



A WORLD LEADER IN FUME  
EXTRACTION TECHNOLOGY

# TCU

USER MANUAL









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# Safety

## Warning Notices

To ensure the safe operation of equipment, all personnel must follow generally accepted safety procedures. These procedures ensure their own safety and the safety of those around them. In this manual and on the machine, safety symbols of the type described below are shown when a potential hazard is given, the advisory notices should be heeded at all times.

SYMBOL	DEFINITION
	<b>WARNING</b> <b>ELECTRICAL HAZARD.</b> High electrical voltage is present that could cause injury or death. Do not remove protective covers from the equipment housings or override protective devices.
	<b>WARNING</b> <b>BEWARE OF MOVING PARTS.</b> Rotating fans are present that could cause injury or death. Switch off power to fan motors before removing panels and proceed with caution.
	<b>CAUTION</b> Refers to a possibly harmful situation. If not avoided, damage could be caused to the product or something in its environment.
	<b>WARNING - DANGER</b> Ensure machine is isolated from all sources of electrical energy before removing access covers for service and maintenance.
	<b>CAUTION - DO NOT COVER</b> Care must be taken to ensure airflow through the Air Conditioning Unit is not obstructed. Over-heating and possible failure of the machine may occur if not observed.
	<b>PROTECTIVE EARTH CONNECTION</b> If it is necessary to remove Protective Earth Connections to enable repair/maintenance, care should be taken to ensure connections are remade on completion and prior to reinstating the machine power supply.

## Intended Use



**WARNING – Use only as described.  
Consult manufacturer before using for any other purpose.**

The Temperature Control Unit (TCU) is a precision Temperature Control Unit designed to enhance the Print Process by providing a highly stable and accurately controlled air temperature within the printer.

The operating range of the TCU offers wide control of the process temperature either side of factory ambient. As applications become more varied the requirement to produce high yield results can be aided by the ability to heat as well as cool from factory ambient.

The TCU uses a re-circulating air system. Air entering the TCU is passed via a fan through an air conditioning module where it is cooled and dehumidified before being ducted into a plenum containing air heaters. A PID controller modulates the power output of the heaters to accurately achieve the required set temperature. The temperature conditioned air then passes through a filter and fed on through ducting into the print process area of the printer. The air is then re-circulated back to the TCU.

Due to its optimized design and re-circulating system, the TCU is energy efficient and requires minimal input power from a single-phase mains supply. The design minimises the production of waste heat, which is vented through the top of the TCU alleviating the need for any connection to factory extraction systems.

To prevent process contamination conditioned air is passed through a filter before entering the printer. The possibility of process contamination is further reduced due to the TCU maintaining a higher air pressure within the printer compared to the surrounding environment thus limiting the ingress of airborne particles.

The Module's operating status is indicated by provision of a 'four colour' beacon clearly visible to line operators. Any condensate produced can be gravity piped to drain or collected in an easy to empty 5-litre container. Two sensors monitor condensate level and give a warning via the beacon when the container requires emptying. The TCU will automatically shut down if the container is not emptied to prevent overflow.

The TCU has been designed for robust reliable operation, resulting in a long lifetime product. Ergonomic modular design features allow for ease of maintenance without any requirement for specialist refrigeration resource.

## Installation


### Technical Data


ITEM	DESCRIPTION
Ambient Temperature	15 - 35°C
Ambient Humidity	30 - 70% @ 20°C
Process Temperature Range	+/- 8°C of ambient within a programmable range of 19° to 30°C
Process Temperature Control	+/- 1°C
Air Delivery System	Re-circulating
Cooling capacity	2000W
Temperature sensor	0 – 10Vdc (0 - 50°C) Shared output from printer sensor
Refrigerant gas	R134a/0.75Kg
Full Load Current	12.6A
Start up current	20A
Voltage	230V +/- 10% (207V to 253V working range)
Frequency	50/60Hz
Power Supply Cable Specification	2.5mm (14AWG) 3-Core, 300/500V PVC: H05VV-F (SJT), Rubber: H05RN-F (S)
Power Supply Cable Connections	L = Brown, N = Blue, E = Green/Yellow
Internal Power Wiring	0.5mm (22AWG), 600V, 105°C 1.5mm (16AWG), 600V, 105°C
Acoustic Noise	75dB
Dimensions	1285mm (H) + (beacon 450mm), 540mm (W), 670mm (D)
Weight	100Kg
Condensate	Collected in a 5 litre container for disposal or diverted directly to a drainage system where available.

## Services Required

Bofa requires additional machine supply protection with the fitment of an external double pole circuit breaker conforming to national/federal regulations. Use the following table to ensure the recommended circuit breaker is used.


Voltage	Frequency	Value of Supply Circuit Breaker
230V +/- 10% (207 to 253V)	50/60Hz	16 Amp

	<b>CAUTION OVER CURRENT PROTECTION.</b> An over current circuit breaker protects the machines internal wiring and components from over heating or catching fire during fault conditions. Under no circumstances must a circuit breaker of greater value than 16 Amps be used
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	<b>WARNING</b> Connect to a properly earthed/grounded outlet..
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## Transportation

The unit may only be lifted using suitable equipment capable of lifting 120Kg. Move the unit to the location where it is going to be installed and remove the unit from its transportation crate along with any accessories. Remove the protective covering.

	<b>CAUTION FORK LIFTING.</b> The lifting forks must enter under the machine from either end of the transportation crate only. Care must be taken to ensure stability at all times.
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## Power Supply Connection



**WARNING**

All electrical connections should be carried out by suitably qualified personnel ensuring relevant rules and regulations are observed.



**WARNING**

To reduce the risk of fire, electric shock, or injury:  
Connect to a properly earthed/grounded outlet.  
Use only as described in the manual.  
Isolate from power supply before opening covers.



**WARNING**

**LETHAL VOLTAGE.** Dangerous voltages exist within this equipment. Ensure all electrical covers and main machine covers are fitted before operating equipment.



**WARNING**

**ELECTRICAL HAZARD.** If any damage to the electrical cable is found the unit must not be connected. Installation is to cease until inspected by a qualified electrician.

1. Check the integrity of the electrical power supply cable.
2. Test the mains input at the isolated supply is the correct voltage and frequency before proceeding.
3. Connect to the mains supply.

## Temperature sensor placement

Install the temperature sensor as close to the operating area of the printer, without effecting the printing process.

## Condensate Collection

Condensate is collected in the plastic container at the base of the machine and is accessed from the rear (FIG 1).



FIG 1

Alternatively, condensate can be diverted directly to a drain via pipe work (not included) connected to the spout on the underside of the condensate tray (FIG 2 – Condensate Collector removed).

