INSTRUCTIONS

3S7932LA100, LA101, LA102, LA103 POWER SYSTEM STABILIZER

INTRODUCTION

This Supplementary Control Panel equipment is designed for aiding system stability by introducing a supplementary control panel signal into a continuously acting voltage regulator equipment which is already installed on steam driven or hydro driven generators. The control may also be furnished with new excitation controls. This control can be supplied to operate with General Electric generator excitation systems consisting of a rotating exciter controlled by regulators of the rotating amplifier or static type.

The equipment will supplement the conventional voltage regulator control with a control function derived so that, under deviations in machine speed or load, excitation becomes regulated as a composite function of voltage and some other appropriate quantity such as speed.

This supplementary control panel equipment includes the functions of input transducer (not including shaft-mounted tachometers on units using speed as a supplementary control panel signal), signal conditioning, limiting, and provisions for addition or injection of the signal into the appropriate type of conventional voltage regulator.

The signal conditioning transfer function applied to the input variable by the signal conditioning portion will be of the form:

$$K \quad \frac{(T_1S)}{(1+T_1S)} \quad \frac{(1+T_2S)}{(1+T_3S)} \quad \frac{(1+T_4S)}{(1+T_5S)}$$

RECEIVING AND HANDLING

Immediately upon receipt, the equipment should be carefully unpacked to avoid damage. As soon as the equipment is unpacked, it should be examined for any damage that may have been sustained in transit.

If injury or rough handling is evident, a damage claim should be filed immediately with the transporation company and the nearest General Electric Sales Office should be notified promptly.

FUNCTIONAL DESCRIPTION

SPEED INPUT TRANSDUCER

For supplementary control panel equipment operating from shaft speed, a signal from a turbine-mounted tachometer is required for input to the power system stabilizer. This speed signal input shall be three-phase AC, not less than 90 hertz and 35 volts rms at generator rated speed, with linear voltage variation near rated speed.

An input circuit for accepting the speed (tachometer output) signal will be furnished in the supplementary control panel.

Modulation and noise content of the input signal to the supplementary control equipment must be below the level which would produce a change of more than 0.1% in the output to the voltage regulator.

FREQUENCY INPUT TRANSDUCER

For supplementary control panel equipment operating with hydrogenerator regulators, a frequency input signal will be used for stabilizing. A frequency transducer is included with the supplementary control panel to operate from the user's three-phase potential transformer secondary. The input may be from the same potential transformer circuit that supplies the generator voltage signal to the voltage regulator.

The transducer output will be accurate over a range between 59.5 and 60.5 hertz. Any associated filtering is compatible with the required characteristics of the supplementary control panel.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

GENERAL ELECTRIC

Modulation and noise content of the input signal to the frequency transducer must be below the level which would produce a change of more than 0.1% in the output of the supplementary control panel.

SIGNAL CONDITIONING

The signal conditioning function will take its input from the transducer and provide an output that is a function of the deviation in the input signal.

The signal conditioning function is capable of processing signals from the input transducer that vary at frequencies from approximately 1 cycle/minute to 80 cycles/minute.

The signal conditioning function will apply the following transfer function to modify the sensed variable signal for insertion into the voltage regulator:

$$K \frac{(T_1S)}{(1+T_1S)} \frac{(1+T_2S)}{(1+T_3S)} \frac{(1+T_4S)}{(1+T_5S)}$$

Adjustments are provided to vary the parameters of the signal conditioning function so as to permit compensation for the variations in the characteristics of the regulator, excitation system, and generator to which it is applied. These adjustments can be made by calibrated dial settings which will be accurate to within 10% of the desired parameter value.

The adjustments are capable of modifying the transfer function parameters through the following typical ranges:

K = 2 to 100 (in per unit)

T_1 = 0.1 to 50 seconds

T_2 = 0.2 to 1.5 seconds

T_3 = 0.02 to 0.1 second

T_4 = 0.2 to 1.5 seconds

T_5 = 0.02 through 0.1 second

The signal conditioning equipment will reset to zero, and wash out or otherwise eliminate output signals that may occur because of a long time deviation in input signal level or due to drift that exists for longer than a period of approximately 1 cycle/minute.

LIMITING

Limiting is provided in the supplementary control panel equipment so that the output signal will not completely override voltage regulating action. Limiting will be such as to prevent supplementary control panel output from causing changes in voltage regulator output that would exceed preset limits. This limit will be of the clamping or "wind-up" type which will hold the supplementary control output at the preset limit value whenever the input signal is such as to produce an unlimited output equal to or greater than the limit setting.

The amount of limiting is adjusted by a calibrated dial between ±2% and ±10%, corresponding to limiting the effect on voltage regulator output to that which the same % voltage error would have.

OUTPUT

The supplementary control panel equipment has included provisions for the insertion of its output into the amplifier circuitry of the voltage regulator by a means suitable for the type of regulator with which the supplementary control panel is to be used.

The supplementary control panel equipment includes a relay for disconnecting its output from the voltage regulator. This relay can be controlled by an "OFF-ON" momentary contact or switch located on the supplementary control panel and through a set of terminal points to which the user can connect logic of his choice for removing the supplementary control panel signal from regulator control.

The output relay will also be controlled by a circuit which will operate to disconnect the supplementary control panel from the voltage regulator if the supplementary control panel output goes into the limit and remains to limit for longer than a preset time (adjustable from 2 to 60 seconds).

A zero-center meter is furnished on the panel to indicate supplementary control panel output. A remote high impedance (2000 ohms/volt) meter may be added in parallel for remote indication.

APPLICATION

The supplementary control panel equipment described herein is designed for operation only with voltage regulators of the continuous-acting type manufactured by the General Electric Company.

Each voltage regulator will required a corresponding separate supplementary control panel. The control is not designed to be compatible with more than one regulator unit.

EQUIPMENT DESCRIPTION

GENERAL

The supplementary control panel circuitry is furnished with static components with the exception of adjustable devices and relays required for switching the output.

Circuit components are conservatively rated and are protected against harmful transients which might occur. The equipment is designed to operate satisfactorily in ambient temperatures from -10°C to +55°C without auxiliary cooling equipment.

Where practical, electronic circuit components are assembled on modular printed-circuit boards, each with its individual terminal block located at the front of the board for off-board connections.

POWER SUPPLY

Each supplementary control panel equipment is furnished with its own power supply, arranged to utilize power from the same AC source that supplied auxiliary power to the voltage regulator. Maximum power requirement will be 500 VA, single-phase, 60 Hz, 230, 460, or 575 volts.

INSTALLATION

MOUNTING

The supplementary control panel equipment will be furnished completely mounted and wired on a steel panel. All connections will be made at the front with components and connections arranged for maximum accessibility.

The panel will be mounted and wired with the regulator, when ordered with new excitation controls.

The panel may be furnished (for existing regulators) mounted in a rigid, self-supporting sheet steel NEMA I, indoor enclosure with full length, hinged front door. Louvered openings will be provided as required for proper cooling. This enclosure will be suitable for either floor or wall mounting.

Approximate dimensions of the enclosure will be 60 inches high by 28 inches wide by 18 inches deep. An additional 14 inches is required for the door opening.

INTERCONNECTIONS

CAUTION

A very high AC gain is developed in this panel and care must be used in connecting the input signal. The AC gain will change with a change in time constant. Refer to the following recommendations.

Signal Input

For the speed signal, use a three-conductor shielded lead from the tachometer to the control panel. Tie the shield to common at the control panel.

