C-56, ±24 VDC POWER SUPPLY REGULATOR

I. INTRODUCTION

The over-all power supply is composed of two major modules; a power rectifier module (1339A10) and its associated filter capacitors and fuses, and the power supply regulator module (1326A10), shown in figure 1 below. The regulator module is mounted on 6" x 6" printed circuit board module and is designed to be plugged into a standard 6" printed circuit board cage. The power rectifier module consists of the input (isolated) distribution transformer and full-wave rectifier bridges to provide both ± outages to the regulator module and an outage for the unregulated relay supply.

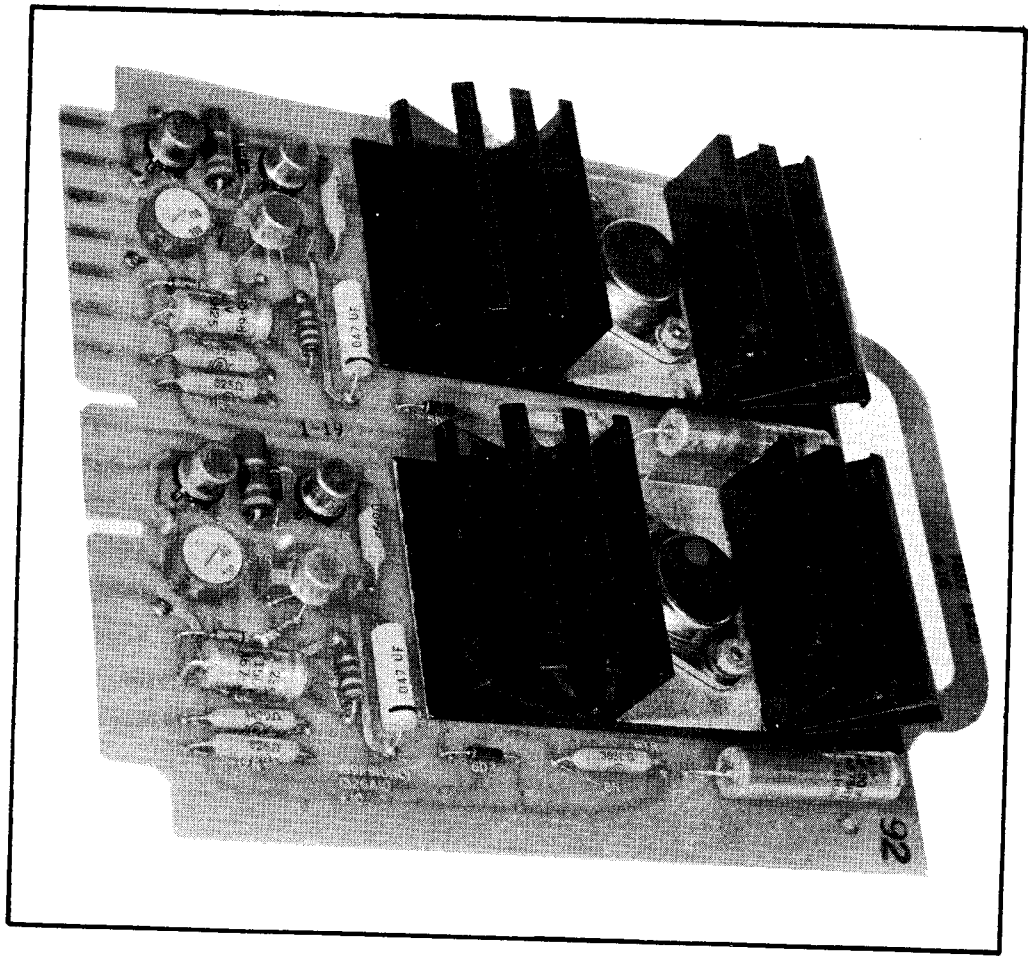

FIGURE 1

C-56 24 VDC CONTROL POWER SUPPLY

The ± 24-volt power supply regulator module may be used wherever ± 24-volt, regulated power is needed, not to exceed 750 ma except under certain environmental conditions discussed in Section II.

