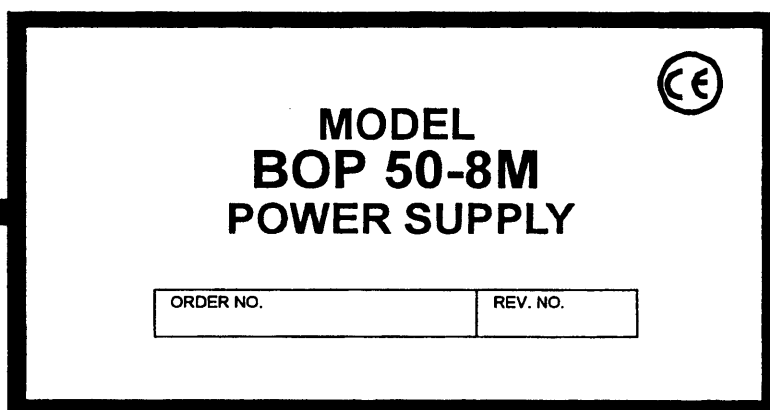


INSTRUCTION MANUAL

BOP 50-8M

OPERATIONAL POWER SUPPLY

KEPCO INC.
An ISO 9001 Company.



IMPORTANT NOTES:

- 1) This manual is valid for the following Model and associated serial numbers:

MODEL	SERIAL NO.	REV. NO.
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- 2) A Change Page may be included at the end of the manual. All applicable changes and revision number changes are documented with reference to the equipment serial numbers. Before using this Instruction Manual, check your equipment serial number to identify your model. If in doubt, contact your nearest Kepco Representative, or the Kepco Documentation Office in New York, (718) 461-7000, requesting the correct revision for your particular model and serial number.
- 3) The contents of this manual are protected by copyright. Reproduction of any part can be made only with the specific written permission of Kepco, Inc.

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5-9 TROUBLE SHOOTING

5-10 Trouble analysis of precision power supplies containing operational amplifiers requires a thorough understanding of the operational concept, experience with solid-state circuitry and appreciation of the problems encountered in closed-loop systems. Repair beyond simple part replacement and recalibration should therefore be handled only by personnel familiar with those concepts. "Trouble Shooting Charts" giving resistance and voltage ratings at various parts in the circuitry are of little value in feedback amplifiers and for this reason are not included here.

Instead, a systematic approach to trouble analysis is presented. Follow the flow diagram (FIG. 5-3) and refer to the applicable paragraphs. For further help in circuit analysis, refer to Section IV (Operational Theory and Circuit Description) and to the Main Schematic Diagram, Section VI (Fig. 6-5). For the actual repair and replacement of components refer to the Disassembly Diagram FIG. 5-1, the Parts Location Diagram, the Connection Diagram and the Replacement Parts List, in Section VI of this manual.

NOTE: KEPCO FIELD ENGINEERING OFFICES, AND THE KEPCO REPAIR AND APPLICATIONS ENGINEERING DEPARTMENTS, ARE ALWAYS AVAILABLE FOR PROMPT SERVICE IN DIFFICULT REPAIR OR APPLICATION CASES.

5-11 TROUBLE ANALYSIS

NOTE: The POWER STAGE consists of one heatsink assembly (A4) in BOP ¾ Rack models and of two heatsink assemblies (A4, A5) in BOP Full Rack models.

STEP NO. 1: Disconnect BOP from the a-c input source, from the load and from all auxiliary sources such as input signal generators, etc.

STEP NO. 2: Restore ALL jumper links on the rear barrier-strip and on the REAR PROGRAMMING CONNECTOR PC-12 to those for Standard Power Supply operation (see Section IV, FIG. 4-5).

STEP NO. 3: Perform the PRELIMINARY ELECTRICAL CHECK, as described in Section II of this manual. **If the BOP functions as described** in this operating mode, the trouble or malfunction must be traced to external causes or interface problems. Check all interconnecting wires between the input sources and the BOP, and all load and error-sensing wiring between the BOP and the load. **If the BOP does not function** in the standard power supply mode, proceed to Step No. 4.

STEP NO. 4: Follow the FLOW CHART (FIG. 5-3) and refer to the appropriate paragraphs.

5-12 DISCONNECT BOP FROM THE A-C POWER SOURCE and:

- A) Check if the BOP is set to the correct a-c input voltage. (See Section II, paragraph 2-4).
- B) Check if the thermo-switch (S401) in the POWER STAGE (A4) is open. Replace if defective. Check S501 in A5 if used. If it is not, check the power stage as described in paragraph 5-13B.

5-13 Check LED lamp DS103 and replace if defective.

- A) If there is no output voltage, check if the d-c control voltage reaches the E_o COMP AMP input by placing a voltmeter from COMMON to pins 5,17 on the REAR PROGRAMMING CONNECTOR (PC-12). The voltage read-out should be from (-)10 volt, over zero, to (+)10 volt, as the front panel VOLTAGE CONTROL is turned from its maximum counterclockwise to its maximum clockwise position. If the control voltage is not as described, check the nominal voltages on the CONTROL ASSEMBLY (A1) as indicated on the MAIN SCHEMATIC DIAGRAM. Check for burned components. Check IC-1,2,3, zener diodes, CR6,7, PREAMP "A" (IC-5). Replace defective components.
- B) If the output voltage is high (either positive or negative) and not controllable by the front panel voltage control, check the DRIVER STAGE (A3) and the POWER STAGE as follows:
 - 1) FOR HIGH NEGATIVE OUTPUT: Remove Q301 from its socket. Output should now be zero. Replace Q301. If output is still high, investigate the other NPN drivers (if applicable) by replacing them with known functioning units. Check the POWER STAGE for shorted NPN power transistors. Replace defective units.
 - 2) FOR POSITIVE HIGH OUTPUT: Remove Q302 from its socket. Output voltage should now be zero. Replace Q302. If output is still high, investigate the other PNP drivers (if applicable) by replacing them with known functioning units. Check the POWER STAGE for shorted PNP power transistors. Replace defective units.
- C) If the I_o LIMIT LED light is on, and the POWER STAGE is functioning, remove IC-9 from its socket. Replace if defective. **NOTE: Make certain when reinserting any IC, that pin 1 of the IC is oriented toward the marker placed near each IC socket on the CONTROL ASSEMBLY (A1) printed circuit board.**

5-14 Check LED lamp DS104 and replace if defective.