For the frequency signal, use a three-conductor shielded lead from the potential transformer secondaries to the control panel (100 - 130 volt).

Auxiliary Power

Use two leads for single phase AC input power (500 volt amps).

Output to Regulator

Use a two-conductor lead for transmitting the power system stabilizer signal from the panel to the regulator amplifier circuit. The lead should be shielded if the distance is over 10 feet.

Permissive Contact

A permissive contact (N. O.) from the line breaker is required to permit the supplementary control panel signal to modulate the excitation only while the generator is connected to the load. The speed may vary several percent with the machine disconnected from the system and should not modulate the excitation.

Remote Control (Optional)

Local control and indication are provided. A three-conductor lead is required for remote ON, OFF control and a two-conductor lead is required for an ON indicating light. A two-conductor lead is required for an alarm from the time delay relay contact. A two-conductor lead is necessary from the output to a remote indicating meter (2000 ohm per volt). (Scale 10-0-10 volts)

SETTINGS AND ADJUSTMENTS

The time constants can be set with the potentiometer using Graph 1. A typical reference is the elementary diagram (Figure 1).

An arbitrary set of time constants with gain and phase is plotted against radians as shown on Graphs 2 and 3.

The adjustments are best derived from an analytical group or from the General Electric Company. Contact your local Sales Office. A paper, "Concepts of Synchronous Machine Stability as Affected by Excitation Control", by F. P. deMello and C. Concordia may also be used as a reference (68TP129PWR).

The amplifier will require a minimum of three minutes, after the power has been turned on, to settle down. The output meter (L1M) is connected to read before and after the output so that the control can be zeroed before being switched to the regulator. With a zero input signal the meter should settle to zero as the amplifiers settle down. With a steady tach signal the meter will read zero and will increase in jitter as the gain is increased.

A JOG pushbutton is provided for TEST and will (with tachometer input) cause a momentary negative output (. 04 second) as the JOG is depressed. A momentary positive output will result as the pushbutton is released.

The jog test may result in the saturation of the amplifiers and produce an output as shown in pictures No. 1 and 3. The desired jog result is shown by readjusting the time constants to reduce the AC gain as shown in pictures No. 2 and 4.

The trace is taken in parallel with meter L1M, using 5 volts per centimeter vertical and . 5 second per centimeter sweep. The top picture is the Push and the lower trace is the Release jog. The sweep is right to left with positive toward the top, from zero.

The output of LA3 will be a lower voltage level and of the opposite polarity than LA4. The output of LA2 will have the same polarity as LA4, at a lower magnitude. The output of LA1 will have the same polarity as LA3 and will show the step function, decaying with the preset time constant.

Photographs 1 and 2 are with a speed or tachometer input.

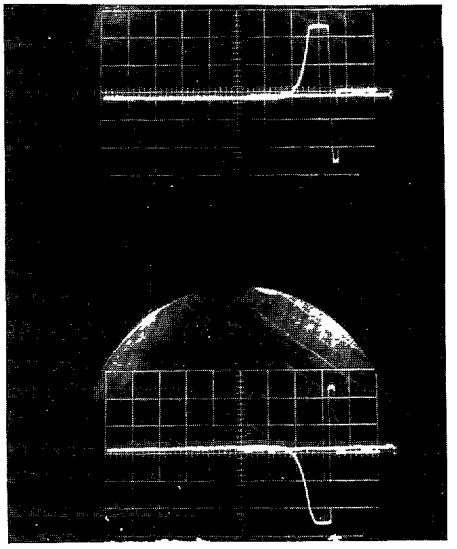
Photographs 3 and 4 are with frequency input on the 3S7932LA102G Series type controls, and were taken with the input voltage sensing removed. Note the opposite polarity with speed or with frequency sensing.

The following potentiometer settings were used with pictures 1, 2, 3, and 4.

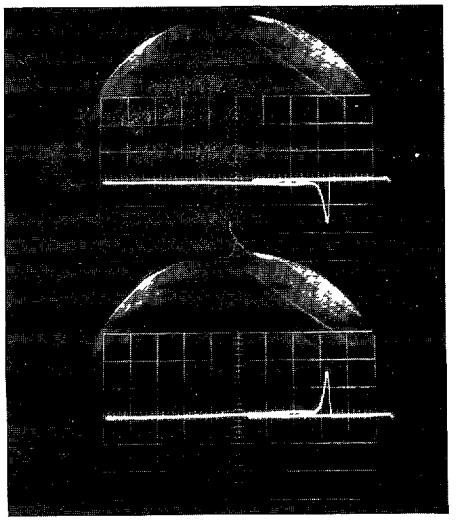
Potentiometer	Speed Input		Frequency	
	No. 1	No. 2	No. 3	No. 4
P1	5(A')	5(B')	5(A')	5(A')
P2	9.3	1.5	9.3	4.0
P3	9.35	9.35	9.35	9.35
P4	9.35	1.5	9.35	4.0
P5	9.3	9.3	9.3	9.3
P6	030	030	030	030

With a frequency input, a positive momentary output will occur as the pushbutton is depressed and a negative output will result when released. The magnitude will increase as the gain adjust is increased.

It might be well to start with the resistance of P14 in the circuit (decreased gain). The output should be at zero when switching the supplementary control panel to the regulator.



Photograph No. 1



Photograph No. 2

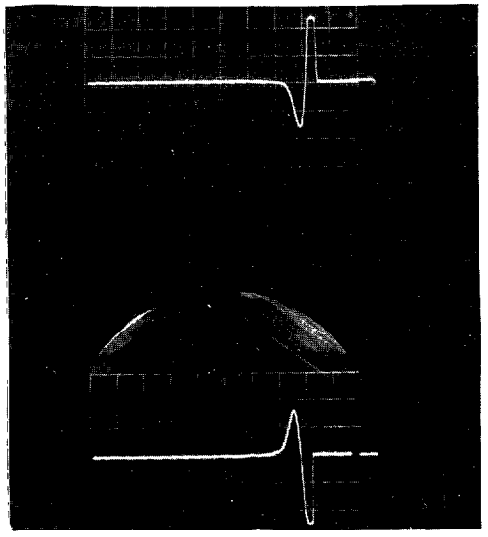
TACHOMETER INPUT

The tachometer signal is put into an isolating transformer and has a taped winding to hold 100 volts, ±10% on the rectified output. A 1% speed change will give a 1 volt change.

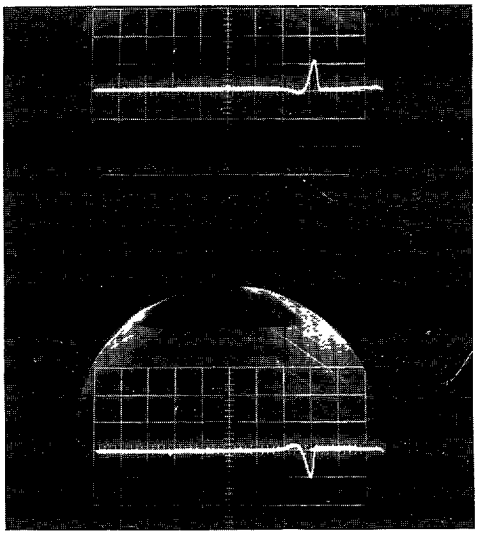
FREQUENCY INPUT

Frequency Transducer (Reference 44C301602)

The Circuit converts 115 volts, 3-phase variable frequency into (-) 3 volts DC that varies with frequency. The gain of the circuit is controlled with 48R and has a nominal gain setting of 1 volt change with a 1% change in frequency ±10%.