The power supply may be used to supply ±24-volts power to a local load or a load remote from the regulator, since a terminal for "remote voltage sensing" has been provided. When these remote sensing terminals (pins 43 and 59 of the (+) and (-) supplies respectively) are connected to the load, the load voltage is regulated, rather than the terminal voltage of the power supply. This feature eliminates loss of regulation due to power lead resistances. One should not get carried away with this feature, because large drops in output voltage may occur (due to loss in regulation) unless there is at least 8.0 volts difference between the dc output and input voltages of the regulator module, which is the case when the ac line voltage is 10% low at full load current.

II. DESCRIPTION

Figure 2 is a schematic of the over-all power supply.

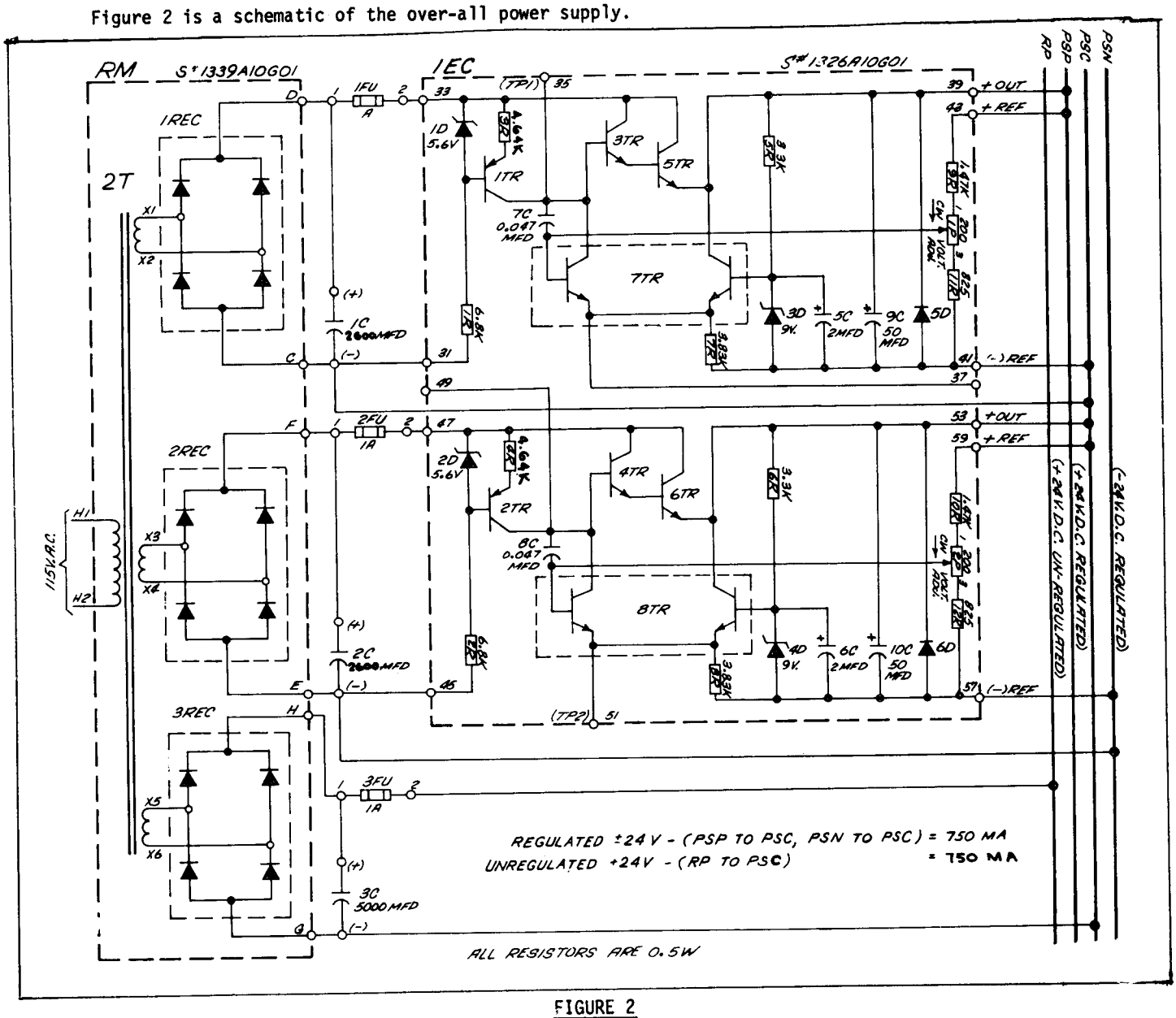

FIGURE 2

The input is 117V, 50 or 60 cycle power. This voltage is transformed and isolated to three channels; two are 31.5 volts rms at full load (.75A), the third is 19.2 volts rms at .75A.

The sample element samples a portion of the load voltage and feeds this signal into the comparison element, which compares the sampled signal with the reference voltage from the reference element. The comparison element then pulls current from the preregulator element proportional to the difference between the sample and reference signals.

The preregulator is a constant current generator and eliminates input transient and ripple voltages from appearing at its output. The more current consumed by the comparison element, the less is available to the amplifier and control elements.

The sample and comparison elements act as a negative feedback loop in that when the load voltage increases, a signal from the sample element forces the comparison element to draw more current, which means less current to the amplifier element, which in turn means less load current and hence a decrease in load voltage until equilibrium is obtained.

To help in understanding operation of the components of Figure 2 in terms of the elements described above, a list of components making up each element follows:

Preregulator: 1D, 3R, 1TR, 1R
Control Element: 5TR
Amplifier Element: 3TR
Comparison Element: 7TR, 7C, 7R
Reference Element: 3D, 5C
Sample Element: 1P, 9R, 11R

With the functional element descriptions ~~on the preceding page~~ and the component groupings listed above one may evaluate how each component operates in the voltage regulator. A few components which may not seem to have any important function will be discussed below.

Capacitor 7C across the collector and base of 7TR is used as a phase shift capacitor Physically, it slows down the regulator's response to transient changes in output and input voltages. By reducing the ac gain in such a manner, the output is kept from oscillating at high frequencies. Capacitor 5C is used to reduce zener noise voltage from zener diode 3D. Capacitor 9C functions to reduce ripple voltage and transient voltages at the output of the regulator. The reason for the differential stage for 7TR was to eliminate the problems of V_{be} changes due to changes in load current and temperature. Together with temperature-compensated (3D) zener diode, the regulator becomes almost temperature insensitive as well as better load regulated.

The adjustments are potentiometers 1P and 2P. Both are adjusted at the factory and should not need further adjustment.

The ratings and specifications of the power supply rectifier module are:

Input Requirements: Voltage - 115 VAC ±10%
Frequency - 50 or 60 Hz
Line Load - 69 va

Output Capabilities:

	No Load	Full Load
Output Voltage	±43V ±10%	±37V ±10%
Ripple		<2V (p-p)
Ripple Frequency	120 Hz	120 Hz
Current		±0.75A

Relay Output:

Voltage -	≤26V ±10%	<22V +10%
Current -		0.50A
Ripple -		≤0 50V (p-p)

The ratings and specifications of the Power Supply Regulator Module are:

Input Requirements:

Same as those of the "rectifier output capabilities" above.

Output Specifications:

Voltage Range: ±22 VDC to ±26 VDC (adj. pots 1P & 2P)

Current Range: 0 to 0.75A

Line Regulation: <0.01% change for a 15-volt change in the ac input voltage to power rectifier module.