- A) If there is no output current, check if the d-c control voltage reaches the I_o COMP AMP input by placing a voltmeter from COMMON to pins 2,19 on the REAR PROGRAMMING CONNECTOR (PC-12). The voltage read-out should be from (-)10 volt, over zero, to (+)10 volt, as the front panel CURRENT CONTROL is turned from its maximum counterclockwise to its maximum clockwise position. If the control voltage is not as described, check the nominal voltages on the CONTROL ASSEMBLY (A1) as indicated on the MAIN SCHEMATIC DIAGRAM. Check for burned components. Check IC-1,2,3, zener diodes CR6,7, PREAMP "B" (IC-6). Replace defective components.
- B) If the output current is high (either positive or negative) and not controllable by the front panel CURRENT CONTROL, check the DRIVER STAGE (A3) and the POWER STAGE as follows.
- 1) FOR HIGH NEGATIVE OUTPUT: Remove Q301 from its socket. Output should now be zero. Replace Q301. If output is still high, investigate the other NPN drivers (if applicable) by replacing them with known functioning units. Check the POWER STAGE for shorted NPN power transistors.
 - 2) FOR POSITIVE HIGH OUTPUT: Remove Q302 from its socket. Output should now be zero. Replace Q302. If output is still high, investigate the other PNP drivers (if applicable) by replacing them with known functioning units. Check the POWER STAGE for shorted PNP power transistors. Replace defective units.
- C) If the E_o LIMIT LED light is on, and the POWER STAGE is functioning, remove IC-9 from its socket. Replace if defective. **NOTE:** Make certain when reinserting any IC, that pin 1 of the IC is oriented toward the marker placed near each IC socket on the CONTROL ASSEMBLY (A1) printed circuit board.

5-15 If the BOP functions correctly after the load has been removed (Voltage Mode), or after a short circuit has been placed across the output terminals (Current Mode), investigate your load condition:

NOTE: For VOLTAGE MODE operation, your minimum load resistance ($R_{L\ MIN}$) is given by:

$$R_{L\ (MIN)}\ (K\Omega) = \frac{\text{OUTPUT VOLTAGE SETTING (VOLTS)}}{\text{CURRENT LIMIT SETTING (mA)}}$$

Any load resistance SMALLER than $R_{L\ (MIN)}$ will transfer the BOP into the CURRENT LIMIT MODE (Current Limit Light "on").

NOTE: For CURRENT MODE operation, your maximum load resistance ($R_{L\ MAX}$) is given by:

$$R_{L\ (MAX)}\ (K\Omega) = \frac{\text{VOLTAGE LIMIT SETTING (VOLTS)}}{\text{OUTPUT CURRENT SETTING (mA)}}$$

Any load resistance GREATER than $R_{L\ (MAX)}$ will transfer the BOP into the VOLTAGE LIMIT MODE (Voltage Limit Light "on").

5-16 OPERATIONAL POWER SUPPLY PERFORMANCE MEASUREMENTS

5-17 **GENERAL.** Measurements to verify the performance specifications are a frequent requirement of "Incoming Inspection" departments, as a part of a routine maintenance program or as a part of repair procedures. Some operational power supply measurements (OUTPUT IMPEDANCE, DRIFT, TEMPERATURE COEFFICIENT, etc.) require specialized test equipment and /or a controlled environment, and are therefore not described here. For information on these measurements, consult the Kepco Engineering Test Department. The measurements described in the following paragraphs, require only a minimum of equipment, and are generally sufficient to verify the most important d-c and dynamic performance specifications.

5-18 REQUIRED INSTRUMENTATION

- A) **STABILIZED A-C INPUT SOURCE**, with provisions for "stepping" the voltage over the specified a-c input range (105 to 125V or 210 to 250V). A variable AUTO-TRANSFORMER is generally adequate if it can deliver the required a-c input current.
- B) **RESISTOR LOAD**, variable, capable of dissipating the full d-c output power of the unit under test and equipped with "on-off" and "shorting" switch (S1).
- C) **D-C VOLTAGE MONITOR**, digital or differential voltmeter with a suitable voltage range for the model under test and able to resolve at least 1 microvolt (M1).
- D) **OSCILLOSCOPE**, vertical sensitivity at least 10 mV/cm and with a minimum bandwidth of 10 megahertz.
- E) **SQUARE-WAVE GENERATOR**, with a variable output amplitude of 0-10 volts into 600 ohms and rise time of at least 0.1 microseconds. A "floating output", where the signal is available either in positive or in the negative direction is desirable.