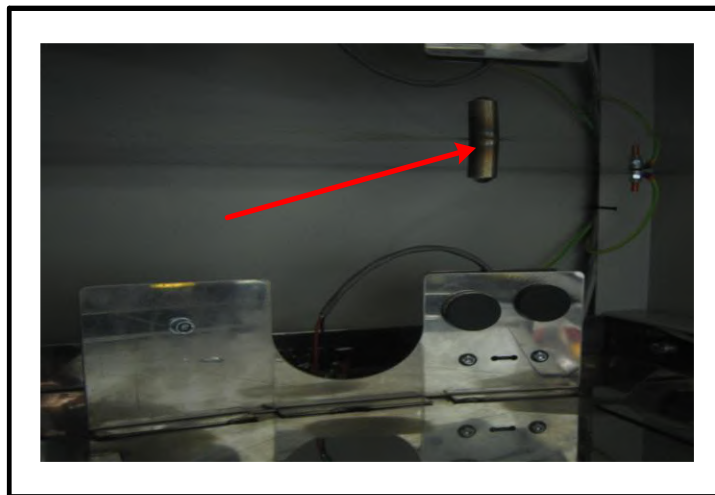


FIG 2

## Indicator Beacon



Remove the indicator beacon from its protective packaging. Pass the beacon loom connector through the plenum base into the electrical compartment (FIG 3) and secure the beacon with the supplied fasteners (FIG 4).

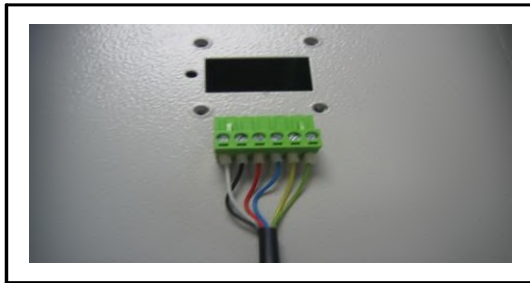


FIG 3

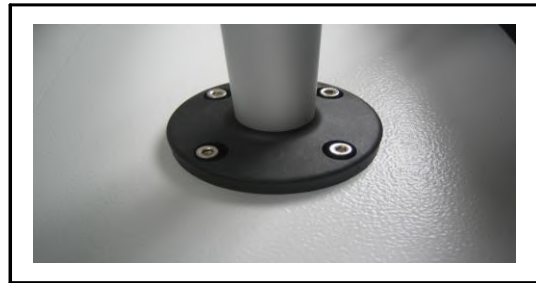


FIG 4

Connect the beacon loom to the Control PCB connector CN2.

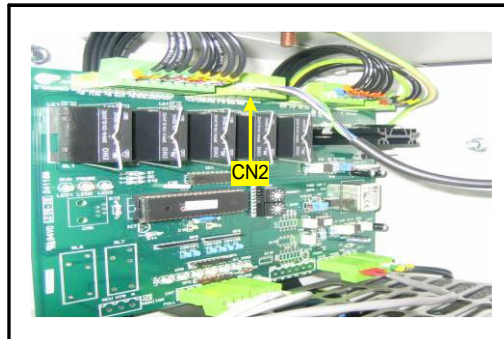


FIG 5

	<b>WARNING</b> <b>ELECTRICAL HAZARD.</b> Ensure Isolator is in the OFF position before opening access door.
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	<b>WARNING</b> <b>BEWARE OF MOVING PARTS.</b> Allow time for fan rotation to cease before opening access door.
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## Air Ducting Hose

Connect Air Ducting Hoses to the TCU using the supplied hose clips. The upper port is the conditioned air outlet. The lower port is for air returning from the Printer.

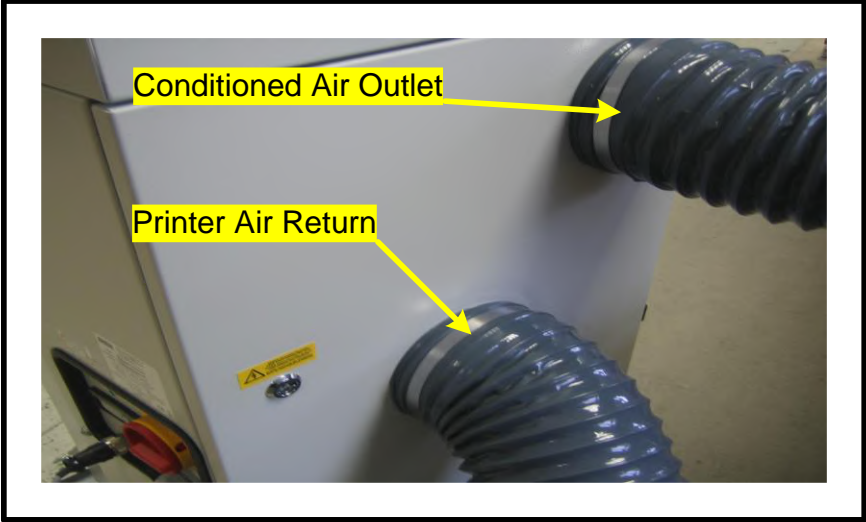


FIG 6

	<p><b>WARNING</b> <b>BEWARE OF MOVING PARTS.</b> Do not operate printer with blanking plate removed and TCM ducting not fitted.</p>
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## Operation

### Initializing the Machine

1. On completion of the Printer/TCU installation turn the TCU Isolator to the ON position (FIG 7). The Green lamp should illuminate indicating that the TCU is energized and the Controller display will initially show as (FIG 8) with 'tEst' flashing.



FIG 7



FIG 8

- 2a. After approximately 5 seconds, the Controller display will change. If no output temperature signal is available from the printer, the controller will display 'UUUU' and the Orange beacon segment flash quickly. The TCU will not start (FIG 9).

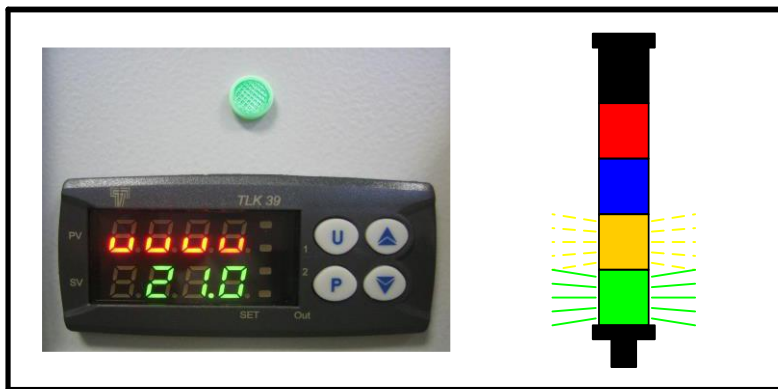


FIG 9

#### Note:

The printer does not output temperature signal to the TCU until the initialization sequence has completed. If after 1 min a temperature signal is still not present the Orange beacon flashes at a slower rate. After a further 1 min without signal the Amber beacon is continuously lit. These periods are determined by the 'Disconnect' and 'Shutdown' settings on the control PCB.

