CURRENT CONTROLLER

I. GENERAL DESCRIPTION

The current controller consists of a PI controller with a lead in the current feedback, which ensures the exponential response of the armature current to a step reference and limits the rate of rise of current. The reference inputs of the current controller can be disconnected through a relay contact thus allowing for control at zero current.

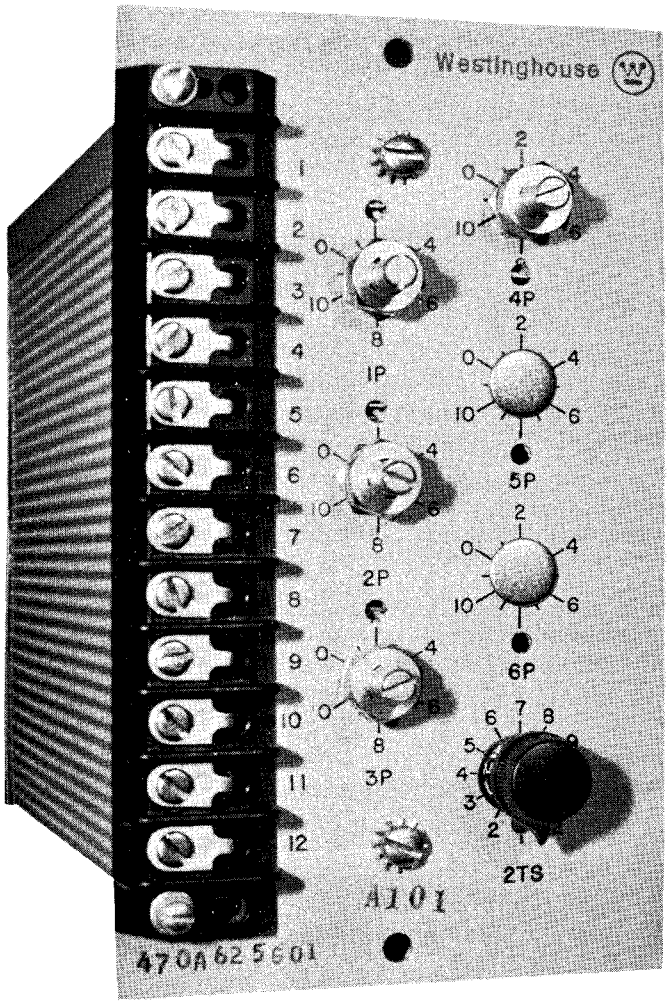

FIGURE #1

The module shown in Figure 1, contains a P101A operational amplifier (IL 16-800-24) and its associated function board and sequencing relay board extending from a 4" x 7" faceplate on which are mounted front accessible adjusting potentiometers, selector switch and screw type terminals to which all external connections are made.

II. RANGE OF APPLICATION

The current regulator can be applied with all C-56 thyristor power supplies used as motor armature supplies. The reference voltage representing current limit must be 10 volts or more.

III. RESPONSE

The response of the current loop approximates the step response of a first order delay with a time constant of 27 msec. The cross-over frequency of the current loop is approximately 150 rad/sec

IV. DESCRIPTION OF OPERATION

The current controller consists of the inner voltage loop with an outer current loop. The reference is fed directly into the current controller, the output of which acts as reference to the inner voltage loop. For scheme of current controller see Figure #2.

The current controller is a PI controller with a fixed lead in the current feedback. The lead of the PI controller is fixed and is necessary in order to cancel the delay associated with the inner voltage loop. The four inputs to the current controller, terminals #1, #2, #3 and #4, are as follows.

Terminal #1 is for the current feedback signal, and is composed of a lead of 26 ms and a small delay of 1 ms.

Terminal #2 is for reference signal.

Terminal #3 is a spare input.

Terminal #4 is used for non-regenerative (single converter) power supplies and is where the output of the reverse current simulator is connected.

