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# ***CIRPAC***

**Kelan Circuits Ltd**

P.C.B. PROCESSING TANKS

INSTRUCTION MANUAL

WEL ELECTRONICS COMPANY

## PCB PROCESSING TANKS

### Models

M4 PCB Processor

General Process Tank

Bubble Etch Tank

Spray Wash Tank

FOR ADDED SAFETY AND PROTECTION ALL HEATED  
TANKS ARE NOW FITTED WITH A LOW LIQUID LEVEL  
SENSOR WHICH PREVENTS HEATER ENERGISING IF  
TANKS ARE SWITCHED ON WHEN EMPTY.

## CONTENTS

Fault Diagnosis and Rectification.....	19
Fuse Replacement.....	21
General.....	1
Maintenance.....	22
Operating Instructions	
M4 Processor.....	4
General Process Tank.....	11
Bubble Etch Tank.....	14
Spray Wash Tank.....	17
Specifications	
M4 Processor.....	4
General Process Tank.....	11
Bubble Etch Tank.....	14
Spray Wash Tank.....	17
Thermostat Settings.....	12

## CONSTRUCTION

Tanks are manufactured from polypropylene selected for its inherent resistance to impact, heat distortion and chemicals. All seams are plate welded to prevent splitting.

Frequently used sealed electrical controls are mounted in the angled top control panel to allow units to be let into work surfaces for permanent installation. Thermostat control knobs are mounted internally away from chemical contact. Board holding baskets are fitted into the individual tank lids of chemical process tanks

FOR ADDED SAFETY AND PROTECTION ALL HEATED TANKS ARE FITTED WITH A LOW LIQUID LEVEL SENSOR WHICH PREVENTS HEATER ENERGISING IF TANKS ARE SWITCHED ON WHEN EMPTY OR IF LIQUID DROPS BELOW CRITICAL LEVEL.

The inner tank is secured to the top plate with removable plastic rivets at front and rear. To facilitate thermostat adjustment or fuse replacement, these rivets require to be removed before the inner tank may be lifted from the console body.

## NOTES ON RIVET REMOVAL

The rivet is in two parts. The outer pin may be removed by placing a thin bladed blunt instrument between the tank wall and the rivet head. Gentle pressure allows removal of the pin, the inner rivet body may now be removed releasing the tank. IT IS ESSENTIAL THAT THIS RIVET IS REFITTED PRIOR TO THE TANK BEING USED.

## DEVELOP TANK

Fitted with silica sheathed 600W heater and thermostatically controlled. Temperature variable to a maximum of approximately 60 deg C. Factory set to a temperature of 25 deg C +/- 5 deg C, for optimum results.

#### WASH TANK

Unheated. Electrically operated water inlet valve with 1.5mm hose for connection to  $\frac{1}{4}$ " BSP threaded tap 1.5mm crush proof drain hose for connection to waste water drain.

#### ETCH TANK

Fitted with silica sheathed 600W heater and thermostatically controlled. Temperature adjustable up to 60 deg C. Bubble air agitated for fast results. Factory preset to approximately 50 deg C +/- 5 deg C for optimum results.

#### TIN TANK/GENERAL PROCESS TANK

Fitted with silica sheathed 600W heater and thermostatically controlled.

TIN tank temperature preset to 70 deg C +/- 5 deg C. suitable for high temperature tinning solution.

GENERAL PROCESS tank preset to 25 deg C +/- 5 deg C., adjustable to 70 deg C.

#### PRE-TEST

WE RECOMMEND THAT WHEN USING TANKS FOR THE FIRST TIME THAT WATER BE USED IN PLACE OF CHEMICALS TO CHECK THAT ALL FUNCTIONS ARE OPERATING CORRECTLY AND ALSO WHEN ADJUSTING OPERATING TEMPERATURE OF SINGLE PROCESS TANK.

#### WARNING !

1. Isolate the unit from main electrical supply prior to thermostat adjustment, inner tank removal, fuse replacement, fault finding, filling or emptying of tank.

2. NEVER SWITCH THE HEATING ELEMENT 'ON' WHEN TANK IS EMPTY.
3. We recommend the use of an earth leakage or residual current circuit breaker.

## M 4 P C B P R O C E S S O R

### Specifications:

Power requirement	240V A.C. 10 amps max.
Overall dimension	Width: 690mm
	Depth: 575mm
	Height: 455mm
Tank internal dimensions	320 x 310mm
Tank capacity	4.5 litres approx.
Maximum board size	305 x 220mm

The M4 PCB Processor is fitted with a 2 metre length of 3 core cable for connection to the 240v AC mains via a standard 13 amp plug. Although there are no exposed metal parts it is essential that the green/yellow wire is connected to earth.