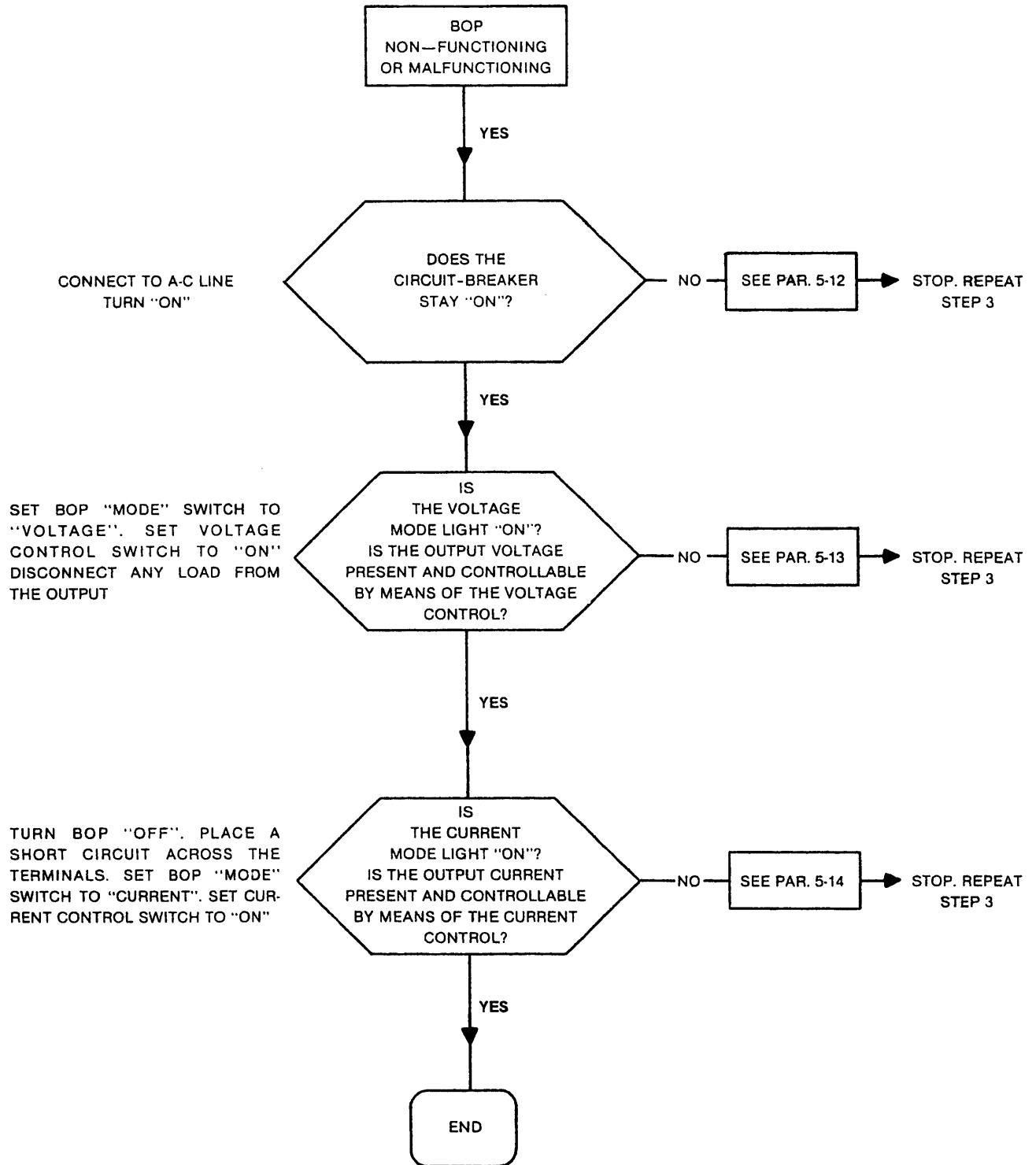


FIG. 5-3 TROUBLE SHOOTING, FLOW DIAGRAM

- Notes:
- 1) Front and rear sensing links must be removed.
 - 2) PC-12, wired for local (front panel) control must be connected (see Sect. IV, FIG. 4-5).
 - 3) Mode Switch position: "VOLTAGE".

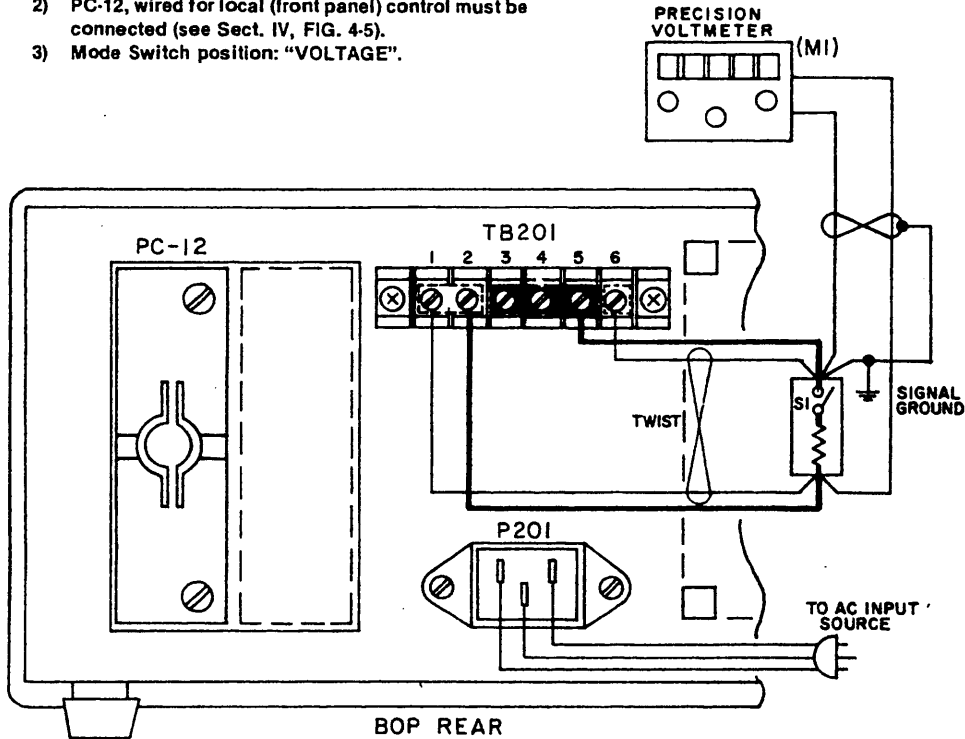


FIG. 5-4 OUTPUT EFFECT MEASUREMENTS, VOLTAGE CONTROL CHANNEL (TEST CIRCUIT).

5-19 OUTPUT EFFECT MEASUREMENTS, VOLTAGE CONTROL CHANNEL. The output effects due to load or a-c input source changes in the voltage mode can be measured with the circuit shown in FIG. 5-4. These output effects ("SOURCE EFFECT" and "LOAD EFFECT") are defined as the amount of output voltage change resulting from specified variations in the a-c source voltage, or from a change in load resistance (see Section I, Table 1-2). The output effects can be expressed as an absolute change (ΔE_o) or as a percentage of the total output voltage (E_o):

$$\% \text{ OUTPUT EFFECT} = \frac{\Delta E_o}{E_o} \times 100\% \text{ (Eq. 5-1).}$$

(Source or Load Effect)

where: ΔE_o = Change in output voltage
 E_o = Total output voltage

5-20 PROCEDURE (Refer to FIG. 5-4)

- 1) Connect the BOP to a metered a-c input source, such as described in Paragraph 5-18A.
- 2) To measure the SOURCE EFFECT, vary the a-c source voltage over the specified range (105 to 125V or 210 to 250V) and note the deviation (ΔE_o) on the PRECISION VOLTMETER (M1).
- 3) To measure the LOAD EFFECT, open and close the load switch (S1) and note the deviation (ΔE_o) on the PRECISION VOLTMETER (M1).
- 4) From the results of the two previous measurements, calculate the Source Effect and the Load Effect by means of equation (5-1).