Photograph No. 3



Photograph No. 4

Transistors 1 through 12 multiply the circuit frequency by 4 to develop a high response charge on 14C capacitor (. 02 Sec).

The base of 15Q acts like a summing junction of an amplifier with 43R being the input and 48R the feedback and a bias adjust and resistor 51R.

The voltage on the emitter of 13Q and 14Q operates at (+)8 volts ±10%.

Pulses are collected from the 12 transistors and passed through diodes 13, 14, 15, and 16 to the base of 13Q.

The pulses are then amplified and squared up with 14Q. Each of the 12 transistors is turned on as the transformer pulse goes positive. The coupling capacitor 1C on the collector of 1Q is at +15 volts and is suddenly reduced to zero when the 1Q transistor is turned on. A negative spike is picked up by 13D diode and used to charge up 14C capacitor. The rate at which the pulses are collected on 14C determine the output voltage. A 60-cycle input will put 720 pulses per second at the collector of 14Q.

The output of the frequency to voltage converter has a voltage range from (-)8 volts to zero. With nominal frequency and voltage on the input, adjust the bias to - the approximate center of this range (-3) volts DC ±20%. The bias trim potentiometer is located near the terminal board E-3.

NOTE

The input is not voltage sensitive but is phase sensitive and may require an independent set of potential three-phase transformers or a set of three transformers with a balanced load. It is not recommended that a set with open delta connections be used unless it would be isolated and used only with this control.

SUPPLEMENTARY CONTROL PANEL FOR TYPE 101 REGULATORS (3S7932LA101G1 and G2)

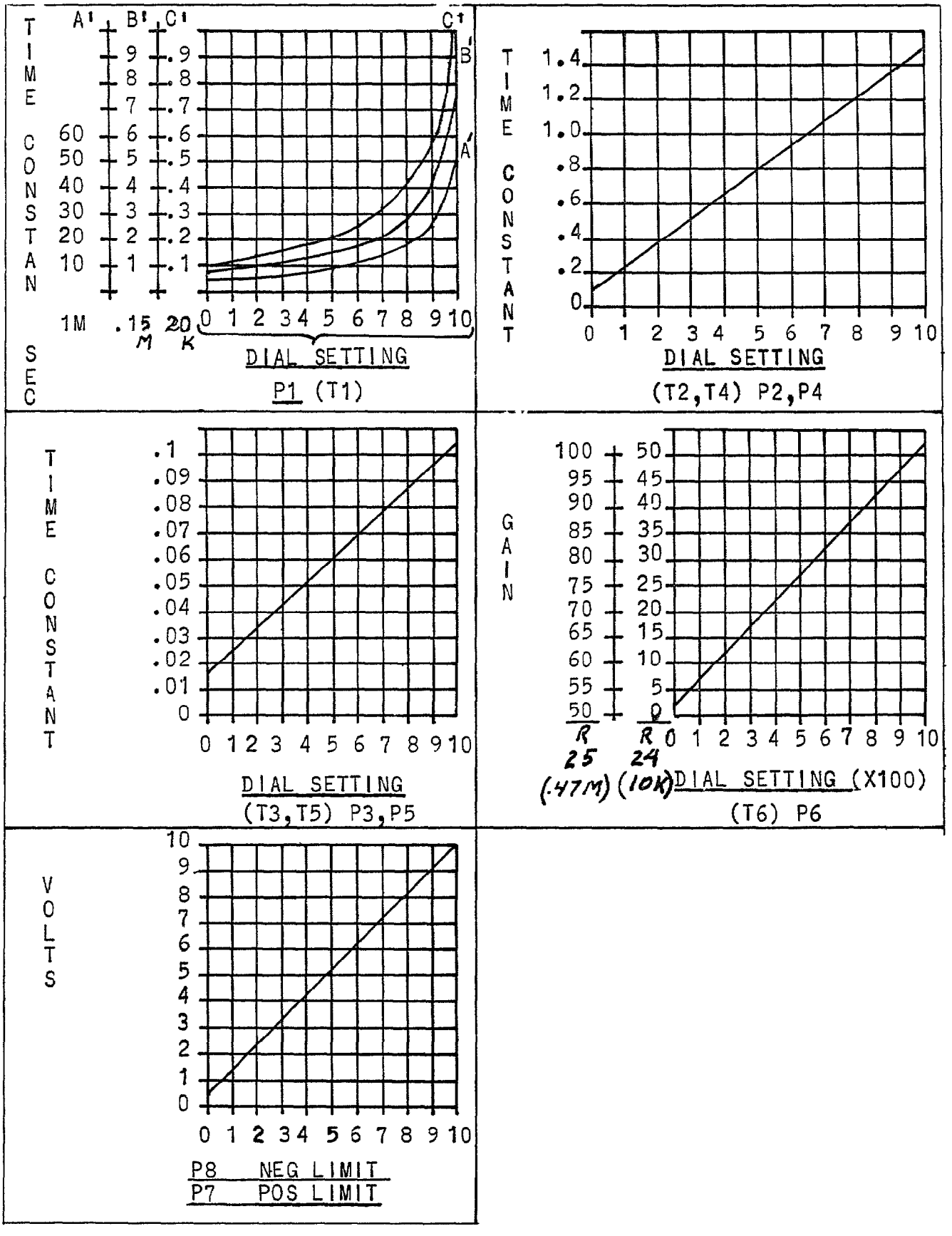
The existing Type 101 regulators described in Instruction Book GEI-31260 required an amplifier for boosting and one for bucking the output of the voltage regulator. This is included with the 3S7932LA101 model supplementary control panel.

The output of the supplementary control panel has a power transformer with a secondary voltage of 145 volts ±10%. A high impedance series resistor is provided to prevent the voltage regulator from being affected by the addition of the supplementary control panel.

One end of the amplidyne field must be reconnected to the supplementary control panel to insert a resistor, to force the buck and the boost current from the supplementary control to divide evenly. (The resistor is provided.) The gain of the voltage regulator should be compensated by decreasing the resistance of (A4R) 10-15%.

Each output is controlled by two SCR's which have a saturable reactor winding in the gate. The series resistor is set to allow . 76 amperes maximum with the SCR full on. The bias is set to about .38 amperes from each boost and buck circuit (potentiometers 9 and 10). A pushbutton is provided to remove the buck or boost power for bias adjustment.

