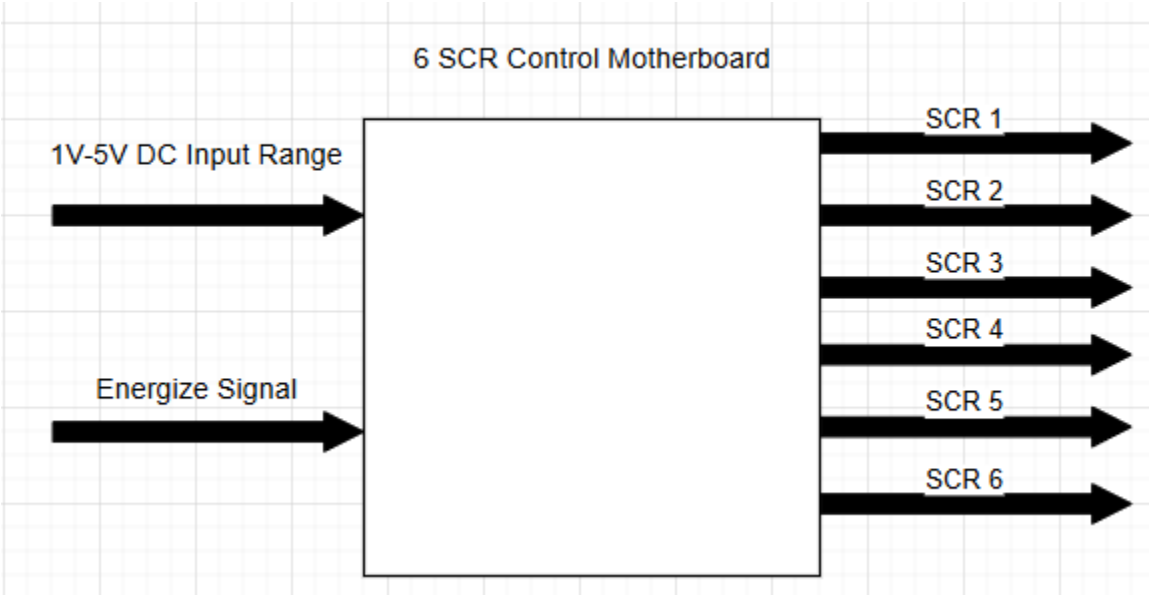
6 SCR Controller Motherboard Project Outline

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 design

Requirements:

- Motherboard specifications
    - Power Source
        - 240V - 480V AC
    - Input
        - 1V-5V Range Clean DC Signal
        - Clean Energize Signal
    - Output
        - 0V-16V AC to 6 SCRS with 3 SCRS for Positive half-waves and 3 SCRs for Negative half-wave. Phase angle difference of 120 degrees.



Input/Output Example	
DC Input (1V - 5V)	**Half-wave Output to SCR (0V - 16V)**
1V DC	0V Half-wave
3V DC	8V Half-wave
5V DC	16V Half-wave

New Motherboard Features:

- Software Logic
- Updateable Software
- Compact Board
- 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