- Notes: 1) PC-12, wired for local (front panel) control (see Sect. IV, FIG. 4-5).
2) Mode Switch position: "VOLTAGE".

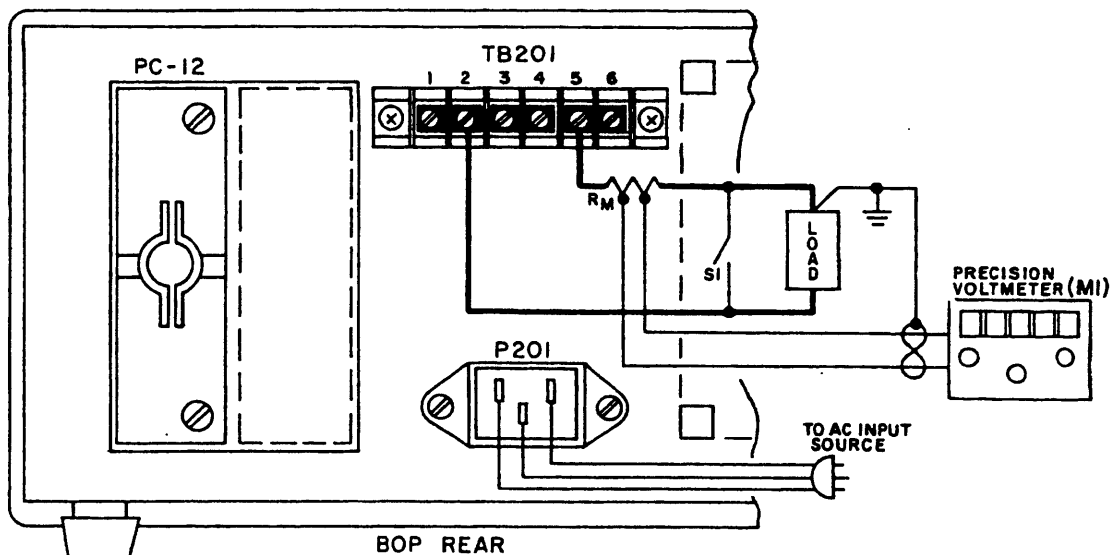


FIG. 5-5 OUTPUT EFFECT MEASUREMENTS, CURRENT CONTROL CHANNEL (TEST CIRCUIT).

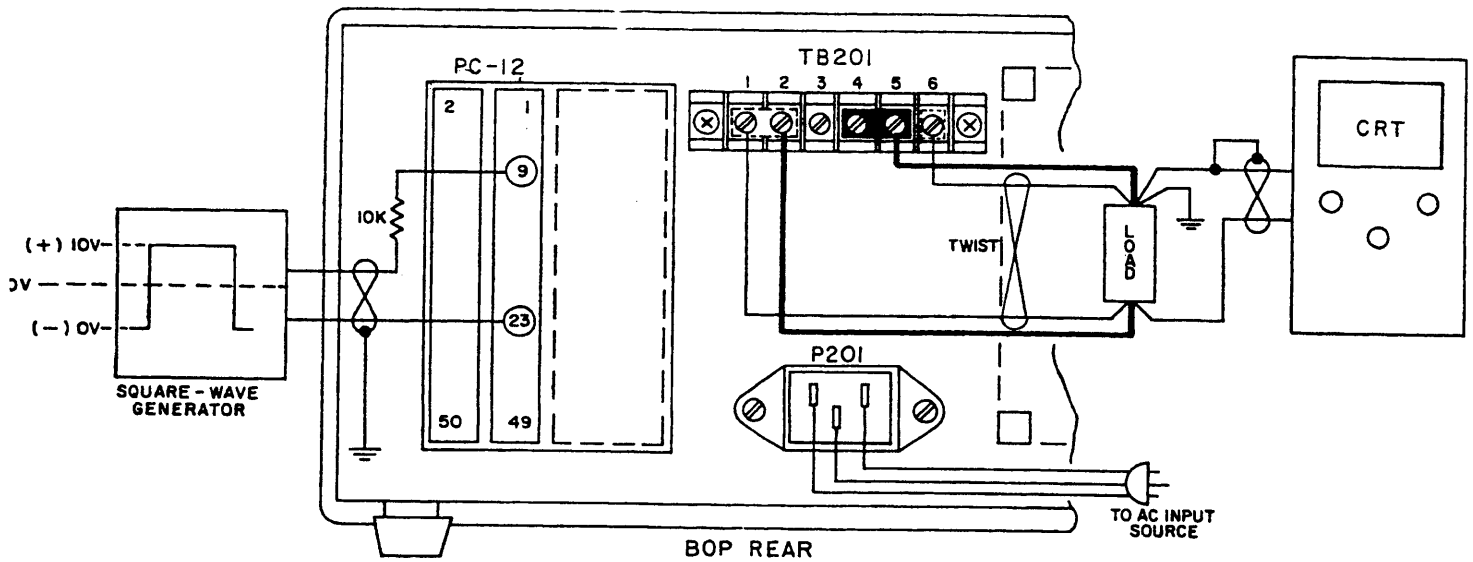
5-21 OUTPUT EFFECT MEASUREMENTS, CURRENT CONTROL CHANNEL. The output effects due to a-c source or d-c load variations in the current mode can be measured with the circuit shown in FIG. 5-5. These output effects ("SOURCE EFFECT" and "LOAD EFFECT") are defined as the amount of output current change resulting from specified variations in the a-c source voltage, or from a change in load resistance (see Section I, Table 1-2). The output effects can be expressed as an absolute change (ΔI_o) or as a percentage of the total output current (I_o):

$$\% \text{ OUTPUT EFFECT (Source or Load Effect)} = \frac{\Delta I_o}{I_o} \times 100\% \text{ (Eq. 5-2).}$$

where: ΔI_o = Change in output current
 I_o = Total output current

5-22 PROCEDURE (Refer to FIG. 5-5)

- 1) Connect the BOP to a metered a-c input source, such as described in Paragraph 5-18A.
- 2) To measure the SOURCE EFFECT, vary the a-c source voltage over the specified range (115 to 125V or 210 to 250V) and note the deviation (ΔV divided by $R_M = \Delta I_o$) on the voltmeter (M1 across R_M).
- 3) To measure the LOAD EFFECT, close the load switch (S1) and note the deviation ($\Delta V/R_M$) on the voltmeter (M1 across R_M).
- 4) From the results of the two previous measurements, calculate the Source Effect and the Load Effect by means of equation (5-2). Note: $\Delta I_o = \Delta V/R_M$.



