



F80 FIELD EXCITER SUBSYSTEM AND FIELD VOLTAGE CONTROL

I. INTRODUCTION

The F80 Field Exciter Subsystem includes a TPM assembly and up to four associated plug in cards. The TPM assembly operates from single phase AC and provides full wave, phase controlled, rectified DC for control of field current. The TPM assembly can be either a single or a dual converter. The plug in cards provide coordination for the selection of the proper thyristors, generate a picket fence pulse train for the thyristor gates at a controlled gating angle (α) and provide an inner field voltage loop for both converter configurations. An optional feature on the cards is a field loss or an overexcitation function.

Figures 1 and 2 are pictures of the single converter and dual converter TPM assemblies. For a more detailed explanation of the associated cards referenced in this leaflet refer to I.L. 16-800-265 (GS&D), I.L. 16-800-266 (GC), I.L. 16-800-267 (BS) and I.L. 16-800-247 (VS).

II. RATING AND SPECIFICATIONS

A. AC Input:

Transformer secondary voltages should be 230VAC or 460VAC, 60 Hz or 50 Hz, single phase. Tolerance +10%, -5%. Maximum transformer impedance should be 6%.

B. Line Frequency: 60 ±2 Hz and 50 ±2 Hz.

C. DC Output:

Maximum output voltages are 170VDC for 230VAC input and 340VDC for 460 VAC input for the dual converter. Maximum output voltages are 180VDC for 230VAC input and 360VDC for 460 VAC for the single converter. Maximum current ranges are:

10A - 20A	}	For Single Converter
20A - 40A		
40A - 60A		
10A - 20A	}	For Dual Converter
20A - 40A		
40A - 80A		

D. Ambient Temperature ranges: 0°C to 40°C.

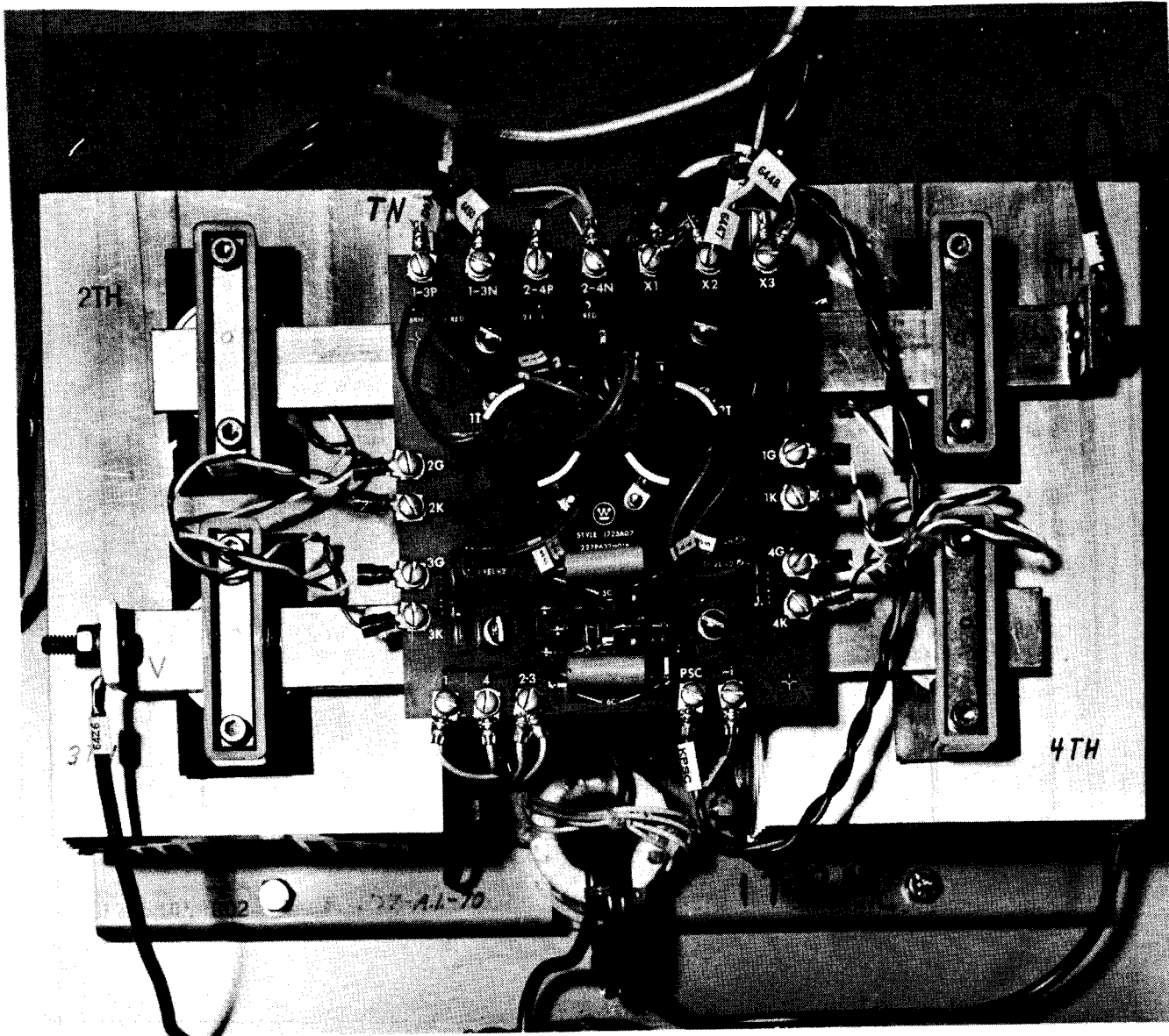
E. Elevation Limit: 3300 feet above sea level (without derating).

