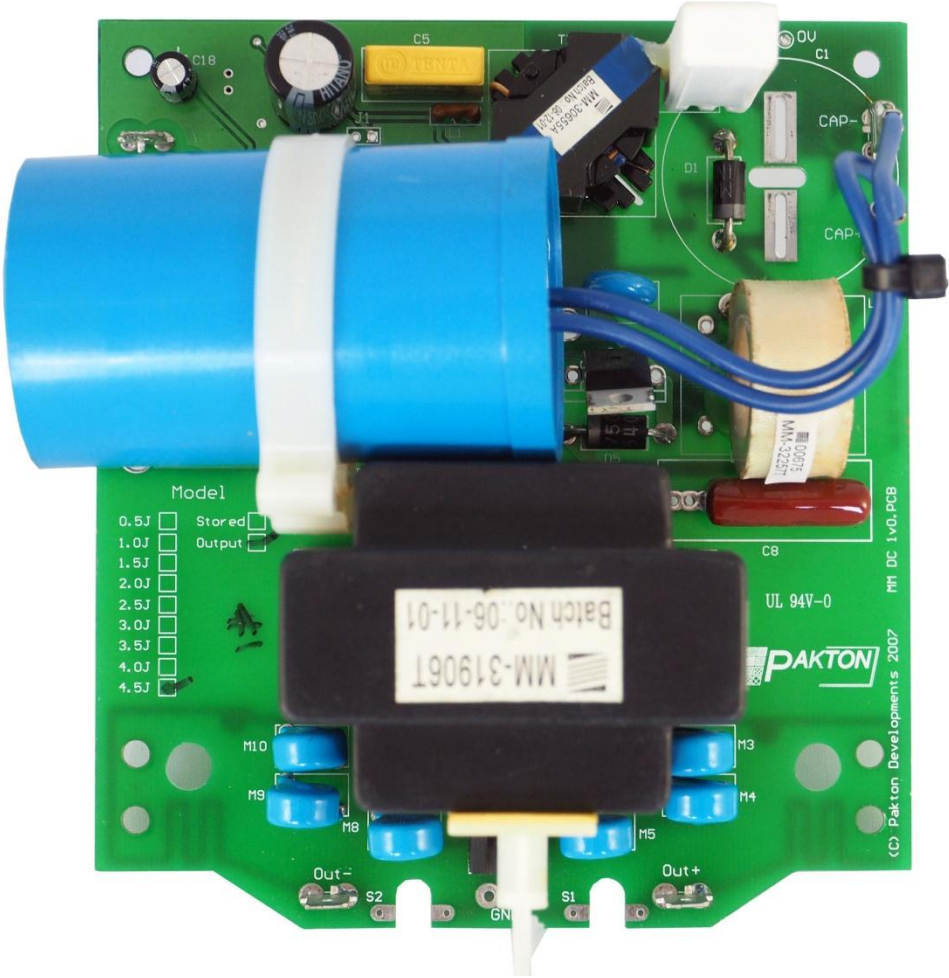


Basic Repair Chart

PAE058 (PC057) Version 1.0+ 12-24V DC, 0.5 to 5 Joule output energisers

Rev 1v05



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 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. The Polyswitch (self resetting fuse) F2 can fail, the symptoms are that the unit will stop on Error 3 after a period of running.
2. On early versions Q1 was a 60V MOSFET, replacing these with a 100V device reduced the failure rates.
3. Q4 can fail shorted or partially shorted, leading to an error 3
4. 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.

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 apply 12V power and push the on switch. **Off**, means turn it off at the PCB switch and then remove 12V power.

A test method in *italics* is described in the Technical resource document.

