Westinghouse

A310 THYRISTOR GATING MODULE

I. General Description

The A310 gating module produces one isolated, phase controlled pulse to fire thyristors for each cycle of the supply voltage. The phase angle (φ) of the output pulse can be shifted with respect to the synchronizing supply voltage by a d-c input voltage.

The module, shown in Figure 1, consists of a printed circuit board mounted in a metal enclosure. All connections to the module are made to screw type terminals on the face plate of the enclosure.

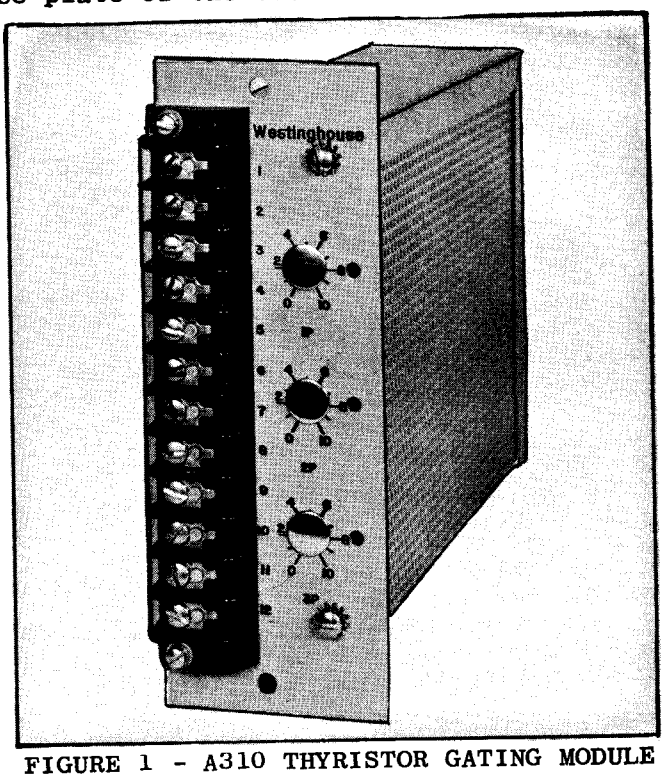


FIGURE 1 - A310 THYRISTOR GATING MODULE

II. Scope of Application

The A310 gating module will control thyristors up to and including size 5 (70 ampere) cells in single-phase or multi-phase rectifier type thyristor power amplifiers.

III. Characteristics and Ratings

Ambient temperature:	0 to 50° C
Power Requirements:	115 VAC ± 10%, approx. 220 mA Supply frequency: 48 cps to 62 cps
Input Voltage (V_{1-2}):	(-)2 to 50 volts d-c

Transfer Curve:

Gain: 14 degrees/volt

Maximum shift of the transfer curve due to line voltage variation of ± 10%: less than ± 2 degrees.

Maximum shift of the transfer curve due to frequency change from 62 cps to 48 cps: less than +3 degrees.

Response:
One cycle maximum

Phasing:
Terminal 5 is pulsed positive during the half-cycle when terminal 11 is positive.

Output Pulse:

Rise Time:	200 μs
Pulse Width:	3.6 ms ± 1.4 ms
Amplitude:	Approx. 1-6 volts

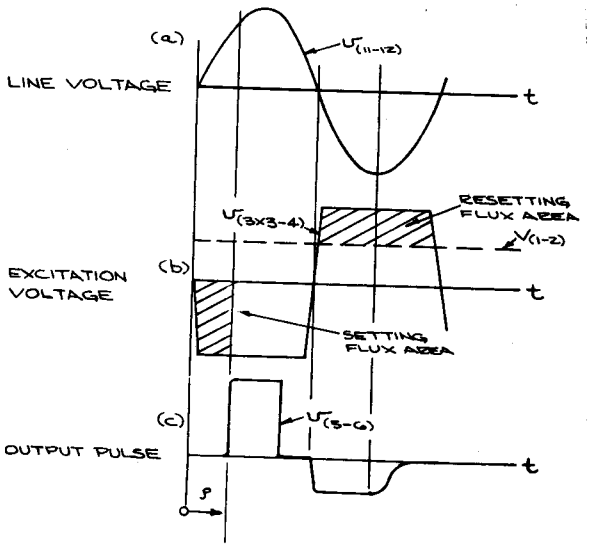


FIGURE 2 - WAVE FORMS

The above values for the output pulse are only approximate and depend on the gate circuit components and thyristor gate characteristics.

Refer to Figure 2 for phase relations and pulse shapes.

IV. Operation

The operation of the gating module will be explained with reference to the schematic diagram, Figure 3, and the wave shapes in Figure 2.

A flux reset magnetic amplifier is used as a phase shifter. Reactor 1X is excited by a square wave produced from the line voltage by a zener clipper circuit consisting of resistor 6R, the isolation transformer 3X, a diode bridge 3D to 6D, and zener diode 7D. With no control input voltage, the reactor is capable of absorbing the full excitation voltage $V_{3X3-3X4}$.