Each individual tank power socket incorporates a 4 amp fuse for protection in the event of an electrical fault.

Note: Replacing the 4 amp fuse with one of a higher value is not only dangerous, but will also void the warranty! (See page 20 for fuse replacement instructions).

### PROCEDURE

1. Mix 4.5 Litres of developing solution as per supplier's instructions and fill the DEVELOP tank to within 50mm of the tank top moulding. Fill the ETCH tank and TIN tank with etchant and tinning solutions respectively to within 50mm of the top mouldings.

2. Connect the Processor to the 240V AC mains and switch on.
  3. Switch on the power to the DEVELOP, ETCH and TIN tanks by pressing RED MAINS ROCKER SWITCHES which should now illuminate. The AMBER NEON INDICATORS will illuminate if the temperature of tank contents is lower than the preset thermostat setting. The AMBER NEON indicates that the tank heating element is energised.
  4. Once the preset tank temperatures have been reached the heating elements will be automatically cycled on and off as temperatures vary in use.
- NOTE When using the WASH tank the AMBER NEON INDICATOR will be illuminated whenever the MAINS ROCKER SWITCH is in the ON position.

#### DEVELOPING

1. Once exposure to ultra violet light is completed, place the PCB into the basket and completely immerse into the developer.
2. After 30 seconds, begin to slowly agitate the board up and down inspecting the conductor pattern whilst doing so, this will gradually become more defined.
3. Once the clear areas appear to be of free photoresist, switch the WASH tank on and place the board between the sprays. Agitate whilst withdrawing the PCB past the sprays.
- 4a. Immerse the developed board briefly into the ETCH tank. Remove and wash well between the spray bars in the WASH tank. Inspect the board to determine that all unwanted photoresist has been removed.



- b. If not completely clear of photoresist repeat the development cycle for a few seconds longer. Clear areas will show as pink when resist is fully removed. Stubborn patches may be removed by selective exposure and redevelopment.
- c. When complete, dry the board and inspect.

Points to note:

- I. Development time in fresh solution at 30 deg C is approximately 2 minutes. With use this time will increase gradually until the develop solution is fully saturated with photoresist. In general a 4.5 litre mix will saturate after 8 square metres of photoresist has been removed.
- II. Over development will cause loss of definition or complete loss of print.
- III. CIRPAC liquid developer is a mild caustic blend. In case of skin contact, rinse immediately with cold water. In case of eye contact, bathe with cold water and seek medical attention.

Fault correction:

During the course of the process, dust or scratching may have caused small defects on the conductor areas, and it is important that these are corrected before etching. An etch resist pen is available for this purpose. Having dipped the PCB into etchant to test for full development, the copper areas clear of resist are shown pink, any defect is therefore clearly visible.

## ETCHING

1. The ETCH tank should be switched on for approximately 30 minutes prior to use, to allow the preset temperature to be reached.
2. Place board in the basket and immerse into the tank. Leave for 5 - 10 minutes in fresh etchant, or longer as necessary to fully remove all the unwanted areas of copper. Agitating board holding basket will ensure even etching during this process.
3. Remove, wash well and inspect.

### Points to note:

- I. Only Ferric Chloride etchant liquid or crystallised should be used. Your supplier will advise the compatibility of other chemicals
- II. The etch rate will vary from 5 - 15 minutes according to the amount of copper which the solution has to remove. In general a 4.5 litre mix will absorb 1 metre square of removed copper (an average of 25 single sided PC boards 305mm x 235mm removing 50% of the copper area).
- III. The continuous air agitation is designed to give excellent resolution and fast etch rate. Once the board is fully etched it should be removed and washed to prevent undercutting and over-etching.
- IV. Normal acid precautions should be taken with spillages i.e. Wash well with clean water. Seek medical attention if eyes are splashed. To avoid staining always wear protective clothing, gloves and goggles.

## ELECTROLESS TINNING HIGH TEMPERATURE SALTS

1. The TIN tank should be switched on at least 1 hour prior to use, to allow the preset temperature to be reached. Best results will be obtained with the tank temperature around 70 deg C. (Setting no. 9 on the thermostat dial).
2. Remove all traces of photoresist residues from the areas that require tinning and degrease with scrub polish block.
3. The cleaned PCB is placed into the tinning solution using the basket, and left immersed for a minimum of 3 minutes. Occasional agitation assists the plating process and gives a brighter finish.
4. After plating, thoroughly wash and dry the PCB.