Symptom	Line	Theory	Tests	Possible Results
No Pulse, no LEDs Or drawing too much current.	1	MOSFET failure	Off. <i>Continuity Test</i> from the +12V test point near J1 to Bat-	a) Continuity – Go to 101 b) No Continuity – Go to 2
	2	External Power Supply Failure	On. <i>Measure DC voltage</i> at the DC input terminal Bat+ on PCB. Expect 12V depending on the source.	a) No voltage – Go to 3 b) Voltage OK – Go to 4
	3	External Power Supply Failure	Disconnect the External Power Supply at the SAE connector On. <i>Measure DC voltage</i> at the SAE connector from the external power supply. Expect 12V depending on the source.	a) No voltage – Go to 108 b) Voltage OK – Go to 117
	4	Blown fuse on PCB	On. <i>Measure DC voltage</i> at the far end of fuse F2 or the Cathode of D2. Expect 12V.	a) No voltage – Go to 112 b) Voltage OK – Go to 5
	5	Blown D2	On. <i>Measure DC voltage</i> at the +12V test point near J1. Expect 12V.	a) No voltage – Go to 105 b) Voltage OK – Go to 6
	6	Failing to latch 12V	On. <i>Measure DC voltage</i> at the +12VSW test point. Expect 12V.	a) No voltage – Go to 118 b) Voltage OK – Go to 7
	7	+5V power supply missing	On. <i>Measure DC voltage</i> at Pin 1 of T9. Expect 5V.	a) Low voltage – Go to 106 b) 4.8 to 5.2V OK – Go to 109
No Pulse. Energiser OK LED flashes then stops. Overload LED flashes Error code 3	8	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 10 b) OK – Go to 21
	9	Discharge circuit Failure	Off. Check or Replace Q4.	a) Was bad – Goto 102 b) OK – Go to 10
	10	Charging circuit Failure	Off. <i>Diode Test Mosfet Q1</i>	a) Bad – Go to 101 b) OK – Go to 11
	11	Charging circuit Failure	Off. <i>Diode Test D6, D11, D1</i>	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 D5</i> (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 once.	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 D6, D11, D1, D5. Also check for poor solder joints and “head on pillow”.	a) Bad – Go to 107 b) OK – Go to 16
	16	Q1 Failed	Off. Replace Q1.	a) Was bad – Goto 101 b) OK – Go to 118
	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
More than 1 pulse per second. Overload LED flashes Error 4	19	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	20	Not firing, firing circuit failure	Off. Danger! Discharge Capacitor before test. <i>Measure Resistance In-circuit</i> of R24. Expect 47 Ohms.	a) Bad – Go to 115 b) OK – Go to 21
	21	Firing circuit failure	Off. Danger! Discharge Capacitor before test. <i>Diode Test a NPN type Bipolar transistor</i> Q3.	a) Bad – Go to 116 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

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	Q1 failed	Replace Q1. Check D2, Also check bead L7, check for burnt track work leading to Q1.
102	SCR Q4 failed	Replace Q4. You may need to snip two leads off at SCR body to remove it.
103	Output Transformer TR1 failed	Replace TR1. There is a tool available from Pakton to desolder all 5 pins at once. Otherwise use multiple soldering irons.
104	Main capacitor failed	Replace main discharge capacitor. Use a pulse grade capacitor of the same specifications as the original.
105	D2 failed	Replace D2, Also check bead L7, check for burnt track work leading to Q1, Check Q1.
106	IC1 Failed	Replace IC1
107	A Diode failed	Replace it with the same type
108	Power Supply Failure	Replace the external power supply with a 12DC 1.0A supply.
109	IC2 (PIC) Failed	Replace IC2 – requires SMD rework tools and IC1 must be purchased pre-programmed from Pakton
110	Shorted 5V rail	One of IC1, IC1 or Q3 is dead. Repair is beyond Basic level.
111	M2 failed	Replace M2
112	F2 failed	Replace F2, also check bead L8 for continuity. Do a diode test on Q1.
115	R24 failed	Replace R24, check Q3 and Q4
116	Q3 failed	Replace Q3, check Q4
117	Break in input lead	Replace the input lead, Pakton part number COX032
118	Unknown	Repair is beyond Basic level.

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

Model	Module Part Number	Joules	Main Cap	Charge V	kV on 500R
PTE2213 – TB50	PAE074	0.5	8uF	420	4
PTE2214 – TB100	PAE075	1.0	8uF	545	4.7
PTE2215 – TB300	PAE076	3.0	16uF	665	6.2
PTE2216 – TB500	PAE077	4.5	30uF	680	6.0
PTE2224 – LIMB20	PAE095	1.0	8uF	620	3.5
PTE2225 – LIMB30	PAE096	3.0	16uF	660	4.5
PTE2226 – LIMB50	PAE097	4.5	30uF	680	6.2
PTE2210 – 15BT	PAE095	1.0	8uF	620	3.5
PTE2211 – 35BT	PAE096	3.0	16uF	660	4.5
PTE2212 – 65BT	PAE097	4.5	30uF	680	6.2
PTE2233 – MB4.5	PAE097	4.5	30uF	680	6.2
MBx – MB1.5	PAE097*	1.5	30uF	375	3.5
MBx- MB3	PAE097*	3	30uF	530	5.1
MBx – MB4.5	PAE097*	4.5	30uF	680	6.2
PTE2240 – FG0.5	PAE074	0.5	8uF	420	4
PTE2241 – FG1.5	PAE095	1.0	8uF	620	3.5
PTE2242 – FG3.0	PAE096	3.0	16uF	660	4.5
PTE2243 – FG4.5	PAE097	4.5	30uF	680	6.2

* The PTE2253 MBx can be programmed to be a MB1.5, 3 or 4.5

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