Load Regulation: <0.05% output voltage change from no load to full load

Temperature Coefficient: <0.002% output voltage change/^{o}C change in ambient temperature.

Ambient Operating Temperature Range: 0^{o}C to 55^{o}C.

Output Impedance:

0.02 Ohms	0 Hz to 200 Hz
0.08 Ohms	200 Hz to 1K HZ
0.30 Ohms	1K HZ to 10K Hz
0.60 Ohms	10K Hz to 100K Hz

For Use Above Rated Current:

There are certain instances where the supply may be used above rated load current of 750 ma. These are cases where the ambient temperature is below 55^{o}C and/o there is sufficient air circulation to keep the case temperature 5TR and 6TR below 150^{o}C. Under normal conditions (full-load current and nominal ac input of 115 vac) about 9.75 watts will be dissipated by 5TR and 6TR

Above 750 ma load current, one should use the curve in Figure 3 to determine the safe (derated) ambient temperature in still air and 10% high line voltage.

Under no circumstances should load current exceed 1.0 Ampere.

III. SERVICE

Repair and servicing of the modules should be conducted as follows:

Nothing should ever fail on the rectifier module due to its extreme simplicity and overload protection. However, using a printed circuit board extender, there should be a dc voltage of (+) 31.5 volts to (+) 49 volts between pins (33) and 31), and the same range of voltage should be measured between pins (47) and (45). If the above conditions are not met a defective rectifier module is apparent.

If the voltage between pins (43) and (57) is not (+) 48 volts ±5 volts, there is a fault in the regulator module and servicing is required

Proper servicing of the regulator module and/or the "rectifier module" requires instruments and techniques particular to transistorized circuitry. Customers without the proper facilities are advised to return the unit to Westinghouse Electric Corporation, Industrial Systems Division, Buffalo, New York.

To keep the down time of a control system to a minimum should a power supply fail, it is recommended that a spare "regulator module" and a spare power "rectifier module' be available for immediate replacement. A parts list of the equipment can be obtained through your nearest Westinghouse District Sales Office.

APPROXIMATE

TEMPERATURE DIFFERENCE BETWEEN HOTTEST

PORTION OF HEAT SINK AND AMBIENT TEMPERATURE

AT 10% HIGH LINE VOLTAGE (STILL AIR)

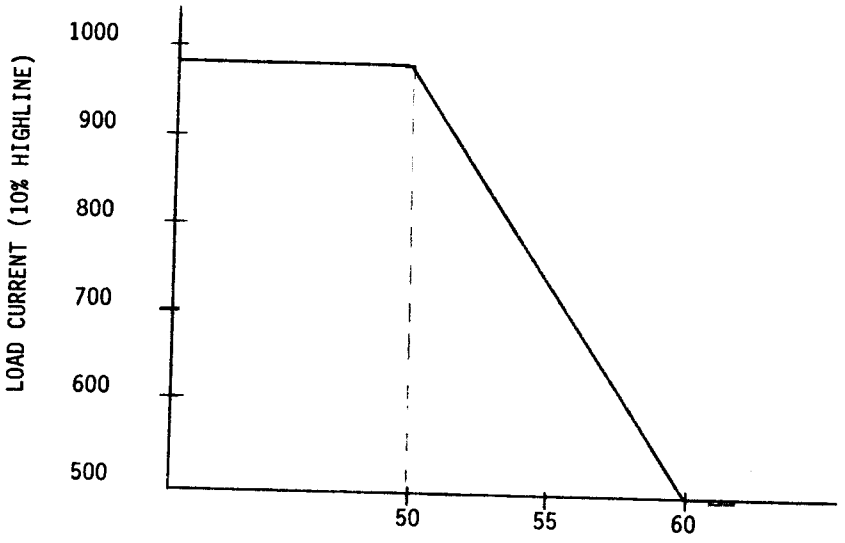

FIGURE 3