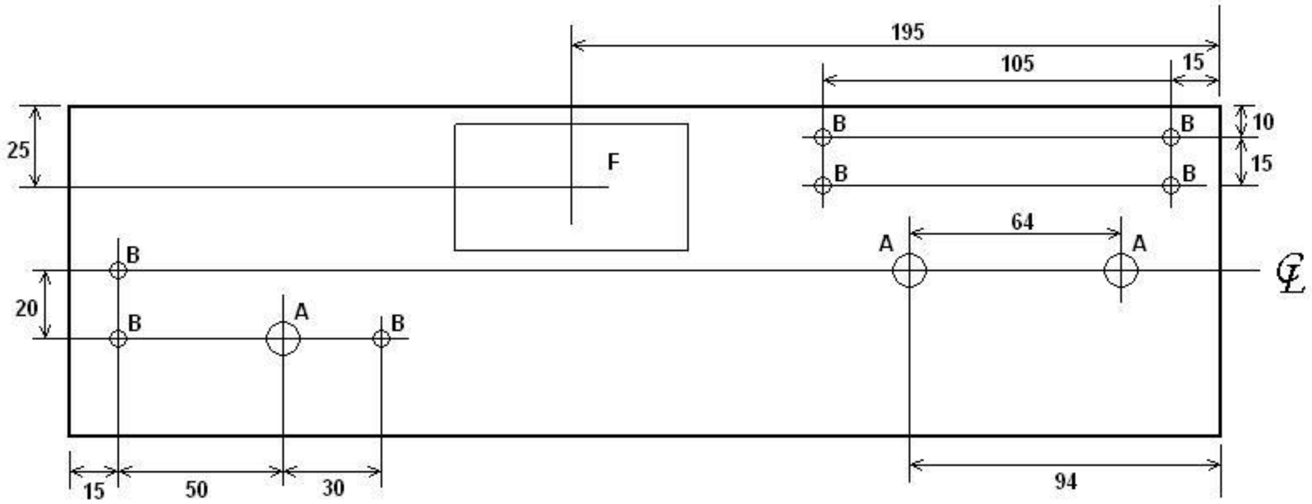
Front Edge:



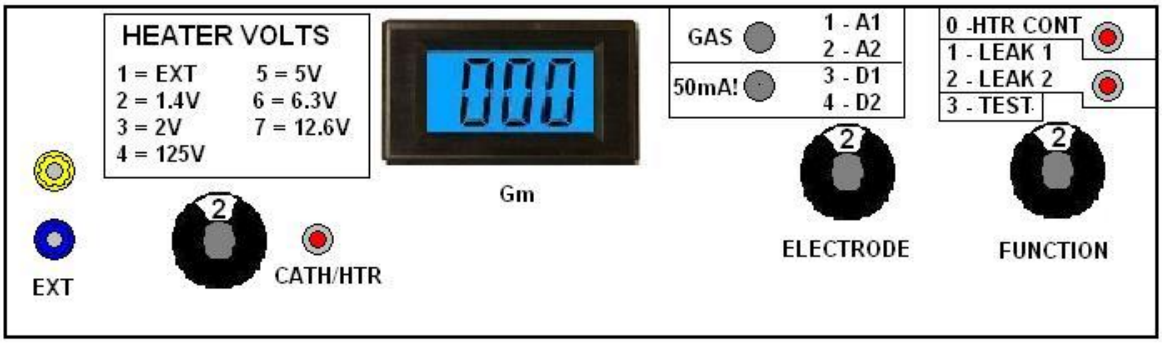
SIDE A



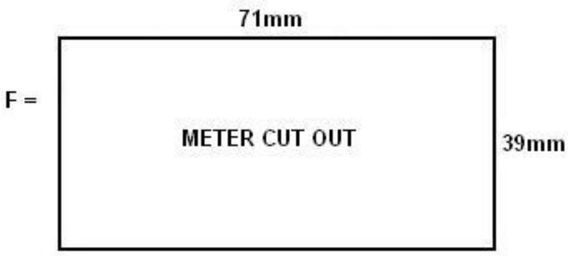
Sloping Front:



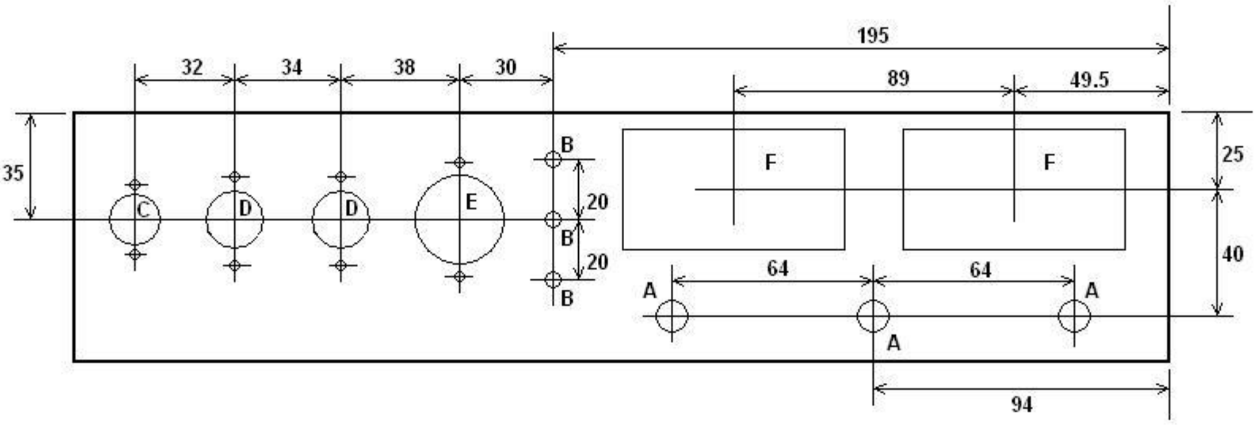
SIDE B



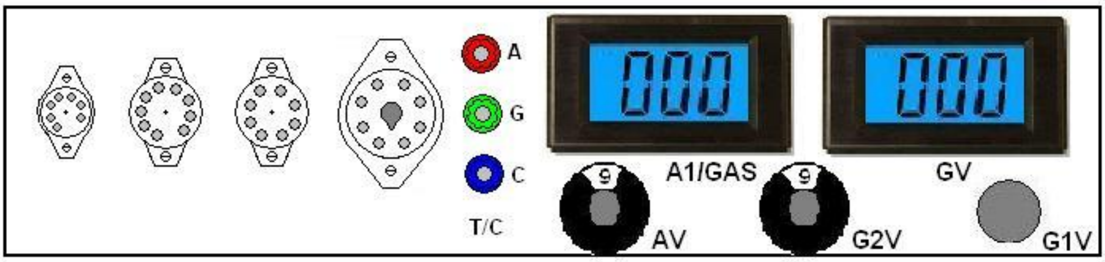
A = 10.5mm
B = 6mm

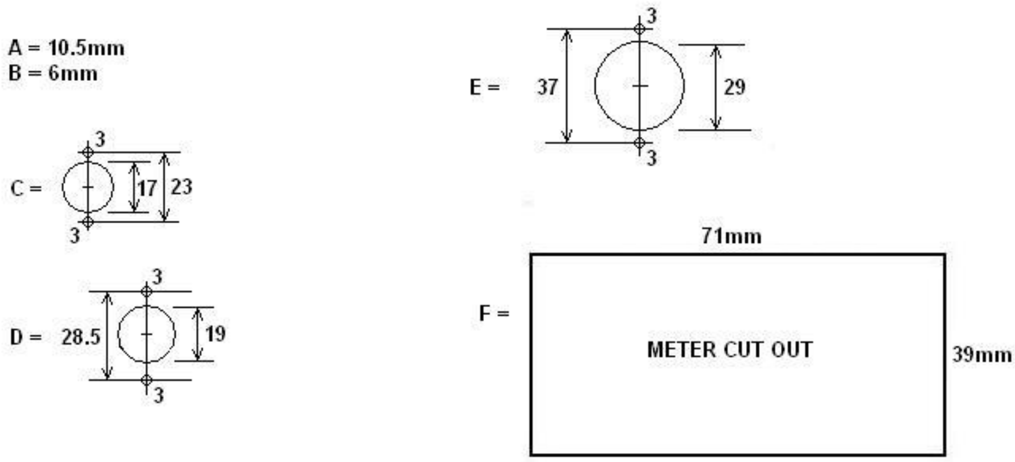


Top Edge:

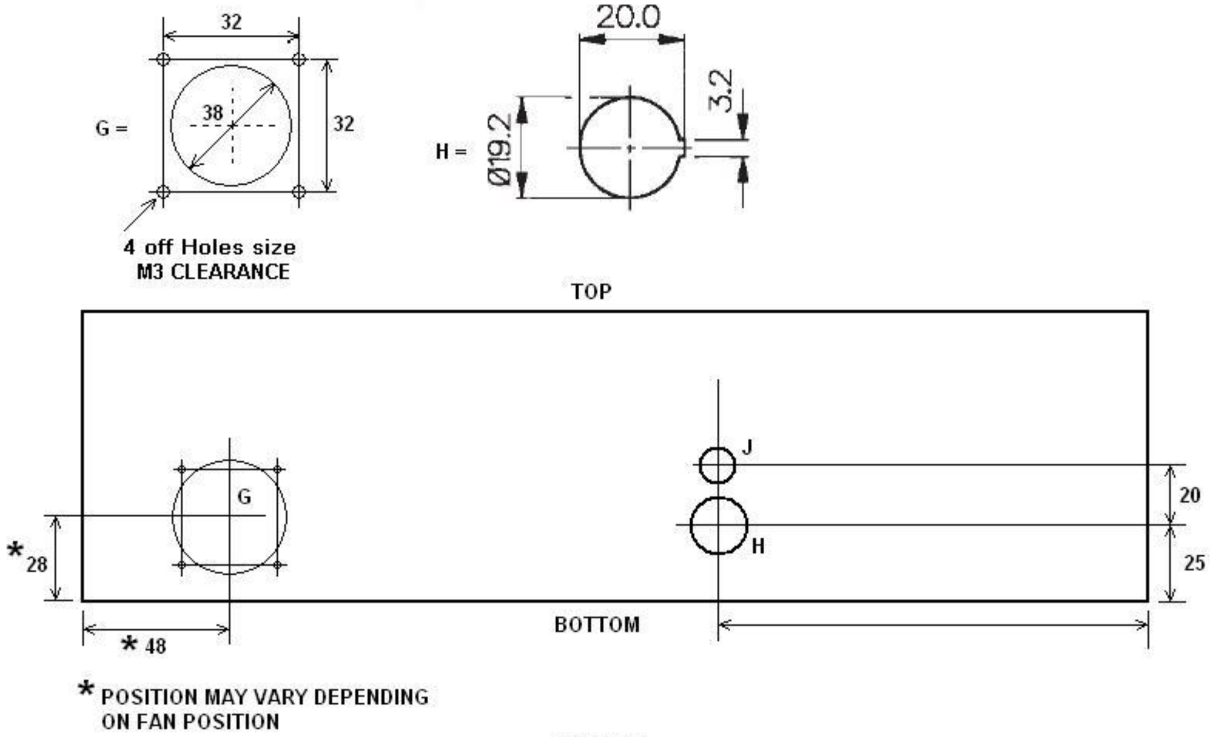


SIDE C

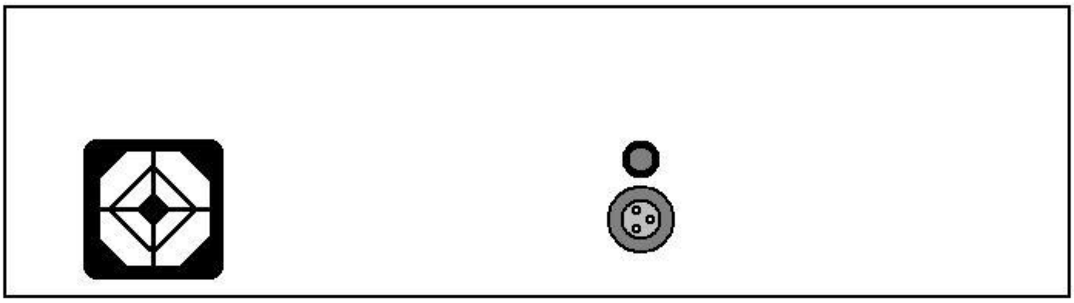




Rear Panel:



SIDE D



Parts List:

Circuit Designator	Qty	Value
Resistors		
R1, R21, R26	3	470R
R2	1	120K
R3, R8	2	1M
R4, R14, R15, R18, R19, R20, R22, R23, R24, R28, R29, R32	12	10K
R5, R9	2	100R
R6	1	120R
R7, R12	3	10R
R10	1	22R
R11	1	470K
R13	1	1R
R16	1	100K
R17	1	300K
R25, R31, R33	3	1K
R27	1	2K7
R30	1	820K
R35 (early design)	1	27R
R35 (later design)	1	11R
R36 (early design)	1	22R
R36 (later design)	1	27R
R37 (early design)	1	68R
R37 (later design)	1	27R
R38 (deleted on later design)	1	68R
R39 (deleted on later design), R100	2	47R
voltage selector switches	10	15K
voltage selector switches	32	150K
VR1	1	220R
VR2	1	4K7
VR3	1	50K
Capacitors		
C1	1	100uF
C2	1	220nF
C3	1	47uF
C4, C5, C6	3	6.8nF
C7	1	100nF
C8	1	1uF
C9	1	1uF
C10, C14	1	100uf/63V
C11	1	470uF
C12	1	1uF
C13	1	22uF/400V
C100	1	1000uF/16V
C101	1	100uF/16V
Circuit Designator	**Qty**	**Value**
Semiconductors		
D1, D1a, D2, D2a, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D101, D102, D103, D104	19	1N4007
D3, D4, D5, D6	4	1N4148

TR1	1	MPSA92
TR2, TR4	2	1RF 830
TR3, TR5	2	MPSA42
TR6, TR7	2	BC307
TR8	1	MJE350
TR9	1	BC237
TR100	1	TIP41A
ZD1 -ZD6 (47V 1W Zener alt: BZX85C47)	6	1N4756A
ZD7 - ZD9, ZD11, ZD12 (15V 1W Zener alt: BZX85C15)	5	1N4744A
ZD10 (8V2 1W Zener alt: BZX85C8V2)	1	1N4738A
ZD100 (2V7 1W Zener alt: BZX85C2V7)	1	
LED Panel Mount	3	
LED Wire ended	1	
Panel Meters		
M1 - Grid Volts (200V DC)	1	
M2 - Anode current/Gas test (200mV DC)	1	
M3 - Gm (200mV AC)	1	
Switches		
G2 Voltage Selector Switch (1P 12W) MBB – LORLIN CK1034	1	
Anode Voltage Selector Switch (1P 12W) MBB – LORLIN CK1034	1	
Valve Pin selector switches (1P 12W) BBM – LORIN CK1024	9	
Heater selector switch (1P 12W) BBM – LORIN CK1024	1	
Function switch (3P 4W) BBM – LORLIN CK1026	1	
Anode/Diode switch (3P 4W) BBM – LORLIN CK1026	1	
Gas Test switch (Push to Make)	1	
50mA Diode switch (Push to Make)	1	
Relays and Inductors		
RL1, RL2,RL3	3	48V DPCO
Transformer (Ed Dinning Custom made)	1	
Hardware		
Case, console, 350 x 180 x 100/50 mm (Deltron 5190920)	1	RS232774
Knob, 15mm, black (Sifam)	14	RS225704
Cap for 15mm knob (Sifam)	14	RS225899
Figure Dial, 15mm 0-11 at 30 deg. (Sifam)	14	RS4680644
Terminal block, 12 way 6A	2	RS4649867
20mm Fuse Holder for FS1	1	
20mm open Fuse Holder for FS2	1	
4mm Socket – Red (Anode)	1	
4mm Socket – Blue (Cathode)	1	
4mm Socket – Green (Grid)	1	
4mm Terminal Post - Yellow	1	
Circuit Designator	**Qty**	**Value**
4mm Terminal Post - Blue	1	
FS1 – 2A A/S 20mm	1	
FS2 – 250mA QB	1	