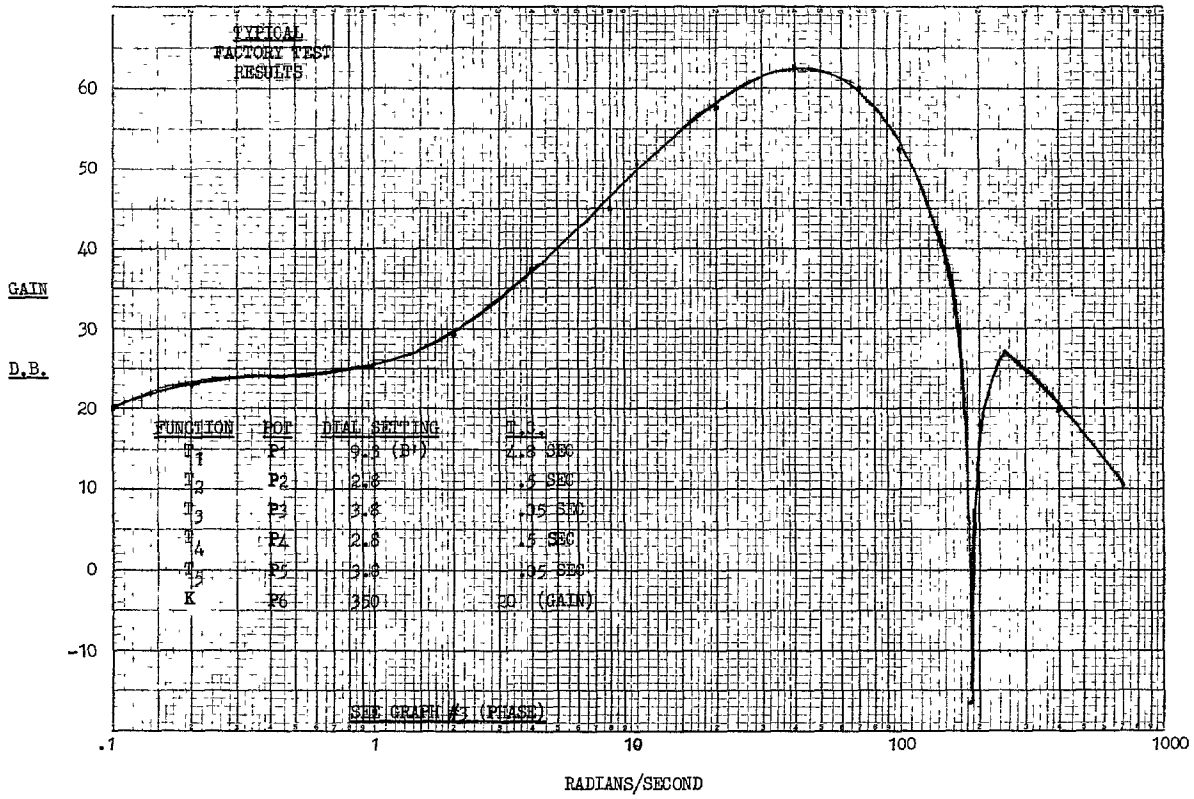
The output from the supplementary control panel signal conditioning circuit has a winding from the saturable reactor which turns the boost circuit on and the buck circuit off with a positive or increase in speed signal.



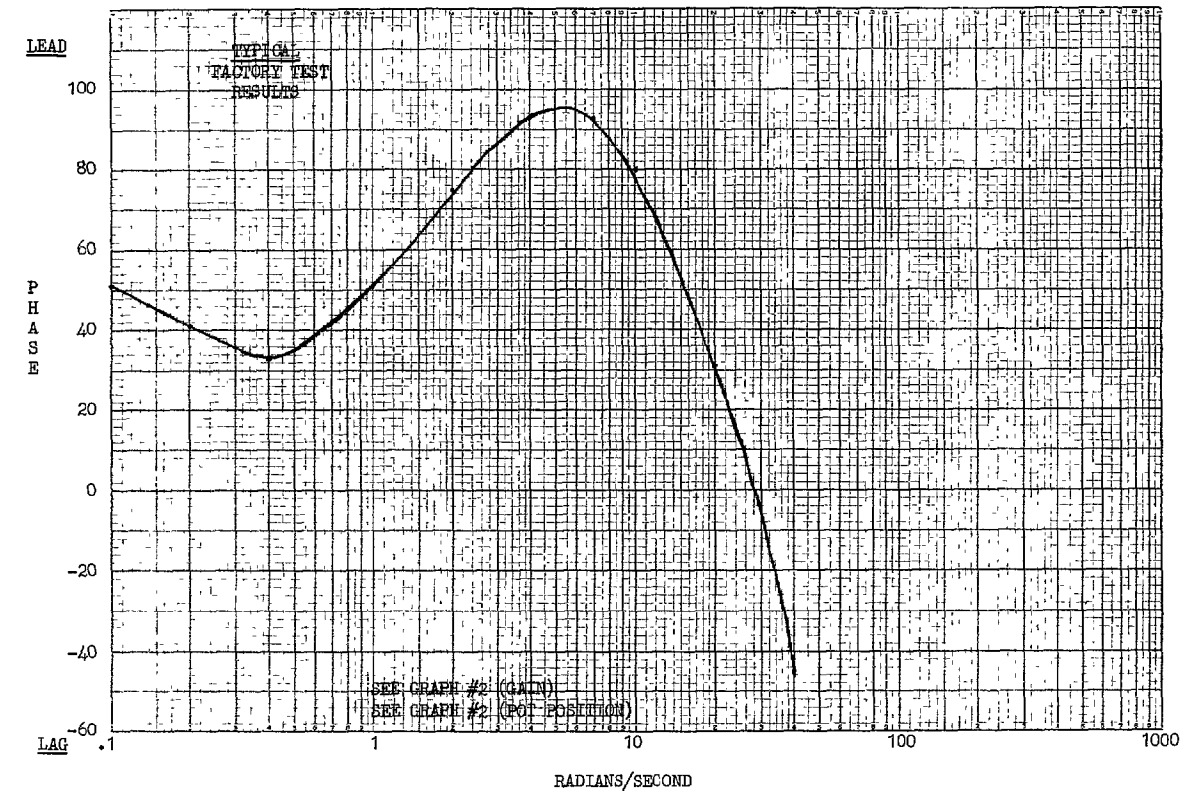
GRAPH #1

TYPICAL TIME CONSTANT-VS-POTENTIOMETER POSITION

GRAPH #2



GRAPH #3



The limit meter is shown in Figure 1 connected to the power stage used with type 101 regulators.

The voltage on L1M can be adjusted to zero with the meter L2M at zero, and at ± 10 volts when the circuit is driven to ± the maximum available.

Two 3.3K resistors are added in series from the Positive and Negative Boost Buck amplifiers to develop 10 volts across a variable 470 ohm resistor, with a Positive or Negative 10 volts out from the signal conditioning stage (Fig. 2). The limit meter can then be reconnected to this circuit to detect the true output of the Power System Stabilizer.

Component values are shown for the new circuit to develop ± 10 volts across reconnected (L1M) meter. The limit adjust in resistors R41 and R42 is sufficient to reduce the effectiveness 2:1 if this is desired (all resistance in).

FUNCTIONAL OPERATION

The rectified tach output is filtered and connected to an isolating capacitor so that the signal conditioning amplifiers will only see the change in speed or frequency. The capacitor is a special type with very low leakage.

There is one amplifier for each lead or lag or lead-lag function as required by the signal conditioning transfer function. The resistors and capacitors are mounted on a printed circuit board with the associated operational amplifier. The adjustments are made with potentiometers located adjacent to the amplifiers. (Refer to Figure 2.)