### Points to note:

- i. IT IS ADVISABLE DURING WARM UP, THAT THE CRYSTALLISED SOLUTION IS STIRRED USING A PVC ROD, TAKING CARE NOT TO DAMAGE THE HEATER.
- ii. The solution level should be maintained not less than 50mm from the tank top moulding. Replenish with distilled water, replacing lid to minimise evaporation.
- iii. The copper conductors are plated by chemical deposition, a small amount of copper is replaced by an equal amount of tin. Immersion times may be varied according to thickness of plate required:  
  
5 minutes - 1.00 microns
- iv. A 4.5 litre mix of tinning salts will provide 9 metres square copper coverage when plating to a thickness of 0.5 microns. Immersion times will require to be increased with usage.

- v. When the solution is exhausted it is recommended that it is replaced by a fresh mix. Do not attempt to replenish by adding further salts or acid as the correct chemical balance is essential.
- vi. The faint odour emitted by the salts when hot is harmless. An extractor fan may be used in enclosed spaces. The solution is mild acid - take normal precautions.
- vii. Care should be taken not to contaminate the bath with etchant or developer.

## SOLUTION REPLENISHMENT

### 1. DEVELOP TANK

- i. Drain using syphon.
- ii. Clean tank thoroughly. Wash silt from bottom of tank with clean water. Inspect for damage.
- iii. Refill with fresh developer to within 50mm of the top moulding.

### 2. ETCH TANK

- i. Drain using syphon.
- ii. Clean tank out thoroughly, removing any scale.
- iii. Fill with clean water and check that all air holes are free.
- iv. Drain and inspect for damage.
- v. Refill with fresh ferric etchant to within 50mm of top moulding.

### 3. TIN TANK

- i. Drain using syphon whilst the liquid is still hot.
- ii. Clean thoroughly and examine for damage.
- iii. Refill with fresh solution to within 50mm of top moulding.

### 4. WASH TANK

- i. Switch the unit on and circulate fresh water for at least 10 minutes to clear any blocked jets.

## GENERAL PROCESS TANK (SGP1)

### Specifications:

Power requirement	240V A.C. 50HZ
Fuse rating	4 amps
Heating element	600W silica sheath type
Thermostat	Range: 20 - 70 deg C Pre-set to: 25 deg C +/- 5 deg C
Internal tank dimensions	320 x 310mm
External unit dimensions	Width: 220mm Depth: 575mm Height: 455mm
Tank capacity	4.5 litres
Maximum board size	305mm x 220mm

### GENERAL

This tank is fitted with a 1.5 metre length of 3 core cable for connection via a 13 amp fused plug to the 240V A.C. electrical supply. The tank is also fused internally at 4 amps. For replacement of this fuse refer to page 21.

This unit may be used with any PCB or photographic related process which requires chemicals to be safely heated and temperature controlled within the range of 20 deg C to 70 deg C approx.

## THERMOSTAT SETTINGS

This tank is factory adjusted to provide a temperature of approximately 25 deg C. The temperature corresponds to setting '1' on the thermostat dial. The maximum setting on the thermostat dial corresponds to a tank temperature of approximately 70 deg C.

## WARNING !

DISCONNECT THE TANK FROM THE MAINS WHILST MAKING THERMOSTAT ADJUSTMENTS.

## TYPICAL TEMPERATURE SETTINGS

	DIAL SETTING	
DEVELOPERS	(0-1)	25 - 35 deg C
FERRIC ETCHANTS	(5-6)	45 - 55 deg C
STRIPPERS	(4-5)	35 - 45 deg C
HIGH TEMPERATURE TINNING	(9-10)	65 - 75 deg C

## PROCEDURE

1. Fill the tank to within not less than 50mm of the top moulding with the desired process chemical.

2. Connect the tank via the mains cable to a 240V AC supply and switch on mains supply.
3. Switch the RED MAINS ROCKER SWITCH on, this should now illuminate, the AMBER neon should also illuminate if the temperature of the tank contents is lower than the preset temperature setting. The AMBER neon indicates that the tank heating element is energised.
4. Once the preset temperature has been reached the heating element will automatically be cycled 'ON' and 'OFF' as temperatures vary in use.
5. A thermometer should be used to monitor tank temperatures until dial settings of the thermostat have been calibrated (see page 12 for thermostat setting note).