Design changes made from original

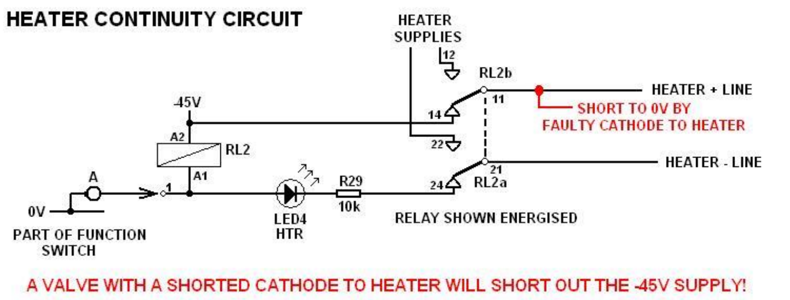
(These have been embodied into the circuit diagram)

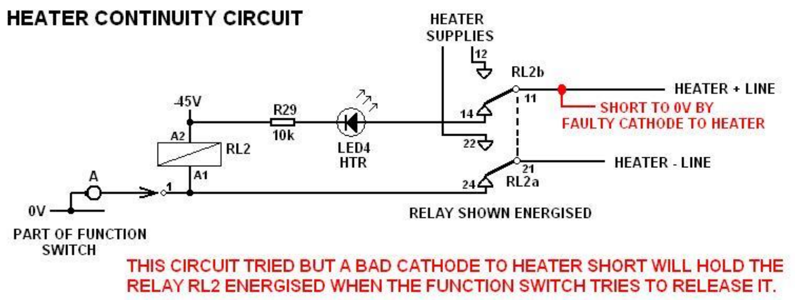
Shorting -45V supply

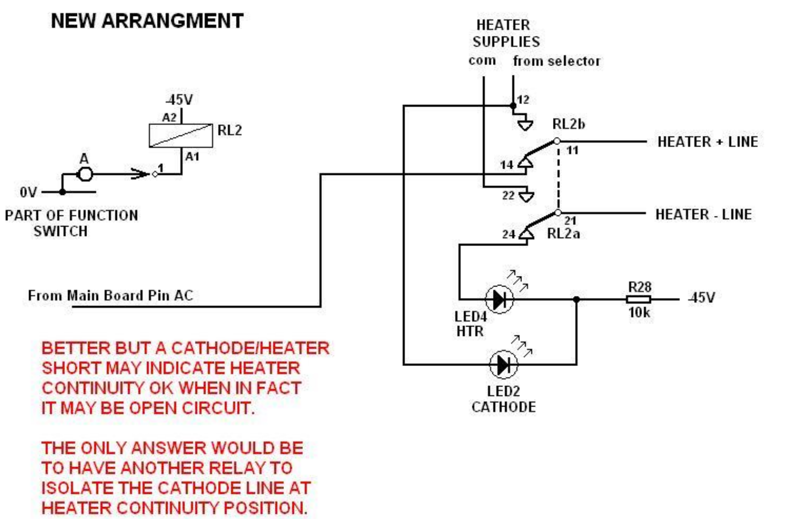
When an EZ41 was inserted it into the socket it flashed violently inside and the Tester gave a horrible buzzing sound due to the minus supply being shorted. This happened with the valve selectors properly set up and with the Tester set to Heater Continuity. The valve had a shorted cathode/heater and thus was shorting out the minus supply which is why it produced fireworks.

The first attempt at solving this, shown below, worked fine except that a short circuit cathode heater now kept Relay 2 energised due to its A1 pin being connected to the grounded heater line.

Simple answer, take RL2b pin 14 to its own separate 0V, I used main board pin AC in the final new arrangement. Unit works first class now, no nasty sparks if the valve has a direct cathode to heater short and yet the cathode/heater LED picks up the fault when you select leak tests etc.







Relay shown energised. Continuity is via shared resistor R28 through LED4, the heater and its supply lines and back to 0V taken from Board Pin AC.

A valve with a shorted cathode to heater will apply a 0V to the circuit but will cause non shorting of the -45V supply. It may however show the heater as being ok when it is not!

However, when the Function switch is set to the next position and RL2 drops out, the cathode/heater LED will illuminate.

Drifting oscillator amplitude.

Reports of varying 1kHz sine wave amplitude with temperature have been received from numerous constructors. Although the Author has not had this problem with the Sussex after a suitable warm up time, one answer is to modify the oscillator into a temperature controlled Wien bridge circuit. The following is an example of what may possibly be done to the present main board oscillator section. The underside view shows in Red what tracks need to be cut and those lines in Green show new connections, some using short lengths of hook up wire.

Caution: This arrangement has not been tried so there may be unknown errors!