Basic Repair Chart

PAE034b (PC037) Version 1.32 110Vac and 240Vac, 5 to 16 Joule output energisers



Notes:

- 1. Electrical Appliance Repairs can be dangerous and should only be carried out by suitably qualified persons. If in doubt consult your local electrical safety authority.
- 2. This is a BASIC level repair chart; it covers repairs which can be done without Schematics or an Oscilloscope. It is designed to allow the repair of 80% of expected or known faults.
- 3. There is a minimum set of tools and equipment required, see the list at the end of the document.
- 4. Schematics are available from sales@pakton.com.au
- 5. For other support documents please see <u>http://www.pakton.com.au/support.php</u>
- 6. For explanations of the test methods used herein, see the Pakton document "Technical resources for repairs".

Preliminary checks before power on

- 1. Check the power lead for breaks or shorts
- 2. Check the case is not wet inside or full of ants
- 3. Check for lightning damage, burn marks etc. If found start by doing a Diode test of every semiconductor
- 4. Inspect the PCB both sides for any signs of moisture or physical damage

Known Issues with this design

- 1. C2/C16 can lose capacity and hence 5V rail is lost, the results can be erratic operation
- 2. M7 diodes (d2 etc) may not have been soldered well, leading to arcing or open circuit on one end or completely falling off PCB causes Error 3
- 3. M2 can fail, this usually causes it to look burnt and causes Error 3

Symptom Table.

Start with the **Symptom**. Then work through the **Tests**. *On*, means turn the power on. *Off*, means turn it off. A test method in *italics* is described in the Technical resource document.

Symptom	Line	Theory	Tests	Possible Results
No function at all	1	Open circuit in supply line	On . Measure AC voltage at the AC input terminal A. Expect 110Vac or 240Vac depending on country. Danger! The Capacitors may be charged.	a) No voltage – Go to 1a b) Voltage OK – Go to 1b
	1a	Blown Fuse in lead plug	110Vac leads have a fuse in the plug.	Go to 118
	1b	Blown fuse on PCB	On . Measure AC voltage at the far end of fuse F2. Expect 110Vac or 240Vac depending on country. Danger! The Capacitors may be charged.	a) No voltage – Go to 119 b) Voltage OK – Go to 2
	2	+5V missing	On . Measure DC voltage at Pin 1 of T1 (ICSP). Expect 5V.	a) Low voltage – Go to 3 b) 4.8 to 5.2V OK – Go to 101
	3	Power Supply Failure	Off. Remove or <i>Lift one end</i> of C2 and C16 (if used). <i>Measure Capacitance</i> of C2 and C16. Expect 220nF or 0.33uF depending on the model.	a) Low – Go to 102 b) OK, resolder – Go to 4
	4	Power Supply Failure	Off. Diode check D12 and D6	a) Low – Go to 103 b) OK – Go to 5
	5	Power Supply Failure	<i>Off. Lift pin</i> 1 of IC2 from the PCB pad. <i>On. Measure DC voltage</i> on IC2 Pin 1, expect 5V	a) Voltage Low – Go to 6 b) OK – Go to 105
	6	Power Supply Failure	On . Measure DC voltage at IC2 pin 8. Expect over 8V.	a) Voltage Low - Go to 106 b) OK – Go to 107
Error 3 shown	7	Main Capacitor not charging	<i>Off.</i> Unplug one primary lead of the output transformer from the PCB (Note 1) <i>On. Measure Maximum DC voltage</i> on the main capacitor at Cap+. Expect over 600V in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low - Go to 8 b) OK – Go to 13
	8	Charging circuit Failure	Off. Measure Resistance In-circuit of R4. Expect 10 Ohms.	a) Bad – Go to 108 b) OK – Go to 9
	9	Charging circuit Failure	Off. Diode Test D2, D3, D10, D11, D8, D17, D14, D9 (Note 2)	a) Bad - Go to 103 b) OK – Go to 10

	10	Charging circuit Failure	Off. Diode Test D1 and D4	a) Bad - Go to 109 b) OK – Go to 11
	11	Charging circuit Failure	<i>Off.</i> Remove or <i>Lift one end</i> of M9 (Note 1) <i>On. Measure Maximum DC voltage</i> on the main capacitor at Cap+. Expect over 600V in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low - Go to 12 b) OK – Go to 104
	12	Charging circuit Failure	<i>Off.</i> Remove or <i>Lift one end</i> of M2 (Note 1) <i>On. Measure Maximum DC voltage</i> on the main capacitor at Cap+. Expect over 600V in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low - Go to 106 b) OK – Go to 104
	13	Shorted High Voltage	Off . Diode Test D16	a) Bad - Go to 103 b) OK – Go to 110
Error 4 shown	14	Main Capacitor fast firing	Assume it is caused by a dying SCR	Go to 110
Error 5 Shown	15	Not firing	<i>Off</i> . Danger! Discharge Capacitor before test. <i>Measure Resistance In-circuit</i> of R20. Expect 12 Ohms.	a) Bad – Go to 121 b) OK – Go to 111
Output Voltage is lower than normal (Note 3)	16	Capacitors not charged correctly	On. Measure Maximum DC voltage on the main capacitor at Cap+. Expect over 600V in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low – Go-to 17 b) OK – Go to 18
	17	Charging circuit faulty	Off. Diode test Check all Diodes D2, D3, D10, D11, D8, D9. Also check for poor solder joints and "head on pillow".	a) Bad – Go to 103 b) OK – Go to 106
	18	Capacitor dying	Off. Danger! Discharge Capacitors. Disconnect capacitors and <i>Measure capacitance</i> main capacitors. Expect 30uF +/- 10%.	a) Low - Go to 112 b) OK – Go to 19
	19	Transformer	Off. Danger! Discharge Capacitor.	Go to 113
LCD showing Incorrect Voltage	20	Calibration error	<i>Off.</i> Connect a Electric fence voltmeter and a 500 Ohm load <i>On.</i> Trim P1 to make the LCD read the same or 0.1kV higher than the external voltmeter. (Note 5)	a) Cannot calibrate – Go to 21 b) OK – Go to 114.
	21	Voltage reading error	<i>On.</i> Look at the LCD	a) LCD reading 0.0 – Go to 22 b) LCD reading too high – Go to 23
	22	Opto drive issue	<i>Off. Diode test</i> D18, 19, 20, D21 (Note 4). Also D7	a) Bad – Go to 103 b) OK – Go to 115
	23	Opto receiver issue	Off. Diode check base to emitter of Q5	a) Bad – Go to 116 b) OK – Go to 106

