Calder Centaur

Workshop Manual

Revision: 04-03-2013

Covers all Calder Centaur electrofusion units incorporating the following circuit boards:
CVTE0030 Issue 9 Power Board
CVTE0034 Issue 9 Control Board
CVTE0055 Issue 1 Analogue Board
Version 4.XX Software

The components in this equipment are RoHS certified.
Only use RoHS components in the servicing of this equipment.
Components supplied by Caldervale Technology Ltd are certified RoHS compliant.

Dispose of any components replaced during service correctly.
Not to be disposed of in domestic waste.
Contact your local authority for authorised disposal centres.
Caldervale Technology Limited is not responsible for the disposal of component parts replaced during service.

Contents.

Section 1.

Overview of equipment.

The purpose of the Calder Centaur electrofusion processor is to supply a stabilised 39.5V rms (or other voltage as set) at a current of between 0.5 and 60 amps for a period of between 1 and 4000 seconds.
Power from the generator is fed to the primary of a 2.5kW power transformer via a power control triac. The low voltage secondary winding of this transformer feeds controlled power to the electrofusion accessory via the output lead. The electrofusion accessory has moulded into it a resistive heating element which heats up the plastic of the accessory and the pipe to form a joint.
The controlled voltage is sensed at the terminals of the electrofusion accessory and is used as part of the feedback loop to control the point at which the triac is switched on every half cycle.
This output voltage is electrically isolated from the supply generator by the power transformer, thus under any fault condition the worst case output voltage will be a floating voltage of approximately 50 volts rms.
The triac is switched on once every half cycle of the incoming generator waveform (100 times a second for a nominal 50Hz supply). The point or time when it is switched on can be from about 3% to 98% of each half cycle period. Once switched on, it stays on until the cycle is reversed at the next zero voltage crossing point where it switches off by itself. Depending on where in the half cycle the triac is switched on determines how much voltage is passed through to the power transformer, early on in the half cycle will give more power whilst late on in the half cycle will give less power.

The triac may seem to be in an odd position, driving the transformer primary as opposed to the more usual way of being fitted in the output line. Driving the primary in this way gives significant improvements in overall equipment power conversion efficiency by cutting transformer losses. Also the rating of the triac can be reduced and the heatsinking can be 25% of that required in the transformer secondary.

The triac switching point is controlled by the main processor and the analogue board which output a stream of pulses, with each pulse arriving at the triac some time after the start of each supply half cycle, sufficient to maintain the output voltage at the electrofusion accessory at the controlled voltage level. As the triac is at mains potential and cannot be driven directly from the electronics, the solution being to optically isolate the stream of pulses by the use of an optical isolator which feeds the main triac.

Section 2.

Calibrating the electrofusion unit.

Tools required.
Non-metalic trim tool.
True RMS multimeter.
True RMS current meter.
5 amp test load.
50/60 amp test load.
Resistance test box.
4mm to 4.7mm output lead terminal adaptors.
Thermometer or temperature meter.

Powering up the electrofusion unit.
Connect the electrofusion unit to a suitable ac supply (110V or 240V dependant on the supply variant of the unit to be calibrated).
Note! Ensure that the test bench is protected by a suitably rated fuse and RCD to protect against risk of electrical shock in the event of a fault condition.

Activating the calibration.
Select the **Settings** option from the **Weld Mode** menu.
Select the **Other** option from the **Setting menu**.
The unit will now ask for a password to be entered; using the keypad enter **MPWD** then press the START button.
Select the **Calibrate** option from the **System Menu** then press the START button.
The display will show **Calibrate System**; press the START button to begin the calibration.
The display will now show **System Uncalibrated**, this indicates that the calibration information stored inside the unit has been erased; press the START button to continue.

Adjusting the display contrast.
Note. If the electrofusion unit has been previously calibrated the display contrast should not require adjustment; if adjustment is required then the unit's casing will need to be opened by releasing the four screws at the back of the casing.
Using the trim tool adjust VR1 on the control board so that the characters on the alphanumeric display are clearly visible.

Adjusting the ambient air temperature sensor.
Note. If the electrofusion unit has been previously calibrated the ambient air temperature sensor should not require adjustment; if adjustment is required then the unit's casing will need to be opened by releasing the four screws at the back of the casing.
Using the trim tool adjust VR2 on the control board so that the displayed temperature is the same as the recorded temperature on the thermometer.
Press the START button when complete.

Setting the time and date.
Using the unit's keypad enter the correct date and time, by pressing the START button after each value is entered will advance the cursor to the next position, if an incorrect value is entered the display will show ERROR and the correct value will have to be re-entered.
Press the START button when complete.

Setting the supply voltage.
The display will now show the supply voltage entry screen.
Measure the supply ac voltage using the RMS multimeter, enter the value of the supply recorded using the keypad.
Press the START button when complete.

Resistance measurement calibration.
Connect the output lead to the electrofusion unit.
Connect one of the output lead terminal ends of the output lead to the common terminal of the resistance test box.
Connect the other terminal end of the output lead to the resistances 0Ω, 3.9 Ω, 16 Ω, 39 Ω and 160 Ω in turn. Whilst each resistance value is connected the display will indicate a pass status next to each resistance value if the measurement was successful.
Disconnect the resistance test box from the output lead.
Press the START button when complete.

Note. If the measurement of one of the resistance values was not successful,
the measured ADC (analogue to digital) value will be displayed and the calibration will stop
at this point; this can be caused by:

a. the resistance test box is faulty (check that the resistors are correct)
b. the output lead is faulty (check the continuity of the output lead)
c. the analogue board is faulty (check/replace the analogue board)
d. the control board is faulty (check/replace the control board)

until the fault is corrected calibration of the electrofusion unit cannot be completed.

Timer test.
The display will now show a timed countdown of 10 seconds, this is to check that the real time clock/calendar inside the unit is working correctly.
Note. If the date and time have not been set as in the earlier stage, or the real time clock/calendar is faulty then the timer countdown will not start.
When complete the display will show a value of approximately 10, press the START button to continue.

High resistance load (5 amps) output voltage and current calibration.
Connect the RMS voltmeter across the 5 amp test load and clamp the RMS current meter on to one of the test load leads.
With the output lead still connected to the electrofusion unit, when prompted connect output lead terminal ends to the 5 amp test load.
Press the START button when ready, the unit will now start the power cycle.
Leave the unit to run for at least 20 seconds to allow for the output voltage to stabilize at a value of about 40V ac rms and the output current reads about 5A ac rms, note down the measured voltage and current values then press the START button the output will switch off.
Enter the voltage and current recorded on the RMS voltage and current meters using the keypad.
Press the START button when complete.

Low resistance load (50 amps) output voltage and current calibration.
Connect the RMS voltmeter across the 50 amp test load and clamp the RMS current meter on to one of the test load leads.
With the output lead still connected to the electrofusion unit, when prompted connect output lead terminal ends to the 50 amp test load.
Press the START button when ready, the unit will now start the power cycle.
Leave the unit to run for at least 20 seconds to allow for the output voltage to stabilize at a value of about 40V ac rms and the output current reads about 50A ac rms, note down the measured voltage and current values then press the START button the output will switch off.
Enter the voltage and current recorded on the RMS voltage and current meters using the keypad.
Press the START button when complete.

Entering the product code.
Note. If the electrofusion unit has been previously calibrated the product code will not need re-entering.
Using the keypad enter the product code of the electrofusion unit.
Press the START button when complete.

Entering the serial number.
Note. If the electrofusion unit has been previously calibrated the serial number will not need re-entering.
Using the keypad enter the serial number of the electrofusion unit.
Press the START button when complete.

Entering the owner name.
Note. If the electrofusion unit has been previously calibrated the owner name will not need re-entering.
Using the keypad enter the first line of the owner name. Press the START button when complete.
Using the keypad enter the second line of the owner name. Press the START button when complete.

Clearing the weld record memory.
The option to clear the weld record memory is now displayed.
Select **YES** to delete the weld record memory or **NO** to keep the weld records. Press the START button when complete.

Entering the calibrated by initials.
Use the keypad to enter the initials of the person who has calibrated the electrofusion unit.
Press the START button when complete.

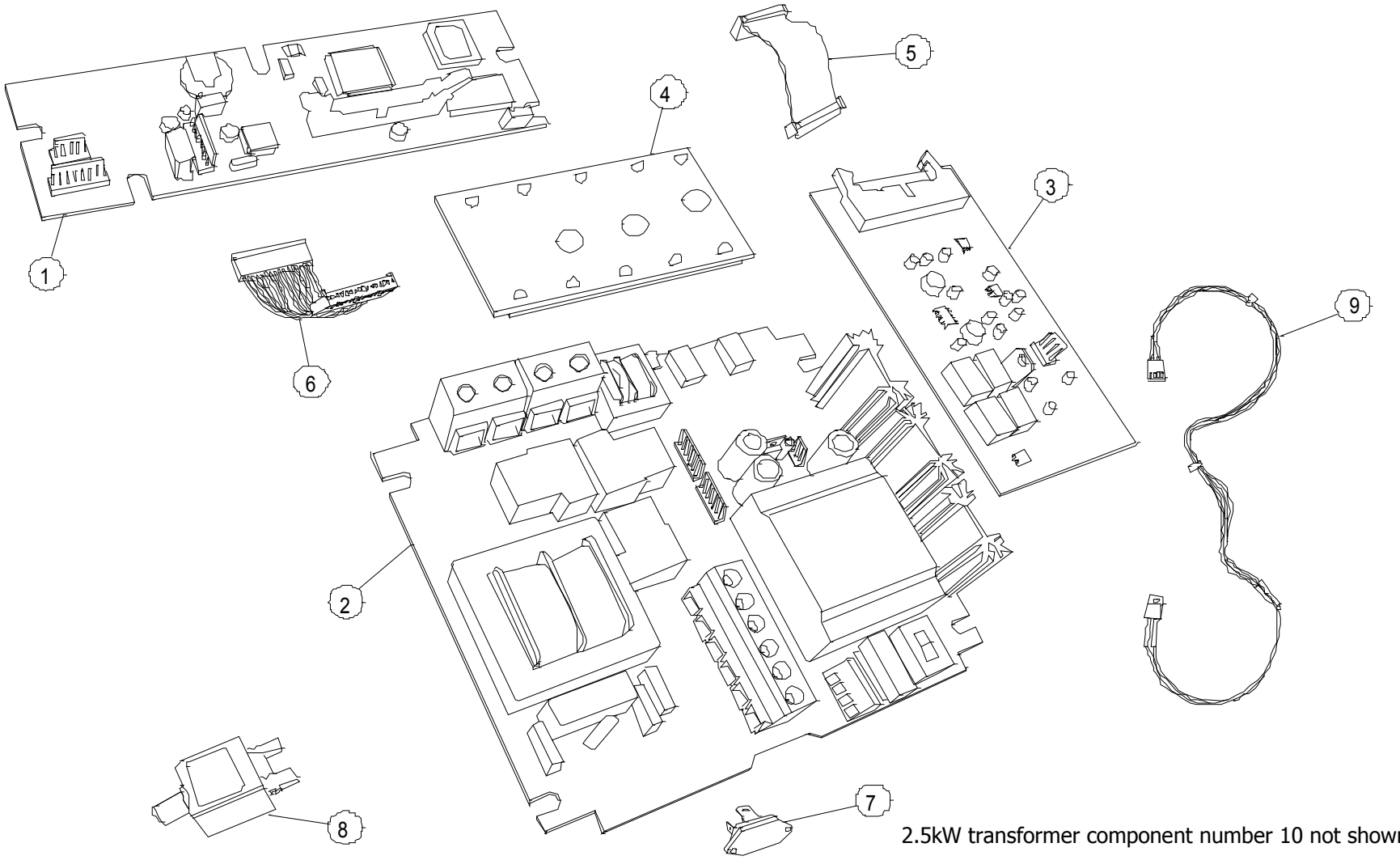
Calibration is now complete.
Remove the supply from the electrofusion unit.
Check all connections inside the unit are secure and fasten the casing by securing the four screws at the back of the unit.
Reconnect the supply and perform a test weld to confirm calibration condition.

Section 3.

Internal circuitry components.

External circuitry components parts list.

Internal circuitry components.



2.5kW transformer component number 10 not shown.

Internal circuitry components part list.

Component	Part number	Description
1		CVTE0034 Issue 9 Rev 1 control board
2		CVTE0030 Issue 9 Rev 1 power board
3		CVTE0055 Issue 1 Rev 1 analogue board
4		4 line x 20 column alphanumeric display
5		Interconnecting ribbon cable assembly
6		Alphanumeric display cable loom assembly
7		Triac
8		30 amp thermal circuit breaker (110 volt supply variant) or
		20 amp thermal circuit breaker (240 volt supply variant)
9		Case temperature sensor and transformer temperature sensor assembly
10		2.5kW transformer

External circuitry components parts list.

Component	Part number	Description
1		Front casing (pre-drilled)
2		Back casing (pre-drilled)
3		Display label
4		Keypad label
5		Display window
6		16A Input lead assembly
7		32A Input lead assembly
8		Output lead assembly (inc. accessory bag)
9		Storage net (inc. screws)
10		Rubber casing gasket
11		Start button (normally open contacts)
12		Stop button (normally closed contacts)
13		Emergency stop switch complete
14		Set of M8xXXmm bolts (4 per set) for front to back casing fixing
15		Thermal circuit breaker weatherproof cover

Section 4.

Circuit descriptions.

Control board circuitry (refer to drawing CVTE0034 Control Board 40V).

The main components of the control board comprise of the main processor (U1), the eprom (U2), the non-volatile memory (U3), the USB controller (U7), the clock/calendar (U5) and the alphanumeric display connected to V1.

The main processor controls all the functions of the machine by communicating with the eprom, non-volatile memory, clock/calendar, the display, the analogue circuitry via PL1, the control buttons via PL4, and the touch keypad via PL5.

The eprom holds the software which the main processor uses to function. It is held in a holder which allows it to be removed and replaced when software updates have been issued.

The non-volatile memory is used to store the weld record information and other system related information.

The clock/calendar is used to store the time and date and other system related information.

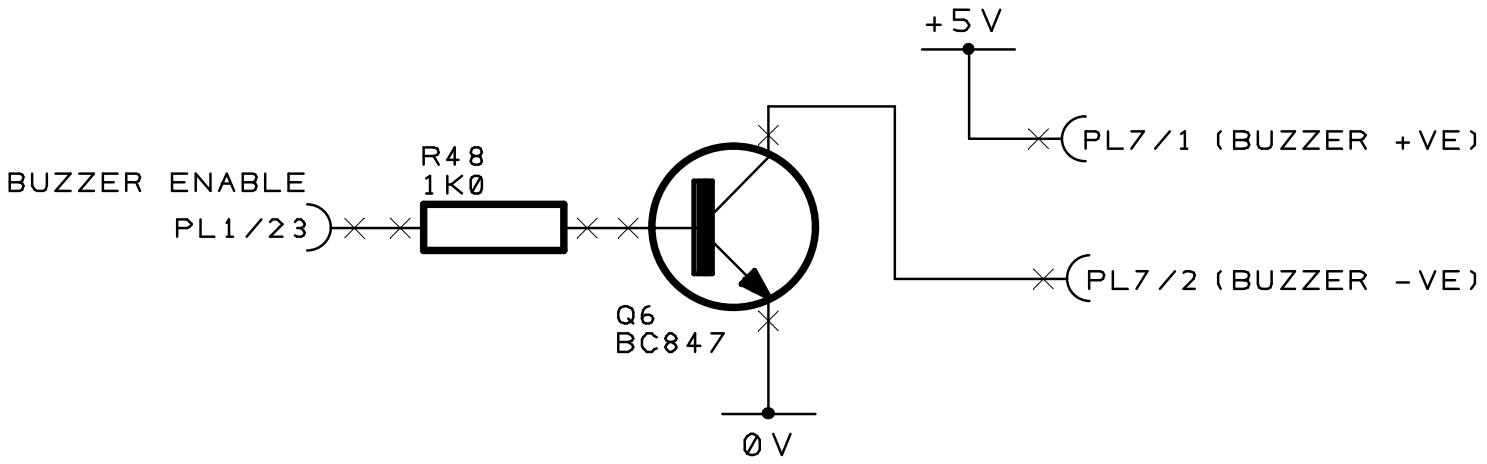
The USB controller controls the communication between the USB flash memory used in downloading weld information and the USB barcode reader.