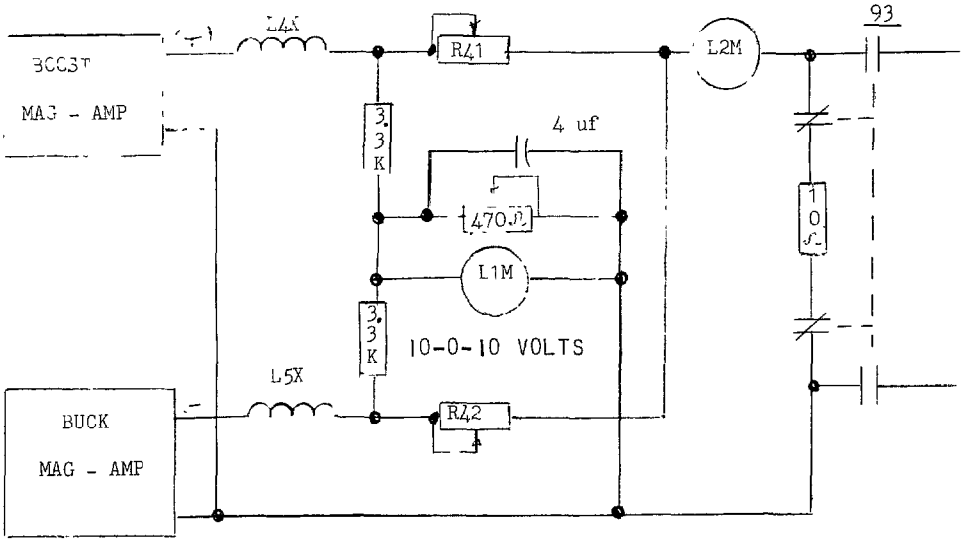


Figure 1

There are three ranges for T1 function with 30% overlap between ranges. The range is selected by changing the connection to the proper terminal. (Refer to Figure 2 and Graph 1.)

There are two ranges for gain (K). The equipment is furnished with a jumper on the gain amplifier board which puts the gain in the low range (1-50). The jumper is located on the amplifier board just back of the terminal board. Removing the jumper will give 50-100 range on gain.

An increase in speed or frequency will give the regulator a signal to increase the excitation.

GAIN

The overall gain of the supplementary control panel is as follows. A 1% speed change per second will drive the excitation to a level equivalent to a 1% voltage change. The gain adjustment (P6) should be at zero. There is an additional potentiometer (P14) in the output that should be shorted. The adjustment of P14 can be set to decrease the gain to 1/3 or 1/10. (Note Graph No. 1)

TACHOMETER MODULATION

There is a slight modulation in the tach signal on each revolution due to unbalance or vibration or misalignment. This develops a 30 Hz modulation on the 1800 RPM machines and a 60 Hz modulation with 3600 RPM machines. A Twin-T filter has been inserted on the second amplifier to tune-out this specific frequency.

TWIN-T FILTER

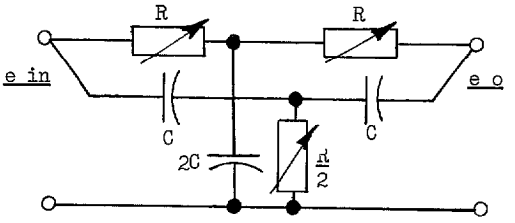
The filter has been carefully adjusted for the specific machine speed for which the panel was ordered. The filter is made with 5 μf capacitors and resistors adjusted for value to 60 Hz attenuation. When 30 Hz is required, an additional 5 μf is added.

The adjustment of the Twin-T filter on frequency sensing controls or hydro driven controls may vary. Refer to note under frequency input. These units will be furnished with 30 Hz adjusted Twin-T filter but may be changed as needed. Calculations may be made as follows.
W_o = resonant frequency required for attenuation.

$$W_o = \frac{1}{RC} \qquad W_o = 2\pi f$$

CAUTION

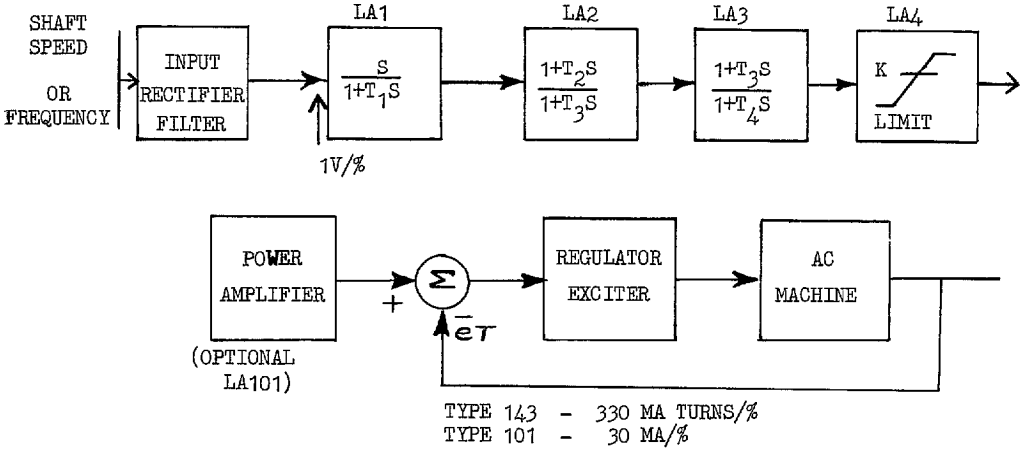
Decreasing the tuned frequency will cut into the response. Increasing the resistor above 530 ohms will also decrease response. For example, to change the tuned frequency from 30 Hz to 45 Hz, decrease the resistors from 530 ohms to 354 ohms.



TWIN-T FILTER

POWER SUPPLY

To hold down generated noise, the power supply was designed with a reference zener for each amplifier. The wiring has been twisted to prevent pickup and the common jumpered together in a sequence and tied to ground at the common of LA1.



BLOCK DIAGRAM

LIMIT

The amplifier, LA4, has a power stage on the output, Q1 transistor. The feedback circuit is taken from the emitter of Q1 and will control gain at that point. The limit adjustments feed back to the same amplifier through directional diodes. The position of P7 will hold the output from going further positive and the position of P8 will hold the output from going further negative. A setting of 10 on the dial will allow the output to go to (10) volts. A zero on the dial will hold output to (0. 6) volts.

OUTPUT

The output from the supplementary control panel will connect to the voltage regulator, peculiar to the specific regulator involved.

TROUBLE SHOOTING

Trouble	Fix
Output does not go to zero.	1. Remove tachometer input for initial check. 2. Check output voltage of each amplifier. Look for trouble in first amplifier in which voltage first appears. 3. Check supply voltages.
Low gain in output.	1. With oscilloscope on output, make sure amplifiers do not have high frequency oscillations. 2. Check supply voltages. 3. Open-circuit.

