

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 <http://www.pakton.com.au/support.php>
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 can lose capacity (especially HQX brand) and hence 5V rail is lost, the results can be erratic operation
2. Q4 can fail shorted or partially shorted, leading to an error 3
3. TR1 can develop a shorted winding in the output, the result is low output voltage. This is characterized by unequal readings from each of the 2 outer pins on the output with respect to the centre pin.
4. Some 4.5J models have a thermal fuse fitted to R4. If this fuse blows it is usually due to a failure of Q4.
5. R17 can fail open circuit. Arcing can sometimes be seen and heard. Note R10 and R17 must be wire wound, not a film type.

Fence OK Or Overload

Energisers made on this PCBA have two LEDs.

The upper LED is either "Fence OK" OR "Overload". The Fence OK LED flashes on with each pulse **unless** there is an overload, An Overload LED only flashes when **there is** an overload. An overload is a load that takes the fence voltage down to approximately 2kV.

All models with the Overload LED show error codes, only some with the Fence OK LED show error codes.

Illegal Copies

We suspect that there are illegal copies of Pakton PCB's being made. All Pakton PCB's will show © Pakton or Ex-PT somewhere on the PCB. Pakton has not authorised any copies and holds patents over some features of the PCB's. The PIC firmware code is also copyright protected.

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 Pulse, no LEDs	1	Open circuit in supply line	On. <i>Measure AC voltage</i> at the AC input terminal A on PCB. Expect 110Vac or 240Vac depending on country. Danger! The Capacitors may be charged.	a) No voltage – Go to 2 b) Voltage OK – Go to 3
	2	Blown Fuse in lead plug	110Vac leads have a fuse in the plug.	Go to 113
	3	Blown fuse on PCB	On. <i>Measure AC voltage</i> 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 112 b) Voltage OK – Go to 4
	4	+5V power supply missing	On. <i>Measure DC voltage</i> at Pin 1 of T10 (ICSP). Expect 5V.	a) Low voltage – Go to 5 b) 4.8 to 5.2V OK – Go to 109
	5	Power Supply Capacitor Failure	Off. Remove or <i>Lift one end</i> of C2. (Note 1) <i>Measure Capacitance</i> of C2 and C16. Expect 220nF.	a) Low – Go to 101 b) OK, resolder – Go to 6
	6	Other Power Supply Failure	Off. <i>Diode check</i> D12 and D6	a) Low – Go to 107 b) OK – Go to 110
No Pulse. Energiser OK LED flashes then stops. Overload LED flashes Error code 3	7	Main Capacitor not charging	On. <i>Measure Maximum DC voltage</i> on the main capacitor at Cap+. See the table below for expected voltage. It should achieve the minimum in approx 1 second. You have 3 seconds after power on to take this measurement. So connect the voltmeter and then turn on. Danger! Discharge Capacitor after test.	a) Voltage Low - Go to 9 b) OK – Go to 20
	8	Discharge circuit Failure	Off. Replace Q4.	a) Was bad – Goto 102 b) OK – Go to 9
	9	Charging circuit Failure	Off. <i>Measure Resistance In-circuit</i> of R4. Expect 10 Ohms.	a) Bad – Go to 114 b) OK – Go to 10
	10	Charging circuit Failure	Off. <i>Measure Resistance In-circuit</i> of R17. Expect 10 Ohms.	a) Bad – Go to 105 b) OK – Go to 11
	11	Charging circuit Failure	Off. <i>Diode Test</i> D2, D3, D7, D9	a) Bad - Go to 107 b) OK – Go to 12

	12	Discharge circuit Failure	Off. Remove or <i>Lift one end</i> of D5. <i>Diode Test</i> D5 (note 2)	a) Bad - Go to 107 b) OK – Go to 13
	13	Charging circuit Failure	Off. Remove or <i>Lift one end</i> of M2 On. <i>Measure Maximum DC voltage</i> on the main capacitor at Cap+. See the table below for expected voltage. It should achieve the minimum in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low - Go to 118 b) OK – Go to 111
Output Voltage is lower than normal (Note 3). Over Load LED flashing with fire LED.	14	Capacitors not charged correctly	On. <i>Measure Maximum DC voltage</i> on the main capacitor at Cap+. See the table below for expected voltage. It should achieve the minimum in approx 1 second. Danger! Discharge Capacitor after test.	a) Voltage Low – Go to 15 b) OK – Go to 17
	15	Charging circuit faulty	Off. Diode test Check all Diodes D2, D3, D4, D7, D9. Also check for poor solder joints and “head on pillow”.	a) Bad – Go to 107 b) OK – Go to 16
	16	Charge capacitor	Off. Danger! Discharge Capacitors. Remove or <i>Lift one end</i> of C4, C5 and C6. <i>Measure capacitance</i> of C4, C4 and C6 Expected values depend on model (Note 4)	a) Low - Go to 117 b) OK – Go to 19
Main capacitor voltage does not seem to drop at fire.	17	Main Capacitor	Off. Danger! Discharge Capacitors. Disconnect main pulse capacitor and <i>Measure capacitance</i> main capacitor. Expect 8,16 or 30uF +/- 10%.	a) Low - Go to 104 b) OK – Go to 18
	18	Transformer	Off. Danger! Discharge Capacitor.	Go to 103
	19	Q1 Failed	Off. Replace Q1.	a) Was bad – Goto 106 b) OK – Go to 118
More than 1 pulse per second. Overload LED flashes Error 4	20	Fast firing	Assume it is caused by a dying SCR	Go to 102