Analogue board circuitry (refer to drawing CVTE0055 Analogue Board 40V).

The following section gives a detailed description of the functions of the analogue board circuitry.

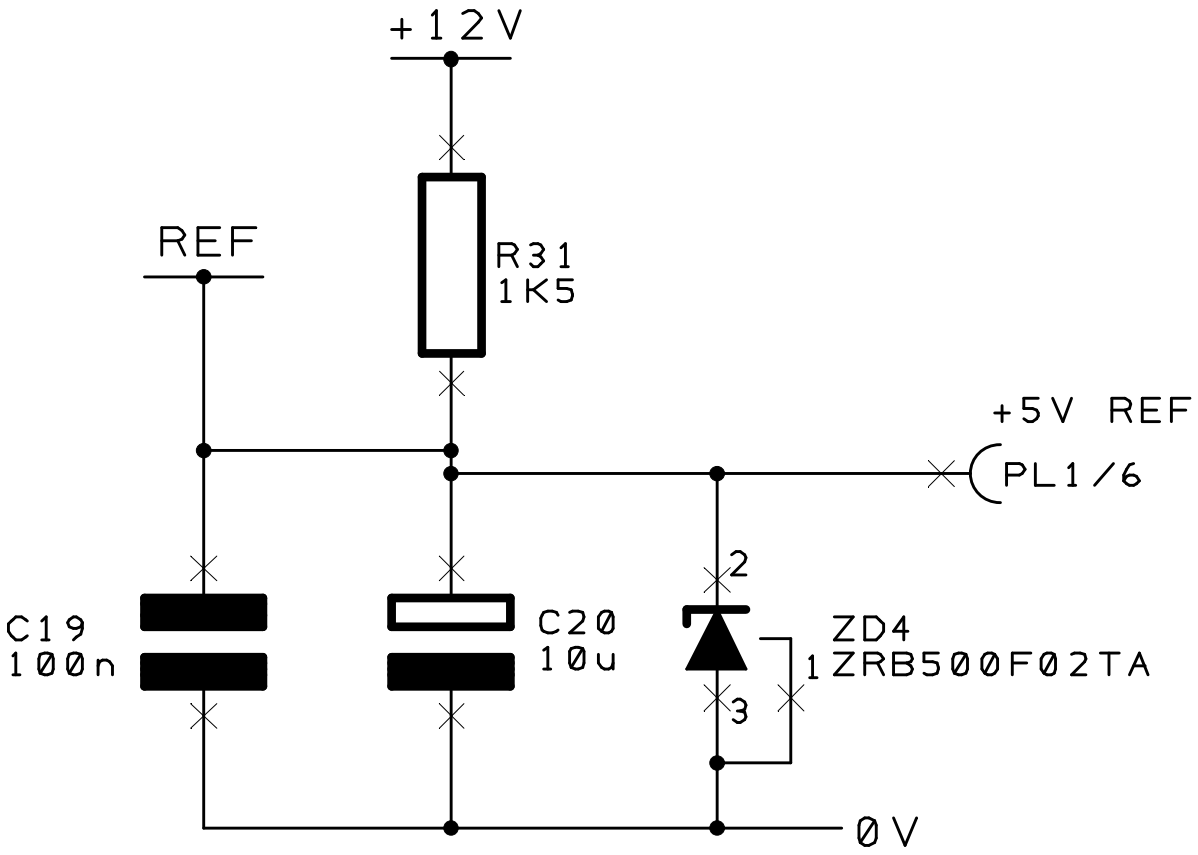
This page is intentionally blank

Buzzer circuit.



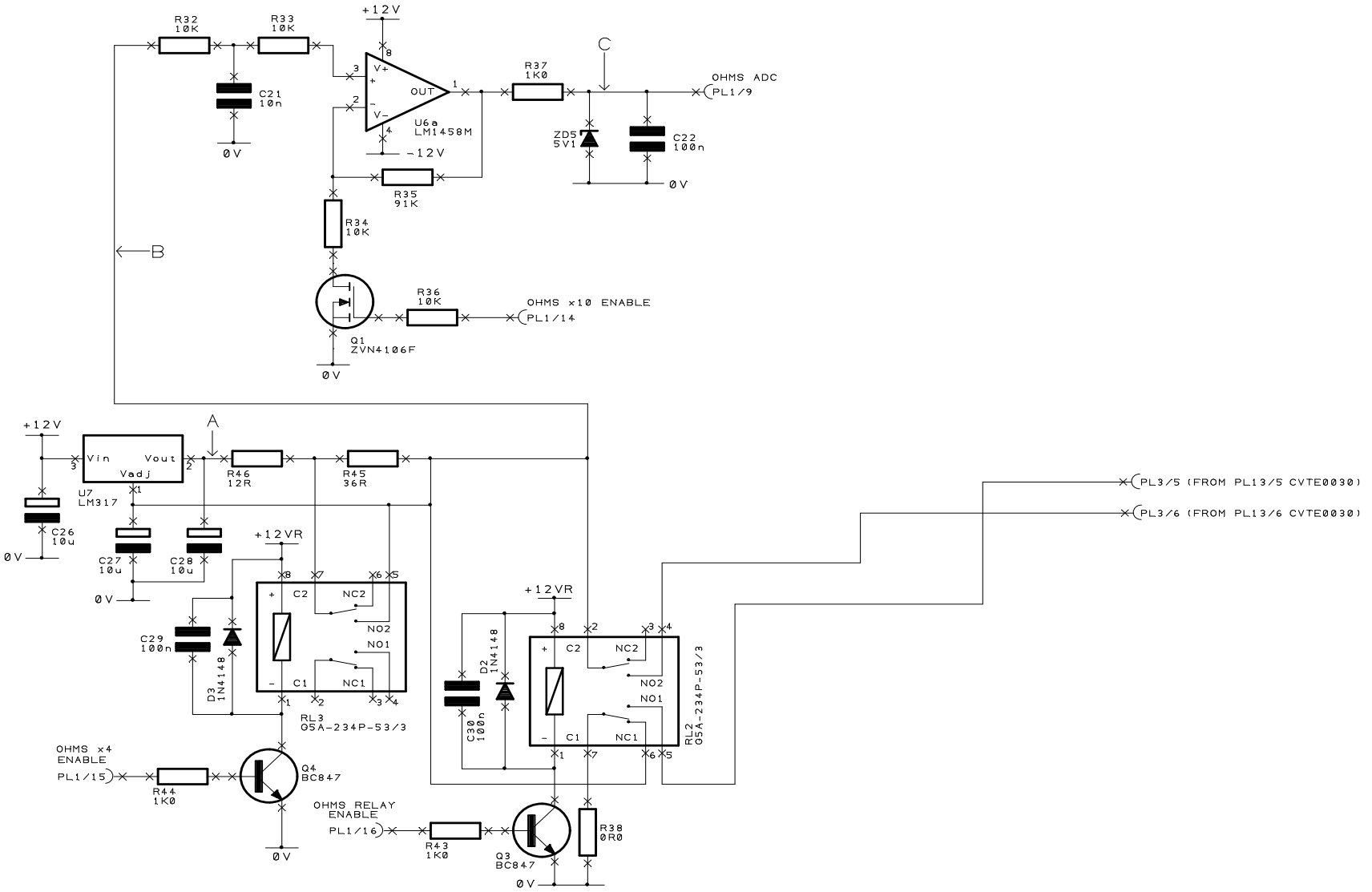
When Q6 is switched on via PL1/23 by the main processor on the control board CVTE0034 this allows current to flow through the buzzer connected across the connections PL7/1 and PL7/2.

+5V precision voltage reference circuit.



ZD4 is a precision voltage reference, which is used primarily to supply a stable reference voltage for the main processor's ADC processes. R31 limits the current passing through ZD4 whilst C19 and C20 provide smoothing.

Fitting resistance measurement circuit.

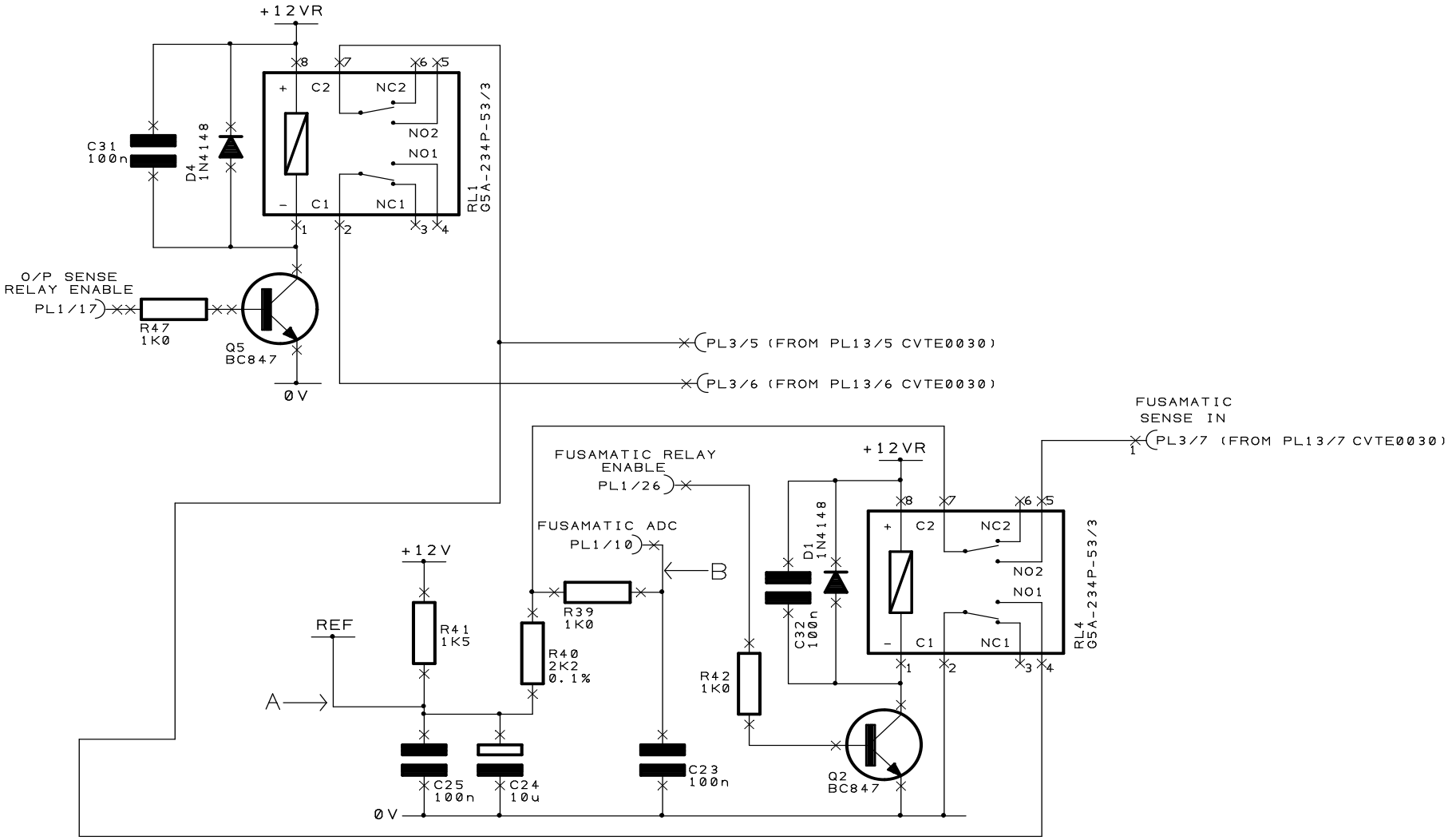


U7 is a 1.2V to 37V voltage regulator, which gives a 1.27V dc output. With RL3 off the resistors R45 and R46 are connected between the V_{OUT} terminal and the V_{ADJ} terminal; this gives a constant current of 26mA flowing out of U7 at point A. With RL3 on the resistor R45 is by-passed with R46 remaining in circuit with the V_{OUT} and V_{ADJ} terminals of U7; this now gives a constant current of 105mA flowing out of U7 at point A.

When a fitting is connected via PL3/5 and PL3/6 and RL2 is switched on, then the selected constant current (see above paragraph) flows through the fitting resistance to 0V. This current flow through the fitting resistance develops a dc voltage at point B. This voltage passes to the circuit of R32, C21 and R33 which provides filtering before it passes through to the circuit of U6a, R34, R35, Q1 and R36 which are configured as a switchable x1 or x10 amplifier. With Q1 switched off the voltage at point B is amplified by a factor of 1; with Q1 switched on the voltage at point B is amplified by a factor of 10.

The resultant voltage at point C is fed via PL1/9 to the ohms ADC input of the main processor on the control board CVTE0034.

Fusamatic measurement circuit.

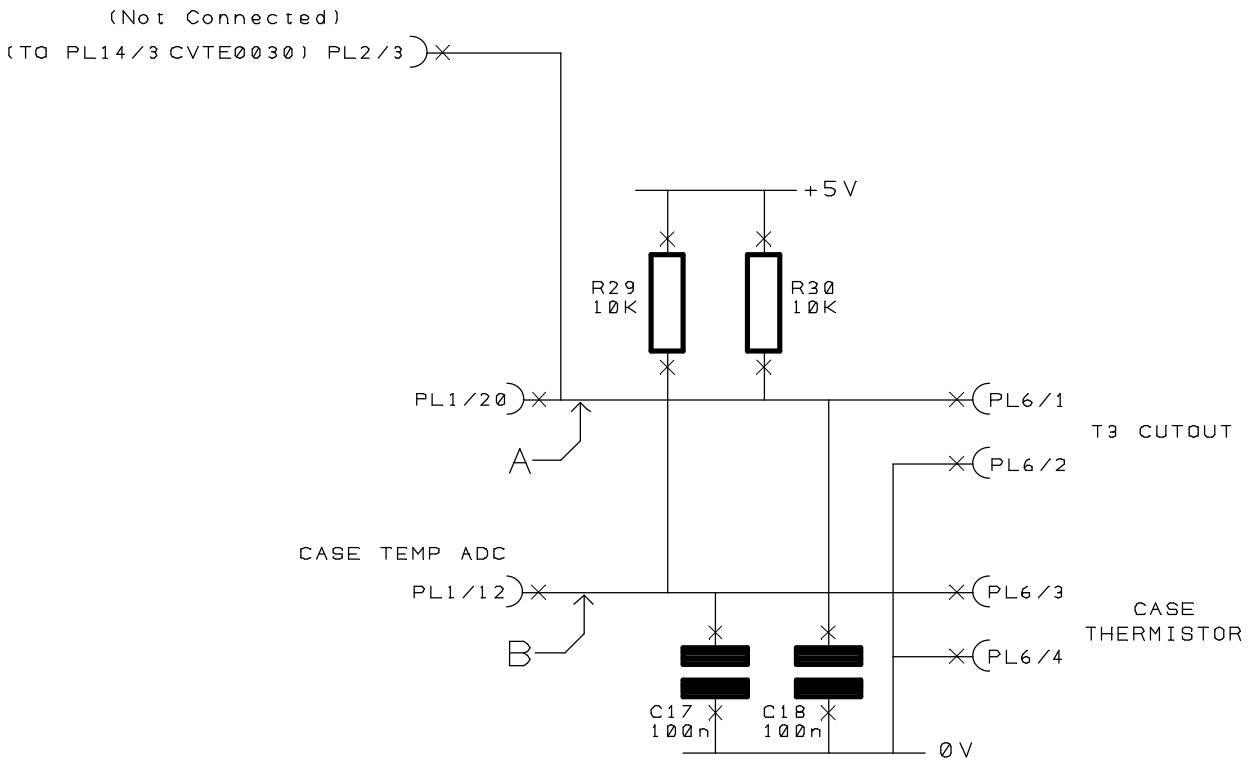


A Fusamatic® fitting comprises of a built in fusion time determining resistor. When the fitting is connected to the output of the electrofusion unit, one side of this resistor is connected to PL3/5 via PL13/5 on the power board CVTE0030; whilst the other side is connected to PL3/7 via PL13/7 on the power board CVTE0030.

