Brief Hardware Overview

How it works
- 8 relays are controlled with the 9S12
- Can be controlled by setting the start and end time for the relay to come on.
- Each relay has 12 of these activation periods.
- Relays can also be controlled by the corresponding external trigger inputs depending on the mode of operation.
- Emergency shutoff inputs deactivate the corresponding relay in all modes of operation.

The layout
- System is composed of two boards. The digital logic is on the Digital Circuit Board. The relays are on the Relay Circuit Board.

Power Supply
- Power source is a 12VDC lead-acid battery bank with a storage capacity of 12.8 AH.
- 12VDC is used for sourcing power to the devices and for activating the relay coils.
- A switching power supply to supply 5VDC for the digital circuitry.

User interface
- The user inputs information with the Enter key, Cancel key, and Scroll Wheel.
- 4 x 2 LCD screen is used to communicate with the user.
- Green LED’s indicate which relays are on
- Red LED’s indicate which relay has been turned off due to an emergency shutoff input
- External inputs will be input ports on the chassis of the unit which except a TTL logic level input.

Digital Circuit Board
- Switching regulator capable of supplying up to 3A. System only requires 1.75A.
- Reset circuit resets the 9S12 until the voltage reaches about 4.5 V.
- All IC have .1uF caps from Vcc to ground to protect against switching noise.

- All buttons connected to bits 0-3 of port B. All are active low to reduce the chance of an error caused by noise.
- Connector allows the buttons to be connected to the chasis.

- Relays are controlled by all the bits of port T
- Transistors are used to drive the coils of the relays. Resistors used to limits current.

- Green LED’s driven with an octal buffer capable of sourcing 35mA. Resistors limit LED current to 8.5mA. Enable pin of octal buffer connected to the PWM of the 9S12 to decrease the power consumption of the LEDs.
- Wires connected to the connector to bring the LEDs to the chassis.

- Red LEDs similar, except the signal comes from the output of the buffer to the emergency shutoff inputs.
- Inputs from chassis for emergency shutoff inputs connect to an octal buffer. Connect to bits 0-7 of port AD.
- Inputs from chassis for external trigger inputs connect to an octal buffer. Connects to bits 8-15 of port AD.

- LCD connector allows the LCD to be mounted on the chassis. Fixed resistors to set the contrast. Backlight is powered by a power inverter which is driven by a transistor controlled by bit 0 of port H.
- Current limiting resistor to transistor.

- Clock circuit uses a 16MHz crystal with accuracy of 30PPM for my RTC in software.
- Other circuit for PLL circuit.

-BDM connector also has connectors for MODA MODB and ECLK.

**Relay Board**

- Relays are on a separate board to limit the noise of the relays from getting into the digital signals.
- Diodes used to protect the transistors from the fly back current of the relay coils.
- Relays source 12V from the battery to a device connected to the connector on the chassis.