A) TEST SET UP

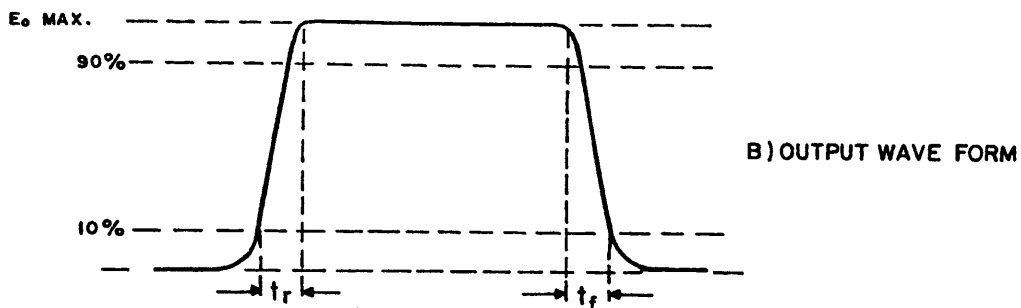


FIG. 5-6 MEASUREMENT OF THE RISE AND FALL TIME

5-23 DYNAMIC MEASUREMENTS. The verification of the specification for the RISE AND FALL TIME are excellent means of checking the dynamic performance of the BOP. In this test, the output voltage rise and fall time of the BOP is measured in response to a square wave input.

5-24 PROCEDURE (Refer to FIG. 5-6)

- 1) Connect the BOP and the external instrumentation as shown in FIG. 5-6. **Note:** The Signal Generator may be connected (without the 10K Ω resistor) to the BOP front panel VOLTAGE PROGRAMMING INPUT terminals.
- 2) Turn BOP "on". Adjust the gain of the SQUARE WAVE GENERATOR until the output wave form, displayed on the OSCILLOSCOPE shows a peak amplitude of $E_o \text{ max}$, where " $E_o \text{ max}$ " is the maximum rated BOP output voltage.
- 3) Measure the rise and fall time of the displayed wave form from 10% to 90% of the displayed amplitude.

SECTION VI—ELECTRICAL PARTS LIST AND DIAGRAMS

GENERAL

This section contains the main schematic, the parts location diagrams, and a list of all replaceable electrical parts. All components are listed in alpha-numerical order of their reference designations. Consult your Kepco Representative for replacement of parts not listed here.

ORDERING INFORMATION

To order a replacement part or to inquire about parts not listed in the parts list, address order or inquiry either to your authorized Kepco Sales Representative or to:

KEPCO, INC.
131-38 Sanford Avenue
Flushing, N.Y. 11352

Specify the following information for each part:

- a) Power Supply Model number, Serial number, and Revision number stamped on the Nameplate of the unit.
- b) Kepco part number. See Parts List.
- c) Circuit reference designation. See Schematic Drawing.
- d) Description. See Parts List.

To order a part not listed in the parts list, give a complete description and include its function and location.

NOTE: KEPCO DOES NOT STOCK OR SELL COMPLETE POWER SUPPLY SUBASSEMBLIES AS DESCRIBED HERE AND ELSEWHERE IN THIS INSTRUCTION MANUAL. SOME OF THE REASONS ARE LISTED BELOW:

- 1) Replacement of a complete subassembly is a comparatively rare necessity.
- 2) Kepco's subassemblies are readily serviceable, since most of them are the "plug-in" type.
- 2) All active components are socket mounted, making replacement extremely easy.
- 4) The nature of a closed-loop power supply system requires that subassembly replacement is followed by careful measurement of the total power supply performance. In addition, depending on the function of the subassembly, extensive alignment may be required to restore power supply performance to specified values.

IF REPAIRS INVOLVING SUBASSEMBLY REPLACEMENTS ARE REQUIRED, PLEASE CONSULT YOUR LOCAL KEPCO REPRESENTATIVE OR THE KEPCO SALES ENGINEERING DEPARTMENT IN FLUSHING, NEW YORK, N.Y.

ABBREVIATIONS USED IN KEPCO PARTS LISTS

A) Reference Designators:

A	= Assembly	L	= Inductor
B	= Blower (Fan)	LC	= Light-Coupled Device
C	= Capacitor	M	= Meter
CB	= Circuit Breaker	P	= Plug
CR	= Diode	Q	= Transistor
DS	= Device, Signaling (Lamp)	R	= Resistor
F	= Fuse	S	= Switch
FX	= Fuse Holder	T	= Transformer
IC	= Integrated Circuit	TB	= Terminal Block
J	= Jack	V	= Vacuum Tube
K	= Relay	X	= Socket

B Descriptive Abbreviations

A	= Ampere	n	= Nano (10^{-9})
a-c	= Alternating Current	NC	= Normally Closed
AMP	= Amplifier	NO	= Normally Open
AX	= Axial	p	= Pico (10^{-12})
CAP	= Capacitor	PC	= Printed Circuit
CER	= Ceramic	POT	= Potentiometer
CT	= Center-Tap	PIV	= Peak Inverse Voltage
°C	= Degree Centigrade	p-p	= Peak to Peak
d-c	= Direct Current	ppm	= Parts Per Million
DPDT	= Double Pole, Double Throw	PWR	= Power
DPST	= Double Pole, Single Throw	RAD	= Radial
ELECT	= Electrolytic	RECT	= Rectifier
F	= Farad	RECY	= Recovery
FILM	= Polyester Film	REG	= Regulated
FLAM	= Flammable	RES	= Resistor
FP	= Flame-Proof	RMS	= Root Mean Square
°F	= Degree-Fahrenheit	Si	= Silicon
FXD	= Fixed	S-End	= Single Ended
Ge	= Germanium	SPDT	= Single Pole, Double Throw
H	= Henry	SDST	= Single Pole, Single Throw
Hz	= Hertz	Stud Mt	= Stud Mounted
IC	= Intergrated Circuit	TAN	= Tantalum
K	= Kilo (10^3)	TSTR	= Transistor
m	= Milli (10^{-3})	μ	= Micro (μ) (10^{-6})
M	= Mega (10^6)	V	= Volt
MFR	= Manufacturer	W	= Watt
MET	= Metal	WW	= Wire Wound