By switching RL4 on, the time determining resistor is placed in series with R40 forming a potential divider circuit fed by a +5V reference voltage at point A.

The resultant voltage of the potential divider circuit at point B is fed via PL1/10 to the fusamatic ADC input of the main processor on the control board CVTE0034. R39 limits the current flowing into the ADC input whilst C23 provides smoothing.

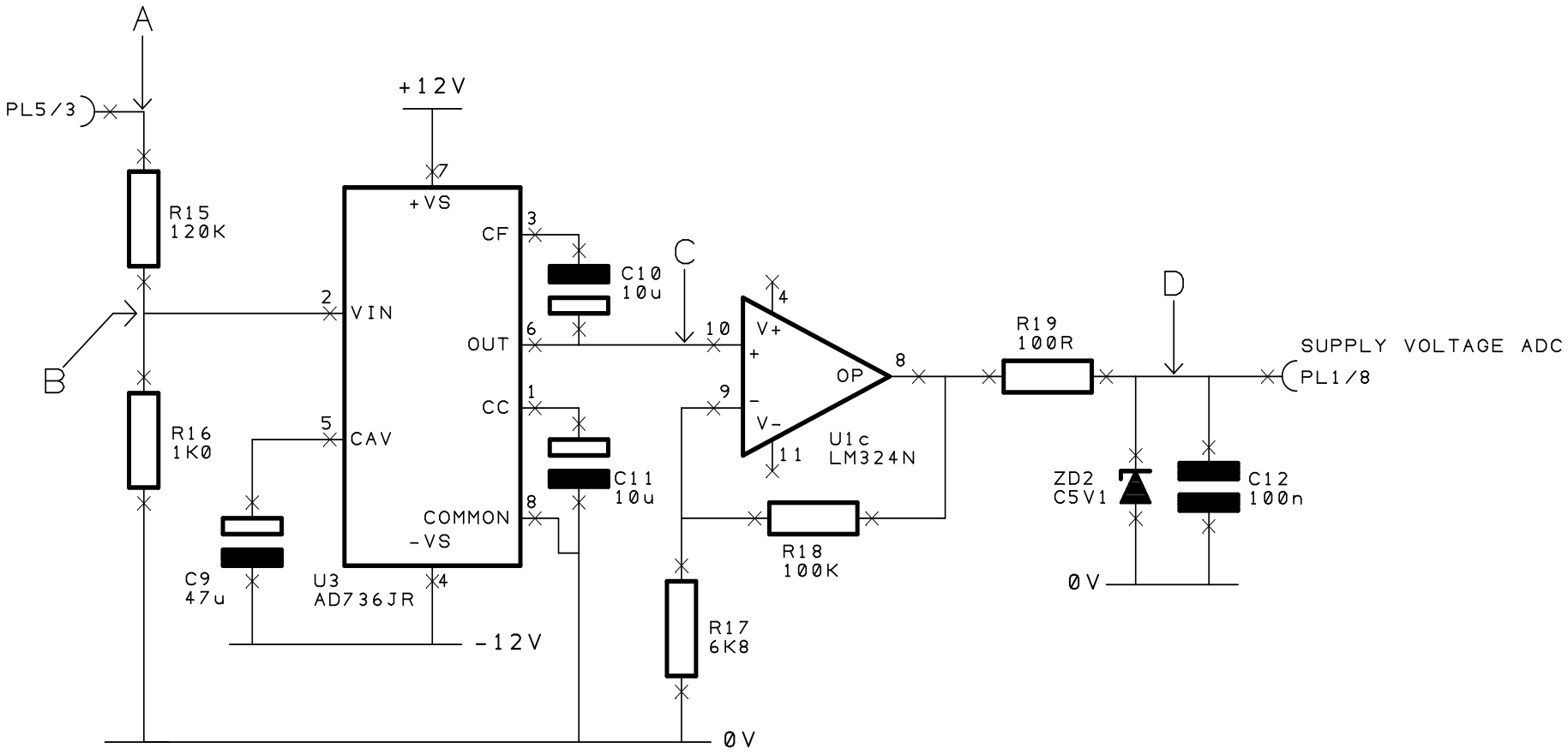
Case and transformer T3 temperature measuring circuit.



A thermal switch is attached to the transformer T3, the switches contacts are normally open at temperatures less than +90°C; above +90°C the switches contacts close and only reset to the open position when the sensor reaches a temperature of approximately +70°C. The thermal switch is connected via PL6/1 and PL6/2 when the contacts are open the voltage at point A is held at a dc level of +5V by the resistor R30. When the contacts close point A is grounded to 0V through the switch contacts. The voltage level at point A is fed to the main processor on CVTE0034 via PL1/20. This circuit is designed to protect the transformer T3 from thermal damage.

A thermistor connected across PL6/3 and PL6/4 is used to measure the temperature of the aluminium section of the casing. The thermistor along with R29 forms a potential divider, which as the resistance of the casing rises, the resistance of the thermistor, alters and therefore the voltage level at point B changes with respect to the case temperature. The voltage at point B is fed to the main processor on the control board CVTE0034 via PL1/12. The case temperature is measured to avoid the casing from becoming so hot that it becomes a hazard to the operator. At around +50°C the main processor will not permit any further welding cycles to be performed until the casing has cooled to a safe limit.

Supply voltage measuring circuit.

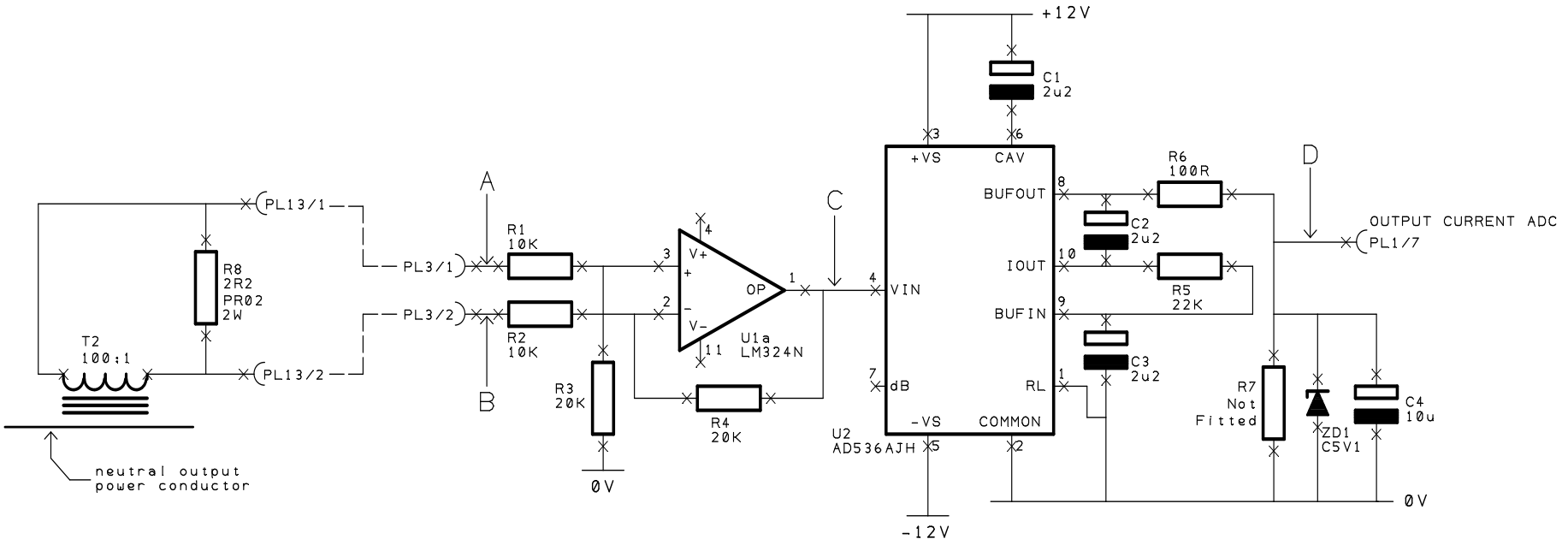


The secondary voltage of the PSU transformer T1 is fed into the potential divider circuit of R15 and R16 at point A. The resultant voltage of the divider circuit at point B is fed into the input of U3, which is an rms to dc convertor, which produces a direct dc equivalent output of the rms voltage feeding into the input.

The dc output at point C is then fed into the circuit of R17, R18 and U1c, where it is amplified by a factor of approximately 16. The final dc voltage at point D is fed via PL1/8 to the supply voltage ADC input of the main processor on the control board CVTE0034. ZD2 clamps the voltage to 5.1 volts and C12 provides smoothing.

Point	Expected point value
A	15V ac rms
B	124mV ac rms
C	124mV dc
D	1.95V dc

Output current measuring circuit.



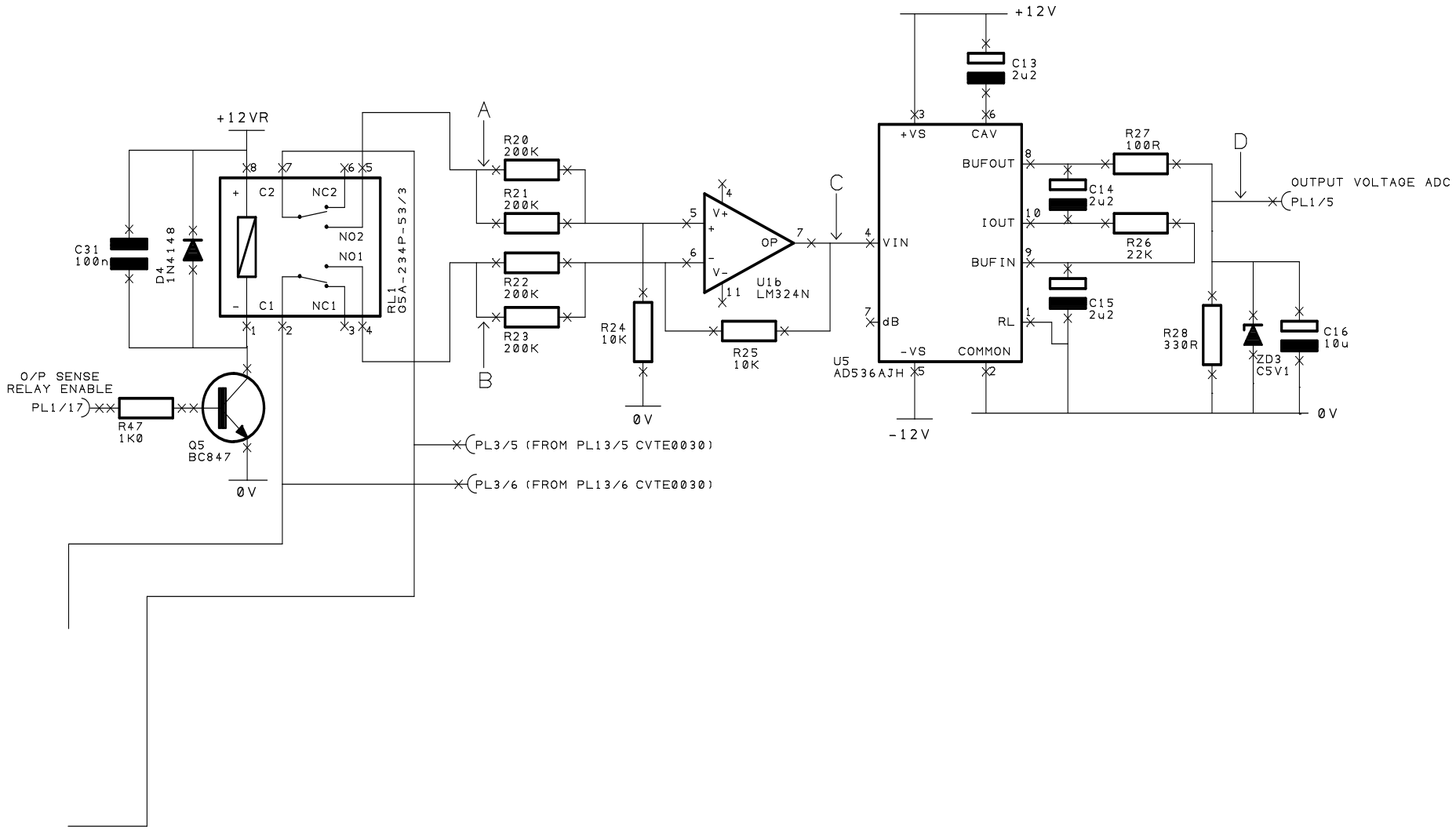
The output current flowing in the neutral output power conductor induces a current into the winding of T2 which has a reduction ratio of 100:1, therefore a current of 20A ac rms flowing in the neutral conductor will induce a reduced current of 200mA ac rms into the winding of T2.
The resistor R8 develops an ac voltage across the winding of T2, which then feeds to the circuit of U1a.

The table below shows the expected ac voltage values at points A and B for differing values of output current flowing in the neutral conductor.

The circuit of U1a and it's associated resistors R1, R2, R3 and R4 is a differential amplifier circuit. The difference between the +ve and –ve terminals on U1a is amplified by a factor of 0.5, so for an ac voltage of 440mV at point A or B the output at point C will be 220mV ac. The resultant voltage at point C is then fed into U2, which is an rms to dc convertor, which gives an equivalent dc voltage output to the ac voltage feeding in. The dc voltage at point D is fed via PL1/7 to the output current ADC pin of the main processor on the control board CVTE0034. ZD1 clamps the voltage to 5.1 volts whilst C4 provides smoothing.

Neutral output power conductor	Points A and B
1A ac rms	22mV ac rms
5A ac rms	110mV ac rms
10A ac rms	220mV ac rms
20A ac rms	440mV ac rms
50A ac rms	1.10V ac rms
60A ac rms	1.32V ac rms

Output voltage measuring circuit.