Further notes on Developing and Tinning can be found on the following page numbers

DEVELOPING - 5 and 6  
HIGH TEMP. TINNING - 8 and 9



## BUBBLE ETCH TANK

### Specifications:

Power requirement	240V A.C. 50HZ
Fuse rating	4 amps
Heating element	600W silica sheath type
Thermostat	Range: 20 - 60 deg C Pre-set to: 45 - 55 deg C
Internal tank dimensions	320 x 310mm
External unit dimensions	Width: 220mm Depth: 575mm Height: 455mm
Tank capacity	4.5 litres
Maximum board size	305 x 220mm

### GENERAL

This tank is fitted with a 1.5 metre length of 3 core cable for connection via a 13 amp fused plug to the 240V A.C. electrical supply. The tank is also fused internally at 4 amps. For replacement of this fuse refer to page 21.

### PROCEDURE

1. Prepare 4.5 litres of ferric etchant and fill the tank to within 50mm of top moulding.

2. Connect the tank via the mains cable to a 240V A C supply and switch on mains supply.
3. Switch the console RED MAINS ROCKER SWITCH on this should now illuminate, the AMBER NEON should also illuminate if the temperature of the tank contents is lower than the preset thermostat setting. The AMBER neon indicates that the tank heating element is energised.
4. Bubble action should start immediately. The normal preset temperature for the most efficient etching action is between 8 and 9 on the internal thermostat control dial. It will take approximately 30 minutes for solution to reach operating temperature.
5. Place the board to be etched in the holding basket fixed to the tank lid, lower into etching solution and completely immerse the board. Agitation of the board holding basket during the etch process will ensure even copper removal.

NOTE

Etching times are dependent upon quantity of copper to be removed, temperature and level of saturation of etching solution. Fresh solution will absorb approximately 1 metre square of removed copper per 4.5 litre mix. An average of 25 single sided PCB's of approximately 305 x 220mm in dimension having 50% of their copper removed. Solution exhaustion is indicated when etching times are excessive.

6. Once all the exposed copper area has been removed, withdraw the lid and basket containing the PCB and thoroughly wash in running water. We recommend the use of a SPRAY WASH tank for this purpose.

## HEALTH & SAFETY

Normal acid precautions should be taken with spillages. Flush affected part with running water and if eyes are splashed seek medical attention.

Always wear protective goggles, gloves and workwear.

## S P R A Y   W A S H   T A N K

### SPECIFICATIONS:

Power requirement	240V A.C. 50HZ
Fuse rating	4 amp
Internal tank dimensions	320 x 310mm
External unit dimensions	Width: 220mm
	Depth: 575mm
	Height: 455mm
Tank capacity	4.5 litres
Maximum board size	305 x 220mm
Inlet Connection	$\frac{3}{4}$ " BSP male fitting
Outlet drain	Crushproof flexible hose 1.5m

Control of water by electrically operated valve.

### GENERAL

This tank is fitted with a 1.5 metre length of 3 core cable for connection to the 240V A.C. mains supply via a 13 amp fused plug. The tank is fused internally at 4 amps.

### PROCEDURE

Spray washing of PCB's is the most efficient way of ensuring that chemical residues are removed from the PCB during processing. It is essential that cross contamination of the process chemicals is prevented, thus ensuring consistent results from batch to batch.

PROCEDURE continued

1. Insert the drain outlet hose into a suitable waste receptacle or waste water drain system pipe.
2. Connect the tank to the water supply ensuring that the screw connectors are tight at both tap and tank ends.
3. Turn on the water supply and check the tank for leaks between inlet tap connection and solenoid connections of inlet hose.
4. Having established there are no leaks, connect the tank via the mains cable to a 240V A C supply.
5. Switch the mains supply on, the RED MAINS ROCKER SWITCH should now illuminate. The AMBER NEON INDICATOR will be illuminated whenever the mains switch is in the on position.
6. Spray action should start immediately. If spray action does not start, check that the water supply and mains supply are switched 'ON', listen for solenoid valve operation as the console switch is operated. If the AMBER neon is illuminated, fault is probably a blocked filter in the solenoid valve (disconnect hose and clear) or blocked spray bar holes.