For control of current zero, relay 1CR should be de-energized, thereby removing all inputs from the current controller except current feedback. Relay 2CR is an initial condition relay which will be picked up once the current loop has been closed and the thyristors energized. This is to prevent the output of the current amplifier from drifting from its zero position.

Dynamic adjustment of the current loop is by means of pot 2P and switch 2TS. Switch 2TS changes the values of resistances associated with pot setting 2P, and has the same effect on the integrating time constant as changing the capacitance in the feedback of the amplifier. Switch 2TS and pot 2P are used to change the crossover frequency of the current loop without changing the response of loop to a step input.

The current controller has a symmetrical limiter using a single Zener Diode, ensuring that the limit in the positive and negative direction are very close to one another.

V. START UP PROCEDURE

The following assumes the basic regulator is working. Disconnect wire leading to terminal #1, and input to inner voltage controller. Turn pots 2P, 3P, 4P and switch 2TS full CCW.

1.0 Check Basic Regulator

1.1. Apply variable voltage source to inner voltage loop, adjust it for zero volts.

1.2 Apply power to thyristor and slowly increase reference feeding into inner voltage loop.

1.3 Adjust reference so that machine turns over.

1.4 Connect Simpson to PSC and with other lead check polarity of current feedback and reference feeding inner voltage loop. These must be of the same polarity.

1.5 De-energize thyristor power supply.

1.6 Reconnect current feedback signal to terminal #1.

1.7 Reconnect inner voltage loop.

CAUTION: The following tests are carried out without field on the motor, take care to continually monitor the speed of the drive to prevent it from taking off. Also do not linger while passing armature current through stalled motor. Return armature current to zero and allow adequate cooling time if necessary.

2.0 Adjustment of Inner Current Loop

2.1 Remove motor field supply.

2.2 Energize thyristors and relay 2CR.

2.3 Adjust pot 1P for zero current. (For single converters adjust 1P to give a small value of current, then reduce this current by pot 1).

2.4 Energize relay 1CR

2.5 Apply +10 volt signal into terminal #2.

2.6 Slowly increase 3P CW till rated current is flowing in armature circuit.

2.7 Apply step reference to terminal #2 and record current response.

2.8 Turn 7TS and 2P CW till current response starts to oscillate then turn 7TS one position CCW.

2.9 The current loop is now dynamically adjusted.

3.0 Adjustment of Gate Pulse Suppression

For gate pulse suppression adjustment, do not circulate armature current for more than 25 seconds allowing at least two minutes for cooling after current is reduced to zero.

3.1 Turn gate pulse suppression pot full CW.

3.2 Turn pot 3P full CW

3.3 Apply (+) 15 volt signal into terminal #2 and increase 3P CW until 115% current limit is reached.

3.4 Decrease gate suppression pot CCW until drive suppresses gate pulses.

3.5 Turn 3P full CCW

For dual converter drives.

3.6 Apply (-) 15 volt signal into terminal #2.

3.7 Turn gate pulse suppression pot full CW

3.8 Increase 3P CW until 115% current limit regeneration reached.

3.9 Turn gate suppression pot CCW until gate pulses are suppressed.

3.10 Remove reference from terminal #2 and turn 3P full CCW

4.0 Reference Calibration

4.1 Apply reference voltage to terminal #2 and turn 14P till rated voltage is reached.

4.2 Remove reference.

THE DRIVE IS NOW BASICALLY ADJUSTED.