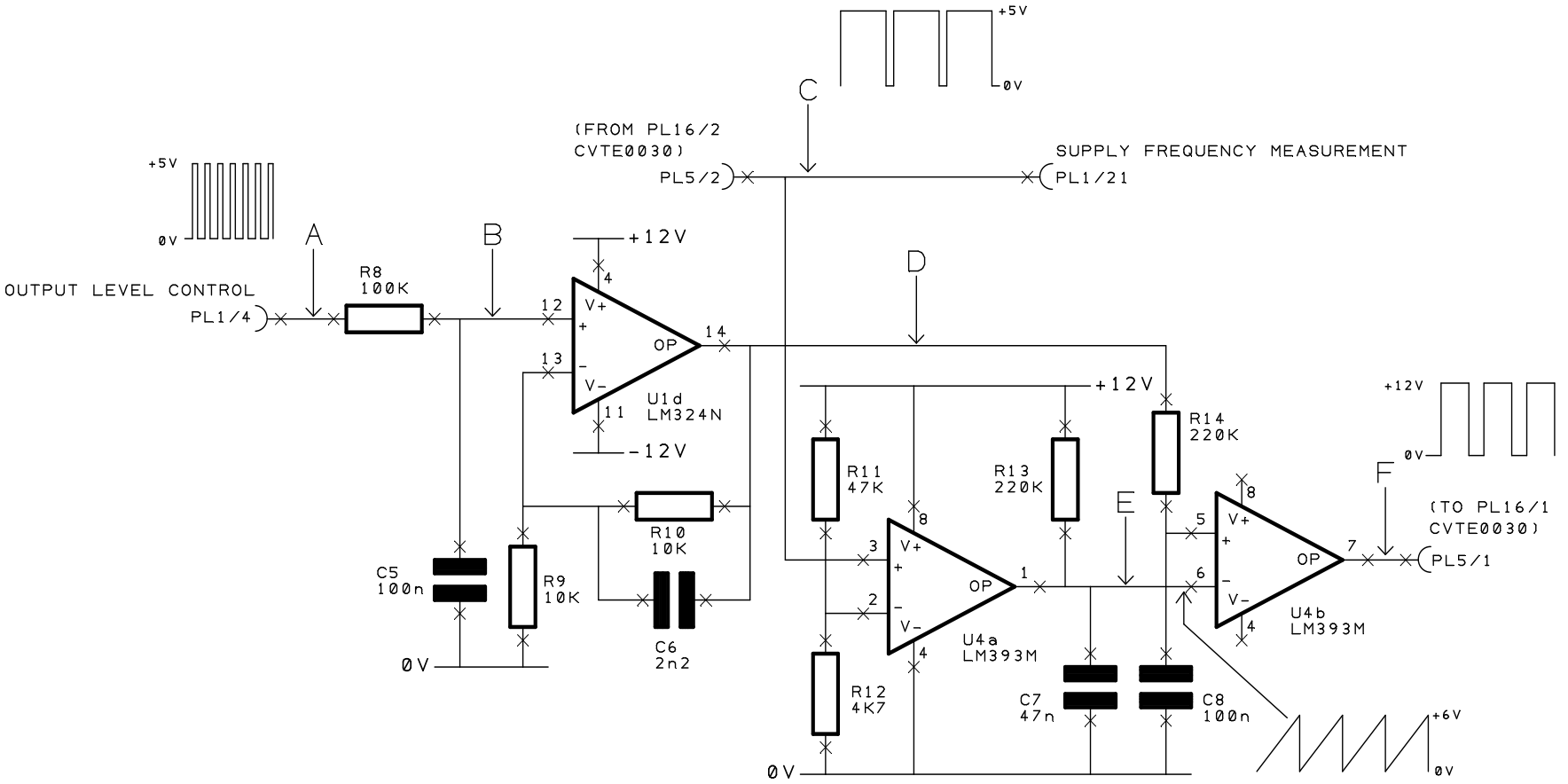


Relay RL1 is turned on by Q5 which in turn is activated by the main processor on the control board CVTE0034 via PL1/17; this allows the output voltage sense connections at PL13/5 and PL13/6 on the power board CVTE0030 to be connected via PL3/5 and PL3/6 respectively to the circuit of U1b.

The circuit of U1b and it's associated resistors R20, R21, R22, R24 and R25 is a differential amplifier circuit. The difference between the +ve and –ve terminals on U1b is amplified by a factor of 0.1, so for an ac voltage of 39.5V at point A or B the output at point C will be 3.95V ac.

The resultant voltage at point C is then fed into U5, which is an rms to dc convertor, which gives an equivalent dc voltage output to the ac voltage feeding in. The dc voltage at point D is fed via PL1/5 to the output voltage ADC pin of the main processor on the control board CVTE0034. ZD3 clamps the voltage to 5.1 volts whilst C16 provides smoothing.

Output control circuit.

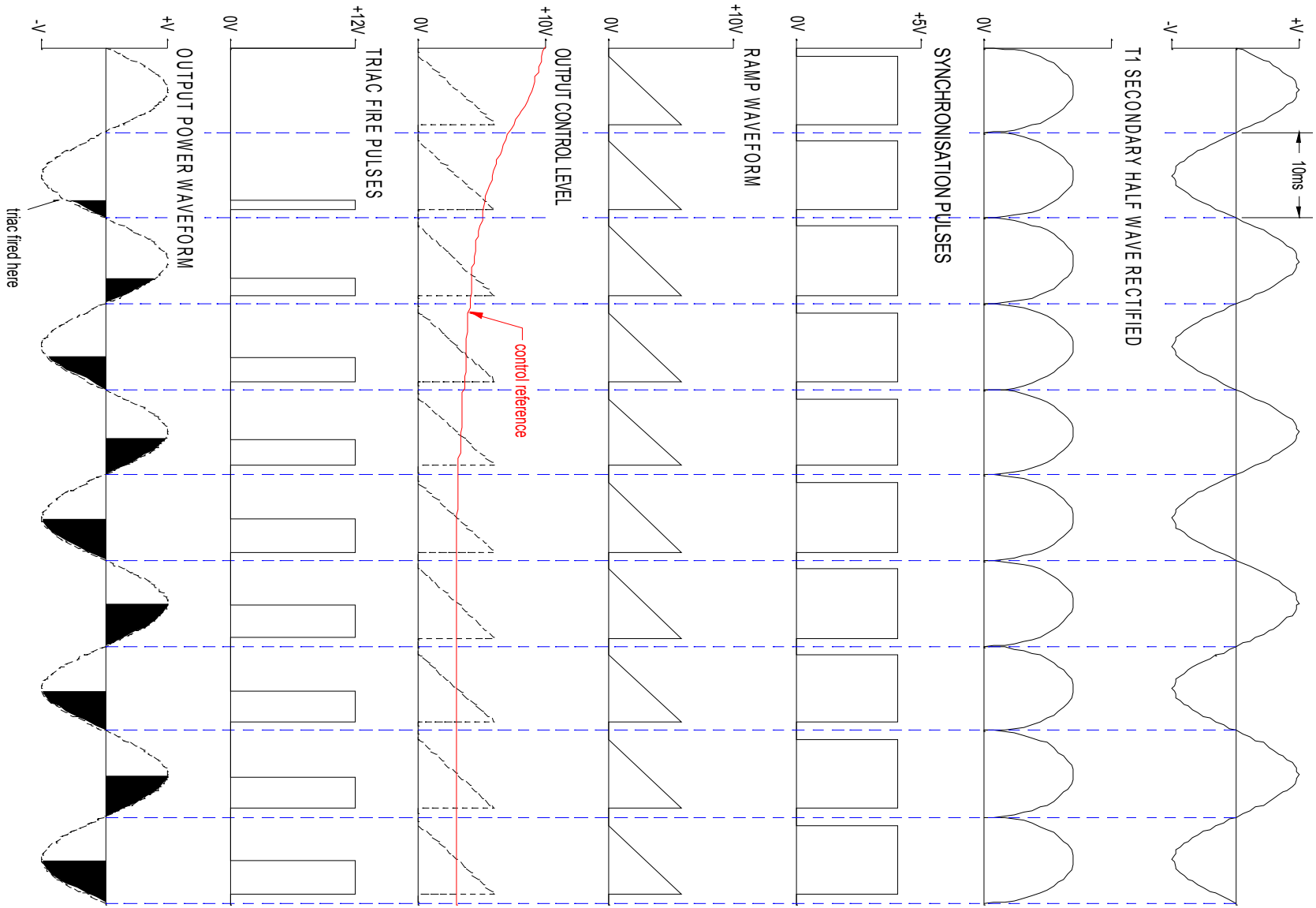


The control output is fed to point A from the main processor on the control board CVTE0034 via PL1/4. The low pass filter of R8 and C5 with a cut-off frequency of approximately 1.6Hz, filters out the PWM (pulse width modulation) output of the main processor to give a dc level control reference at point B. The circuit of U1d, R9 and R10 amplify the voltage at point B by a factor of 2 whilst C6 provides high frequency cut-off.

The amplified dc voltage at point D is then fed via R14 to the positive terminal of U4b. The supply synchronisation pulses at point C are fed from the power board via PL5/2 into the positive terminal of U4a, which is a comparator. As the pulses rise above and fall below the level on the negative terminal this allows C7 to charge and discharge giving a ramp waveform at point E.

When the ramp waveform level on the negative terminal of U4b rises above and falls below the control reference on the positive terminal of U4b which again is a comparator, U4b gives a pulsed output which in turn switches the opto-isolator triac on the power board CVTE0030 on and off in synchronisation with the supply frequency.

The diagram overleaf shows the synchronisation of the output power waveform with respect to the ac supply waveform as well as the magnitude of the output waveform in relation to the control reference passing through the ramp waveform.


AC SUPPLY WAVEFORM
+V
-V
10ms
T1 SECONDARY HALF WAVE RECTIFIED
0V
SYNCHRONISATION PULSES
+5V
0V
RAMP WAVEFORM
+10V
0V
OUTPUT CONTROL LEVEL
+10V
0V
control reference
TRIAC FIRE PULSES
+12V
0V
OUTPUT POWER WAVEFORM
+V
-V
triac fired here

Power board circuitry (refer to drawing CVTE0030 Power Board).

The EMC filter consists of the components L1, C1, C2, C3 and R1. The choke L1 is designed to stop common mode noise entering or leaving the machine via the input lead and forms part of the filter along with the X capacitor C1 and the two Y capacitors C2 and C3. R1 provides a discharge path for the capacitors. UA1 (and UA2 – 240V only) is fitted to remove any excess voltage spikes.

The power supply is a conventional linear supply. The secondary of the transformer T1 is fed into a bridge rectifier BR1, the voltage regulators U3, U4 and U5 are fed from the bridge rectifier and produce the dc voltage levels required by the rest of the circuitry. U2 is a +12 volt dc rectifier fed directly from the secondary of T1 via the diodes D1 and D2 which provide full wave rectification, this voltage is used to supply all the dc relays. All the capacitors within the power supply circuitry are used for smoothing of the rectified voltages.
U1 is an opto-isolator which with it's associated circuitry is used to switch the triac on (the triac automatically switches off at the zero voltage crossing point). U1 in turn is switched on and off by the pulses entering it at pin 2 from the analogue circuit board (see Analogue board circuitry, Output control circuit). R3, R4 (240V only), R5, R6 (240V only) and C4 provide dv/dt transient suppression to avoid the false switching of the triac.

To control the welding voltage accurately, the zero voltage crossing points of the supply waveform have to be detected in order to switch the triac on with the correct timing. The secondary of T1 is used to provide a reference of the supply voltage waveform, this secondary voltage is full wave rectified by D3 and D4 with some filtering provided by the resistors R9 and R10 and the capacitors C12 and C13. This rectified voltage is clipped with a 5.1 volt zener diode ZD1 before being fed into pin 5 of U6. U6 is a small microcontroller which is used to time the period between the waveform pulses and digitally filters out any spurious ones. The filtered signal is then fed to the analogue board (see Analogue board circuitry, Output control circuit) and also to the main processor for supply frequency measurement.

When the relay RL1 is activated the supply voltage is allowed to flow through the primary of the 2.5kW transformer T3. RL1 in turn is activated by RL4 which is switched on and off by the main processor. When relays RL2 and RL3 are activated the secondary voltage of T3 is allowed to flow through to output. RL2 and RL3 are in turn is activated by RL5 which again is switched on and off by the main processor. The purpose of this 'double' switching of the 2.5kW transformer is to reduce the possibility of the triac being inadvertently switched on due to transients which may appear as the supply voltage is connected to the triac, in this case the voltage passed by the triac will only flow in the primary of T3 for that half waveform cycle as the secondary circuit will still be open with RL2 and RL3 not being activated.

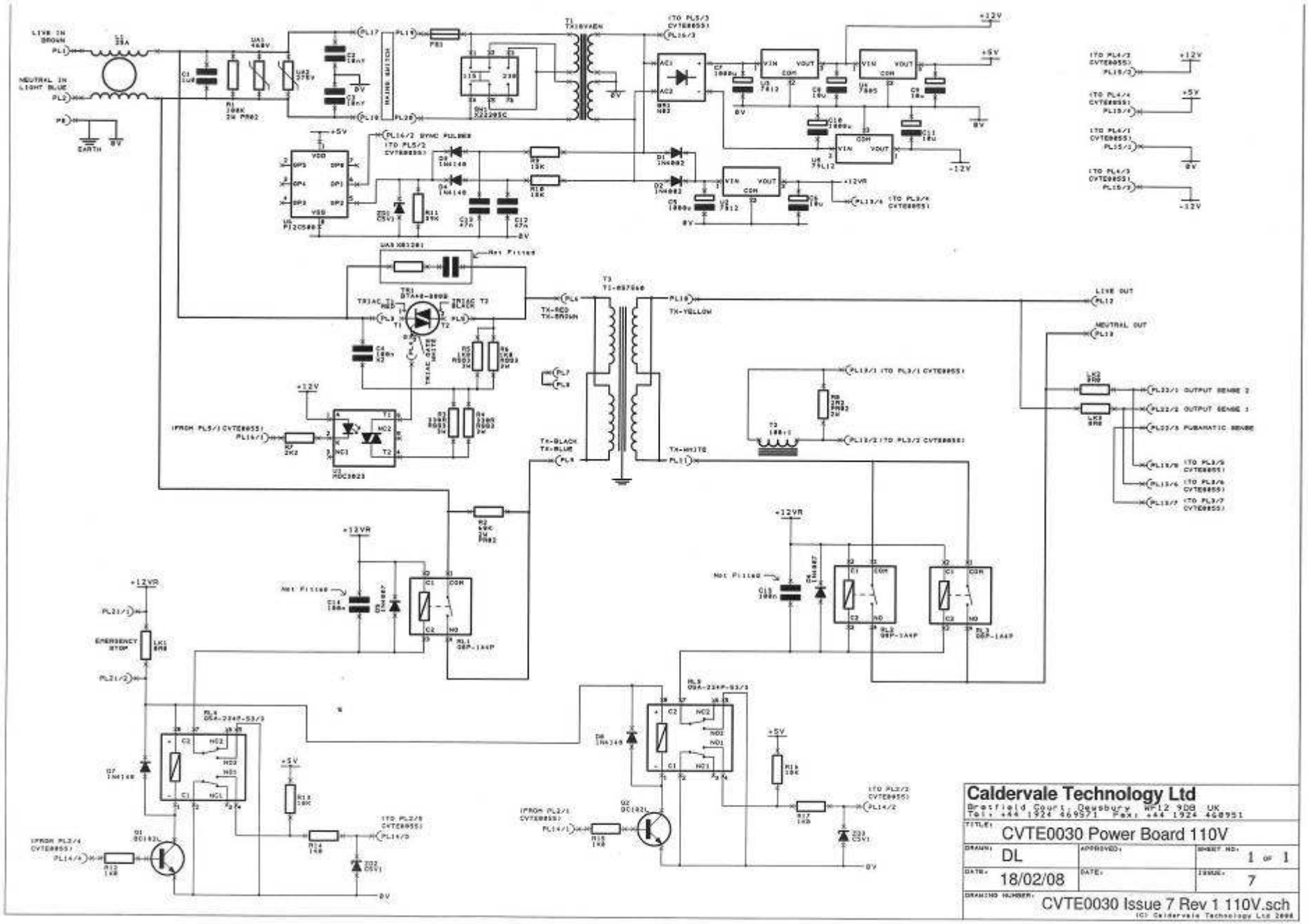
T2 is a current transformer with a ratio of 100:1 which allows for the measurement of the output current. R8 is used to develop a voltage from the current induced into the windings of T2, this voltage is then fed to the analogue board (see Analogue board circuitry, Output current measuring circuit).

