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SCR CONTROLLER SYSTEM

Control and Firing Circuit

The SCR controller system has two printed circuit boards: The first board is ALD03, the firing circuit board, the second one is ALR02, the regulator circuit board and both boards are connected through a ribbon cable. The two boards are conveniently placed inside a plastic box that can be mounted on a DIN-rail. A typical wiring diagram is depicted in Figure 3, at the end of this document. The two boards require ±15 V and a +24 V (only for the firing circuit board) power supplies. The power supplies must be connected to all terminal blocks from Figure 3 that indicate the presence of ±15 V or +24 V.

The Firing Circuit Board

The firing circuit board, ALD03, was specially designed to accomplish heavy industrial requirements (for proper operation in a high electrical and thermal stress ambient). The Firing Circuit Board has the following important functions:

a. Generates the 3 phase synchronization signals used by gate-pulse circuitry.
b. Filters the synchronization voltages, to obtain an increased stability of the system.
c. Senses the lack of a phase voltage or a pronounced imbalance between the phase voltages. When this happens, it blocks the gate pulses and signals a fault.
d. Generates and amplifies the gate pulses. It can fire SCRs in the range of 50A to 1000A.
e. Generates the control signal for the phase angle delay. Contains an interface between regulator board signals and the firing ICs, with independent hi and lo clamping of the firing angle domain.
f. Has an input for external fast inhibit of the gate pulses, but also a soft start/stop input.
g. Contains a delay circuit, which inhibits any external drive signal for several seconds after powering the board, to allow for the stabilization of the supply voltages

Trigger Board Adjustments

Refer to Figure 1 for the location of pots and LEDs for the trigger board adjustments. Note that the first yellow LED is not depicted in Figure 1; it indicates a phase reversal, however the proper functionality of the system is not affected.

1. DO NOT adjust any of the potentiometers on this board, they are factory set.
2. There are six LEDs on the left hand side of the board. They may be *yellow* or *amber* in color. They indicate that gate pulses are present to the SCR's when operating.
3. The next LED to the right is the FAULT LED (red). Whenever a fault occurs this and the front panel FAULT will be illuminated. Any time a fault occurs the RESET button must be depressed to clear the fault. A general FAULT signal is available at terminal 10 as shown in Figure 3. If any of the Pwr Ok (terminal 11) or STOP (terminal 12) pulled to the ground (terminal 2) the gate pulses are immediately inhibited and the red FAULT LED is lit.
4. The second LED to the right is the sync Loss LED (green). This LED will illuminate in the event of a loss of sync and will determine the FAULT LED to be lit. To ensure proper operation the three AC voltages must be present when the trigger board is powered up, otherwise the board will detect a phase loss and it will latch the FAULT.

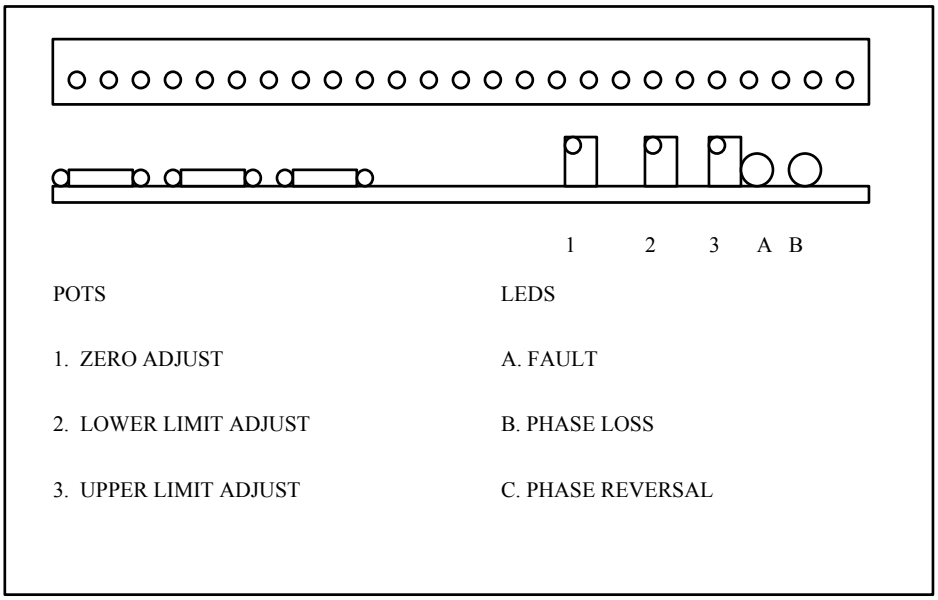

Figure 1 - Trigger Board ALD03

The Regulator Board

The ALR02 regulator board was designed to be adaptable to a variety of requirements imposed by different applications from power supply regulation and protection to AC controllers or soft-start motor starters. The regulator board has the following important functions:

a. Contains 2 independently configurable regulators and a very stable internal reference.
b. The feedback current value input is by default 0-5 V for a full scale output current but it can be easily changed for different scale such as 0- 100mV in case of using a

shunt. Similarly, the feedback value input for the voltage feedback is 0-5 V for a full-scale output voltage.

c. Prescribed value ramp-up/ramp-down circuitry with independently adjustable for the up and down ranges. The standard control circuit integrator prevents transformer saturation for step function signal changes and provides stable operation when using any of the optional regulator features.
d. Contains shutdown protection in case of over-voltage and over-current (electronic fuse), both adjustable
e. Accepts the output from any conventional instrument (e.g. temperature controller) in an integrated system. A 0-10V_{dc} input into 1Kohms is also available for use with either a process control signal or a manual control potentiometer.
f. Reference supply - a 10V_{dc} reference source regulated to $\pm$0.5% is available for use in energizing a manual control potentiometer.

Regulator Board Adjustments

Refer to Figure 2 for the location of pots and LEDs for the regulator board adjustments.

1. Below the trigger board is the regulator board. On the right are two *green* LEDs that indicate the ±15 volts presence.
2. The left most potentiometer is the RAMP UP adjustment. Adjusting the potentiometer clockwise will increase the response of the supply to an upward adjustment of the voltage regulation control.
3. The next potentiometer is the RAMP DOWN control. Adjusting the potentiometer CW will increase the time it takes the supply to react to a downward adjustment of the voltage regulation control.
4. The third potentiometer from the left is the voltage feedback control. It is used to set the maximum desired voltage and the sensitivity of the supply to the voltage regulation control. CW decreases voltage.
5. Fourth from the left is the current feedback control. This sets the maximum current output. CW decreases current.
6. The leftmost *yellow* LED is the OVERTEMP display. It is lit in the event of temperature exceeding design specifications. There is no adjustment. It will light for SCR, or transformer overheats. If a temperature sensor is not used as shown in Fgure 3 then a jumper has to be made instead to allow the operation.
7. The second *yellow* LED from the left is the OVERCURRENT indication. In the event the output exceeds the limit set by the potentiometer to the right, it will turn on. Adjusting the potentiometer can set the sensitivity to overcurrent. CW decreases the threshold for a trip.
8. The third *yellow* LED is the OVERVOLTAGE LED. This is activated in the event the output voltage exceeds the preset limit. The limit is set by the potentiometer to the right of the LED. Turning the potentiometer CW decreases the threshold for a trip.
9. The fourth *yellow* LED is the UNDERVOLTAGE LED. This is illuminated in the event the output voltage is under the preset limit. The pot sets the limit to the right of

the LED. Turning the pot clockwise decreases the threshold for trip. Note that this LED and the potentiometer to its right are not depicted in Figure 2 (they are not normally mounted on standard boards).

In the event of a fault (over-current, over-voltage, over-temperature or under-voltage) the SCR's are immediately shut-off and the fault is latched. The operation can resume after depressing the RESET push-button as shown in Figure 3.