F. DC Power Requirements for plug in pc cards.

PSP	+24V	DC	±0.1V	@	140ma	} Dual Conv.	@	105ma	} Single Conv.
PSN	-24V	DC	±0.1V	@	130ma		@	95ma	
LP15	+15V	DC	±1.5V	@	80ma		@	50ma	
RP1	+24V	DC	±2V	@	200ma AVE				

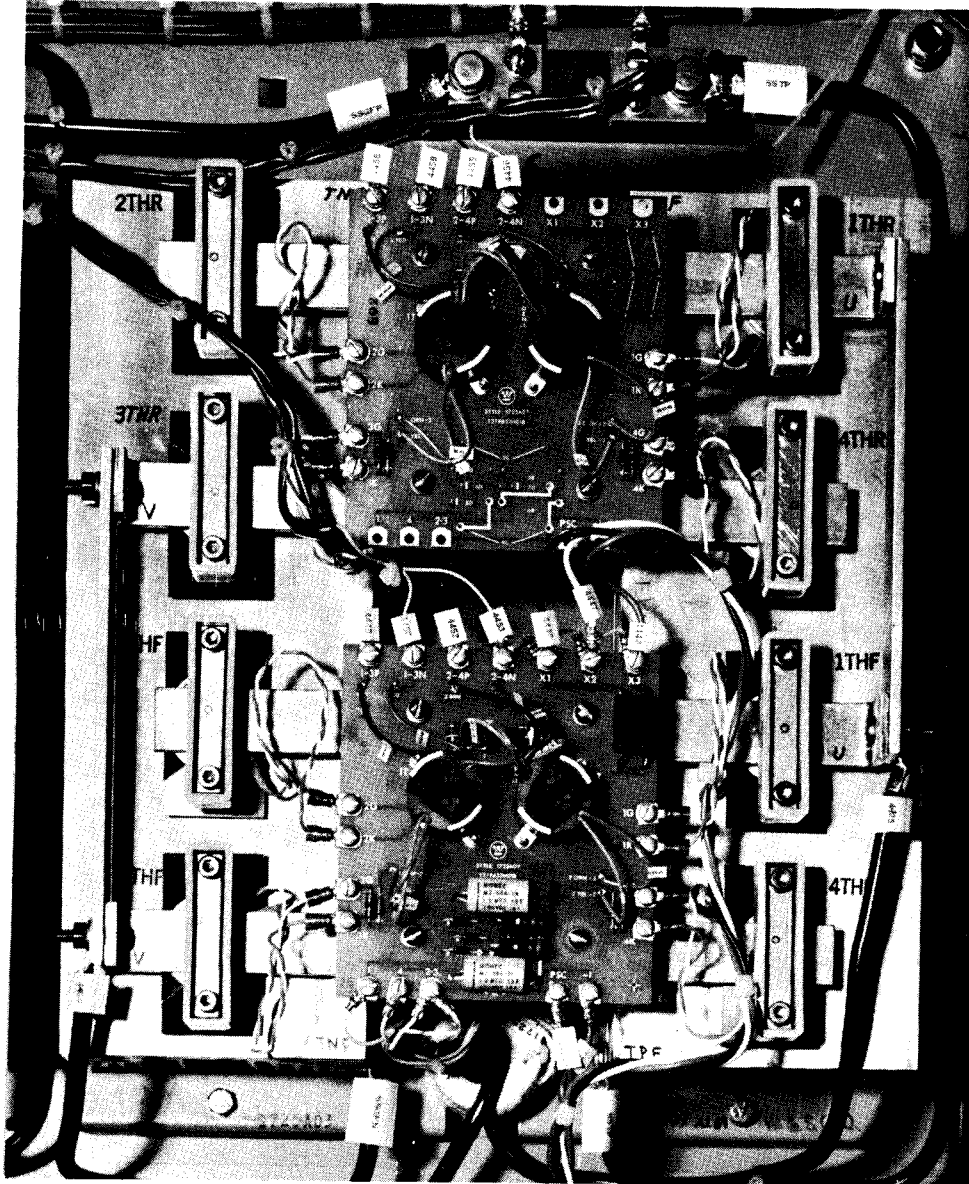
Peak current drawn by pulsing stage will be 0.5A during pulse.