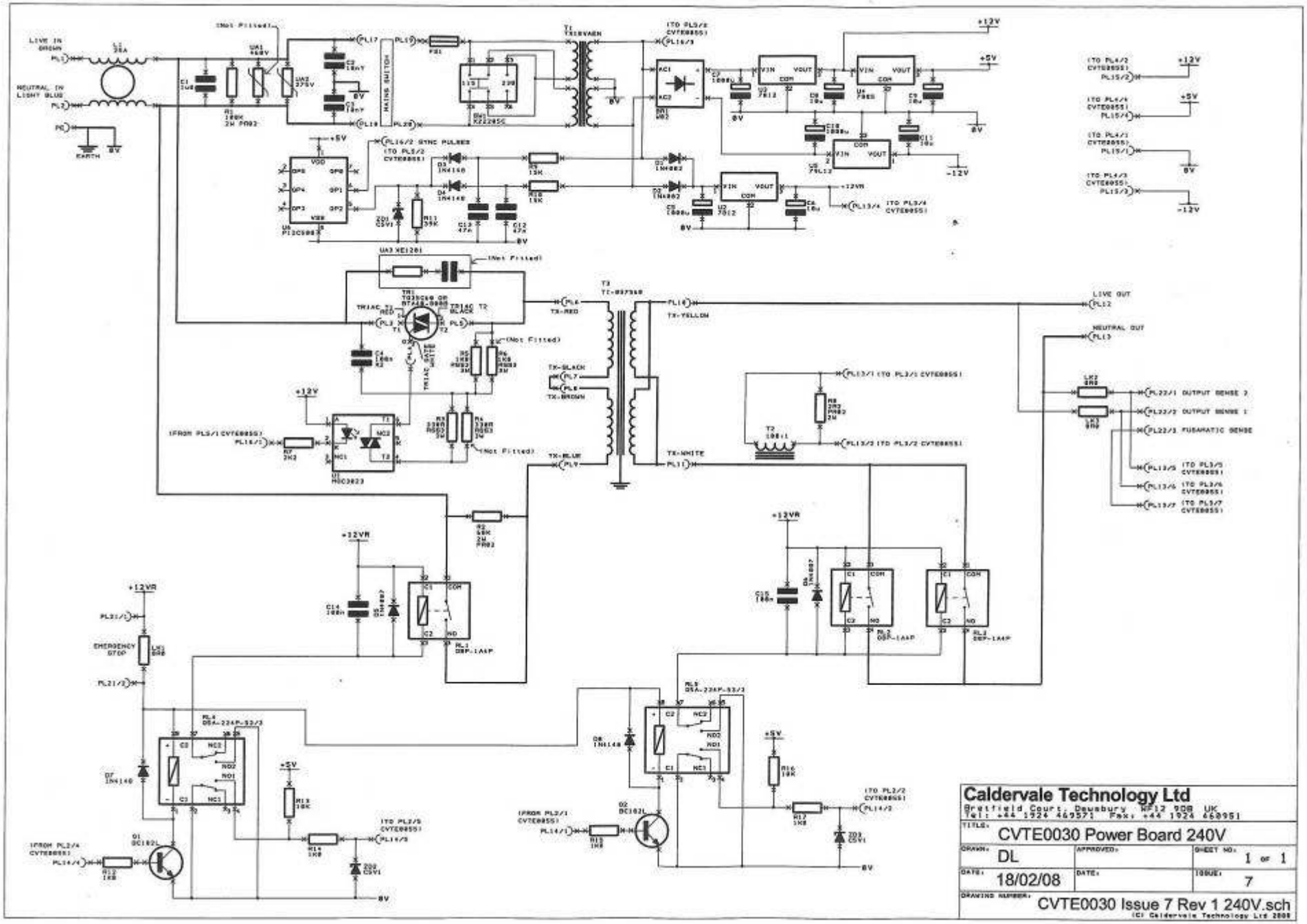
Section 5.

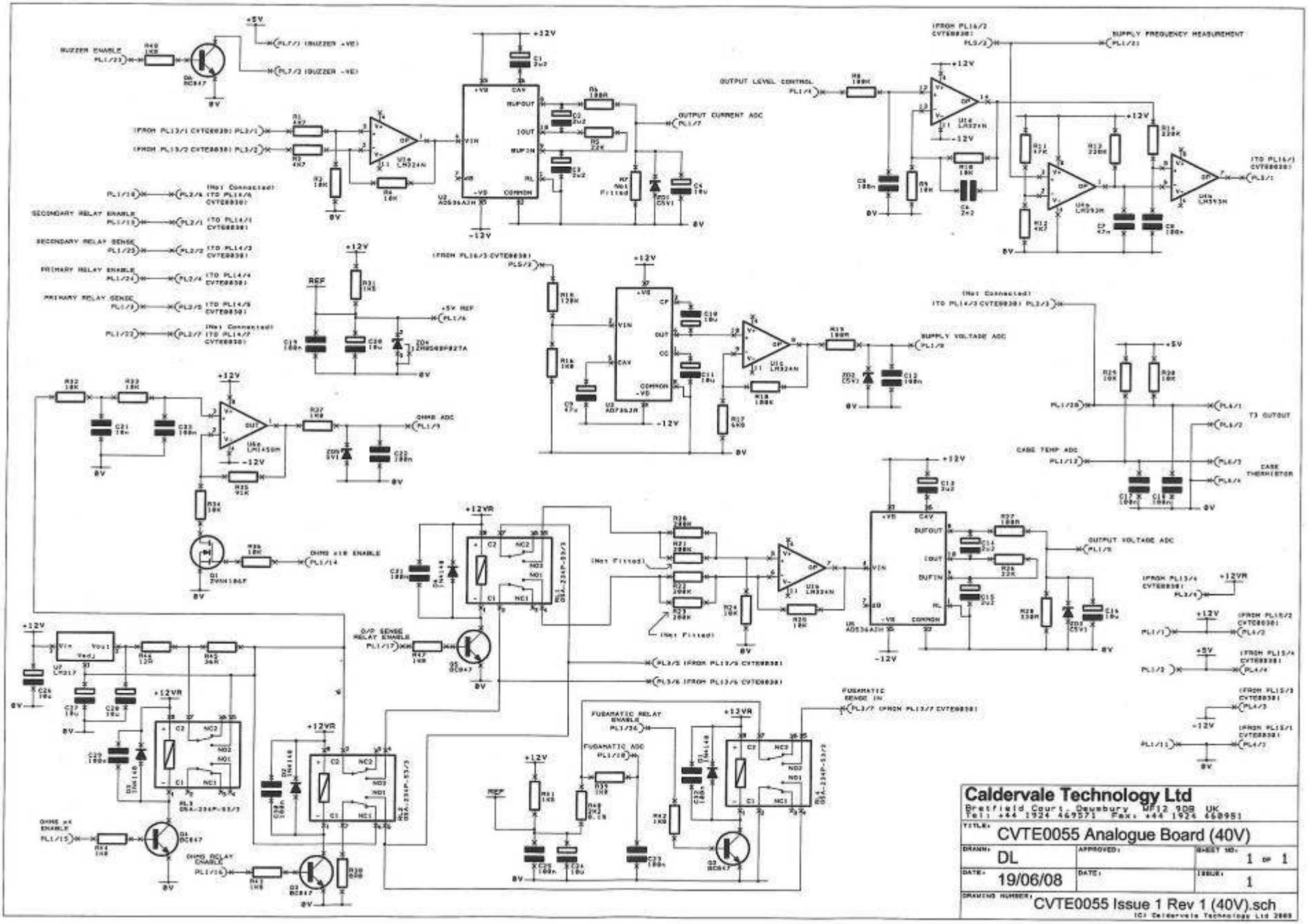
Circuit diagrams.

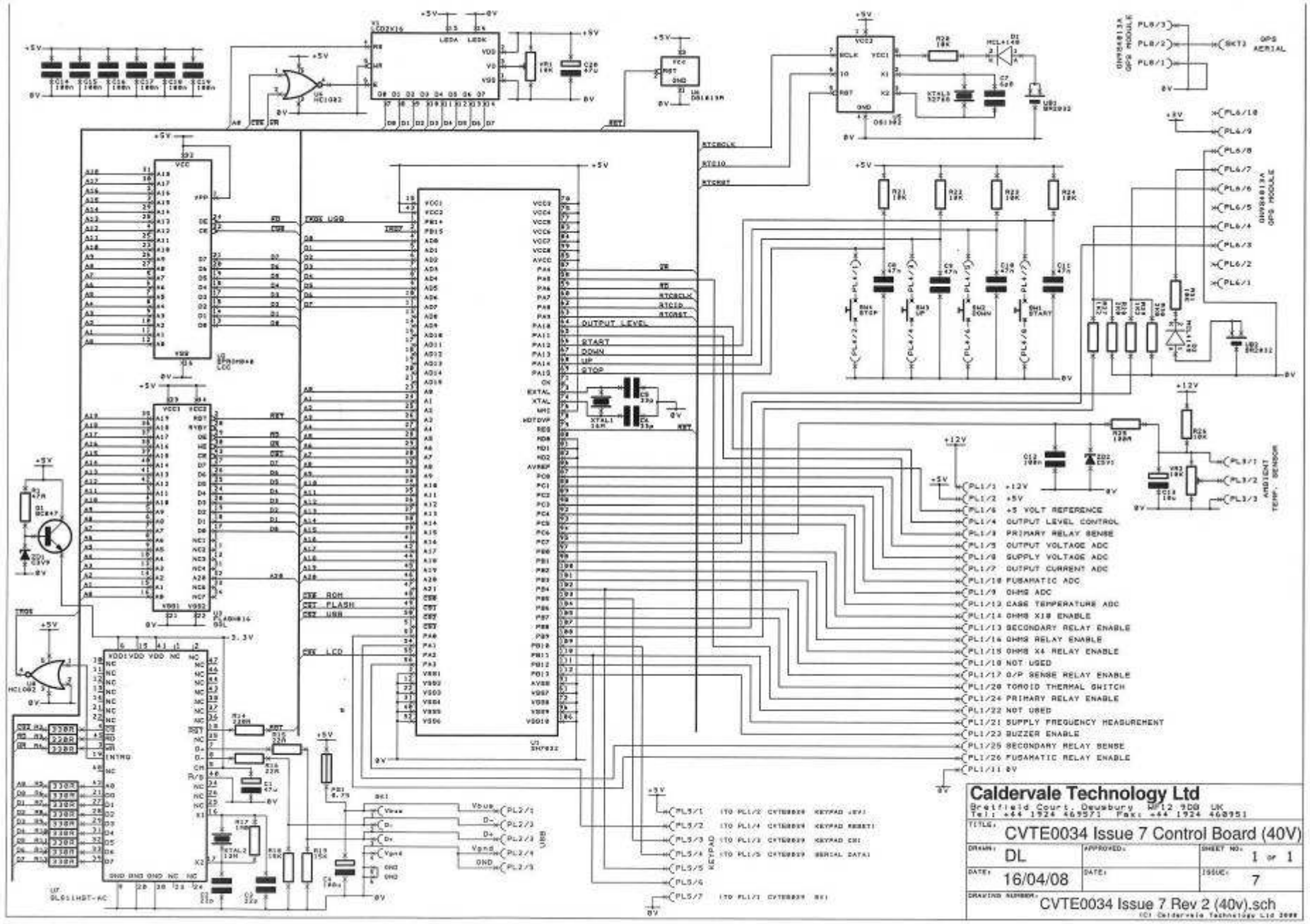
Circuit board interconnections

Circuit board component parts lists


Caldervale Technology Ltd
Bradfield Court, Gawsbury, WF12 9DB UK
Tel: +44 1924 469971 Fax: +44 1924 468951
TITLE: CVTE0030 Power Board 110V
DRAWN: DL
APPROVED:
SHEET NO: 1 OF 1
DATE: 18/02/08
DATE:
ISSUE: 7
DRAWING NUMBER: CVTE0030 Issue 7 Rev 1 110V.sch
(C) Caldervale Technology Ltd 2008


Caldervale Technology Ltd
Brettfield Court, Dewsbury WF12 9QB UK
Tel: +44 1924 469571 Fax: +44 1924 460951
TITLE: CVTE0030 Power Board 240V
DRAWN: DL
APPROVED:
SHEET NO: 1 of 1
DATE: 18/02/08
DATE:
ISSUE: 7
DRAWING NUMBER: CVTE0030 Issue 7 Rev 1 240V.sch
(C) Caldervale Technology Ltd 2008


Caldervale Technology Ltd
Brestfield Court, Dewsbury WF12 9QB UK
Tel: +44 1924 469571 Fax: +44 1924 469581
TITLE: CVTE0055 Analogue Board (40V)
DRAWN: DL
APPROVED:
SHEET NO: 1 OF 1
DATE: 19/06/08
DATE:
ISSUE: 1
DRAWING NUMBER: CVTE0055 Issue 1 Rev 1 (40V).sch
(C) Caldervale Technology Ltd 2008


Caldervale Technology Ltd
Bretfield Court, Dewsbury WF12 9DB UK
Tel: +44 1924 469571 Fax: +44 1924 468951
TITLE: CVTE0034 Issue 7 Control Board (40V)
DRAWN: DL
APPROVED:
SHEET NO: 1 OF 1
DATE: 16/04/08
DATE:
ISSUE: 7
DRAWING NUMBER: CVTE0034 Issue 7 Rev 2 (40v).sch
(C) Caldervale Technology Ltd 2008
PL1/1 +12V
PL1/2 +5V
PL1/6 +5 VOLT REFERENCE
PL1/4 OUTPUT LEVEL CONTROL
PL1/3 PRIMARY RELAY SENSE
PL1/5 OUTPUT VOLTAGE ADC
PL1/8 SUPPLY VOLTAGE ADC
PL1/7 OUTPUT CURRENT ADC
PL1/10 FUSAMATIC ADC
PL1/9 OHMS ADC
PL1/12 CASE TEMPERATURE ADC
PL1/14 OHMS X10 ENABLE
PL1/13 SECONDARY RELAY ENABLE
PL1/16 OHMS RELAY ENABLE
PL1/15 OHMS X4 RELAY ENABLE
PL1/18 NOT USED
PL1/17 O/P SENSE RELAY ENABLE
PL1/20 TOROID THERMAL SWITCH
PL1/24 PRIMARY RELAY ENABLE
PL1/22 NOT USED
PL1/21 SUPPLY FREQUENCY MEASUREMENT
PL1/23 BUZZER ENABLE
PL1/25 SECONDARY RELAY SENSE
PL1/26 FUSAMATIC RELAY ENABLE
PL1/11 0V
PL5/1 (TO PL1/2 CVTE0029 KEYPAD +5V)
PL5/2 (TO PL1/4 CVTE0029 KEYPAD RESET)
PL5/3 (TO PL1/3 CVTE0029 KEYPAD CS)
PL5/4 (TO PL1/5 CVTE0029 SERIAL DATA)
KEYPAD
USB
GPS AERIAL
AMBIENT TEMP. SENSOR
GPS MODULE

Calder Centaur circuit board interconnections.

