Solid-State Timing Device

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Objective

The goal of the design project was to design a solid-state version of a standard electromechanical cycle timer. The new design was required to match the physical footprint of the old device, and meet or exceed all operation parameters of the old device.

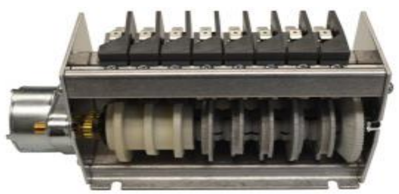


Figure 1: Original C10B 8-Cam Cycle Timer

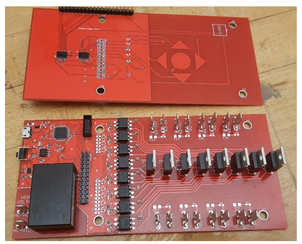
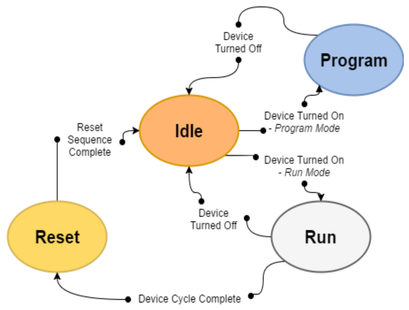


Figure 2: Redesigned Solid-State Cycle Timer

Solid-State Timer Operation



Idle Mode	Timer is off – timing sequence position is saved.
Run Mode	Timer executes timing sequence, turning on/off devices
Reset Mode	Timer prepares for next run, resetting saved position
Program Mode	Timer allows changes to timing sequence, does not run

Figure 3: Solid-State Timer State Machine

Conclusion

Transitioning the cycle timer design to a fully electronic model allows for greater lifetime, lower power consumption, improved ease of use, and greater expandability. This design is easily adaptable to incorporate sensor feedback, allowing the timing sequence to be modified on-the-fly with real-time data. *Applications include commercial dishwashers, HVAC systems, and sterilization equipment.*

Solid-State Design Overview

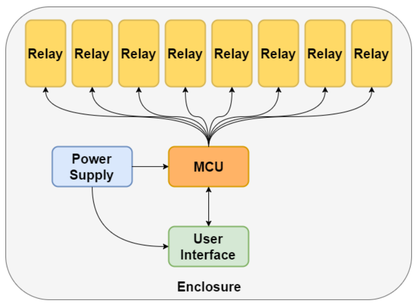


Figure 4: Solid-State Timer Block Diagram

Microcontroller	• Controls on/off timing of relays, and allows for reprogramming of timing sequence.
Relay	• Controls flow of power to connected AC devices (e.g. pumps, motors, heating elements).
Power Supply	• Converts mains voltage (120 – 240 VAC) to logic voltages (5 VDC, 3.3 VDC) to power device.
Enclosure	• Serves to mount the device, as well as protect the device from short circuits.
User Interface	• Allows the end user to quickly change the device timing sequence in the field.

Figure 5: Solid-State Timer Component Description

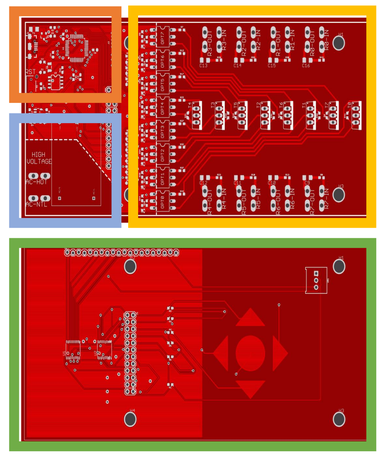


Figure 6: Solid-State Timer PCB Breakdown

Specification Comparison

Timer Design	Cycle Length	Accuracy	Outputs	Cost	Lifetime	Size	Power	Ease of Use
Old – Mechanical	60 – 120 Seconds, Adjustable	±0.25 s	8 Loads (15 A Max)	$50, including labor	100,000 cycles minimum	6.00” L x 2.88” W x 3.30” H	Const. 3 Watts	Requires special tool to reprogram
New – Solid-State		±0.02 s	8 Loads (10 A Max)	$40, not including labor	1,000,000 cycles (predicted)	6.02” L x 2.82” W x 3.5” H	Between 0.25 W and 0.5 W	No tools required to reprogram

Figure 7: Cycle Timer Feature Comparison

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