RP +24V DC ±2V @ 40ma for field loss/overexcitation relay.



SINGLE CONVERTER TPM ASSEMBLY

FIGURE 1



DUAL CONVERTER TPM ASSEMBLY

FIGURE 2

III. TPM CONSIDERATIONS

Mounting of the TPM assemblies is restricted to the positions shown in Figures 1 and 2.

All components are front removable for easy access. When replacing thyristors, procedures outlined in I.L. 16-800-280 must be followed to insure proper heat transfer from device junctions.

TPM's requiring substantial electrical or mechanical repair should be returned to:

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

IV. POWER TRANSFORMERS

The power transformers for the F80 TPM's provide an interface between the primary AC line voltage and the secondary AC voltages required by the TPM. In addition, these transformers introduce an impedance for fault protection of the TPM. For a list of designed transformers refer to Thyristor Power Transformers, F80 Single Phase Field Exciters in the Reference Data Book.

V. TPM SCHEMATICS

Figures 3 and 4 are the schematics for the single and dual converter TPM assemblies. As can be seen on the schematics, there are two groups for each converter assembly. These two groups are for the different input voltages: G01 for 230VAC input and G02 for 460VAC input. Current range selection is performed by wiring an appropriate number of turns through the current sensor transformer when the TPM assembly is wired in a cabinet.

VI. CURRENT SENSING

Current sensing is performed with an AC current sensor ICT. The sensor transformer has two 800 turn secondary windings around two separate cores. In each half cycle of operation, one of the sensor transformers generates an output signal while the other transformer is resetting. When a field current range is selected, the number of turns of the primary winding for the current sensing transformer is also selected. When the TPM assembly is wired in a cabinet, the U lead from the power transformer must be passed through the current sensor core the required number of times before it is bolted to the TPM bus work.

The variation in turns associated with the current transformer maintains a consistent level of feedback signal to the regulator cage. The current feedback signal will have a maximum level between 4V and 8V and is always negative in polarity. The maximum output voltages corresponding to the current levels are:

I_{max}	$-i_f$	# Turns
40A - 80A	4.1V - 8.2V	1
20A - 40A	4.1V - 8.2V	2
10A - 20A	4.1V - 8.2V	4

The above ratings and feedback signals are for both single and dual converter assemblies. The single converter 40A - 60A rating will yield a 4.1V to 6.15V signal level of current feedback. The level of feedback signal can be:

$$-|i_f| = I \times \frac{N}{800} \times 82 \text{ Volts}$$

where I is the primary current and N is the number of primary turns.

CAUTION: The TPM should not be excited with primary loops through the C.T.'s and the C. T. secondaries disconnected from the burden resistors on the pulse transformer pc board ...Terminals 1, 2, 3, and 4 of S#1725A07G01.

VII. SYSTEM DIAGRAMS

Figures 5 and 6 are system block diagrams for the single and the dual converters operating with voltage loops. The gain of the voltage loop is fixed to provide a crossover of approximately 200 rad/sec. Figure 7 is a typical transfer curve of the gating system.

VIII. VOLTAGE LIMIT SETTING

On both converter systems, the Voltage Limit pot must be adjusted to provide satisfactory operating limits for the voltage loop. The normal operating range for α should be restricted to between $\alpha = 25^\circ$ and $\alpha = 165^\circ$. The voltage limit pot should be adjusted with the controller which feeds the pot forced into limit. Anytime this controller is changed, voltage limit should be re-adjusted. If the TPM load is resistive, the TPM output voltage should be set with the voltage limit pot at 170V or 340V depending upon the system voltages. If the TPM load is resistive and inductive (continuous current), the TPM output voltage should be set at 170V or 340V depending upon the system voltages; however, this is not practical in systems with forcing.