CVTE0030	CVTE0055	CVTE0034	CVTE0039	Description
PL14/1	PL2/1	PL1/13		SECONDARY RELAY ENABLE
PL14/2	PL2/2	PL1/25		SECONDARY RELAY SENSE
PL14/3	PL2/3	PL1/20		NOT USED
PL14/4	PL2/4	PL1/24		PRIMARY RELAY ENABLE
PL14/5	PL2/5	PL1/3		PRIMARY RELAY SENSE
PL14/6	PL2/6	PL1/18		NOT USED
PL14/7	PL2/7	PL1/22		NOT USED
PL13/1	PL3/1			OUTPUT CURRENT SENSE 1
PL13/2	PL3/2			OUTPUT CURRENT SENSE 2
PL13/3	PL3/3			NOT USED
PL13/4	PL3/4			+12VR (RELAY DC SUPPLY)
PL13/5	PL3/5			FITTING SENSE 1
PL13/6	PL3/6			FITTING SENSE 2
PL13/7	PL3/7			FUSAMATIC SENSE
PL15/1	PL4/1	PL1/11		0V
PL15/2	PL4/2	PL1/1		+12V
PL15/3	PL4/3			-12V
PL15/4	PL4/4	PL1/2		+5V
PL16/1	PL5/1			TRIAC SWITCHING PULSES
PL16/2	PL5/2	PL1/21		SUPPLY FREQUENCY
PL16/3	PL5/3			SUPPLY VOLTAGE SENSE
	PL1/6	PL1/6		+5V REFERENCE
	PL1/4	PL1/4		OUTPUT LEVEL CONTROL
	PL1/5	PL1/5		OUTPUT VOLTAGE ADC
	PL1/8	PL1/8		SUPPLY VOLTAGE ADC
	PL1/7	PL1/7		OUTPUT CURRENT ADC
	PL1/10	PL1/10		FUSAMATIC ADC
	PL1/9	PL1/9		OHMS ADC
	PL1/12	PL1/12		CASE TEMPERATURE ADC
	PL1/16	PL1/16		OHMS RELAY ENABLE
	PL1/15	PL1/15		OHMS x4 ENABLE
	PL1/14	PL1/14		OHMS x10 ENABLE
	PL1/17	PL1/17		OUTPUT SENSE RELAY ENABLE
	PL1/23	PL1/23		BUZZER ENABLE
	PL1/26	PL1/26		FUSAMATIC RELAY ENABLE
	PL1/19	PL1/19		NOT USED
		PL5/1	PL1/2	KEYPAD +5V
		PL5/2	PL1/4	KEYPAD RESET
		PL5/3	PL1/3	KEYPAD CS
		PL5/4	PL1/5	SERIAL DATA
		PL5/5	PL1/1	KEYPAD 0V

Caldervale Technology Ltd

Title: CVTE0030 Issue 7 Rev. 1 Parts List.
Date: 25th July 2008
Current Document: YES
Page 1 of 3

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
PCB	CVTE0030 Issue 7 Rev. 1		Use 3oz copper
U1	MOC3023	DIL 6	Fit IC socket
	Fit DIL 6 IC socket for U1		
U2	LM340T2 +12V 1.5A	TO-220	Fit TO-220 heatsink
U3	LM340T2 +12V 1.5A	TO-220	Fit TO-220 heatsink
U4	LM340T5 +5V 1.5A	TO-220	Fit TO-220 heatsink
	Heatsink for U2, U3 and U4	TO-220 Screw fixing	Farnell code: 335-4179
U5	MC7912C -12V 1A	TO-220	
U6	PIC12C508A	DIL 8	Fit IC socket
	Fit DIL 8 IC socket for U6		
	Program with sync software		
BR1	WO2 or 1KAB20E		
ZD1	BZX84C-C5V1 zener diode		
ZD2	BZX84C-C5V1 zener diode		
ZD3	BZX84C-C5V1 zener diode		
D1	1N4002	DO-41	
D2	1N4002	DO-41	
D3	1N4148		
D4	1N4148		
D5	1N4007	DO-41	
D6	1N4007	DO-41	
D7	1N4148		
D8	1N4148		
Q1	BC182L		
Q2	BC182L		
CONNECT1	6 Way Molex 91 series 0.400" 40A		
CONNECT2	2 Way Molex 92 series 0.591" 85A		
CONNECT3	2 Way Molex 92 series 0.591" 85A		
PL4	Wago 745-831 Terminal block		
PL13	7 way Molex KK 0.1" straight header		
PL14	7 way Molex KK 0.1" straight header		
PL15	4 way Molex KK 0.1" straight header		
PL16	3 way Molex KK 0.1" straight header		
PL17	Wago 745-831 Terminal block		
PL18	Wago 745-831 Terminal block		
PL19	Wago 745-831 Terminal block		
PL20	Wago 745-831 Terminal block		

Title: CVTE0030 Issue 7 Rev. 1 Parts List.
Date: 25th July 2008
Current Document: YES

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
PL21	2 way Molex KK 0.1" straight header		
PL22	3 way Molex KK 0.1" straight header		
FS1	250mA 250Vac 20x5mm Antisurge (T) Glass	MCF06G Series	Include fuse holder
	Fuse holder 20 x 5mm PCB mounting		Farnell code: 146-123
	Fuse holder cover		Farnell code: 146-124
UA1	BCC 2322-595-54616		460V
UA2	BCC 2322-595-52716		275V
UA3	XE1201 0.1uF-120ohm		Not fitted
RL1	OMRON G8P-14AP 12V DC SPNO RELAY		
RL2	OMRON G8P-14AP 12V DC SPNO RELAY		
RL3	OMRON G8P-14AP 12V DC SPNO RELAY		
RL4	G5A-234P-53/3 DPCO 12V DC RELAY		
RL5	G5A-234P-53/3 DPCO 12V DC RELAY		
C1	1u0F 275V Class X2	B32924A2105M	B3292 Series
C2	10nF 250V Class Y2	PME271E510M	
C3	10nF 250V Class Y2	PME271E510M	
C4	100nF 275V Class X2	B3292 Series	
C5	1000uF 35V DC Electrolytic radial	ECRH Series	12mm
C6	10uF 16V DC Electrolytic radial	ECRH Series	5mm
C7	1000uF 35V DC Electrolytic radial	ECRH Series	12mm
C8	10uF 16V DC Electrolytic radial	ECRH Series	5mm
C9	10uF 16V DC Electrolytic radial	ECRH Series	5mm
C10	1000uF 35V DC Electrolytic radial	ECRH Series	12mm
C11	10uF 16V DC Electrolytic radial	ECRH Series	5mm
C12	47nF 63V DC	BQ Series	
C13	47nF 63V DC	BQ Series	
C14	Not Fitted		
C15	Not Fitted		
R1	100K 2W	PR02	
R2	68K 2W	PR02	
R3	330R 3W	RSS3	
R4	330R 3W	RSS3	
R5	1K8 3W	RSS3	
R6	1K8 3W	RSS3	
R7	2K2 0.25W 1%	MF25 Series	
R8	2R2 2W	PR02	
R9	15K 0.25W 1%	MF25 Series	
R10	15K 0.25W 1%	MF25 Series	
R11	39K 0.25W 1%	MF25 Series	
R12	1K0 0.25W 1%	MF25 Series	
R13	10K 0.25W 1%	MF25 Series	

Title: CVTE0030 Issue 7 Rev. 1 Parts List.
Date: 25th July 2008
Current Document: YES

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
R14	1K0 0.25W 1%	MF25 Series	
R15	1K0 0.25W 1%	MF25 Series	
R16	10K 0.25W 1%	MF25 Series	
R17	1K0 0.25W 1%	MF25 Series	
LK1	0R0 0.25W	MCF 1/4W Series	
LK2	0R0 0.25W	MCF 1/4W Series	
LK3	0R0 0.25W	MCF 1/4W Series	
SW1	Arcolectric X22205C voltage selector		
L1	Emdec 25A Common mode choke		
T1	Emdec U2/4162 2x115V / 2x18V 18VA	low profile	
T2	Emdec U2/4714 100:1 Current transformer		

Other:
Cover all pin headers and apply a conformal coating
to both sides of the PCB after testing.

Caldervale Technology Ltd

Title: CVTE0034 Issue 7 Rev. 2 Parts List.
Date: 19th June 2008
Current Document: YES
Page 1 of 3

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
PCB	CVTE0034 Issue 7 Rev. 2		Red PCB with yellow ident
U1	Hitachi HD6417032F20 MCU	QFP112	
U2	Not Fitted	PLCC SMD Socket	
U3	AM29F080B-120SC 8Mb Flash	44 pin SO	
U4	74HC1G02GW Picogate	SOT-353	
U5	Dallas DS1302Z RTC	SOIC 8	
U6	Dallas DS1813R-5	SOT-23	
U7	Cypress SL811HST-AC USB Controller	TQFP 48	
U8	74HC1G02GW Picogate	SOT-353	
D1	MCL4148	SOT-23	
D2	MCL4148	SOT-23	
ZD1	BZX84C-C3V9 zener diode	SOT-23	
ZD2	BZX84C-C5V1 zener diode	SOT-23	
Q1	BC847	SOT-23	
UB1	BR2032H2A or CR2032PCB 3.3V Battery		
UB2	BR2032H2A or CR2032PCB 3.3V Battery		Not Fitted
FS1	Multifuse MF-MSMD075-2	SMD	
PL1	26 way IDC straight header with latches		
PL2	5 way Molex KK 0.1" straight header		
PL3	3 way Molex KK 0.1" straight header		
PL4	8 way Molex KK 0.1" straight header		
PL5	5 way Molex KK 0.1" straight header		
PL6	Not Fitted		Not Fitted
PL7	Not Fitted		Not Fitted
PL8	Not Fitted		Not Fitted
V1	16 way SIL pin header 0.1" pitch		Fitted on side 2
SKT1	Lumberg 241001USB Socket		PCB Mounting
SKT2	Suhner 82 MMCX-50-0-1/111 NE		Not Fitted
C1	47uF 16V DC Electrolytic Radial	SMD	
C2	22pF 50V DC Ceramic	0805 Case style	
C3	22pF 50V DC Ceramic	0805 Case style	
C4	100uF 16V DC Electrolytic Radial	SMD	
C5	33pF 50V DC Ceramic	0805 Case style	
C6	33pF 50V DC Ceramic	0805 Case style	
C7	6p8F 50V DC Ceramic	0805 Case style	

Title: CVTE0034 Issue 7 Rev. 2 Parts List.
Date: 19th June 2008
Current Document: YES

Reference	Component Description	Package	Comments
C8	47nF 50V DC Ceramic	0805 Case style	
C9	47nF 50V DC Ceramic	0805 Case style	
C10	47nF 50V DC Ceramic	0805 Case style	
C11	47nF 50V DC Ceramic	0805 Case style	
C12	100nF 50V DC Ceramic	0805 Case style	
C13	10uF 16V DC Electrolytic Radial	SMD	
C14	100nF 50V DC Ceramic	0805 Case style	
C15	100nF 50V DC Ceramic	0805 Case style	
C16	100nF 50V DC Ceramic	0805 Case style	
C17	100nF 50V DC Ceramic	0805 Case style	
C18	100nF 50V DC Ceramic	0805 Case style	
C19	100nF 50V DC Ceramic	0805 Case style	
C20	47uF 16V DC Electrolytic Radial	SMD	
R1	47R 0.1W 1%	0805 Case style	
R2	330R 0.1W 1%	0805 Case style	
R3	330R 0.1W 1%	0805 Case style	
R4	330R 0.1W 1%	0805 Case style	
R5	330R 0.1W 1%	0805 Case style	
R6	330R 0.1W 1%	0805 Case style	
R7	330R 0.1W 1%	0805 Case style	
R8	330R 0.1W 1%	0805 Case style	
R9	330R 0.1W 1%	0805 Case style	
R10	330R 0.1W 1%	0805 Case style	
R11	330R 0.1W 1%	0805 Case style	
R12	330R 0.1W 1%	0805 Case style	
R13	330R 0.1W 1%	0805 Case style	
R14	330R 0.1W 1%	0805 Case style	
R15	22R 0.1W 1%	0805 Case style	
R16	22R 0.1W 1%	0805 Case style	
R17	1M0 0.1W 1%	0805 Case style	
R18	15K 0.1W 1%	0805 Case style	
R19	15K 0.1W 1%	0805 Case style	
R20	10K 0.1W 1%	0805 Case style	
R21	10K 0.1W 1%	0805 Case style	
R22	10K 0.1W 1%	0805 Case style	
R23	10K 0.1W 1%	0805 Case style	
R24	10K 0.1W 1%	0805 Case style	
R25	100R 0.1W 1%	0805 Case style	
R26	10K 0.1W 1%	0805 Case style	
R27	1K2 0.1W 1%	0805 Case style	
R28	2K0 0.1W 1%	0805 Case style	
R29	1K2 0.1W 1%	0805 Case style	
R30	2K0 0.1W 1%	0805 Case style	
R31	10K 0.1W 1%	0805 Case style	

Title: CVTE0034 Issue 7 Rev. 2 Parts List.
Date: 19th June 2008
Current Document: YES

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
VR1	Bourns 10K 3/8" trimming potentiometer	3296-W-1-103-LF	
VR2	Bourns 10K 3/8" trimming potentiometer	3296-W-1-103-LF	
XTAL1	HC49/4HSMX 16.000MHz	SM	
XTAL2	HC49/4HSMX 12.000MHz	SM	
XTAL3	MC406/90MX 32.768kHz	SM	

Other:
Cover all pin headers and apply a conformal coating
to both sides of the PCB after testing.