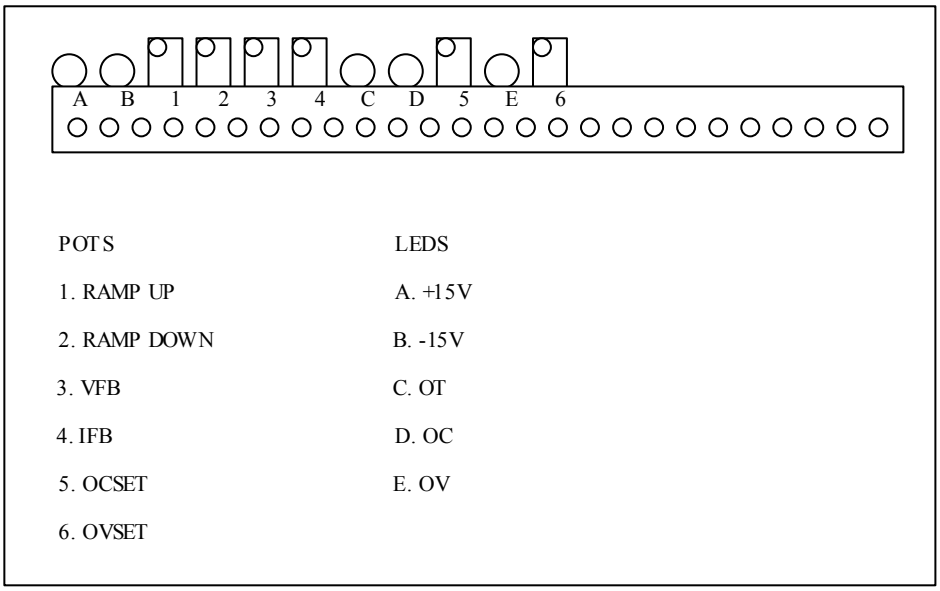

Figure 2 - Regulator Board ALR02

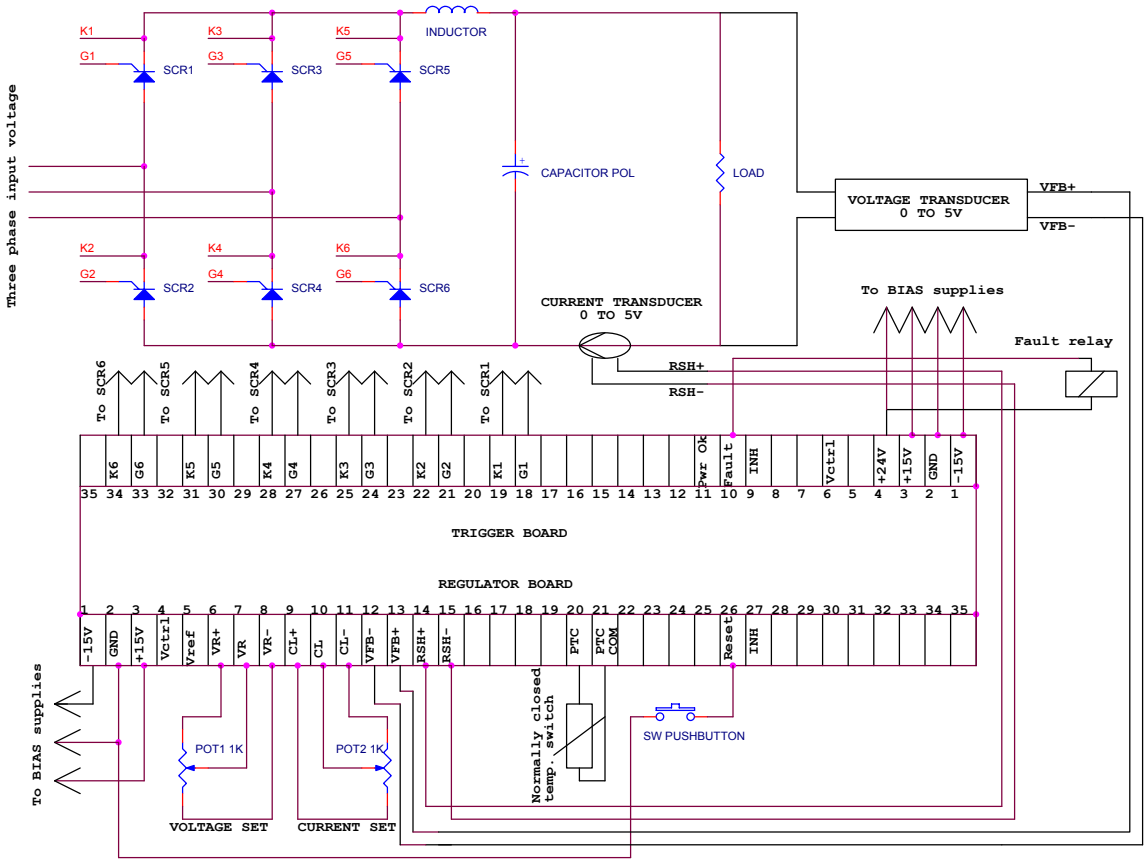

Figure 3 - Wiring diagram