- 2b.) When an output temperature signal is available from the printer, the Controller shows the actual printer temperature (**PV**) in **Red**, with the target temperature (**SV**) displayed in **Green** (FIG 10). The TCU will start and begin working to achieve the target temperature.



FIG 10

3. The target or desired operating temperature (**SV**) of the printer can be adjusted to a value between 19°C and 30°C. To adjust the desired target temperature press button 'P'. The display will change with 'PV' showing 'SP 1' (FIG 11)



FIG 11

The '▲' and '▼' keys can be used to select a target temperature value (**SV**) between 19.0°C and 30.0°C.



FIG 12

On reaching the desired target temperature, press key 'P'. The display will return to normal showing current printer temperature (**PV**) and new target temperature (**SV**). (FIG 16)



FIG 13

A sticker on the machine, adjacent to the Controller, can be used as a guide for the procedure described (FIG 14).

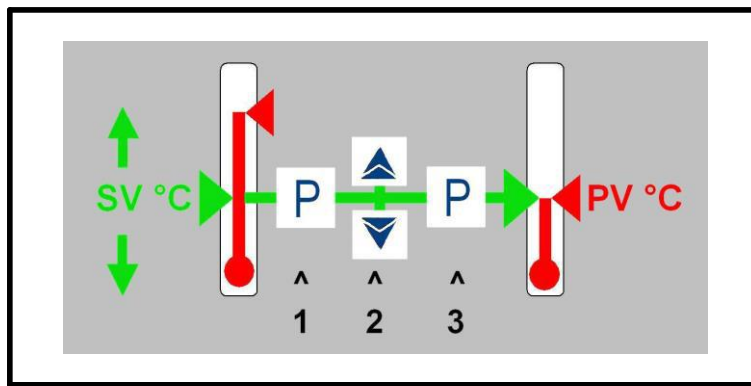


FIG 14

- The Process Temperature (**PV**) within the Printer should move towards and stabilize within +/- 1°C of the Set Value Temperature (**SV**) in approximately 30 minutes (FIG15).

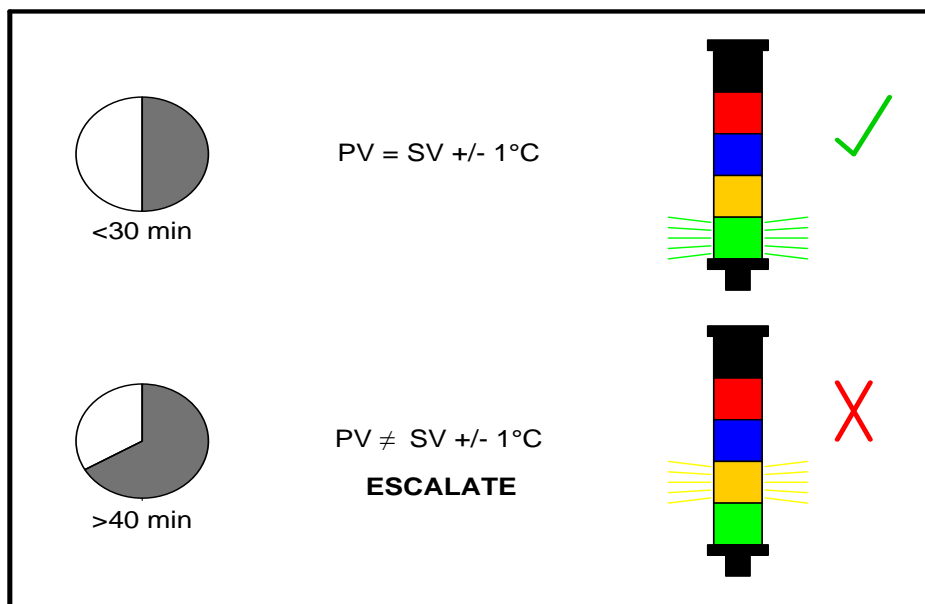


FIG 15

- During TCU operation condensate will be produced by the Air Conditioning Unit (ACU). Condensate will be collected in the Condensate Container. The beacon will indicate the state of the Condensate Container. Failure to empty the Condensate Container will result in automatic TCU shutdown to prevent further condensate being produced (FIG 16).

**Monitor Condensate Level Regularly to Prevent Machine Shutdown.**

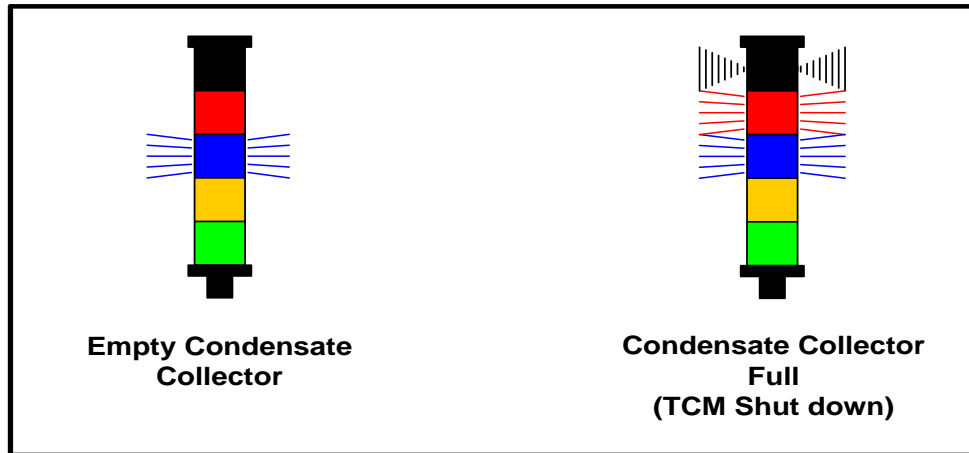


FIG 16

- Fit drip tray plug to Condensate Container to prevent spillage and allow Condensate Container to be carried using the handle. **Remove drip tray plug when replacing container** (FIG 17).



