

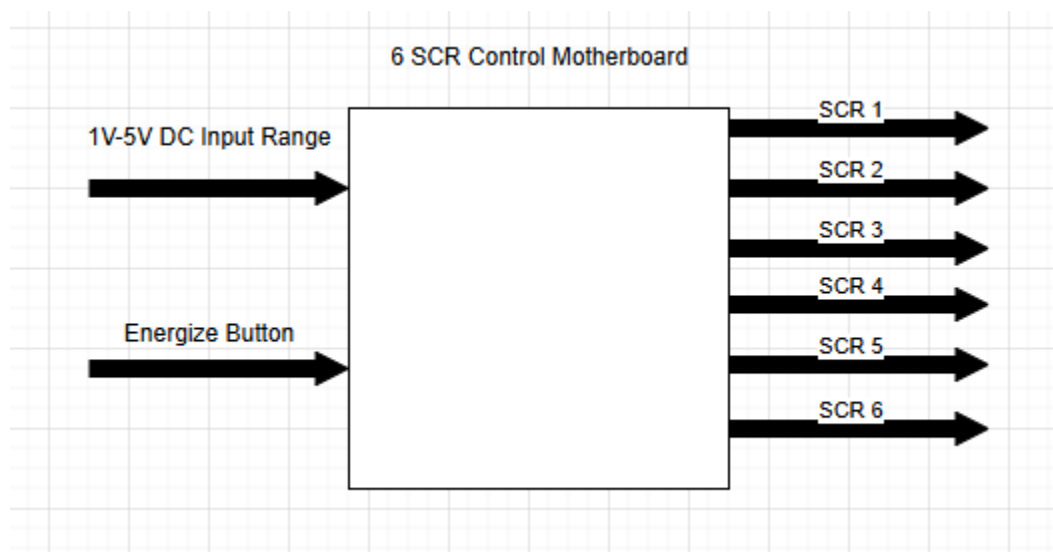
## 6 SCR Controller Motherboard Project Outline

### Synopsis:

- Solid State Systems needs a new motherboard for their 3000 series of magnetic particle inspection machines
- The project proposed is to make a new motherboard that controls 6 SCRs to generate a 3 phase full-wave DC signal using a microcontroller + PWM design

### Requirements:

- Motherboard specifications
  - Power Source
    - 240V - 480V AC
  - Input
    - 1V-5V Range Clean DC Signal
    - Energize button
  - Output
    - 10V DC Burst followed by 3-4V to gate of 6 SCRS with 3 SCRS for Positive half-waves and 3 SCRs for Negative half-wave. 60Hz with Phase angle difference of 60 degrees between each SCR activation.
      - Each SCR must be isolated from each other
      - Electrical Isolation between microcontroller and SCRs
      - Signal at SCR's gate should be in phase with the respective SCR's sine wave across its anode and cathode.



Input/Output Example	
DC Input ( 1V - 5V )	3-4V Output to SCR Gate with 10V Burst at beginning
1V DC	Only burst
3V DC	Burst and 3-4V signal half length of sine wave, starting at middle to end of sine wave
5V DC	Burst and 3-4V signal full length of sinewave

#### **New Motherboard Features:**

- Software Logic
- Updateable Software
- Compact Board
- Modular
- Fewer Electronics Components
- Fewer Modules
- Less Maintenance
- Less Calibration Needed
- LCD Screen Status Display

**Schedule (10 - 18 weeks):**

- Research requirements for prototype (1 week)
  - Determine calibration pots needed
  - Document legacy motherboard waveforms
  - Finalize inputs and outputs of new motherboard
  - Add debugging components (LEDs, Pins, etc.)
  - Obtain current ratings for input and output
  - Simulate circuit in LTSPICE
  - Generate bill of materials
- Create Prototype PCB Board (4-8 weeks)
  - Schematic Design
  - PCB Design
  - Research and order from different manufacturers
  - Repeat prototype process as needed
- Assemble and Test Prototype PCB Board (1 week)
  - Programming Software
  - Function Generator and Oscilloscope Testing
  - Stress Testing
  - Particle Inspection Machine Testing
- Create Finalized PCB Board: (4 - 8 weeks)
  - Schematic Design
  - PCB Design
  - Order from manufacturers
- Assemble and Test Finalized PCB Board (1 week)
  - Software Revisions
  - Function Generator and Oscilloscope Testing
  - Stress Testing
  - Particle Inspection Machine Testing

**Bill of Materials for Prototype (Work In Progress) :**

- Power Supply: 240V - 480V AC to 20V DC and 20V DC to 3.3V DC
- Microcontroller (ESP-32 ) : Development board for now, chip later if needed
- Analog-to-Digital Converter: Reads Incoming Wave
- 6-Channel Digital-to-Analog Converter: Controls 6 SCR Channels at once
- Calibration Pots : Calibrates minimum and maximum SCR values and energize timing