RAPID POWER CORPORATION • 85 MEADOWLAND DRIVE • **SOUTH BURLINGTON, VT**

CAT BOARD

Control Amplifier and Trigger (3-Phase)
A3-29060X

Digital Phase Locked Loop Triggering Circuit

Rapid's Control Amplifier and Trigger

Are designed to the requirements learned from many years of experience with SCR controlled high power equipment. Modern CMOS integrated circuit technology has allowed an extremely compact, unitized design with low power consumption. The following description covers the major features and applications of the design.

Trigger Section

The timing logic of the Trigger Section implements a phase locked loop as originally described by Ainsworth and developed for high power DC converters. This approach gives the best possible triggering balance, as well as immunity to triggering instability due to power line distortion. Proper phase synchronization is obtained from the three phase line voltages and is connected through a resistive divider, eliminating the need for special phasing transformers. Phase reference section is programmable through Dip Switch #1 (DS1), positions **#1-#6.** Setting switches **#1, #2 and #3** in the **ON** position and **#4, #5 and #6 OFF** will produce trigger pulses leading the line voltage by 30 degrees, as is needed by primary SCR and bridge circuit configurations. Setting switches **#4, #5 and #6 ON** and **#1, #2 and #3** in the **OFF** position will produce trigger pulses in phase with the line voltage, as needed by the six phase star configuration.

The Trigger Section also incorporates phase imbalance detection, which, in the event of a lost input phase or high phase imbalance, will inhibit SCR triggering until phase balance is regained.

In closed loop operation, the Control Amplifier provides a zero (0) to five (5) volt command-signal and is connected internally to the Trigger Section through Dip Switch **#1,** position **#8.** The Trigger Section may be manually controlled by switching **OFF** position **#8;** then applying an external zero (0) to five (5) volt command-signal to TB1, terminal **#8.** The phase delay is then a linear representation of the voltage applied with zero (0) volts producing a 180 degree phase delay and five (5) volts producing a 0 degree phase delay.

Control Amplifier

The control Amplifier provides highly accurate regulation of both voltage and current in closed loop applications. Its response time may be tailored to match any load requirements and is programmable through Dip Switch **#2**, positions **#5** to **#8.** Sixteen steps are available with all switches **OFF** setting the slowest response time.

Other features include automatic crossover of the voltage and current regulators and soft-start ramp capability. The soft-start ramp is fixed at 200 milliseconds and is initiated after power up, peak overload detection phase imbalance detection and after the external inhibit has been applied.

The Control Amplifier also provides visual indication of an out of regulation condition through **LED #2.** This condition may occur if the input voltage to the rectifier drops too low or if feedback level may be accommodated without the need to modify the board. A precise 5.00-volt reference is supplied on **TB1,** terminal **#7** to enable both voltage and current control potentiometers.

Peak Overload

The **"CAT"** contains circuitry that monitors the SCR **PEAK** current and, in the event of an overload, will inhibit the gate pulses to the SCR's.

The gates will remain inhibited for approximately 100 milliseconds after which the phase angle will begin to increase, thus ramping the output and reaching the current set point in 200 milliseconds. If a bolted fault exists on the output of the rectifier, the peak current may be very high although the average current is still low (due to retarded firing angle) and the detector will again inhibit the output. This process will continue until the fault is removed. During an overload condition, the ready indicator **(LED #1)** will momentarily turn off providing visual indication of a fault. The level at which the peak detector trips is programmable through Dip Switch **#2** positions **#1** to **#4,** making available 16 steps from 100% to 400% of the rectifier's rated current output.