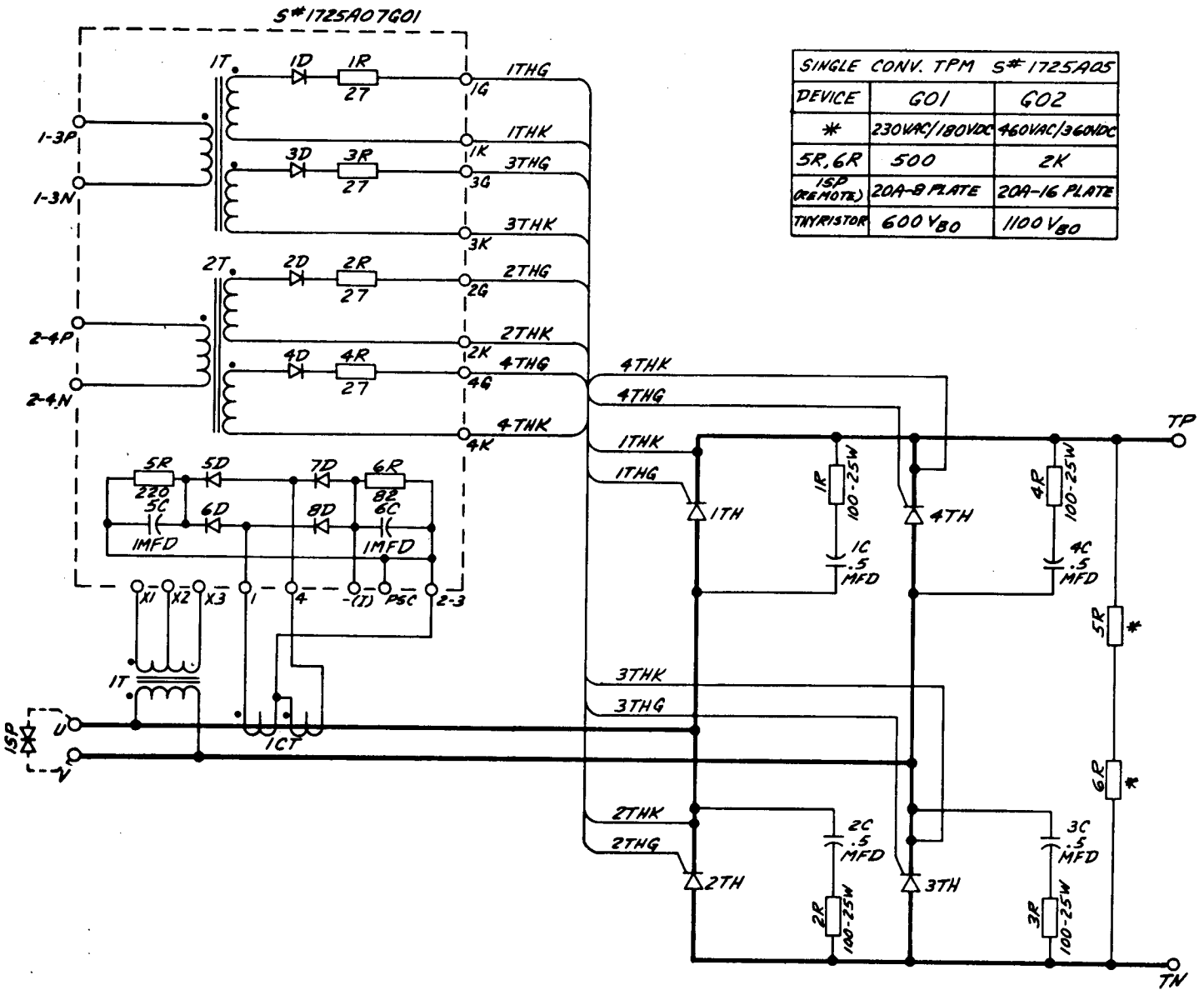
IX. SYSTEM RESPONSE

The single converter shown in Figure 5 has a closed voltage loop with a crossover of approximately 200 rad/sec. The reference input time delay is 1.1ms.

The dual converter shown in Figure 6 has a closed voltage loop with a crossover of approximately 200 rad/sec. The reference input time delay is 15ms and will be the limiting factor in the response of outer loops.