RENEWAL PARTS

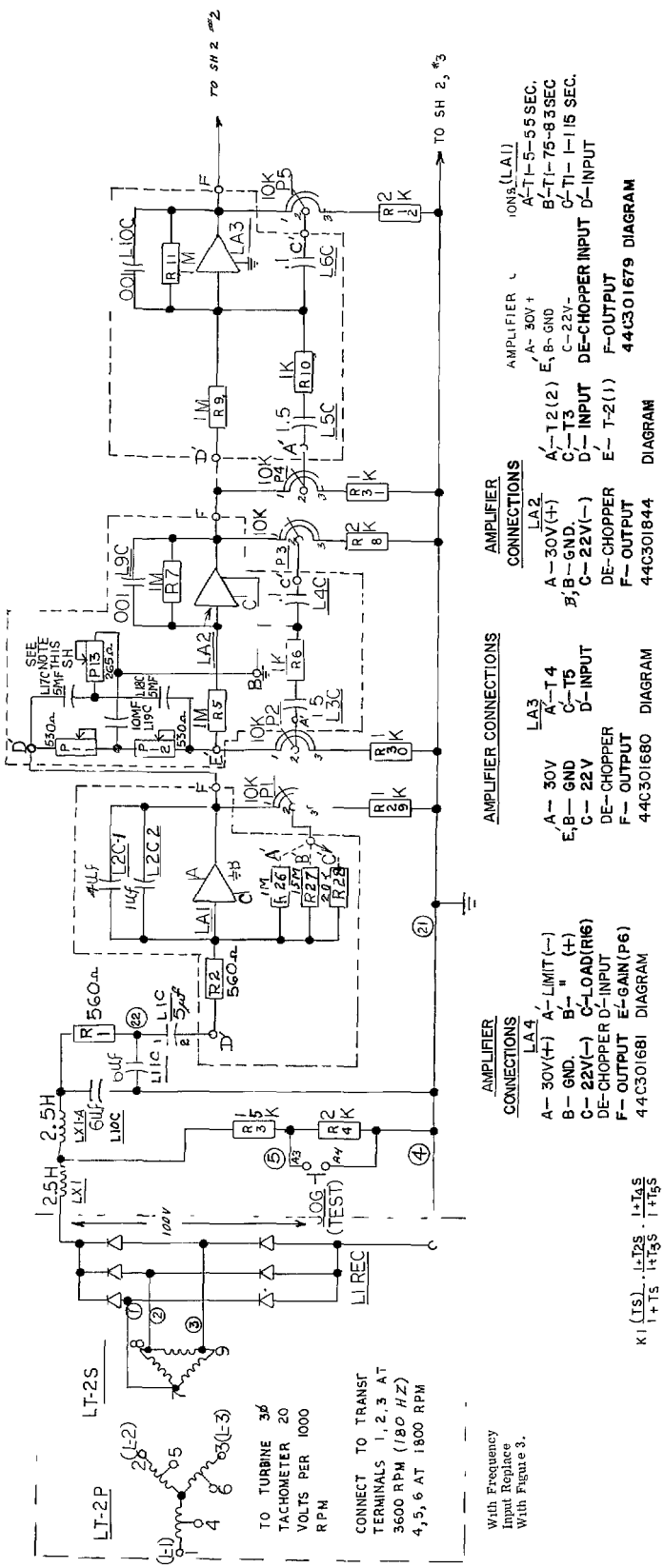
When ordering renewal parts, address the nearest General Electric Sales Office, specify the quantity required and give the rating and catalog numbers or describe the required parts in detail. In addition, give the 3S number and complete nameplate data.

PRINCIPAL RENEWAL PARTS LIST

Diagram Symbol	Ordering Number	Description	Quantity Model 3S7932LAA 100	101	102	103
LT2	44B317107-001	Transformer	1	1	-	-
Comp. Board	44C384427G01	Filter Board	1	1	-	-
	44C384427G02	Filter Board	-	-	1	1
	44C384427G03	Filter Board (G2)	1	-	-	-
	44C384427G04	Filter Board (G3)	1	-	-	-
L1C	44B312446-J50	Capacitor	1	1	1	1
P1-P5, P7, P8	44B313929-G10	Rheostat	7	8	7	-
P1-P5	44A335861-G10	Rheostat (G2)	-	-	-	5
P7, P8	44A335861-F25	Rheostat	-	-	-	2
P6	K9770328H50	Potentiometer	1	1	1	1
LA1	44D236386-G01	A. Amplifier (G1, G2)	1	1	1	-
LA2	44D331902-G01	A. Amplifier (G1, G2)	1	1	1	-
LA3	44D236386-G02	A. Amplifier (G1, G2)	1	1	1	1
LA4	44D236386-G03	A. Amplifier	1	1	1	1
LA1, LA2	44D331903-G02, G03	A. Amplifier (G3)	1	-	-	1
JOG	CR103DN1C1	Pushbutton	3	5	3	5
L1M	44B313992-002	Meter Relay	1	1	1	1
ON	327	Lamp	3	3	3	5
L1Z	1N2823B	Zener	1	1	1	1
L2Z	1N2819RB	Zener	1	1	1	1
P14	M9729433F50	Rheostat	1	-	1	1
P14	M9729433G10	Rheostat	-	1	-	-
L1T	44B317098-001	Transformer	2	1	2	1
L1TA	44B317211-001	Transformer	-	1	-	1
10-17REC	44B232019-005	Rectifier	8	8	8	10

Diagram Symbol	Ordering Number	Description	Quantity Model 3S7932LA 100	101	102
L1TH	6RS20SC4D4AB	Thyrector	2	2	2
L3TH	6RS20SP8B8	Thyrector	-	2	-
L2X	44B211629-001	Choke	2	2	2
R33	M9729441E10	Resistor	1	1	1
R34	M9729441E12	Resistor	1	1	1
L3Z	1N2995B	Zener	-	1	-
P9	M9729433G10	Rheostat	-	2	-
LA3	44D236386-G04	A. Amplifier (G3)	1	-	-
L14C	43F3073CA4	Capacitor	2	2	2
R43-48	K8622213E68	Resistor	6	6	6
L4, 6, 8Z	1N2989B	Zener	3	3	3
L5, 7, 9Z	1N2985RB	Zener	3	3	3
93	3S2791G138D3	Relay	1	1	1
T1R	44A211228-002	Relay	1	1	1
T1R	44A211228-005	Relay (G2)	-	1	-
93	44A332104-001	Relay (G3)	1	-	-
93A	12HGA11H52	Relay (G1)	-	1	-
93A	12HGA11H51	Relay (G2)	-	1	-
R15	K8622213G10	Resistor (G2)	-	1	-
R32	K8622213D10	Resistor	-	1	-
R35	K8622213E56	Resistor	-	1	-
R40	K8622213C33	Resistor	-	1	-
L1T	44B317240-001	Transformer (G03)	2	-	-
L4Z	1N2979B	Zener (G03)	1	-	2
L5Z	1N2979RB	Zener (G03)	1	-	-
P15	44B313929-E50	Pot (G03)	1	-	-
F1, F2	K9774701P2	Fuse 3A, 600V	2	2	2
F3, F4	K9774700P2	Fuse 3A, 250V	2	2	2
L2M	933B579P29	Meter 10-0-10	-	1	-
L1TA	44B317211-001	Transformer	-	1	-
L4X	44B211608-001	Reactor	-	2	-
R41, R42	M9729479E24	Resistor	-	2	-
1CB	3S7932MA294G1	Comp. Board	-	1	-
2CB	3S7932MA294G2	Comp. Board	-	1	-
DIAL (P6)	44A216204-001	Digidial	1	1	1
1SCR	44B212739-007	SCR	-	4	-
1	44D236382-G01	Frequency	-	-	1
2	44D236380-G01	To Voltage	-	-	1
3	44D236381-G01	Converter	-	-	1
PORTION OF BOARD COMPONENTS					
	44D236382-G01		-	-	1
		Qty.			
1T, 2T, 3T	44B317062-001	Transformer (3)			
10R	K8622212E22	Resistor (1)			
28R	K8622212E10	Resistor (1)			
	44D236380-G01		-	-	1
1Q-12Q	44B311057-002	Transistor (12)			
	44D236381-G01		-	-	1
15Q, 16Q, 18Q-20Q	44B311057-002	Transistor (5)			
13Q, 14Q, 17Q	44B238203-001	Transistor (3)			