FIG 17

**If the Condensate Container is not replaced after emptying, or refitted with the plug still fitted, condensate will collect on the lower tray. Sensor probes at the front of the lower tray will detect the presence of condensate and cause the TCU to shutdown (FIG 18).**

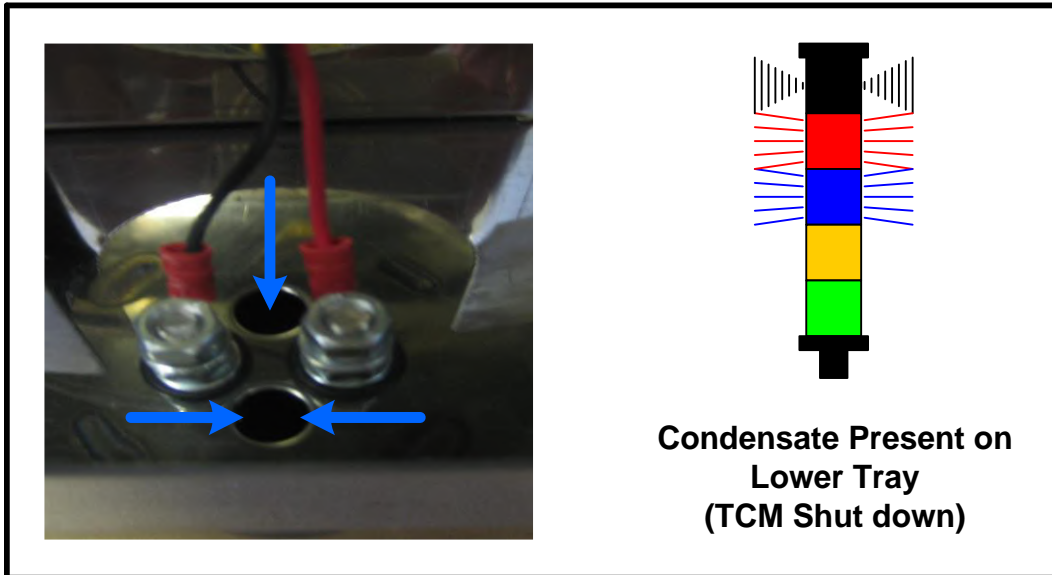


FIG 18

Remove the cap from the lower tray to allow condensate to drain from the tray and empty any condensate within the cap to clear the fault. The TCU will automatically commence operation (FIG 19).

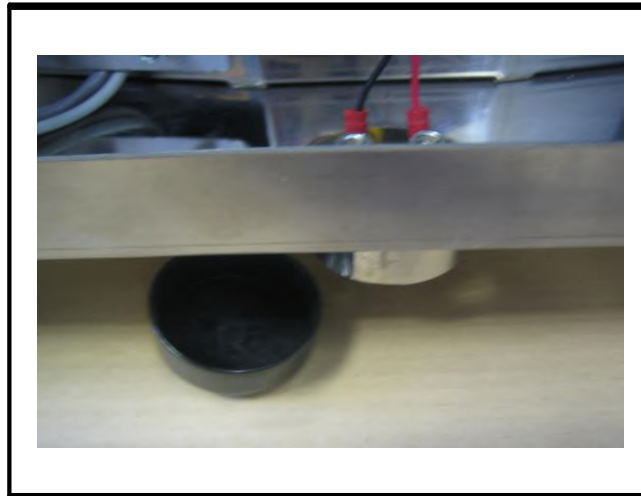


FIG 19

## Disconnect and Shutdown Periods

	<p><b>WARNING</b> <b>ELECTRICAL HAZARD. Ensure Isolator is in the OFF position before opening access door.</b></p>
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The Control PCB is fitted with two rotary switches (FIG 20).

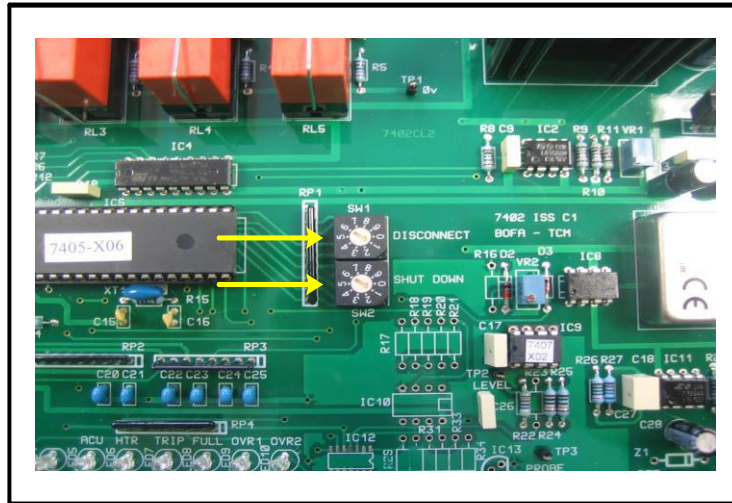
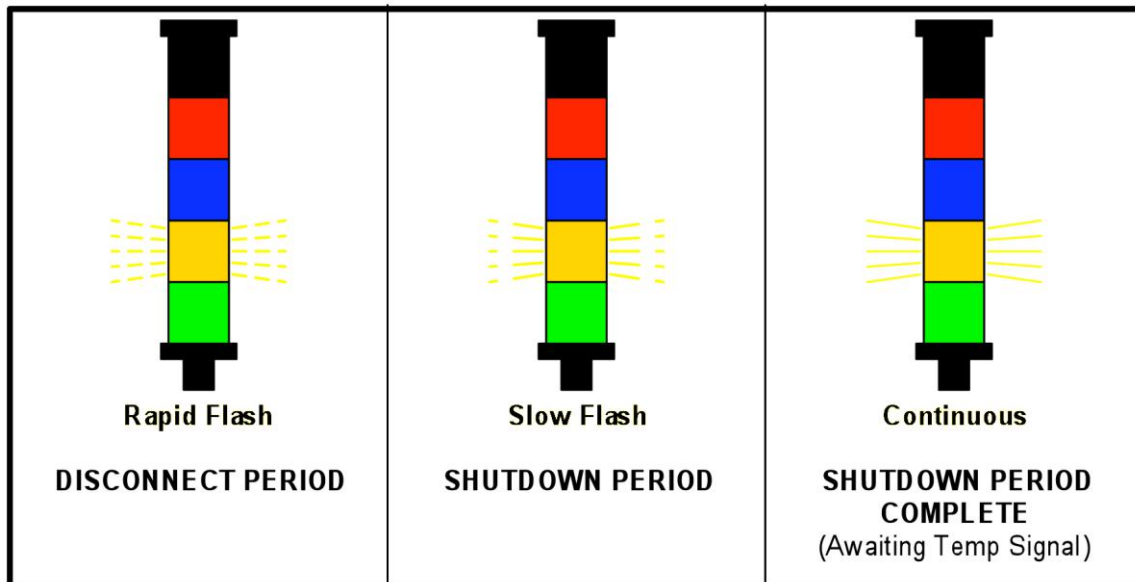


FIG 20

**DISCONNECT** – This defines the period between the Temperature Signal to the TCU being removed or disconnected and the TCU entering a *SHUTDOWN* period. The *DISCONNECT* period is adjustable between 0 – 9 minutes in 1 minute increments. The default setting is 1 minute. The Amber beacon will flash rapidly during the *DISCONNECT* period. If the Temperature Signal to the TCU is reinstated during the Disconnect period, the TCU will continue to run and not enter a *SHUTDOWN* period.