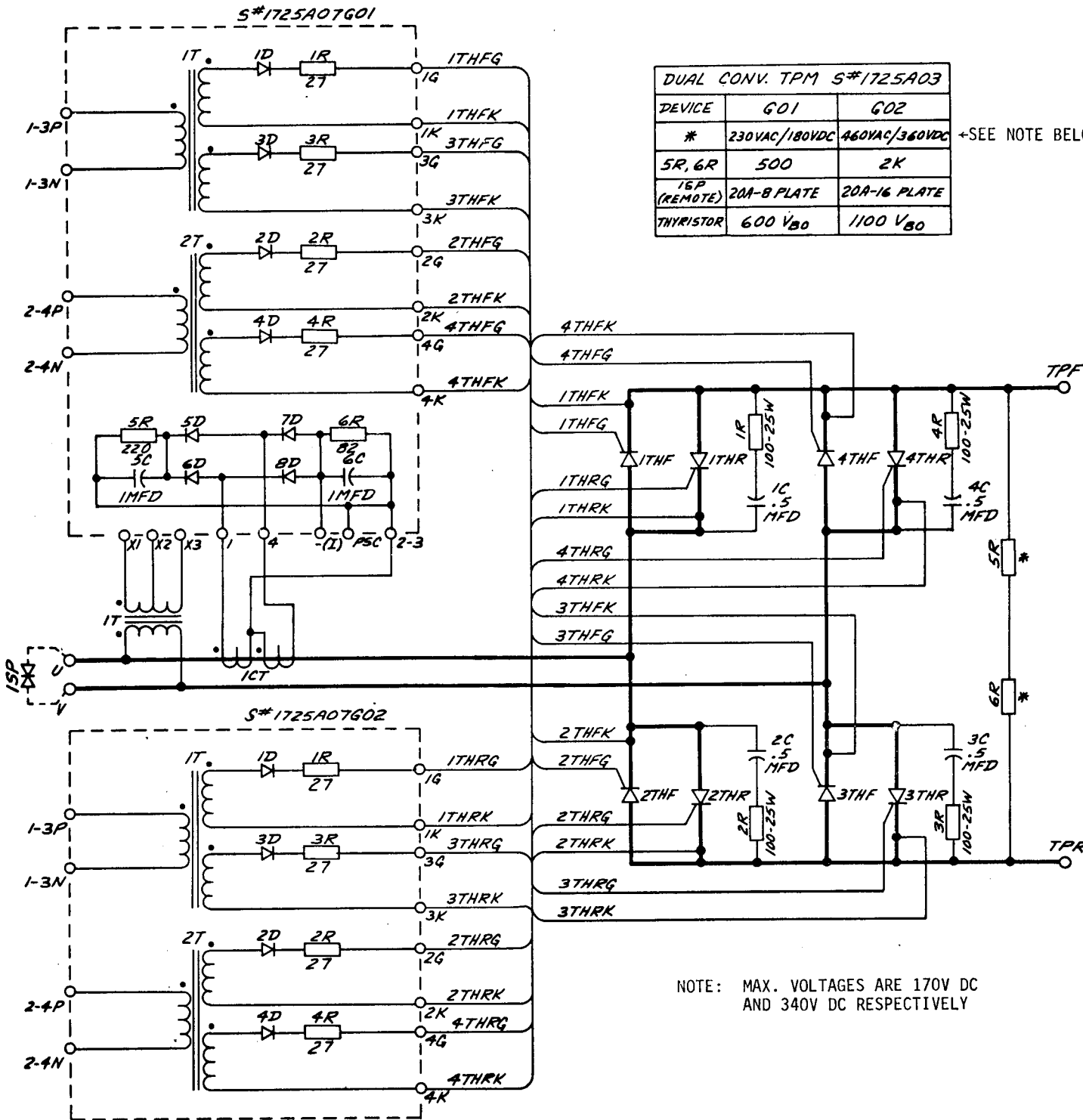
X. POWER CIRCUITS

Figures 8 and 9 are typical of the external power wiring associated with the F80 TPM's.