**KEPCO****REPLACEMENT PARTS LIST**

BOP 50-8M

CONTROL ASSEMBLY, A1

Code 01-1487

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C1,5	2	Cap., Elect., Ax. Leads 10K μ F, 20%, 16V	United Chemi-Con Type KME	117-0978	1
C2,3	2	Cap., Elect., Ax. Leads 680 μ F, + 50 - 10%, 40V	Mallory Type TT	117-0937	1
C4,9	2	Cap., Tantalum, Ax. Leads 1 μ F, 20%, 50V	Sprague Type 162D	117-0815	1
C6	1	Cap., Elect., Ax. Leads 3300 μ F, 20%, 16V	United Chemi-Con Type KMC	117-0986	1
C7,8	2	Cap., Elect., Ax. Leads 10 μ F, + 50 - 10%, 25V	Mallory Type TT	117-0936	1
C10,17,18,21	4	Cap., Met., Film, Ax. Leads 4700pF, 10%, 200V	Westlake Type 32M	117-0588	1
C11	1	Cap., Film, Ax. Leads 0.01 μ F, 20%, 200V	Sprague Type 192P	117-0353	1
C12,13,14	3	Cap., Ceramic Disc 100pF, 10%, 500V	Murata GP5-101K	117-0754	1
C15	1	Cap., Film, Ax. Leads 560pF, 10%, 200V	Sprague Type 192P	117-0569	1
C16	1	Cap., Film, Ax. Leads 1000pF, 10% 200V	Sprague Type 192P	117-0670	1
C19,20	2	Cap., Film, Ax. Leads 0.022 μ F, 10%, 200V	Sprague Type 192P	117-0377	1
C22	1	Cap., Film, Ax. Leads 6800pF, 10%, 200V	TRW Type 663UW	117-0552	1
C24	1	Cap., Elect., Ax. Leads 100 μ F, 20%, 25V	United Chemi-Con Type KMC	117-0437	1
C25	1	Cap., Ceramic Disc 47pF, 10%, 600V	Centralab DD-470	117-0972	1
C26	1	Cap., Ceramic Disc 5000pF, 20%, 500V	Sprague Type 562CZ5U	117-0061	1
C27	1	Cap., Ceramic Disc 200pF, 10%, 1KV	Murata GPK-201K	117-0571	1
C30,34	2	Cap., Monolithic Ceramic 0.1 μ F, 20%, 50V	Kemet Type C320C	117-0967	1
C31	1	Cap., Ceramic Disc 0.01 μ F, + 80 - 20%, 50V	Centralab CK-103	117-0860	1
C35	1	Cap., Ceramic Disc 500pF, 10%, 500V	Murata GP5-501K	117-0755	1
CR1	1	Rectifier, Bridge 200V (PIV), 2A	Semicon Inc. Type F'WLA200	124-0389	1
CR2,3	2	Rectifier, Bridge 200V (PIV), 1.5A	General Instruments Type W02M	124-0346	1
CR4	1	Thyristor, SCR 100V V _{RXM} , 4A, TO-220	Texas Instruments TIC106A	124-0496	1
CR5,63	2	Diode, Rect., Ax. Leads 100V (PIV), 1A	Semicon Inc. Type Si-1	124-0133	1
CR6,7	2	Diode, Zener, Ax. Leads 12V, 5%, 0.4W	Int. Rect. Corp. 1N963B	121-0058	1
CR8	1	Diode, Zener, Ax. Leads 6.2V, 5%, 0.4W	Motorola 1N827	121-0062	1
CR9 thru 57,59, 61,62,64,65,66	55	Diode, Switching, Ax. Leads 75V (PIV), 0.01A, 0.4W	AM Power Devices 1N4148	124-0437	12

6-3/6-4

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.