Diagram Symbol	Ordering Number	Description	Qty.		Quantity Model 3S7932LA 100	101	102	103
1Z, 2Z	1N752A	Zener	(2)					
51R ADJ	983B530F50	Bias Pot	(1)					
	44D236386-G01, G02, G03, G04				1	1	1	1
6Q, 13Q, 17Q	44B238203-001	Transistor	(3)					
1Q-18Q	44B311057-001	Transistor	(15)					
Q1	44B233176-001	Transistor	(1)					
	44C384427-G01, G02, G03, G04				1	1	1	1
LX1, 2	44B317144-001	Reactor	(2)					
L1REC	44B232011-001	Diode	(6)					
	44D331902-G01			(G1, G2)	1	1	1	-
1Q-18Q	44B311057-001	Transistor	(15)					
6Q, 13Q, 17Q	44B238203-001	Transistor	(3)					
P11, P12, P13	44A317710-F10	T. Pot	(3)					
L17C, 18C, 19C	983B579J50	Capacitor	(8)					
	44D331903-G02, G03			(G3)	1	-	-	1
LA1, LA2	44A319869-001	O. Amplifier	(2)					
P17, P18, P19	983B540F10	Potentiometer	(3)					
P16, P20	983B545G50	Potentiometer	(2)					

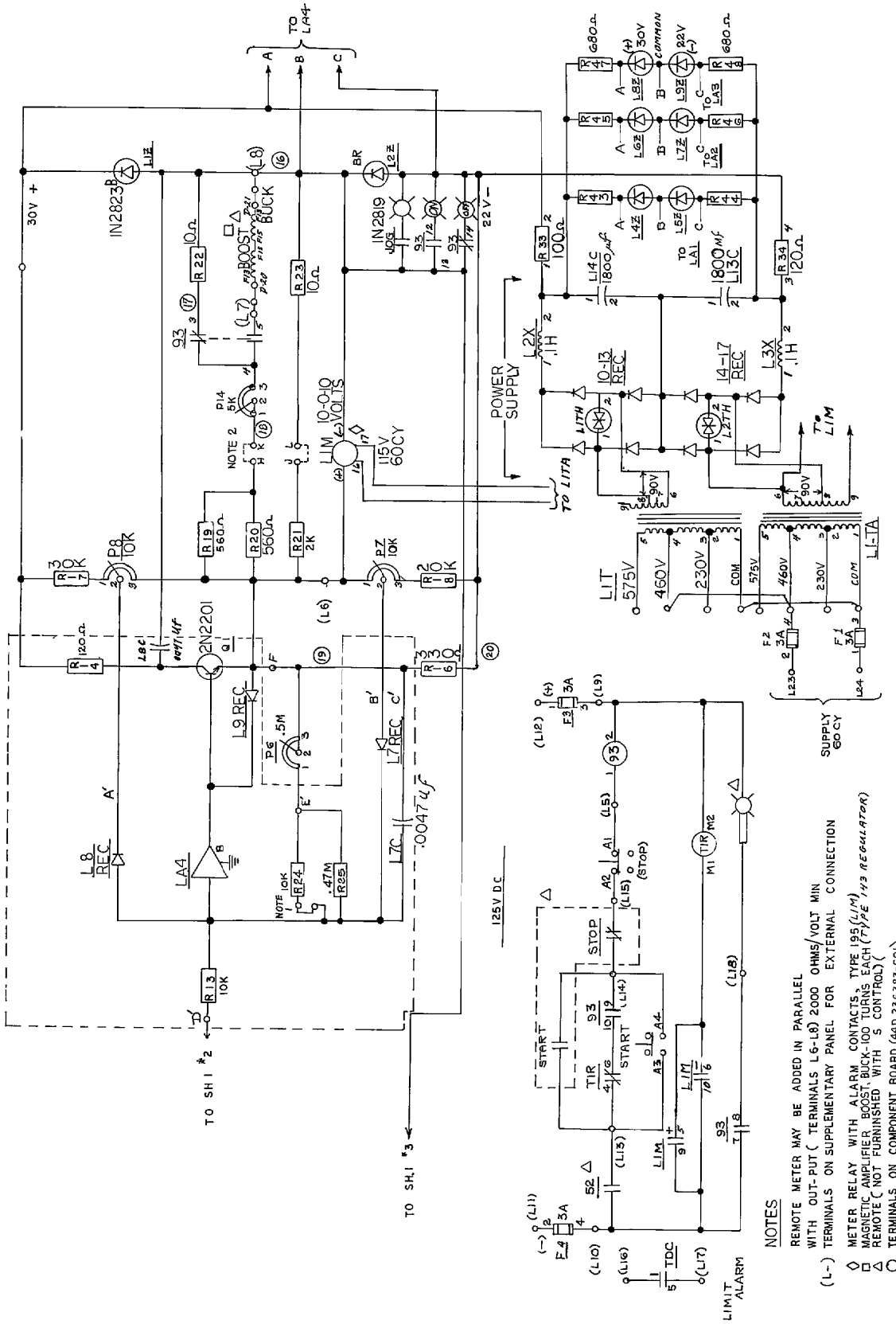


TYPICAL ELEMENTARY DIAGRAM OF 3S7932LA100 SUPPLEMENTARY CONTROL PANEL

Figure 2 (Sheet 1 of 2)

NOTE

VALUES FOR L17C, L18C, L19C, P11, P12, P13 ARE SHOWN NOMINAL FOR 3600 RPM GENERATORS. CAPACITOR VALUES WILL DOUBLE ON 1800 RPM GENERATORS CIRCUITS WILL BE FACTORY ADJUSTED FOR 60 CYCLE OR 30 CYCLE ON 3600 RPM OR 1800 RPM GENERATORS RESPECTIVELY