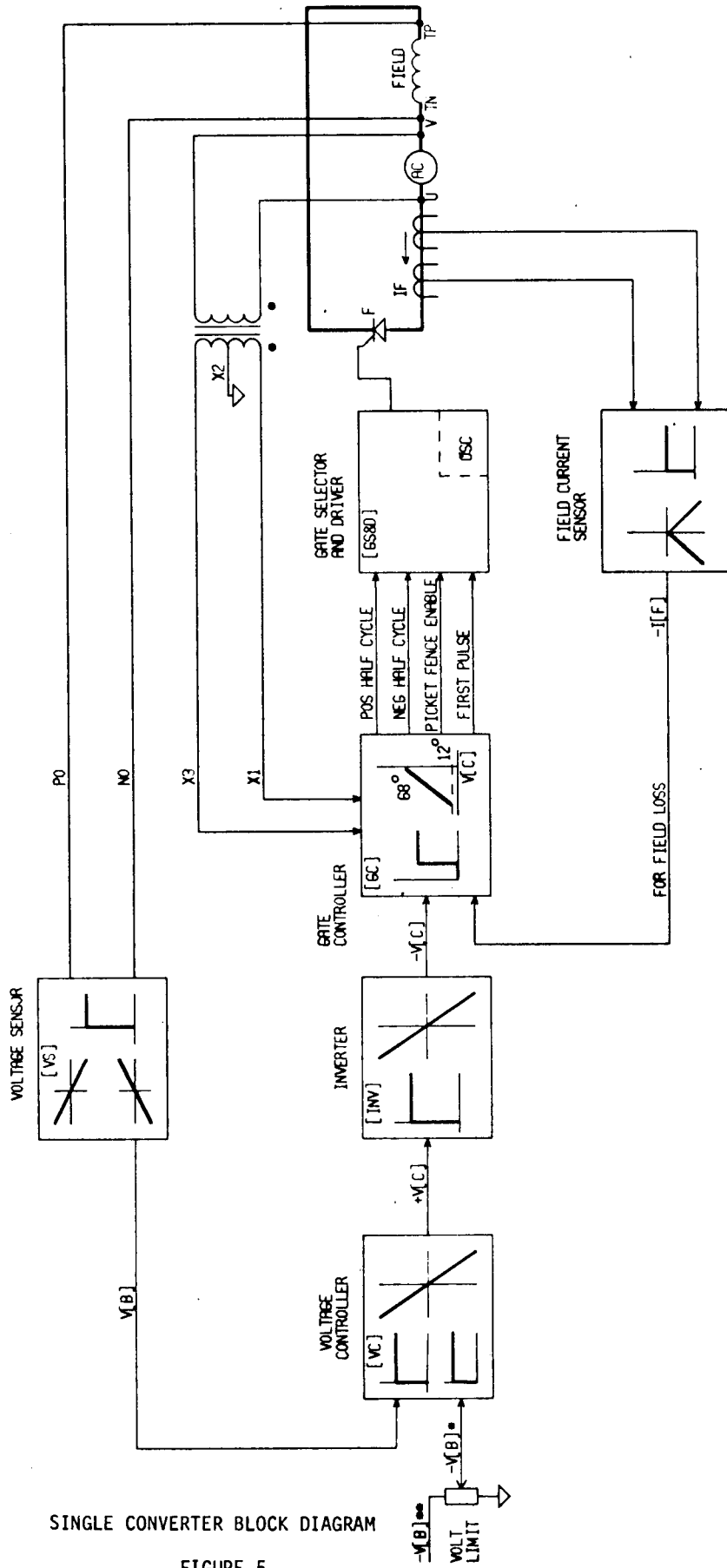


SINGLE CONVERTER SCHEMATIC

FIGURE 3

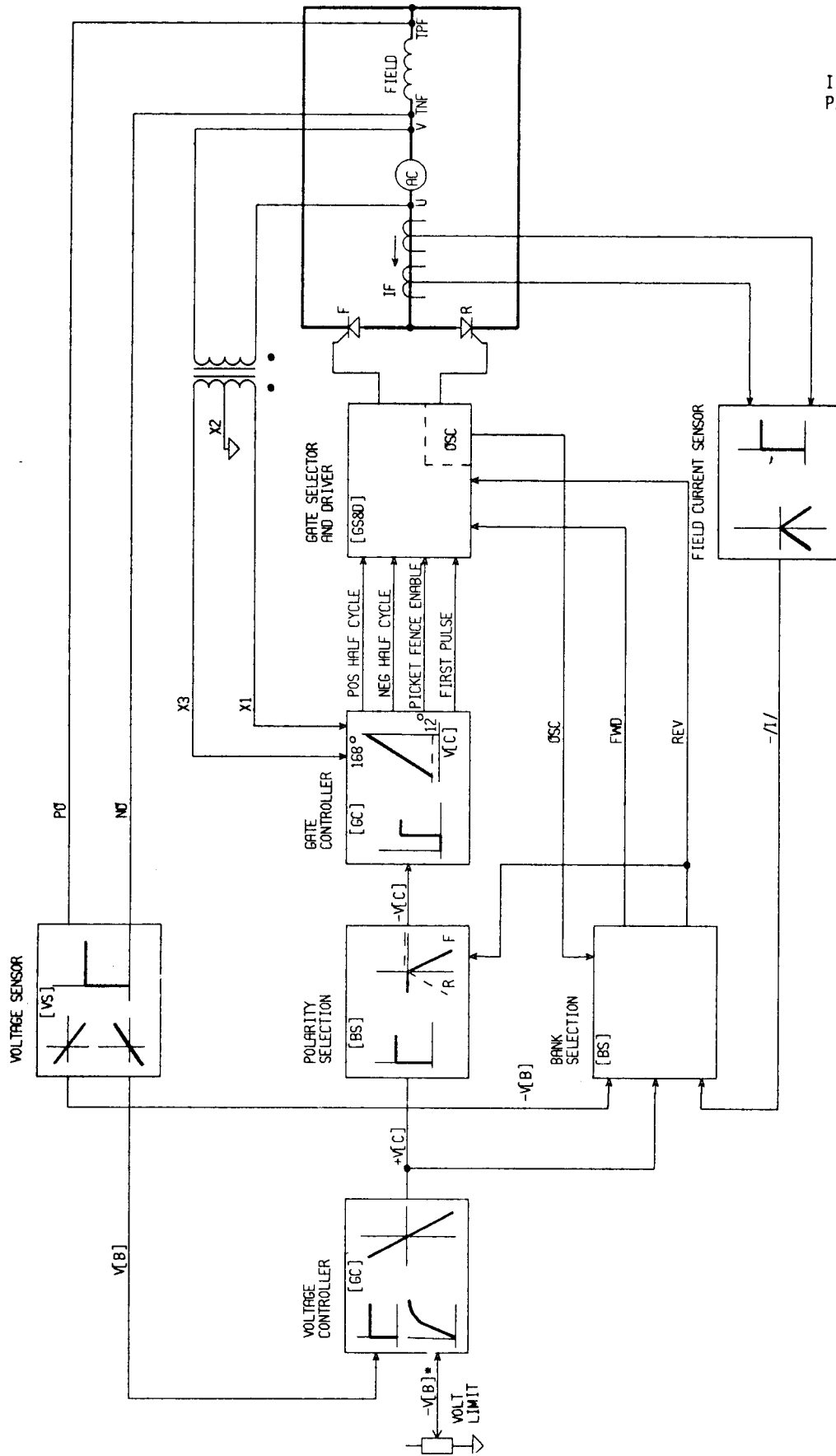


DUAL CONVERTER SCHEMATIC