**SHUTDOWN** – If on completion of the *DISCONNECT* period no Temperature Signal is present, the TCU will cease operation and enter a *SHUTDOWN* period. The *SHUTDOWN* period is adjustable between 0 – 9 minutes in 1 minute increments. The default setting is 1 minute. The Amber beacon will flash slowly during the *SHUTDOWN* period. If the Temperature Signal is reinstated during this period, the TCU will not commence operation until the *SHUTDOWN* period is complete. The Amber beacon will illuminate continuously on completion of the *SHUTDOWN* period with no Temperature Signal present.







**FIG 21**

# Preventative Maintenance

## Checking the Discharge Filter

	<b>WARNING</b> <b>ELECTRICAL HAZARD.</b> Ensure Isolator is in the OFF position before opening access door.
	<b>WARNING</b> <b>BEWARE OF MOVING PARTS.</b> Allow time for fan rotation to cease before opening access door.

The life span of the TCU Discharge Filter; will vary depending on the level of contamination of the ambient air. The filter can be deemed serviceable if the TCU can maintain the process temperature (PV) within +/- 1°C of Target temperature (SV) (FIG 22).



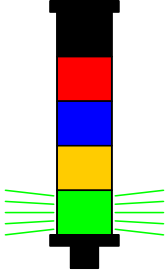

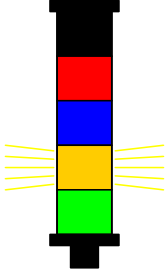


	<b>Filter OK</b>		$PV = SV \pm 1^{\circ}C$	
	<b>Change Filter</b>		$PV \neq SV \pm 1^{\circ}C$	

FIG 22

## Condenser Fan/Coil

	<p><b>WARNING</b> <b>BEWARE OF MOVING PARTS.</b> Allow time for fan rotation to cease before opening access door.</p>
	<p><b>WARNING</b> <b>ELECTRICAL HAZARD.</b> Ensure Isolator is in the OFF position before opening access door.</p>

The condenser fan intake grills should be visually checked on a regular basis to ensure they are free from obstruction with no impedance to air flow (FIG 23).

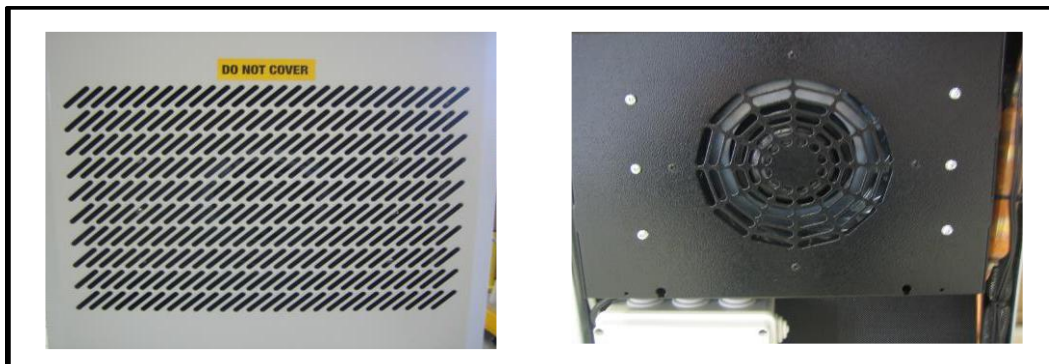


FIG 23

If it is thought likely the underside of the condenser coil may be obstructed, air applied as shown below may help improve TCU operating performance (FIG 24).



FIG 24

## Scheduled Maintenance

Scheduled Maintenance Task	Frequency	Date	Comments	Engineer
Check/Replace TCU Filter	Monthly			
Check/Clean Condenser Fan intake is clear	Monthly			
Check Condensate Collector for leaks and level sensors are in place	Monthly			
Check Condensate drainage path is clear	Monthly			
Inspect Flexible ducting Connections	Monthly			
Check condition of mains input lead	Monthly			
Check condition of Temperature sensor Loom	Monthly			
Check all earth leads and bonding points are connected	Monthly			
Check/Clean Condenser Fan	Yearly			
Check/Clean Evaporator Fan	Yearly			
Check/Clean Condenser Coil	Yearly			
Check/Clean Evaporator Coil	Yearly			