VI. SERVICE

Using the procedure outlined in Section V, any problem can be isolated to either a component on a function board or a faulty A101A transistorized operational amplifier. Our component board designs, utilizing stand-off terminals, facilitate the replacement of components using the proper sized (wattage) soldering iron. However, proper servicing of the A101A TOA requires instruments and techniques particular to transistorized, low-noise level circuits. Customers without the proper facilities are advised to return the defective unit to:

Westinghouse Electric Corporation
Industrial Systems Division
P. O. Box 225
Buffalo, New York 14240

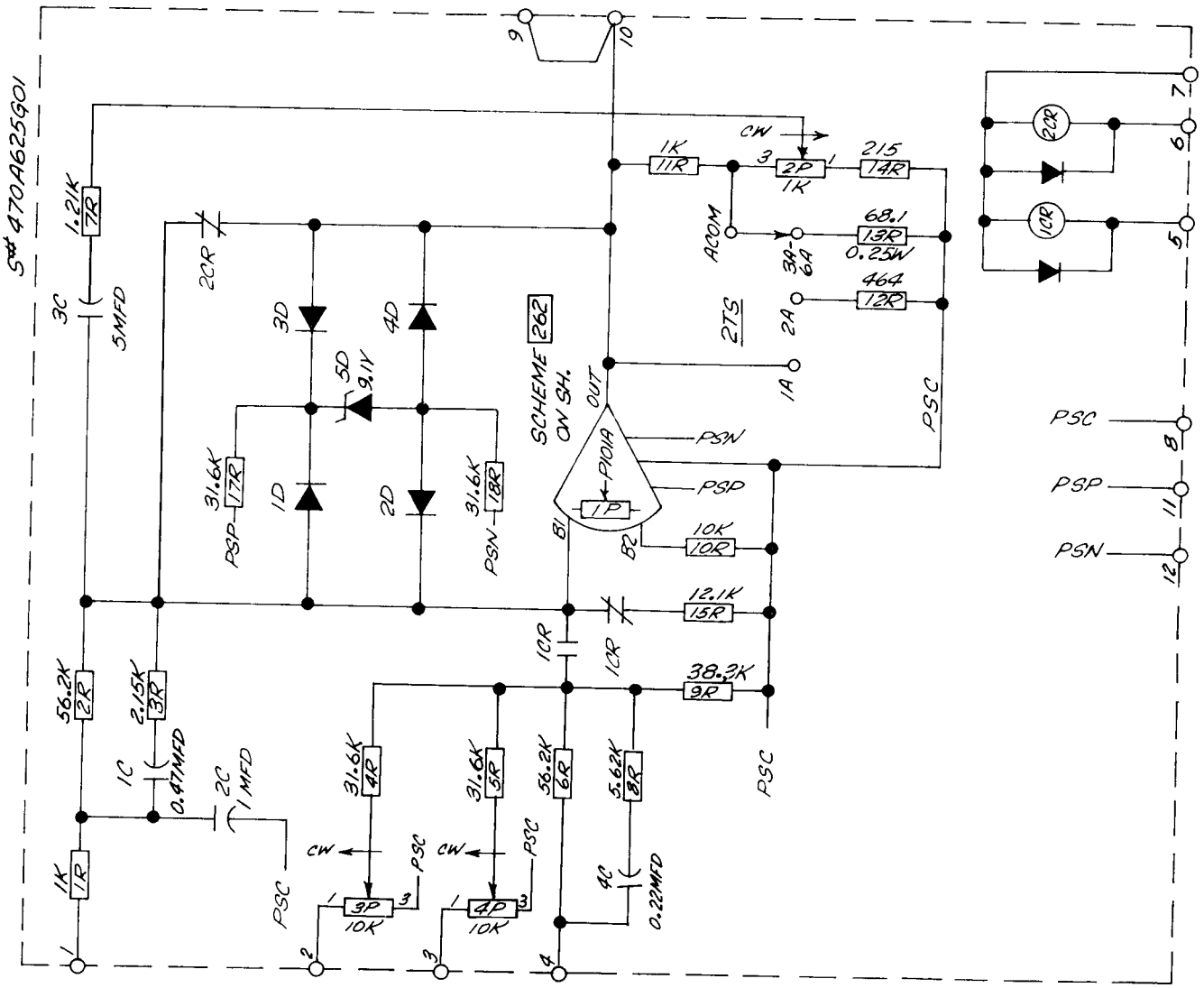

Figure #2

Current Controller