Caldervale Technology Ltd

Title: CVTE0055 Issue 1 Rev. 1 Parts List.
Date: 25th July 2008
Current Document: YES
Page 1 of 3

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
PCB	CVTE0055 Issue 1 Rev. 1		Red PCB with yellow ident.
U1	LM324M	SOIC 14	
U2	AD536AJHZ	TO-100	
U3	AD736JRZ	SOIC 8	
U4	LM393M	SOIC 8	
U5	AD536AJHZ	TO-100	
U6	LM1458M	SOIC 8	
U7	LM317	TO-220	
D1	LL4148	MINI-MELF	Fitted on side 2
D2	LL4148	MINI-MELF	Fitted on side 2
D3	LL4148	MINI-MELF	Fitted on side 2
D4	LL4148	MINI-MELF	Fitted on side 2
ZD1	BZX84C-C5V1 zener diode	SOT-23	
ZD2	BZX84C-C5V1 zener diode	SOT-23	
ZD3	BZX84C-C5V1 zener diode	SOT-23	
ZD4	ZRB500F02TA Voltage reference	SOT-23	
ZD5	BZX84C-C5V1 zener diode	SOT-23	
Q1	ZVN4106F	SOT-23	
Q2	BC847	SOT-23	
Q3	BC847	SOT-23	
Q4	BC847	SOT-23	
Q5	BC847	SOT-23	
Q6	BC847	SOT-23	
PL1	26 way IDC 90 degree header with latches		
PL2	PL2 7-way wire loom assembly	See CVTE0055 work instruction number 1.	
PL3	PL3 7-way wire loom assembly	See CVTE0055 work instruction number 1.	
PL4	PL4 4-way wire loom assembly	See CVTE0055 work instruction number 1.	
PL5	PL5 3-way wire loom assembly	See CVTE0055 work instruction number 1.	
PL6	4 way Molex KK 0.1" straight header		
PL7	2 way Molex KK 0.1" straight header		
RL1	G5A-234P-53/3 12V dc Relay		
RL2	G5A-234P-53/3 12V dc Relay		
RL3	G5A-234P-53/3 12V dc Relay		
RL4	G5A-234P-53/3 12V dc Relay		
C1	2u2F 16V DC Electrolytic Radial	SMD	
C2	2u2F 16V DC Electrolytic Radial	SMD	

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
C3	2u2F 16V DC Electrolytic Radial	SMD	
C4	10uF 16V DC Electrolytic Radial	SMD	
C5	100nF 50V DC Ceramic	0805 Case style	
C6	2n2F 50V DC Ceramic	0805 Case style	
C7	47nF 50V DC Ceramic	0805 Case style	
C8	100nF 50V DC Ceramic	0805 Case style	
C9	47uF 16V DC Electrolytic Radial	SMD	
C10	10uF 16V DC Electrolytic Radial	SMD	
C11	10uF 16V DC Electrolytic Radial	SMD	
C12	100nF 50V DC Ceramic	0805 Case style	
C13	2u2F 16V DC Electrolytic Radial	SMD	
C14	2u2F 16V DC Electrolytic Radial	SMD	
C15	2u2F 16V DC Electrolytic Radial	SMD	
C16	10uF 16V DC Electrolytic Radial	SMD	
C17	100nF 50V DC Ceramic	0805 Case style	
C18	100nF 50V DC Ceramic	0805 Case style	
C19	100nF 50V DC Ceramic	0805 Case style	
C20	10uF 16V DC Electrolytic Radial	SMD	
C21	10nF 50V DC Ceramic	0805 Case style	
C22	100nF 50V DC Ceramic	0805 Case style	
C23	100nF 50V DC Ceramic	0805 Case style	
C24	10uF 16V DC Electrolytic Radial	SMD	
C25	100nF 50V DC Ceramic	0805 Case style	
C26	10uF 16V DC Electrolytic Radial	SMD	
C27	10uF 16V DC Electrolytic Radial	SMD	
C28	10uF 16V DC Electrolytic Radial	SMD	
C29	Not Fitted		Ident on side 2
C30	Not Fitted		Ident on side 2
C31	Not Fitted		Ident on side 2
C32	Not Fitted		Ident on side 2
C33	100nF 50V DC Ceramic	0805 Case style	
R1	4K7 0.1W 0.1%	0805 Case style	
R2	4K7 0.1W 0.1%	0805 Case style	
R3	10K 0.1W 0.1%	0805 Case style	
R4	10K 0.1W 0.1%	0805 Case style	
R5	22K 0.1W 1%	0805 Case style	
R6	100K 0.1W 1%	0805 Case style	
R7	Not fitted	0805 Case style	
R8	100K 0.1W 1%	0805 Case style	
R9	10K 0.1W 1%	0805 Case style	
R10	10K 0.1W 1%	0805 Case style	
R11	47K 0.1W 1%	0805 Case style	
R12	4K7 0.1W 1%	0805 Case style	
R13	220K 0.1W 1%	0805 Case style	
R14	220K 0.1W 1%	0805 Case style	

Title: CVTE0055 Issue 1 Rev. 1 Parts List.
Date: 25th July 2008
Current Document: YES

Note:
This is a controlled document and must not be altered without prior permision.
Any deviation in the component values is not permitted without prior permision.

Reference	Component Description	Package	Comments
R15	120K 0.1W 1%	0805 Case style	
R16	1K0 0.1W 1%	0805 Case style	
R17	6K8 0.1W 1%	0805 Case style	
R18	100K 0.1W 1%	0805 Case style	
R19	100R 0.1W 1%	0805 Case style	
R20	200K 0.1W 0.1%	0805 Case style	
R21	Not Fitted	0805 Case style	Not Fitted
R22	200K 0.1W 0.1%	0805 Case style	
R23	Not Fitted	0805 Case style	Not Fitted
R24	10K 0.1W 0.1%	0805 Case style	
R25	10K 0.1W 0.1%	0805 Case style	
R26	22K 0.1W 1%	0805 Case style	
R27	100R 0.1W 1%	0805 Case style	
R28	330R 0.1W 1%	0805 Case style	
R29	10K 0.1W 1%	0805 Case style	
R30	10K 0.1W 1%	0805 Case style	
R31	1K5 0.1W 1%	0805 Case style	
R32	10K 0.1W 1%	0805 Case style	
R33	10K 0.1W 1%	0805 Case style	
R34	10K 0.1W 1%	0805 Case style	
R35	91K 0.1W 1%	0805 Case style	
R36	10K 0.1W 1%	0805 Case style	
R37	1K0 0.1W 1%	0805 Case style	
R38	0R0 0.25W	MF25 Series	
R39	1K0 0.1W 1%	0805 Case style	
R40	2K2 0.1W 0.1%	0805 Case style	
R41	1K5 0.1W 1%	0805 Case style	
R42	1K0 0.1W 1%	0805 Case style	
R43	1K0 0.1W 1%	0805 Case style	
R44	1K0 0.1W 1%	0805 Case style	
R45	36R 0.1W 1%	0805 Case style	Fitted on side 2
R46	12R 0.1W 1%	0805 Case style	Fitted on side 2
R47	1K0 0.1W 1%	0805 Case style	
R48	1K0 0.1W 1%	0805 Case style	

Other:
Cover all pin headers and apply a conformal coating
to both sides of the PCB after testing.

This page is intentionally blank.

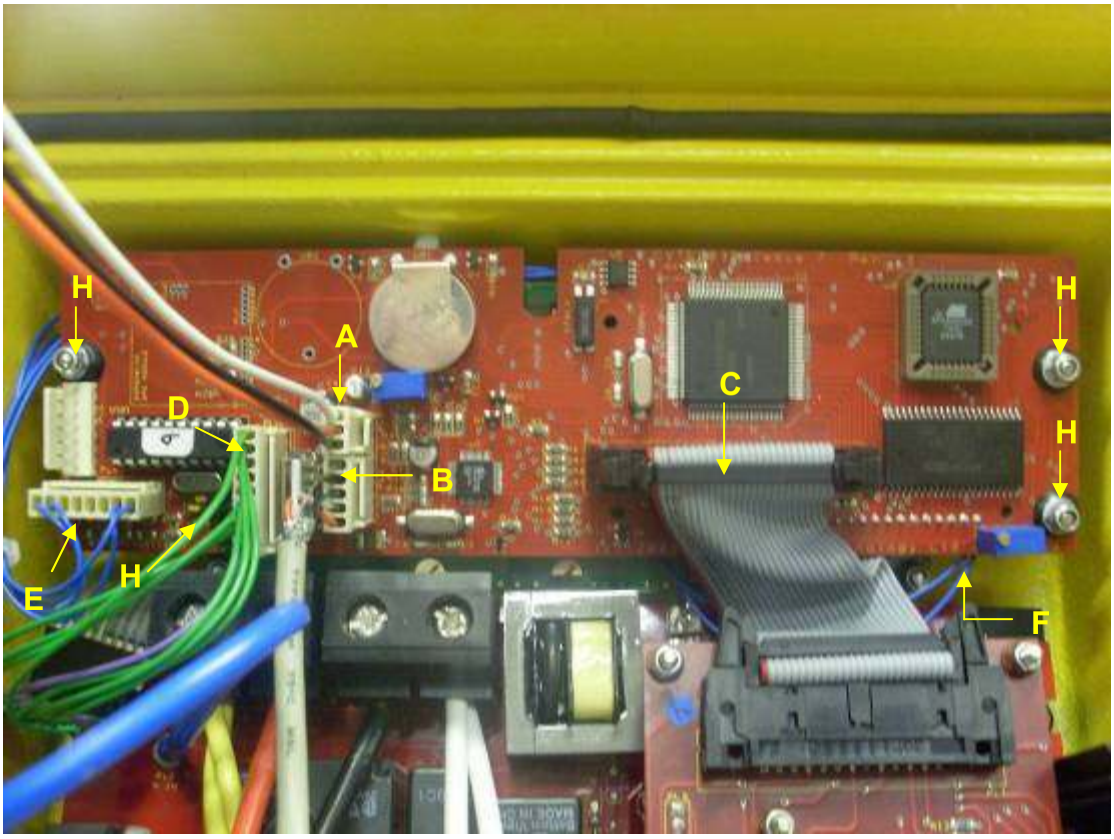
Section 6.

Disassembly and refitting of assemblies.

6.1 Removing the control board.

Remove the leads connected to the plugs marked A, B, C, D and E. Remove the four M4 lock nuts marked H, lift the board upwards and finally remove the lead marked F from the underside of the board as shown below in figure 1.

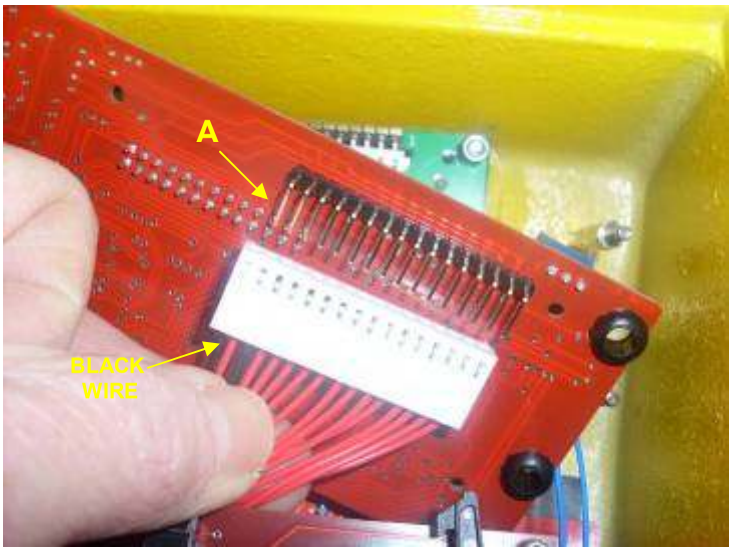
Figure 1.



Remove the rubber grommets from the control board.

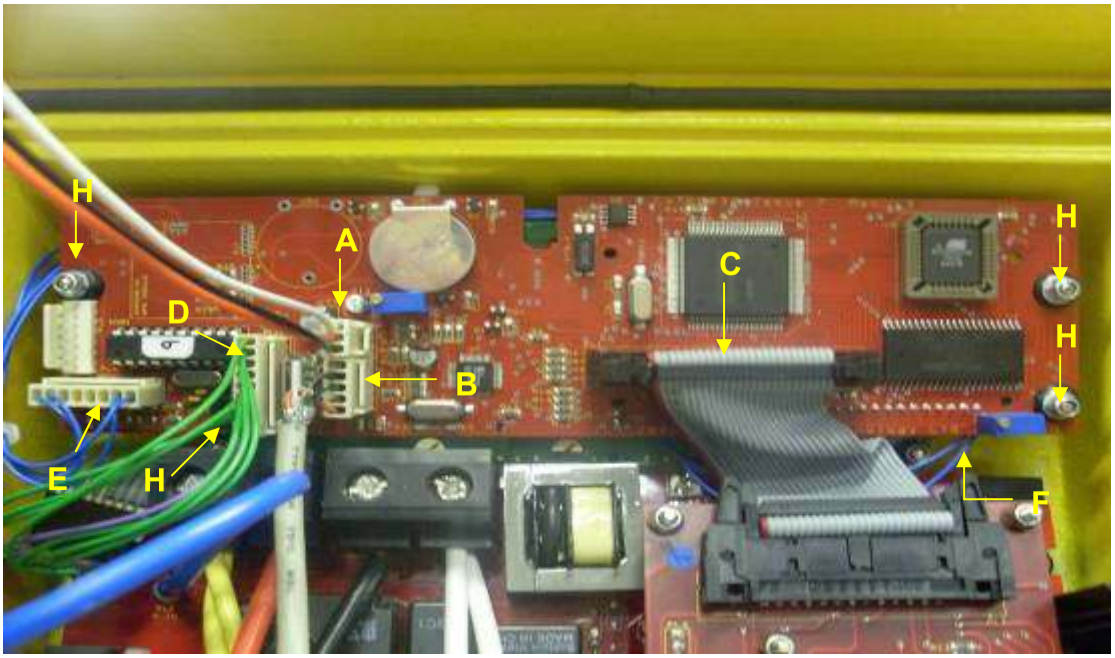
6.2 Fixing the control board.

Figure 1.



Connect the LCD wire loom to the control board in the orientation as shown above in figure 1, ensuring that the outer black wire is connected to the pin marked A.

Figure 2.

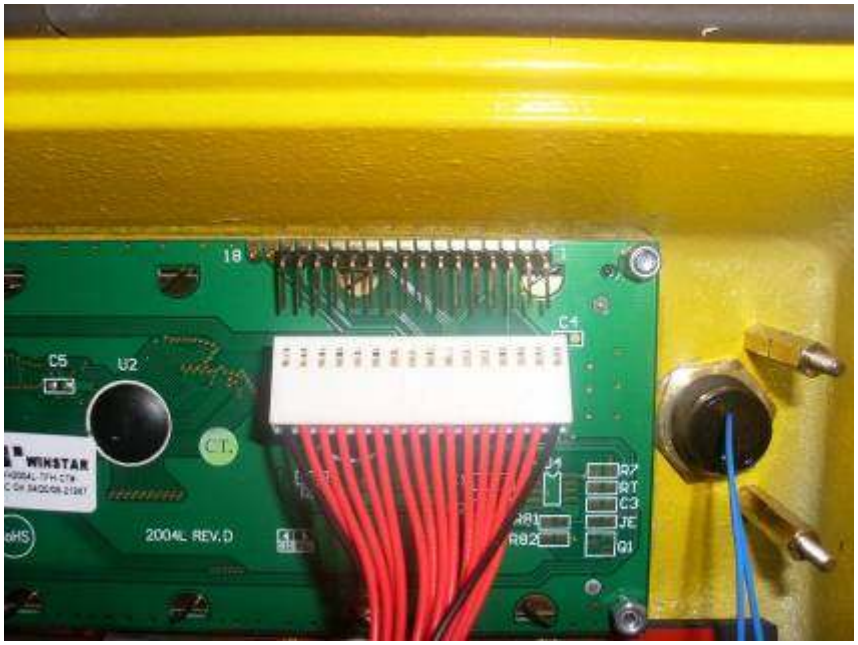


Fit the rubber grommets to the control board and place the board in place making sure that it is aligned over the mounting pillars, secure in place using the M4 lock nuts in the positions marked H in figure 2 above.
Referring to figure 2 above reconnect the ambient temperature assembly socket to the plug marked A, the USB assembly socket to the plug marked B, the interconnecting wire loom assembly socket to the plug marked C, the keypad wire loom assembly socket to the plug marked D, and the start/stop switch wire loom assembly socket to the plug marked E.

6.3 Removing the LCD module.

Remove the control board as shown in section 6.1.
Disconnect the wire loom as shown below in figure 1.

Figure 1.



Remove the four M3 Nyloc nuts, washers and panel grommets at the positions marked A in figure 2 below. Lift the display module clear of the front casing.

Figure 2.