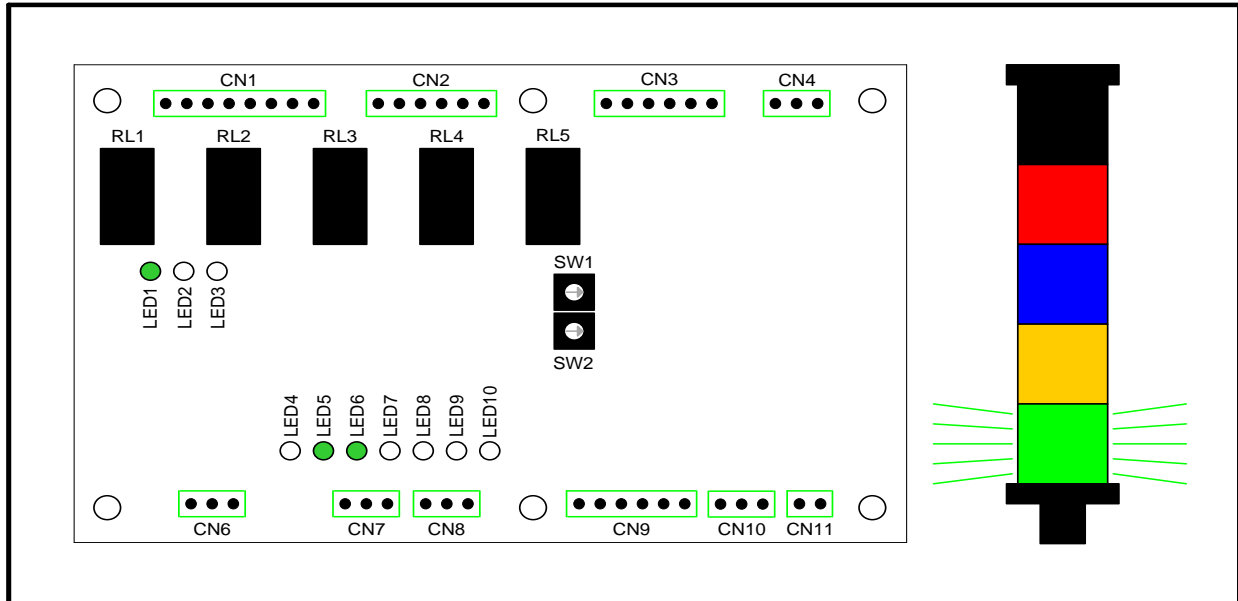
## Spare Parts List

ITEM	PART NUMBER
Air Filter	<b>A1030305</b>

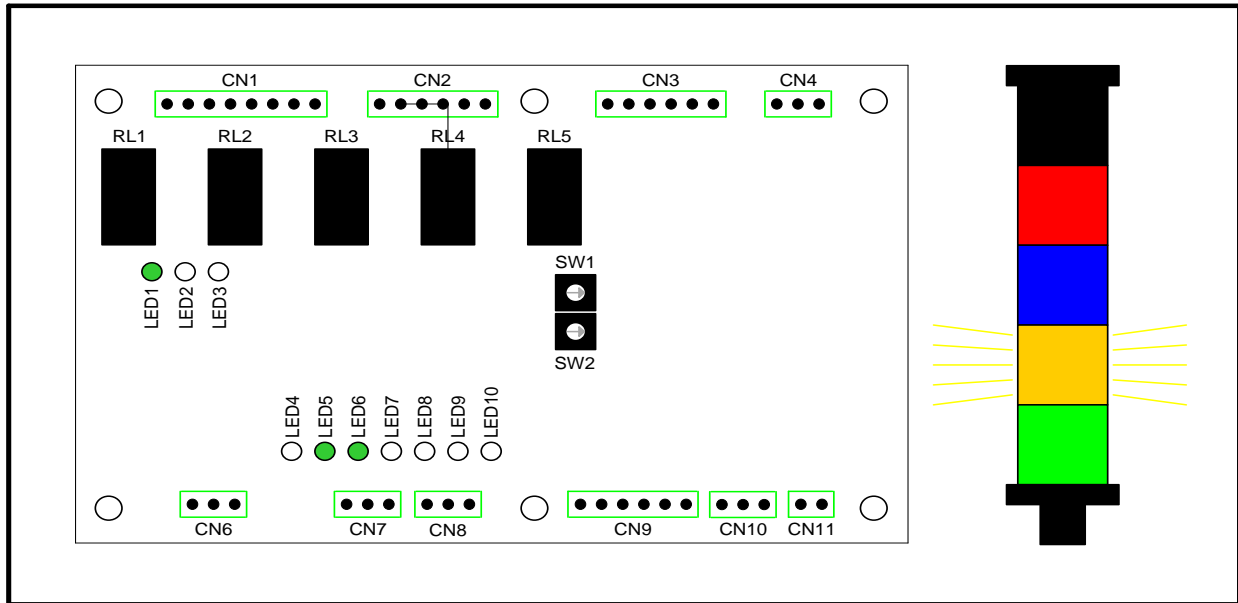
# Beacon/PCB Interpretation and Fault Analysis

## Beacon and PCB Interpretation

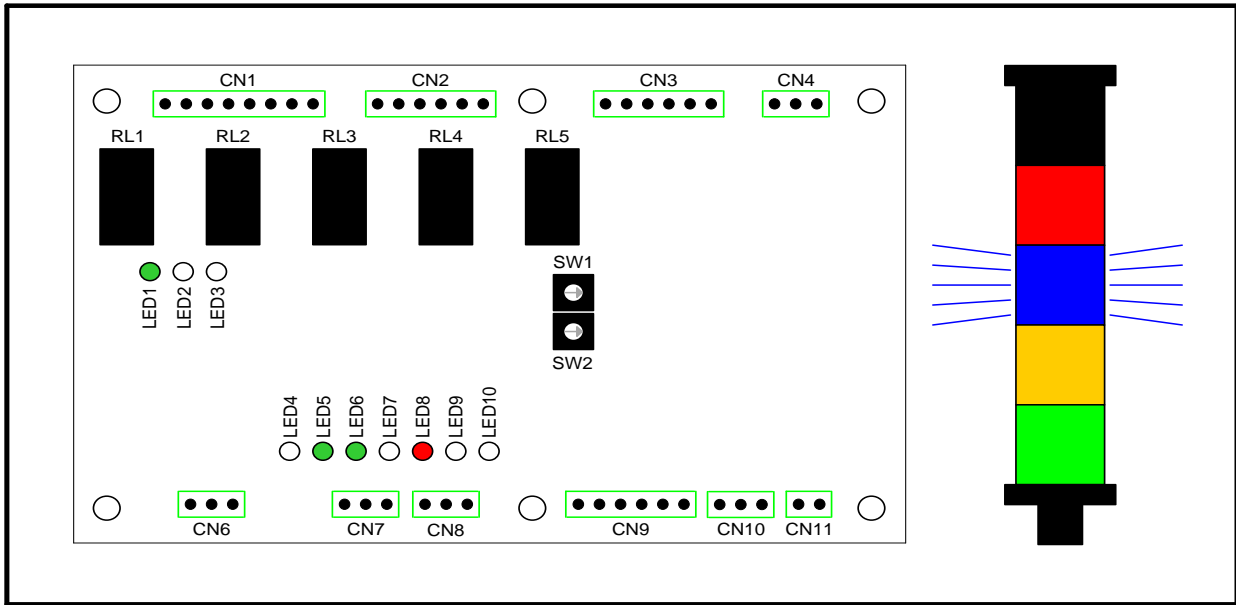
### 1. TCU OK and Printer (PV) within +/- 1°C of Target Temperature (SV)



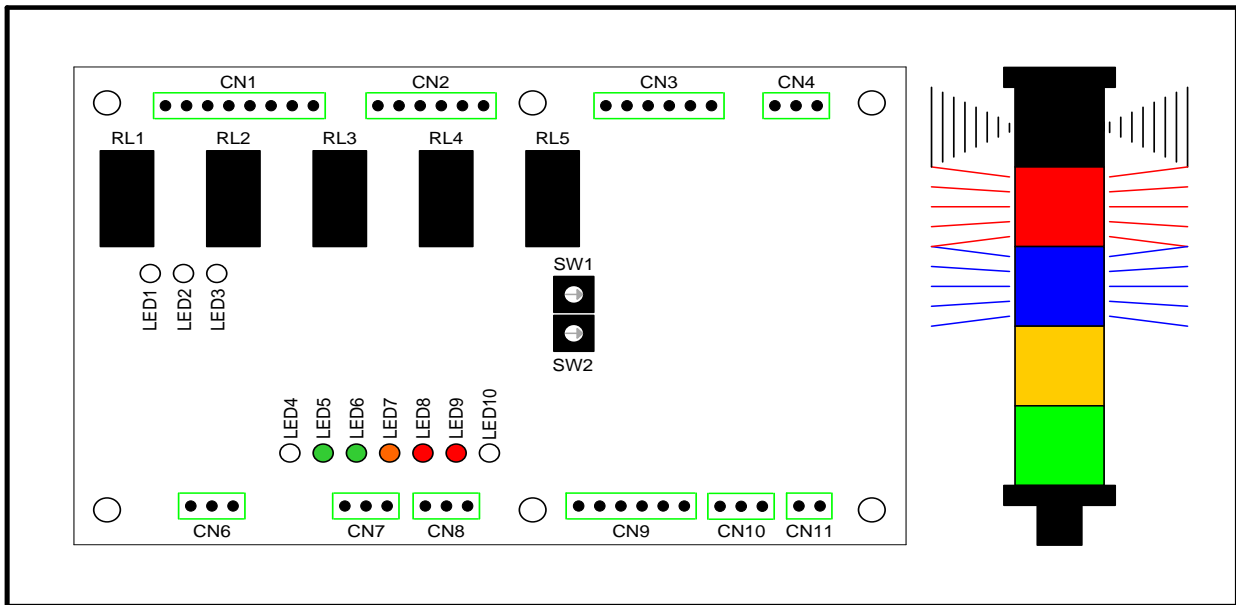
### 2. TCU OK but Printer (PV) > 1°C from Target Temperature (SV)