KEPCO. REPLACEMENT PARTS LIST

BOP 50-8M

CONTROL ASSEMBLY, A1

Code 01-1487

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
CR58,60	2	Diode, Stabistor Ax. Leads 1.3V, 0.01A	AM Power Devices APD203	124-0435	1
IC1	1	IC, Voltage Regulator, Positive 15V, 0.5A, TO-220	Fairchild μ A78M15UC	250-0064	1
IC2	1	IC, Voltage Regulator, Negative 15V, 0.5A, TO-220	Fairchild μ A79M15AUC	250-0065	1
IC3	1	IC, Voltage Regulator, Positive 5V, 0.5A, TO-220	Fairchild μ A78M05UC	250-0062	1
IC4,18	2	IC, Op. Amp. Dual 8 Pin, DIP, Plastic	Texas Instruments TL082CP	250-0107	1
IC5,6,10,11, 19,21,22	7	IC, Op. Amp. FET-Input 8 Pin, DIP, Plastic	Texas Instruments TL081CP	250-0100	1
C7,8	2	IC, Op. Amp. Quad. 14 Pin, DIP, Plastic	National LM324N	250-0050	1
IC9	1	IC, Op. Amp. Quad 14 Pin, DIP, Plastic	Texas Instruments TL084ACN	250-0144	1
IC12	1	IC, Dual SPST CMOS Switch 14 Pin, DIP, Plastic	Analog Devices ADG200CJ	250-0099	1
IC13	1	IC, Op. Amp. Dual 8 Pin, DIP, Plastic	Motorola MC1458P	250-0040	1
IC14	1	IC, Dual Comparator 8 Pin, DIP, Plastic	Texas Instruments LM393P	250-0098	1
IC15,16	2	IC, Quad 2-Input NAND Gate 14 Pin, DIP, Plastic	Texas Instruments SN74LS00N	250-0053	1
IC17	1	IC, Quad 2-Input NAND Gate 14 Pin, DIP, Plastic	Texas Instruments SN7400N	250-0038	1
IC20	1	IC, Op. Amp. 8 Pin, DIP, Plastic	Prec. Monolithics OP-37GP	250-0145	1
IC23	1	IC, Op. Amp. 8 Pin, DIP, Plastic	Prec. Monolithics OP-07CP	250-0146	1
LC1	1	IC, Opto-Coupler (Photo TRST) 6 Pin, DIP, Plastic	Kepeco, Inc. 119-0106	119-0106	1
LC2	1	IC, Opto-Coupler (Photo Darlington) 6 Pin, DIP, Plastic	Gen. Inst. Corp. 4N33	119-0133	1
Q1,2,3	3	Transistor, Si, NPN Small Signal, TO-18	Texas Instruments 2N5450	119-0093	1
R1,3,5,33,34,35 36,43,44,45,47,64, 65,66,67,93,94	17	Res., Fixed, Molded 1K ohm, 10%, 1/4W	Allen Bradley CB1021	115-2238	4
R2	1	Res., Fixed, Molded 2.4K ohm, 5%, 1/4W	Allen Bradley CB2425	115-2394	1
R4	1	Res., Fixed, Molded 470 ohm, 10%, 1/2W	Allen Bradley EB4711	115-0608	1
R6,19	2	Res., Fixed, Molded 180 ohm, 10%, 1/4W	Allen Bradley CB1811	115-2385	1
R7,21,95	3	Res., Fixed, Molded 5.6K ohm, 10%, 1/4W	Allen Bradley CB5621	115-2491	1
R8,9,23,24,28,37, 38,72,74,76,77, 78,79,80,82,13A	16	Res., Fixed, Metal Film 10K ohm, 1%, 1/8W	Dale Type RN55D	115-2174	4
R10,14,97	3	Res., Fixed, Molded 330 ohm, 10%, 1/4W	Allen Bradley CB3311	115-2233	1

6-5/6-6

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES.	KEPCO, INC.
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**KEPCO.****REPLACEMENT PARTS LIST**

BOP 50-8M

CONTROL ASSEMBLY, A1

Code 01-1487

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R11,12	2	Res., Fixed, Metal Film 9.53K ohm, 1%, 1/8W	Dale Type RN55D	115-2686	1
R13	1	Res., Fixed, Metal Film 30.1K ohm, 1%, 1/4W	Dale Type RN60D	115-1461	1
R15	1	Res., Fixed, Molded 1.1M ohm, 5%, 1/4W	Allen Bradley CB1155	115-2657	1
R16	1	Res., Fixed, Metal Film 24.3K ohm, 1%, 1/8W	Dale Type RN55D	115-2451	1
R17,68,70,98 10A,11A,17A	7	Res., Fixed, Molded 10 ohm, 10%, 1/4W	Allen Bradley CB1001	115-2230	1
R18,27,75	3	Res., Fixed, Metal Film 1K ohm, 1%, 1/8W	Dale Type RN55D	115-2180	1
R20	1	Res., Fixed, Metal Film 511 ohm, 1%, 1/8W	Dale Type RN55D	115-2260	1
R22,73	2	Res., Fixed, Metal Film 8.66K ohm, 1%, 1/8W	Dale Type RN55D	115-2511	1
R25	1	Res., Fixed, Metal Film 4.32K ohm, 1%, 1/8W	Dale Type RN55D	115-2539	1
R26	1	Res., Fixed, Metal Film 8.06K ohm, 1%, 1/8W	Dale Type RN55D	115-2445	1
R29	1	Res., Fixed, Metal Film 3.01K ohm, 1%, 1/8W	Dale Type RN55D	115-2214	1
R30	1	Res., Fixed, Metal Film 5.76K ohm, 1%, 1/8W	Dale Type RN55D	115-2222	1
R31,32	2	Res., Var., Cermet, Trim. 1K ohm, 10%, 1.25W	Bourns Type 3009P	115-2456	1
R39,40	2	Res., Fixed, Molded 2.7M ohm, 5%, 1/4W	Allen Bradley CB2755	115-2602	1
R41,42,81,83	4	Res., Var., Cermet, Trim. 100K ohm, 10%, 1.25W	Bourns Type 3009P	115-2399	1
R46,48,53,54	4	Res., Fixed, Metal Film 57.6K ohm, 1%, 1/8W	Dale Type RN55D	115-2466	1
R49,52	2	Res., Fixed, Metal Film 15K ohm, 1%, 1/8W	Dale Type RN55D	115-2452	1
R50	1	Res., Var., Cermet, Trim. 10K ohm, 10%, 1W	Bourns Type 3005P	115-2266	1
R51,55	2	Res., Fixed, Metal Film 750 ohm, 1%, 1/8W	Dale Type RN55D	115-2259	1
R56 thru 59,96, 8A,9A	7	Res., Fixed, Molded 10K ohm, 10%, 1/4W	Allen Bradley CB1031	115-2211	1
R60,63	2	Res., Fixed, Metal Film 2.74K ohm, 1%, 1/8W	Dale Type RN55D	115-2439	1
R61,62	2	Res., Fixed, Metal Film 1.1K ohm, 1%, 1/8W	Dale Type RN55D	115-2176	1
R69,18A	2	Res., Fixed, Molded 8.2K ohm, 10%, 1/4W	Allen Bradley CB8221	115-2482	1
R71	1	Res., Fixed, Metal Film 40.2K ohm, 1%, 1/8W	Dale Type RN55D	115-2391	1
R84	1	Res., Fixed, Molded 5.1K ohm, 5%, 1/2W	Allen Bradley EB5125	115-1659	1
R85 thru 90	6	Res., Fixed, Molded 22K ohm, 10%, 1/4W	Allen Bradley CB2231	115-2458	1

6-7/6-8

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

**KEPCO.****REPLACEMENT PARTS LIST**

BOP 50-8M

CONTROL ASSEMBLY, A1

Code 01-1487

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R91	1	Res., Fixed, Molded 10 ohm, 5%, 1/4W	Allen Bradley CB1005	115-2643	1
R92	1	Res., Fixed, Molded 2M ohm, 5%, 1/4W	Allen Bradley CB2055	115-2659	1
R99,1A,2A,3A	4	Res., Fixed, Molded 3.3K ohm, 10%, 1/4W	Allen Bradley CB3321	115-2257	1
R4A thru 7A	4	Res., Fixed, Molded 750K ohm, 5%, 1/4W	Allen Bradley CB7545	115-2661	1
R12A	1	Res., Fixed, Molded 4.7K ohm, 10%, 1/4W	Allen Bradley CB4721	115-2383	1
RN1	1	Res., Network, SIP 5.6K ohm, 5%, 7 units, 1W	Sprague Type 216	234-0004	1
RN2,3	2	Res., Matched Pair 40K/10K ohm, 0.01% match	Kepeco, Inc. 234-0018	234-0018	1

6-7A/6-8A

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.