#### FAULT DIAGNOSIS AND RECTIFICATION

- 
- |                              |  |
|------------------------------|--|
| 1. Development time too slow | a) Developer saturated - renew.<br>b) Insufficient exposure. |
|------------------------------|--|
- 
- |   |   |
|---|---|
| 2. Stubborn patches of resist will not remove | Increase exposure and ensure developer is warm. |
|---|---|
- 
- |                       |   |
|-----------------------|---|
| 3. Etch time too slow | a) Etchant saturated - renew.<br>b) Etchant cold - check heater and thermostat are operating correctly. |
|-----------------------|---|
- 
- |                                 |                          |
|---------------------------------|--------------------------|
| 4. Electroless tinning too slow | Salts exhausted - renew. |
|---------------------------------|--------------------------|
- 
- |                                      |   |
|--------------------------------------|---|
| 5. Electroless tin plating blemished | a) Too much acid - renew solution.<br>b) Solution contaminated - renew. |
|--------------------------------------|---|
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- |                         |   |
|-------------------------|---|
| 6. Wash tank poor spray | a) Water pressure too low - check plumbing.<br>b) Solenoid filter blocked - remove and clean. |
|-------------------------|---|
- 
- |                           |   |
|---------------------------|---|
| 7. Wash tank uneven spray | Holes in bars blocked - clean with 1mm rod. |
|---------------------------|---|
- 
- |                                   |   |
|-----------------------------------|---|
| 8. No air (or poor) bubble action | a) Drain etch tank - clean holes in bar.<br>b) Check for air leaks in pipework.<br>c) Fit new pump. |
|-----------------------------------|---|
- 
- 19

9. Fuse blows  
(see fuse replacement  
section)

Renew fuse. Switch on mains. Switch each tank 'on' and 'off' in turn to determine source of fault. Disconnect from mains supply before proceeding further. If in doubt refer to qualified personnel. Check all wiring in area of fault for: bad connection/moisture/arcing/defective heater.

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10. Heater does not switch  
'off' - tank overheats

a) Thermostat defective.

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11. Heaters fail to  
function, but all  
wiring is sound and  
neons show correct  
function.

a) Check liquid level sensor is functioning.

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12. Heater energises when  
tank is empty.

a) Check liquid level sensor is not stuck in horizontal position.

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## FUSE REPLACEMENT

In addition to the 13 amp fuse in the mains inlet plug, tanks are fused internally at 4 amps.

In the event of supply failure to a tank indicated by non-illumination of the red neon and lack of thermostatic heater control, adopt the following procedure:

1. Switch unit 'OFF' at the mains and withdraw plug from socket. Check 13 amp mains supply fuse and replace if required. If mains supply and fuse are intact, proceed.
2. Remove plastic rivets (see note on rivet removal).
3. Lift faulty tank clear of the console until the mains plug and socket are exposed.
4. Withdraw plug from socket and lift tank clear of console.
5. Supporting the tank, pull open the slide fuse carrier marked 'fuse' at the bottom of the mains inlet socket to reveal the fuses.
6. Replace the inner fuse with the outer spare or another of 4 amp rating.
7. Close the slide fuse carrier, refit the mains lead plug and insert tank into console.
8. Refit the black plastic rivets.
9. Switch unit 'ON' and inspect, check for illumination of red neon
10. If fault persists seek qualified electrical assistance.

NOTE: THE FITTING OF A FUSE LARGER THAN 4 AMP WILL VOID WARRANTY.



## MAINTENANCE

### DAILY

#### Before use:

Clean the unit top thoroughly.

Switch the unit on and check all neons are operational. ie. On heated tanks both neons will be illuminated when tank contents are cold. The amber neon will switch off when temperature is reached.

Check that spray bars on the WASH tank have flow through all holes.

#### After use:

Clean down thoroughly using damp sponge. Ferric Etchant stains can be removed with a dilute solution of hydrochloric acid (about 1 in 10) followed by a thorough water rinse.

Replenish liquid levels as per instructions.

A good liquid wax polish will assist cleaning and minimise staining.

### PERIODIC CHECKS

Check all tanks thoroughly for any damage.

Inspect for leaks and check all wiring, pipes and fittings.

Fill tanks fitted with heating element with clean water and observe heaters are functioning. Allow tanks to reach temperature and check with thermometer.

Check ETCH tank air pump is operating correctly.

Check WASH tank solenoid valve is working.

Check LOW LIQUID LEVEL SENSOR SWITCH is operational.

If new fittings are required, always consult supplier.

NEVER FIT METAL PARTS

Spare parts are available from:

Kelan Circuits Limited  
Cirpac Division  
Farnell Technology Park  
Boroughbridge  
North Yorkshire  
YO5 9UY

Tel: 0423 323333

Check ETCH tank air pump is operating correctly.

Check WASH tank solenoid valve is working.

Check LOW LIQUID LEVEL SENSOR SWITCH is operational.

If new fittings are required, always consult supplier.

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Tel: 0423 323333



**CIRPAC DIVISION**  
Kelan Circuits Limited  
Farnell Technology Park  
Boroughbridge  
North Yorkshire YO5 9NY  
Telephone: (0423) 323333  
Telex: 57568 FARNBB G  
Facsimile: 0423 324065