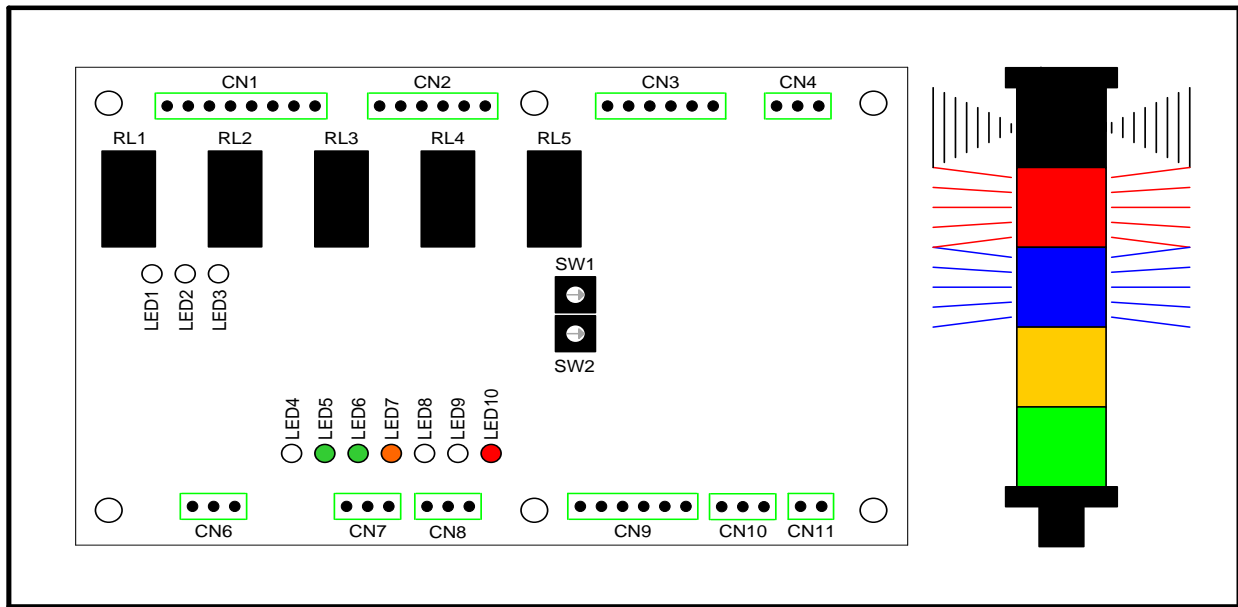
### 3. Condensate Container Full and Requires Emptying



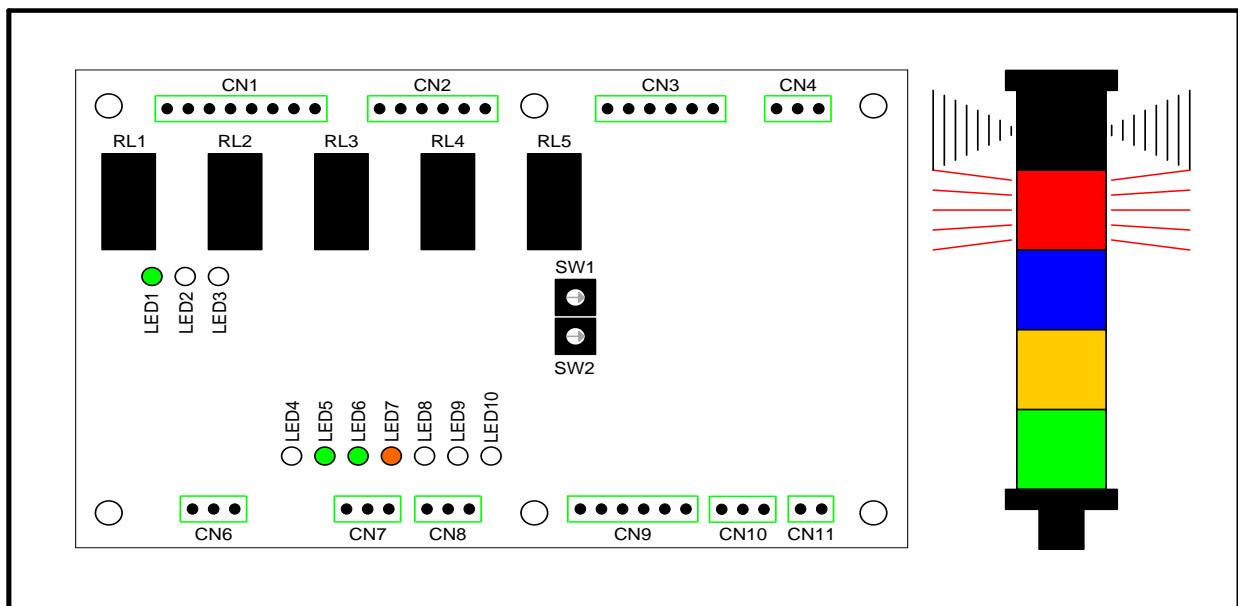
### 4. Condensate Container Overflow (Automatic Shutdown)