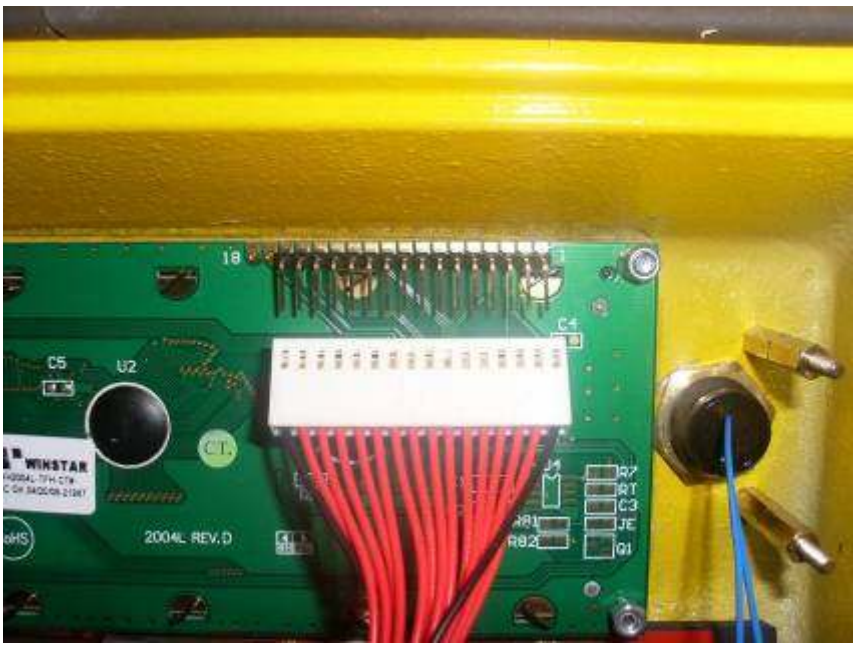
6.4 Fitting the LCD module.

Locate the display module over the four M3 pillars and secure in place using four M3 lock nuts in the positions marked A in figure 1 below.

Figure 1.

Reconnect the wire loom as shown below in figure 2.
Refit the control board as shown in section 6.1.

Figure 2.

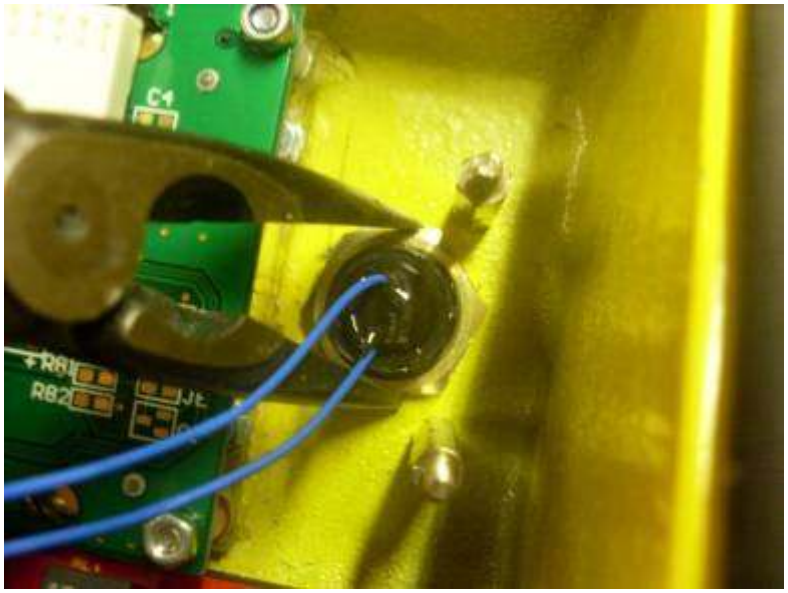


6.5 Removal and refitting of the start or stop button.

Removal.

Remove the control board as in section 6.1.
Using a pair of pliers release the actuator locking nut, and remove the actuator from the front casing as shown below in figure 1.

Figure 1.



Refitting.

Refitting of the start or stop buttons is the reverse of the removal process.

6.6 Removal and refitting of the ambient temperature sensor.

Removal.

Loosen the gland nut of the temperature sensor housing as shown in figure 1 below.

Figure 1.

Figure 2.

From the inside of the back casing pull out the ambient temperature assembly, as shown above in figure 2.

Refitting.

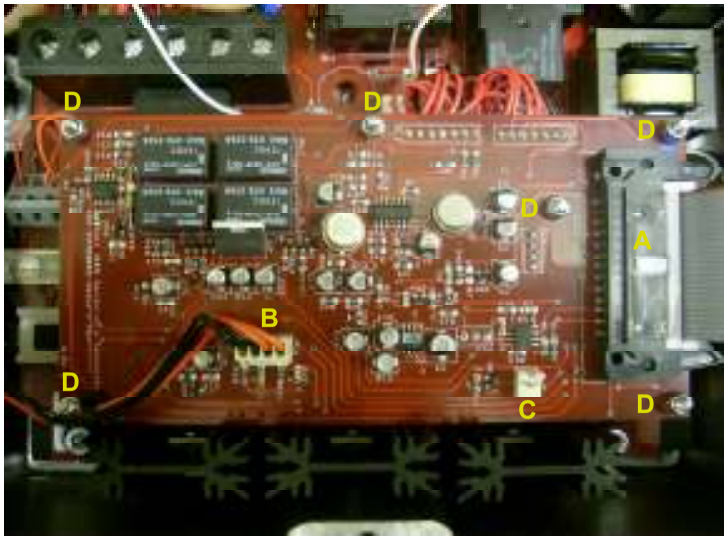
From the inside of the back casing insert the ambient temperature assembly, and tighten the gland nut to secure the sensor body in the housing so that the end of the sensor body is level with the end of the housing as shown below in figure 3.

Figure 3

6.7 Removal of the analogue board.

Remove the plugs marked A and B (if external sounder fitted remove plug from position C) as shown below in figure 1.
Remove the M3 nylock nuts and fibre washers at the positions marked D, shown in figure 1 below and lift the analogue board clear of the mounting pillars.

Figure 1.



Carefully remove the plugs marked E and F from the power board as shown below in figure 2. Tilt the analogue board slightly upwards and remove from the power board the two plugs marked G and H as shown below in figure 3. The analogue board can now be fully removed.

Figure 2.

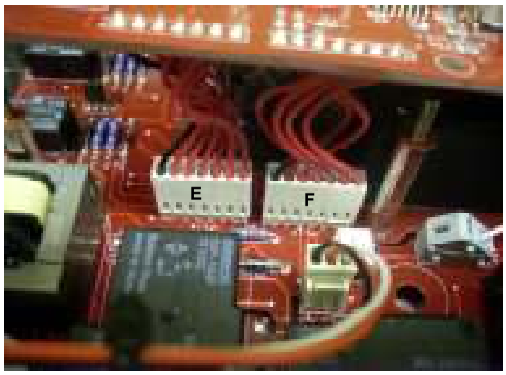
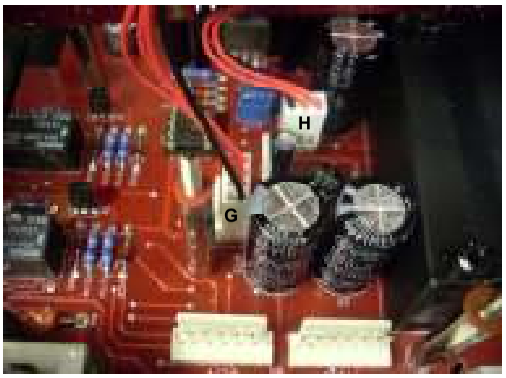


Figure 3.



6.8 Fitting of the analogue board.

Ensure that each of the six mounting pillars each have an M3 fibre washer placed over the threaded stud. Locate the analogue board over the mounting pillars and connect the two plugs marked G and H to the power board as shown below in figure 1. Connect the two plugs marked G and H to the power board as shown below in figure 2.

Figure 1.

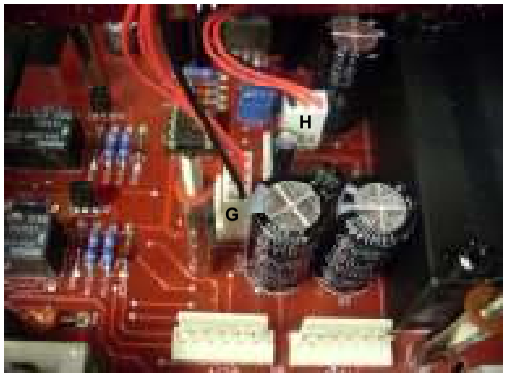
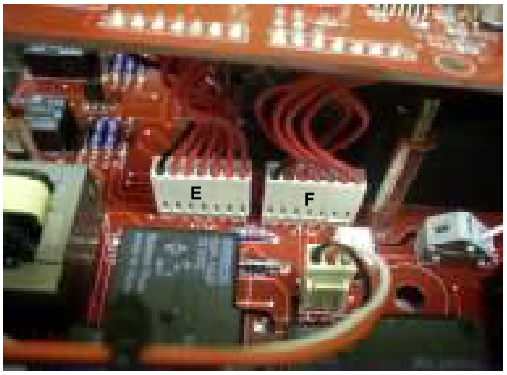
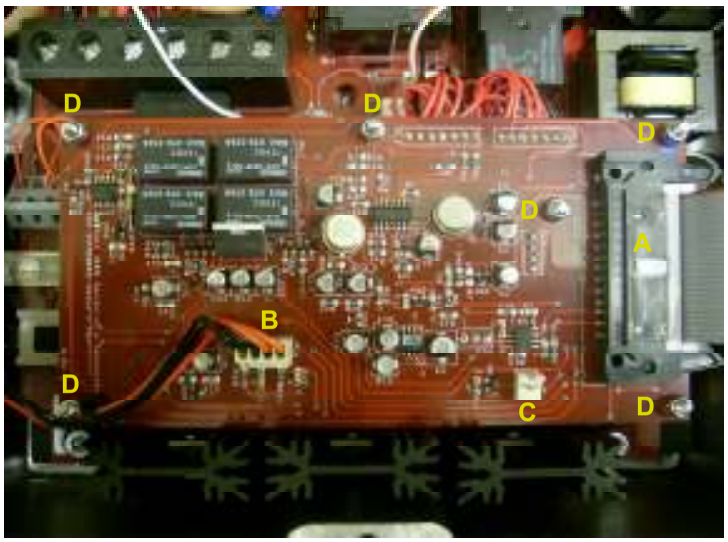


Figure 2.



The analogue board can now be secured to the mounting pillars using the M3 fibre washers and the M3 nylock nuts in the six positions marked D as shown below in figure 3.

Figure 3.



Referring to figure 3 above, connect the interconnecting ribbon cable assembly socket to the position marked A, and connect the case and toroid assembly socket to the position marked B. If an external sounder is fitted connect the socket to the plug marked C.

6.9 Removal of the input lead assembly.

Remove the lower casing by removing the four M5 screws as shown below in figure 1. Disconnect the input lead connections from inside the unit.

Figure 1.

Release the retaining nut on the input lead gland shown in figure 2 and remove the input lead assembly.

Figure 2.

6.10 Fitting of the input lead assembly.

Fitting of the input lead assembly is the reverse of the removal process.

6.11 Removal of the output lead assembly.

Remove the back casing by removing the four M5 screws as shown below in figure 1. Disconnect the output lead assembly connections from inside the unit.

Figure 1.

Release the retaining nut on the output lead gland shown in figure 2 and remove the output lead assembly.

Figure 2.

6.12 Fitting of the output lead assembly.

Fitting of the output lead assembly is the reverse of the removal process.

Section 7.

Fault finding.

Symptom	Fault.	Suggestion.
No display when connected to the supply. (with no backlight illuminated)	Thermal circuit breaker tripped-out.	Check the thermal breaker - reset if required.
	Disconnection of the L or N conductor inside the plug.	Check the wiring connections inside the plug.
	Break in the input lead conductors.	Measure the supply voltage inside the machine - replace the input lead if necessary.
	PSU fuse blown.	Check/replace fuse.
	Fault with the PSU dc supplies.	Check the PSU dc supply voltages.
	Fault with the interconnecting wiring loom.	Check/replace interconnecting wiring loom.
	Fault with the display module wiring loom.	Check/replace display module wiring loom.
	Fault with the LCD module.	Check/replace LCD module.
	Fault with the control board.	Check/replace control board.
No display when connected to the supply. (with backlight illuminated)	Fault with the display module wiring loom.	Check/replace display module wiring loom.
	Fault with the LCD module.	Check/replace LCD module.
	Fault with the control board.	Check/replace control board.
Keypad not responding.	Fault with keypad connector to control board.	Check keypad connector.
	Fault with keypad.	Change keypad.
No recognition of the USB flash disk.	Faulty USB flash disk.	Try another USB flash disk.
	Faulty USB wiring assembly.	Check/replace USB wiring assembly.
	Faulty USB host controller chip.	Replace the control board.
No recognition of the USB barcode reader.	Faulty USB barcode reader.	Try another USB barcode reader.
	Faulty USB wiring assembly.	Check/replace USB wiring assembly.
	Faulty USB host controller chip.	Replace the control board.

Symptom	Fault.	Suggestion.
After 4 seconds weld stops. Display shows: E07 Excessive output voltage	Triac fault.	Check/replace triac.
	Fault with triac switching circuit.	Check/replace analogue board.
	Fault with output voltage measurement circuit.	Check/replace analogue board.
	No control from processor.	Check/replace interconnecting ribbon cable.
		Check/replace control board.
After 6 seconds weld stops. Display shows: E06 Output voltage high	Fault with triac switching circuit.	Check/replace analogue board.
	Fault with output voltage measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
After 6 seconds weld stops. Display shows: E05 Output voltage low	Low supply voltage	Check supply.
	Generator under powered	Check generator rating.
	Fault with output voltage measurement circuit.	Check/replace analogue board.
	Fault with triac switching circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
After 6 seconds weld stops. Display shows: E17 Current Surge	Accessory (fitting / coupler) fault. (heating coils have shorted together)	Change accessory (fitting / coupler).

Symptom	Fault.	Suggestion.
After 6 seconds weld stops. Display shows: E09 Output current low	Accessory (fitting / coupler) fault.	Change accessory (fitting / coupler).
	Output lead fault.	Check/replace output lead terminal ends.
	Fault with output current measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
Display shows: E01 Supply voltage high	High supply voltage	Check supply.
	Fault with supply voltage measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
Display shows: E02 Supply voltage low	Low supply voltage	Check supply.
	Fault with supply voltage measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
Display shows: E03 Supply frequency high	High supply voltage frequency	Check supply.
	Fault with supply frequency measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
Display shows: E04 Supply frequency low	Low supply voltage frequency	Check supply.
	Fault with supply frequency measurement circuit.	Check/replace analogue board.
	Machine requires calibration.	Recalibrate and check.
	Processor fault.	Check/replace control board.
Display shows: E09 Fitting connection fault	Output lead disconnected.	Check output lead connection.
	Output lead fault.	Check/replace output lead.
		Check/replace output socket wiring loom.

Symptom	Fault.	Suggestion.
Display shows: Output fault	Output voltage detected on the output at power up.	Check wiring connections to the earth (ground) terminal on the casing. Check transformer earth (ground) lead terminal connectors.
Display shows: Primary relay fault	The primary relay has failed to activate.	Check connections to power board. Check/replace control board. Check/replace power board.
Display shows: Secondary relay fault	The secondary relays have failed to activate.	Check connections to power board. Check/replace control board. Check/replace power board.
Display shows: Primary & secondary relay fault	The primary and secondary relays have failed to activate.	Check connections to power board. Check/replace control board. Check/replace power board.
Display shows: Vinculum not present	The USB module has not responded.	Check the USB module is inserted correctly. Check/replace USB module. Check/replace control board.

Section 8.

Modifications.