No Pulse. Energiser OK LED flashes then stops. Overload LED flashes Error code 5	21	Not firing, firing circuit failure	Off. Danger! Discharge Capacitor before test. <i>Measure Resistance In-circuit</i> of R20. Expect 47 Ohms.	a) Bad – Go to 115 b) OK – Go to 22
	22	Firing circuit failure	Off. Danger! Discharge Capacitor before test. <i>Diode Test a NPN type Bipolar transistor Q2.</i>	a) Bad – Go to 116 b) OK – Go to 23
	23	Main capacitor disconnected or very low	Off. Danger! Discharge Capacitors. Disconnect main pulse capacitor and <i>Measure capacitance</i> main capacitor. Expect 8,16 or 30uF +/- 10%.	a) Bad – Go to 104 b) OK – Go to 118
Fuse keeps blowing	24	Short on Active	Off. <i>Lift one leg</i> of R4. This isolates the first few components. On. <i>Measure AC voltage</i> at the far side of F2 fuse. Expect 110Vac or 240Vac depending on country. Danger! The Capacitors may be charged.	a) Low – Go to 108 b) OK – Go to 118

Notes

Note 1 After lifting a leg or removing a component to test it, replace it before proceeding to the next test step.

Note 2 D5 will fail a diode test if Q4 has failed short circuit shorted

Note 3 When checked with an Electric fence voltmeter with a 500 Ohm load across the output.

Note 4 The charging capacitors will have the value written on them as a 3 digit code. The 3rd number is a multiplier. So 474 means 47 with 4 zeros or 470000pF which is 0.47uF. 105 means 1uF.

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	C2 failed	Replace C2
102	SCR failed	Replace SCR. You may need to snip two leads off at SCR body to remove it.
103	Output Transformer TRA failed	Replace TR1. Use only a COL023 from Pakton.
104	Main capacitor failed	Replace main discharge capacitor. Use a pulse grade capacitor of the same size and voltage rating.
105	R17 Failed	Replace R17. The replacement must be a wire wound, not a metal film.
106	Q1 Failed	Replace Q1
107	A Diode failed	Replace it with the same type, Diode test others before applying power again.
108	M1 failed	Replace M1, replace Fuse, resolder R4 leg.
109	IC2 (PIC) Failed	Replace IC2 – requires SMD rework tools and IC2 must be purchased pre-programmed from Pakton
110	Shorted 5V rail	One of IC2, Q2, D12, D6 is dead. Repair is beyond Basic level.
111	M2 failed	Replace M2
112	PCB Fuse blown	Replace fuse
113	Fuse or mains lead open circuit	Replace fuse in mains lead plug (110Vac only) or mains lead
114	R4 failed	Replace R4
115	R20 failed	Replace R20, check Q2 and Q4
116	Q2 failed	Replace Q2, check Q4
117	Charging Capacitor Failed	Replace with same value and voltage rating. See Note 4
118	Unknown	Repair is beyond Basic level.

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

Model	Part Number	Joules	Vin	Main Cap	Charge V	kV on 500R
TE50	PAE070	0.5J	110Vac/60Hz	8uF	390-420	4.1
TE100	PAE071	1.5J	110Vac/60Hz	8uF	540-600	5.5
TE300	PAE072	3.0J	110Vac/60Hz	16uF	620-620	6.6
TE500	PAE073	4.5J	110Vac/60Hz	30uF	530-600	5.8
8ME	PAE066	0.5J	230Vac/50Hz	8uF	490-490	3.1
M1.5, LIM20, 16ME	PAE067	1.5J	230Vac/50Hz	8uF	640-700	4.5
M3, LIM30, 35ME, FC3J	PAE068	3.0J	230Vac/50Hz	16uF	580-600	4.9

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