If the control input voltage is larger than zero, the reset voltage ($V_{3X3-3X4} - V_{1-2}$) is smaller than the setting voltage and saturation of the core will occur before the end of the half cycle. The phase angle (φ) at which saturation occurs is, therefore, controlled by the input voltage.

When reactor 1X saturates, it provides a pulse to the primary of the transformer 2X. The output pulse appears across the secondary of transformer 2X, terminals 5 and 6. The transformer saturates in approximately 3 ms and is reset by the current flowing from P through resistor 3R.

Capacitor 1C across the output improves the dV/dt characteristic of the thyristor and absorbs noise picked up in the gate leads to the thyristor.

V. Service

Proper operation of the A310 gating module is insured as long as the components remain within design specifications. There are no external adjustments. If a failure in the gating module is suspected, compare the

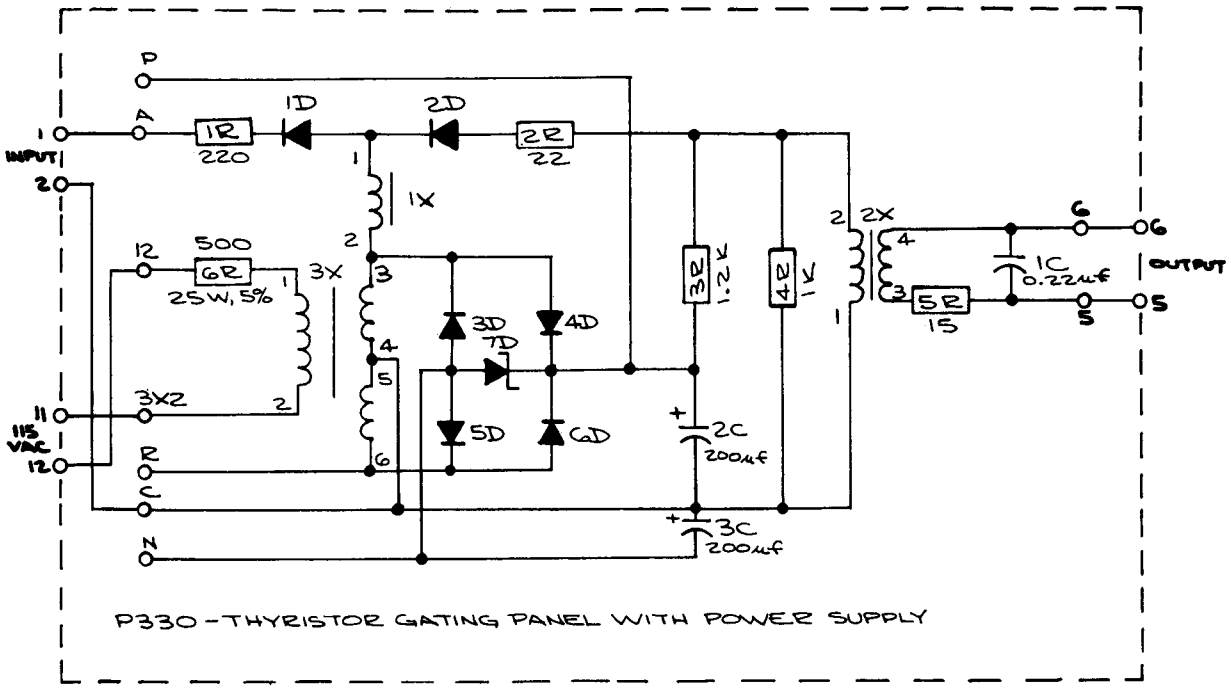


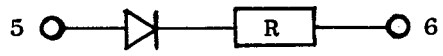
FIGURE 3 - SCHEMATIC DIAGRAM

supply voltage and output pulse wave shapes with those given in Figure 2 a, c. If the output pulse is not satisfactory or the firing angle ρ does not change when the input is changed, replace the module with the recommended spare while the defective unit is being repaired as outlined below.

VI. Repairing the Module

To service the module after it has been removed from the control panel requires the following:

1. A sinusoidal wave shape of 115 VAC applied to terminals 11 and 12.
2. A variable d-c supply from 0-10 V at terminals 1 and 2.
3. An output load on terminals 5 and 6 that simulate the thyristor gate as shown below:



R = 22 OHM

Normal trouble shooting procedure, using wave forms shown in Figure 2, should readily isolate the defective component. If a magnetic component should fail, it is recommended that the unit be returned to Westinghouse Electric Corporation, Systems Control Division, Buffalo, New York for servicing.

VII. Spare Parts

To keep the down time of the control system to a minimum should a gating module fail, it is recommended that a spare module be available for immediate replacement. If the size of the installation will warrant, one spare gating module should be available for every ten modules used in the control system.

A parts list of the equipment can be obtained through your nearest Westinghouse District Sales Office.