FIGURE 4



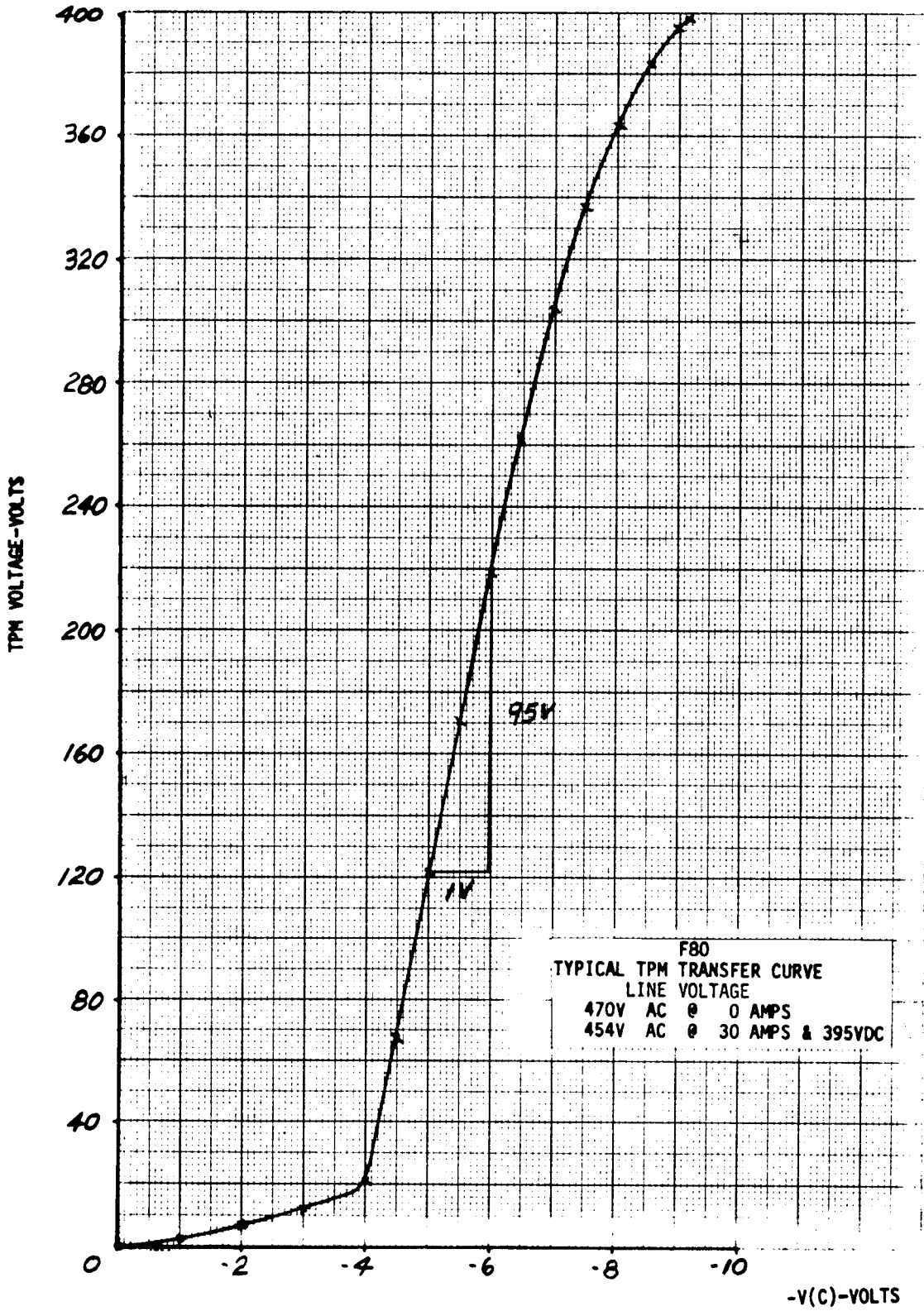
SINGLE CONVERTER BLOCK DIAGRAM

FIGURE 5



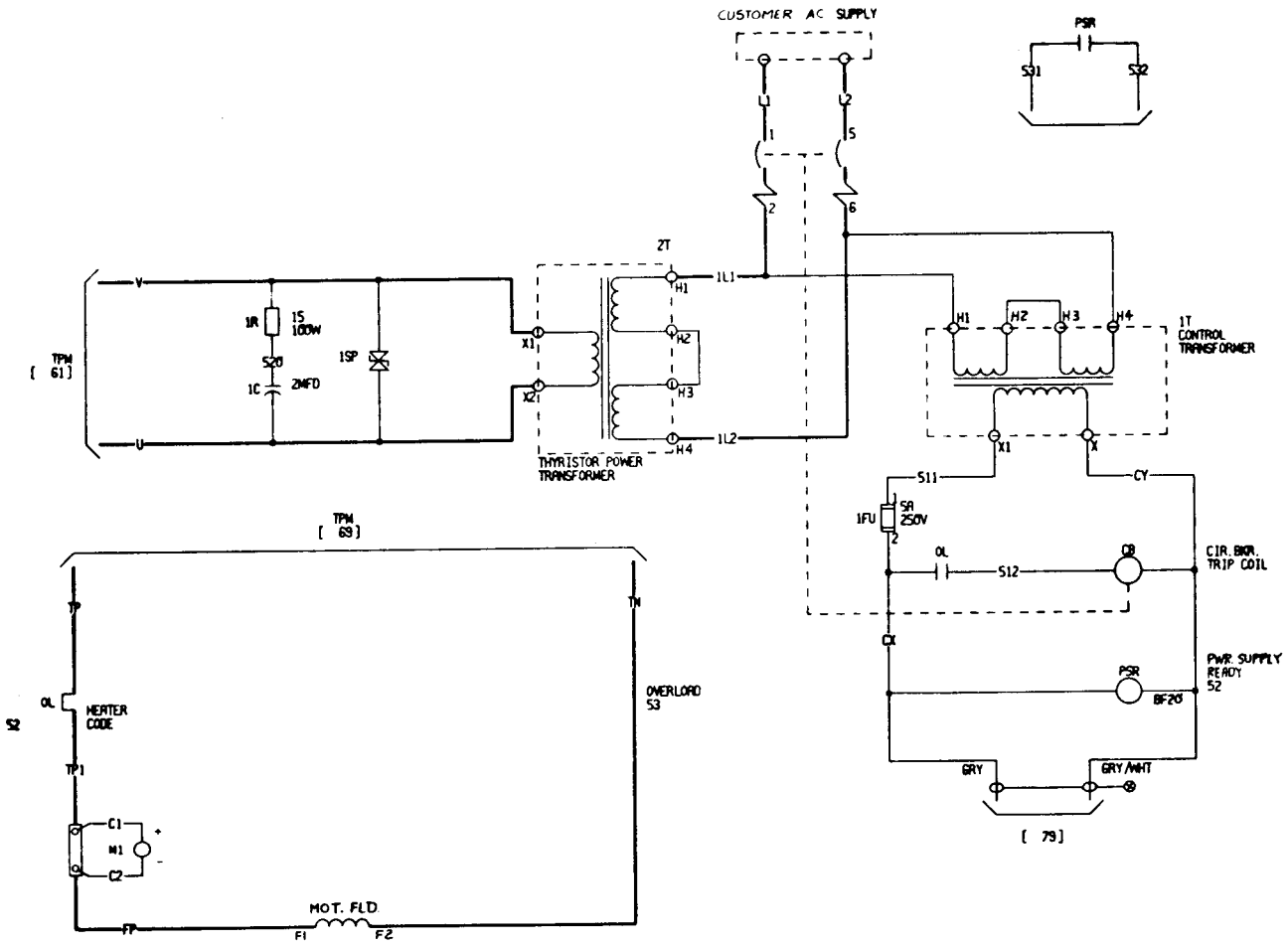
DUAL CONVERTER BLOCK DIAGRAM

FIGURE 6



GATING SYSTEM TRANSFER CURVE-TYPICAL

FIGURE 7



DUAL CONVERTER POWER WIRING-TYPICAL

FIGURE 9