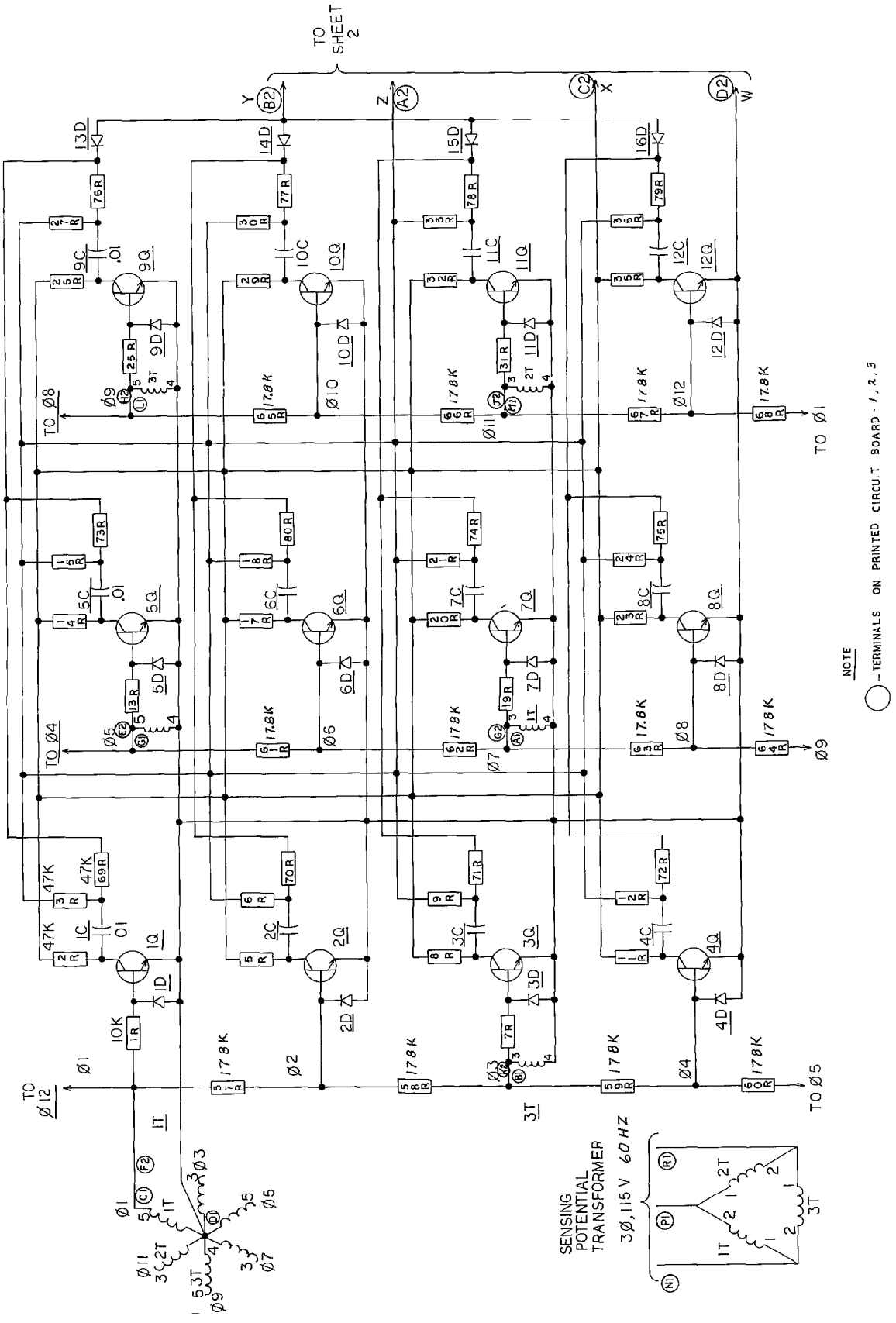
NOTES

REMOTE METER MAY BE ADDED IN PARALLEL WITH OUT-PUT (TERMINALS L6-L8) 2000 OHMS/VOLT MIN
(L-) TERMINALS ON SUPPLEMENTARY PANEL FOR EXTERNAL CONNECTION

◇ METER RELAY WITH ALARM CONTACTS, TYPE 195 (LIM).
□ MAGNETIC AMPLIFIER BOOST BUCK-100 TURNS EACH (TYPE 193 REGULATOR)
△ REMOTE (NOT FURNISHED WITH S CONTROL) (
○ TERMINALS ON COMPONENT BOARD (44D 236383-G01)
1A RANGE OF P6 1-50 WITH JUMPER IN PLACE
1B RANGE OF P6 50-100 WITH JUMPER REMOVED
2 JUMPER MAINTAIN IN HORIZONTAL POSITION

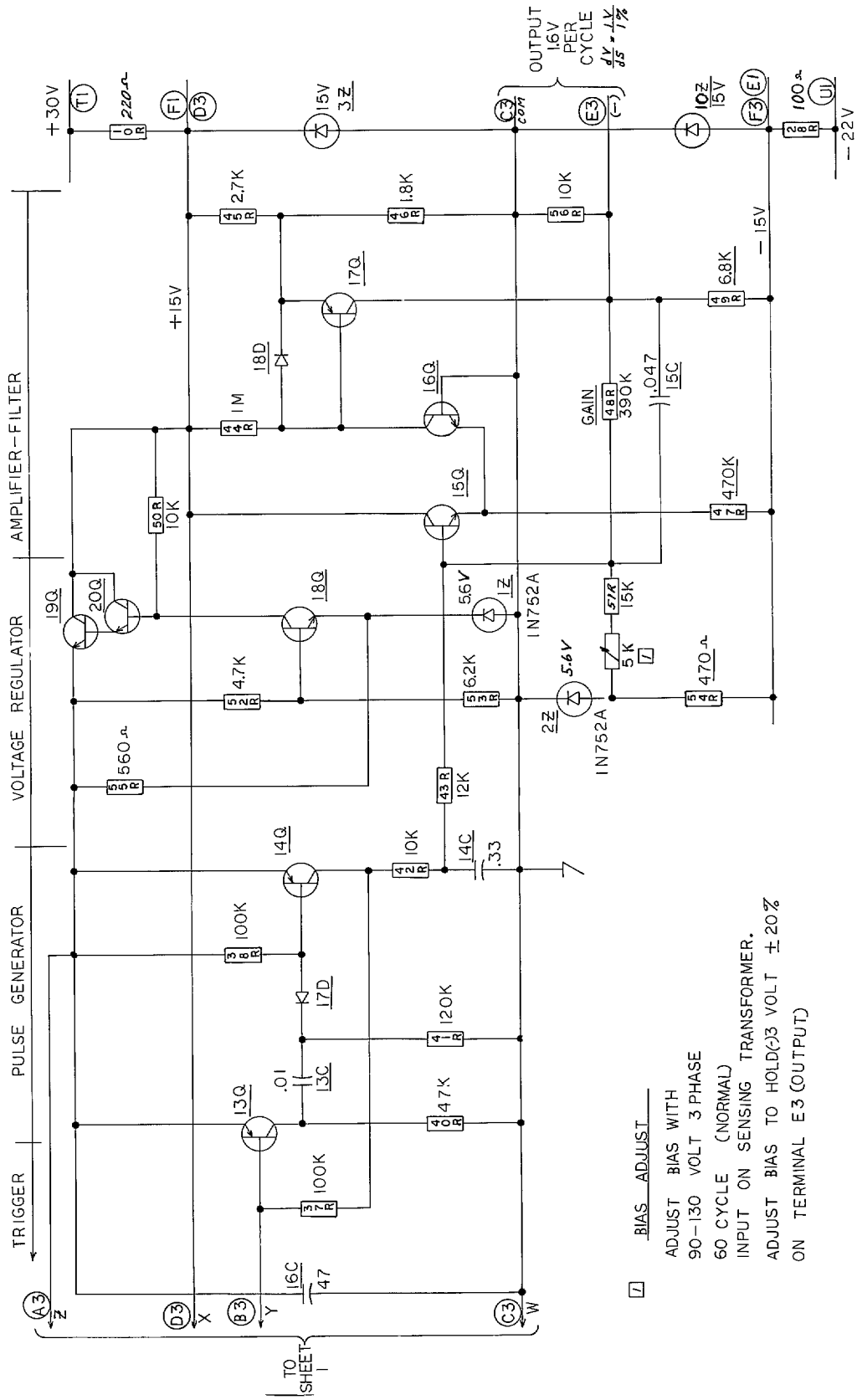
TYPICAL ELEMENTARY DIAGRAM OF 3S7932LA100 SUPPLEMENTARY CONTROL PANEL

Figure 2 (Sheet 2 of 2)



ELEMENTARY DIAGRAM OF FREQUENCY TRANSDUCER

Figure 3 (Sheet 1 of 2)



ELEMENTARY DIAGRAM OF FREQUENCY TRANSDUCER

Figure 3 (Sheet 2 of 2)

DRIVE SYSTEMS PRODUCT DEPARTMENT
GENERAL ELECTRIC COMPANY, WAYNESBORO, VIRGINIA 22980

2-74 (500)