## 5. Condensate Present on Lower Collection Tray (Automatic Shutdown)

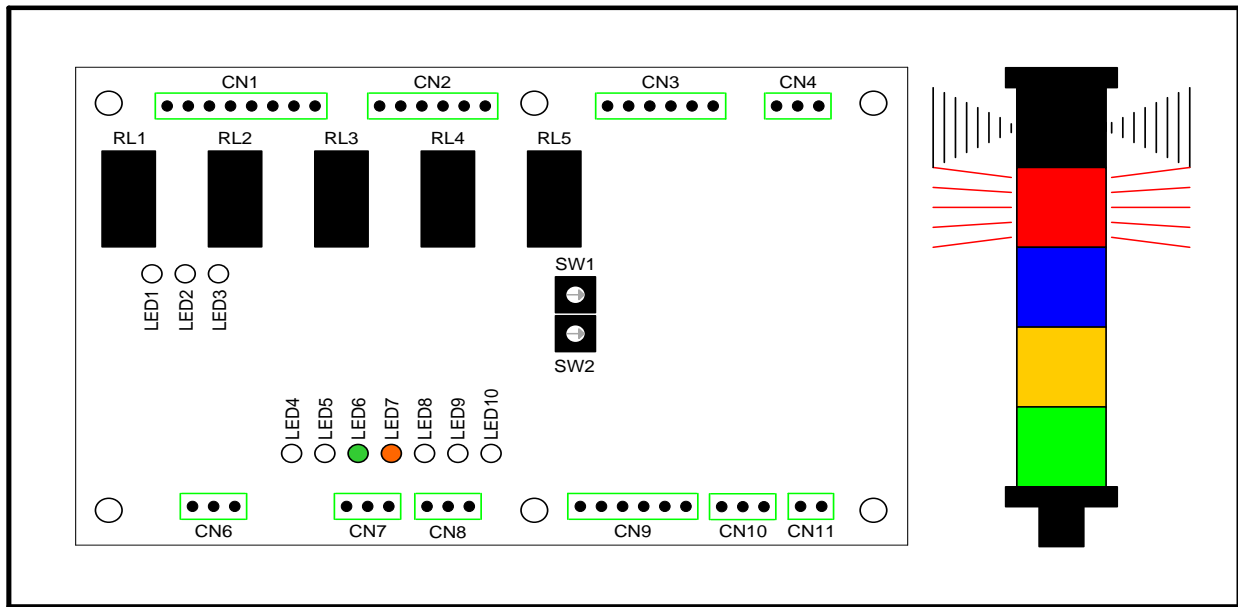


## 6. Heater Enclosure Over Temperature (Automatic Shutdown)

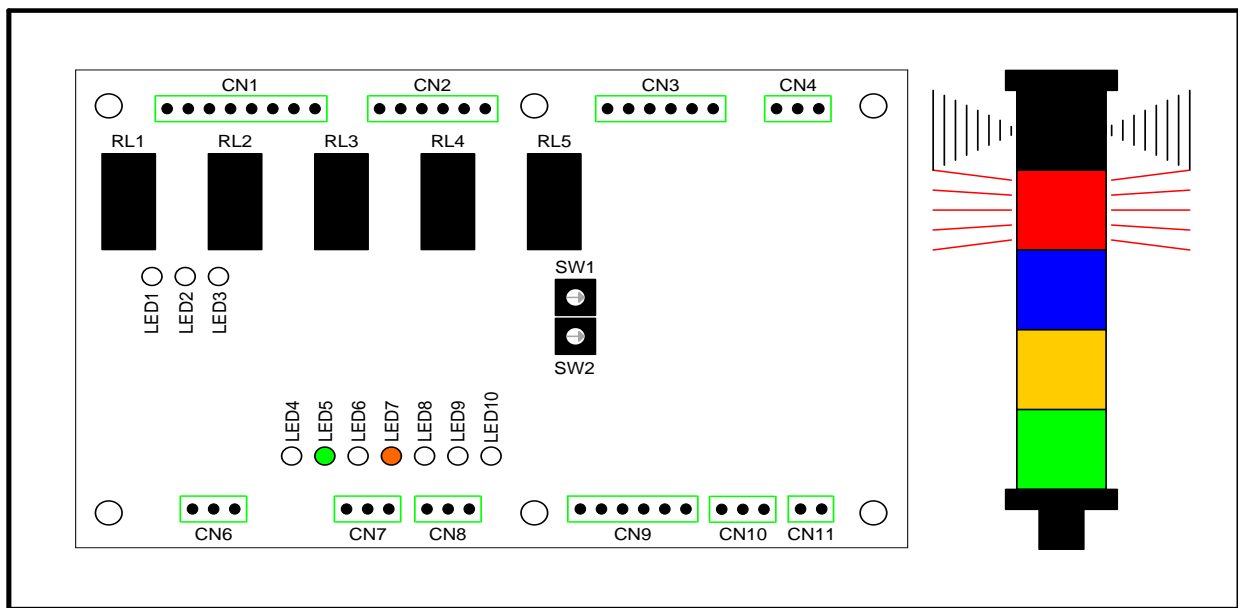




## 7. Air Conditioning Unit Circuit Breaker Open (Automatic Shutdown)



## 8. Heater Circuit Breaker Open (Automatic Shutdown)



## Display and Condensate Error Checklist

ERROR	REMEDY
PV displayed as flashing UUUU	Printer turned off or not initialized.
	Temperature Sensor Loom between Printer and TCU disconnected. Check connections.
SV not reached within 40 minutes. PV not maintained within +/- 1°C of SV.	Check/replace TCU discharge filter.
	Check Air In and Air Return ducting is correctly fitted.
	Check all Printer covers are fitted and closed.
	Check Controller PV is not displayed as UUUU (see above).
	Check SV is set to a value within +/- 8°C of ambient temperature.
	Check ACU condenser grills are not blocked or obstructed.
	No beacon and/or Controller display (see electrical faults section).
	TCU fails to move PV towards SV. Possible fault with ACU, Heater, or Control Module. <b>ESCALATE</b>
	Check supply voltage has not dropped below 207V
	Possible anomaly of the Controllers EPROM memory. Press the <b>P</b> key.
ErEP displayed on Controller	Condensate Container Full and approaching Overflow condition. Empty Condensate Container.
Blue and Red Beacon (TCU Shutdown)	Condensate on Lower Tray. Drain condensate from tray and ensure Condensate Container is in place, drip tray plug is removed, and container is not leaking.

## Electrical Faults

Error	Remedy
Red Beacon (No Blue) (TCU Shutdown)	Check ACU circuit breaker is closed. Check heater circuit breaker is closed Heater Enclosure Thermal Trip may have operated due to an over temperature condition. Investigate cause of failure. <b>ESCALATE</b>
No display on Beacon or Controller	Check Control Module circuit breaker is closed.



**WARNING**  
**ELECTRICAL HAZARD.** Ensure Isolator is in the **OFF** position before opening access door. The following procedures should only be carried out by suitable personnel.

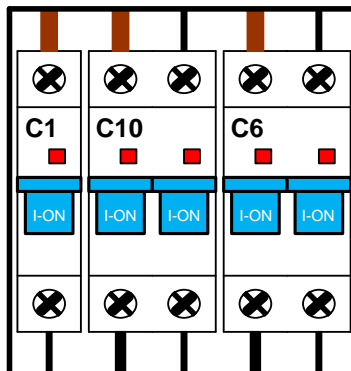


FIG 25

Circuit Breakers (located on the Control Module) protect components and wiring in the 24Vdc Control (C1), Heater (C10), and Air Conditioner Unit (C6) circuits from excessive currents. Should a circuit breaker open, the cause must be investigated before closing and re-energizing the circuit. **ESCALATE** if fault persists and Circuit Breaker will not remain closed.