LCD showing bad segments	24	LCD failed		Go to 117
Fuse keeps blowing	25	Short on Active input	Off. Lift one leg of R4. This isolates the first few components. On. Measure AC voltage at the far side of F2 fuse. Expect 110Vac or 240Vac depending on country. Danger! The Capacitors may be charged.	a) Low – Go to 106 b) OK – Go to 26
	26	Dead M1		Go to 120

Notes

- *Note 1* Put it back after step 13 or when fault found
- *Note 2* D9 may fail diode test if Q1 is shorted
- *Note 3* When checked with an Electric fence voltmeter on a 500 Ohm load. If the LCD is showing a low voltage but an external voltmeter shows a good voltage then it is a calibration issue, see step 20
- *Note 4* When checked with an Electric fence voltmeter on a 500 Ohm load. If the LCD is showing a low voltage but an external voltmeter shows a good voltage then it is a calibration issue, see step 20
- *Note 5* On high powered energisers, the LCD should not read lower than the actual fence voltage at 500R. Otherwise the energiser may produce a dangerous pulse

Faults table

If you find a fault which is not covered in the list below, and it is likely to occur again, please inform Pakton.

No.	Fault(s)	Repair Action / Notes	
101	Dead PIC	Replace IC1 – requires SMD rework tools and IC1 must be purchased pre-programmed from Pakton	
102	C2 or C16 failed	Replace C2 and or C16	
103	A M7 Diode failed	Replace it, Diode test others before applying power again.	
104	M2 or M9 Failed	Replace M2	
105	Shorted 5V rail	One of IC1, IC7, IC3, 4, 5 or 6 is dead and is holding down the 5V rail. Repair is beyond Basic level.	
106	Unknown	Repair is beyond Basic level.	
107	Dead IC2	Replace IC2	
108	R4 failed Open Circuit	Replace R4	
109	D1 or D4 S/C	Remove D1 and Diode check it. If it was OK then replace D4 as well	
110	SCR failed	Replace SCR. You may need to snip two leads off at SCR body to remove it.	
111	Q4 failed	Replace Q4	
112	Main capacitor failed	Replace capacitor. Only replace with the same part 30uF 900v or 30uF 1200 Pulse grade	
113	Output transformer failed	Replace the transformer. Use only COL024 from Pakton.	
114	Bad LCD calibration	On. Trim P1 to make the LCD read the same or 0.1kV higher than the external voltmeter	
115	Opto dead	Replace the opto isolator transmitter and receiver	
116	Q5 failed	Replace Q5	
117	LCD failed	Replace LCD. Use a firm non metallic lever to lift each end slowly from the socket. If the new LCD also shows bad segments then the fault is with IC1 or IC3, IC4, IC5 or IC6 and is beyond Basic level.	
118	Fuse or mains lead open circuit	Replace fuse in mains lead plug (110Vac only) or mains lead	
119	PCB Fuse blown	Replace fuse	
120	Dead M1	Replace M1, replace Fuse, resolder R4 leg.	
121	R20 failed	Replace R20 and Q4	

Model	PTE/PAE	Main Cap Charge V	kV on 500R	kV on 100R
TE800	PTE2103 / PAE041b	60uF 520 - 640	6.8	3.4
TE1200	PTE2104/ PAE042b	60uF 540 – 720	6.1	3.9
MT60	PAE203	30uF 370 – 730	6.5	3.1
MT100	PAE204	60uF 430 – 680	6.2	3.8
LIM80	PTE2136/ PAE205	60uF 375 – 630	7.2	3.6
LIM120	PTE2137/PAE206	60uF 395 – 745	6.8	4.1

Table of Expected Output Voltage (kV) on Load per Model

Minimum Tools Required for Basic level repair charts

- Electric fence kilo-voltmeter and 500 Ohm load Or Electric Fence Impulse Energy Meter
- Digital Multi-Meter with Diode check, Capacitance measurement to 30uF, Voltage range to 1000Vdc and maximum hold function.
- Temperature controlled Soldering Iron
- Desoldering suction tool for through hole re-work and or Solder wick (desoldering braid)
- Capacitor discharge resistor (500 Ohm 10W)
- Small hand tools such as screw drivers and side cutters etc
- Mains Isolation transformer (for 110/240Vac designs)
- A clean and tidy work area with an insulated surface