KEPCO. REPLACEMENT PARTS LIST

BOP 50-8M

FRONT PANEL ASSEMBLY (PART OF A2)

Code 05-1581

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C102	1	Cap., Mylar, Axial Leads 5 μ F, 20%, 200V	TRW Type X663F	117-0372	1
CB101	1	Circuit Breaker 2 Pole, 2 CKT	Kepeco Inc. 127-0354	127-0354	1
DS101 thru 104	4	Panel Light, LED 6V d-c, 20-mA, Red	Dialco Type 507	152-0092	1
DS105	1	Panel Light, LED 6V, 20-mA, Green	Littelfuse Series 900	152-0097	1
M101	1	Meter, 8-0-8A d-c Center Zero	Kepeco Inc. 135-0539	135-0539	1
M102	1	Meter, 50-0-50V d-c Center Zero	Kepeco Inc. 135-0533	135-0533	1
R101 thru 104	4	Res., Var., Cermet 10K ohm, 10%, 2W	Allen Bradley Type 70	115-2612	1
R105,106	2	Res., Var., Wire-Wound 20K ohm, 5%, 2W	TRW Type 8400	115-1224	1
S101 thru 103	3	Switch, Toggle DPDT, 250V-5A (AC)	Carling Switch SGD0410-PR-B	127-0325	1

MISCELLANEOUS MECHANICAL PARTS

N.A.	2	Binding Post, Red (Small)	E.F. Johnson No. 111-102	151-0025	1
N.A.	2	Binding Post, Black (Small)	E.F. Johnson No. 111-103	151-0026	1
N.A.	2	Binding Post, Red (Large)	Superior Type DF30	151-0002	1
N.A.	2	Binding Post, Black (Large)	Superior Type DF30	151-0003	1
N.A.	1	Binding Post, Green (Large)	Superior Type DF30	151-0031	1
N.A.	2	Front Handle	Kepeco Inc. 139-0197	139-0197	
N.A.	2	Control Knob	Alco No. PKA-50B-1/4	155-0052	1
N.A.	5	Clip For Panel Lights	Dialco No. 515-0051	102-0107	1
P201	1	AC Power Receptacle	Switchcraft No. EAC-302	143-0290	1
N.A.	4	Bottom Foot	Kepeco Inc. 158-0004	158-0004	1
TB201	1	Barrier Strip Assembly	Kepeco Inc. 167-0883	167-0883	1
N.A.	1	AC Power Line Cord	Kepeco Inc. 118-0557	118-0557	1
PC-12	1	Programming Connector	Kepeco Model PC-12- (not wired)	N.A.	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.



KEPCO. REPLACEMENT PARTS LIST

BOP 50-8M

CHASSIS ASSEMBLY, A2

Code 05-1581

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
B201,202	2	Fan Motor 50/60 Hz, 115V a-c	Kepeco Inc. 148-0027	148-0027	1
N.A.	2	Fan Blade	Kepeco Inc. 149-0023	149-0023	1
C201,202	2	Cap., Elect., Can-Type 12K μ F, + 75-10%, 100V	Mepeco/Electra Type 3111	117-0907	1
C203	1	Cap., Mylar, Axial Leads 0.1 μ F, 20%, 600V	TRW Type X663F	117-0316	1
C204 thru 207	4	Cap., Ceramic Disc. 0.1 μ F, + 80 - 20%, 500V	Sprague Type 41C	117-0087	1
CR201	1	Rectifier Bridge 200V (PIV), 10A	Motorola MDA 3502	124-0476	1
R201,202	2	Res., Fixed, Molded 2.5K ohm, 5%, 5W	Tepro TS-5W	115-0310	1
R203	1	Res., Fixed, Molded 10 ohm, 10%, 1/4W	TRW Type GBT-1/4	115-2230	1
T201	1	Transformer, Power	Kepeco Inc. 100-2190	100-2190	1
T202	1	Transformer, Auxiliary	Kepeco Inc. 100-2167	100-2167	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.



REPLACEMENT PARTS LIST

BOP 50-8M

DRIVER ASSEMBLY, A3

Code 05-1395

REFERENCE DESIGNATION	QTY	DESCRIPTION	MFRS. NAME & PARTS NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPA PART QTY
CR303,304	2	Diode, Rect., Ax. Leads 400V (PIV), 5A	Semicon, Inc. Type S-5A4	124-0348	1
Q301	1	Transistor, Si., NPN Med. Power, TO-220	Texas Instruments TIP100	119-0127	1
Q302	1	Transistor, Si., PNP Med. Power, TO-220	Texas Instruments TIP105	119-0126	1
R301	1	Res., Fxd., W.W., Ax. Leads 0.0625 ohm, 1%, 25W	Tepro Type TMK-25	115-2665	1
R302,303	2	Res., Fxd., W.W. Ax. Leads 0.05 ohm, 3%, 10W	Tepro Type TM-10	115-2668	1
R312,313	2	Res., Fxd., W.W., Ax. Lds. 1 ohm, 5%, 3W	Tepro Type TS3C	115-0499	1
R315	1	Res., Fxd., Prec., M.F. 82.5 ohm, 1%, 1/4W	Dale Elect. CMF 60D	115-2308	1
R316	1	Res., Variable, Trim-Pot 10 ohm, 10%, 3/4W	Bourns 3009P-1-100	115-2397	1

6-13/6-14

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENT AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC



KEPCO. REPLACEMENT PARTS LIST

BOP 50-8M

HEAT SINK ASSEMBLIES, A4, A5

Code 05-1581

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
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ASSEMBLY A4 CONTAINS:

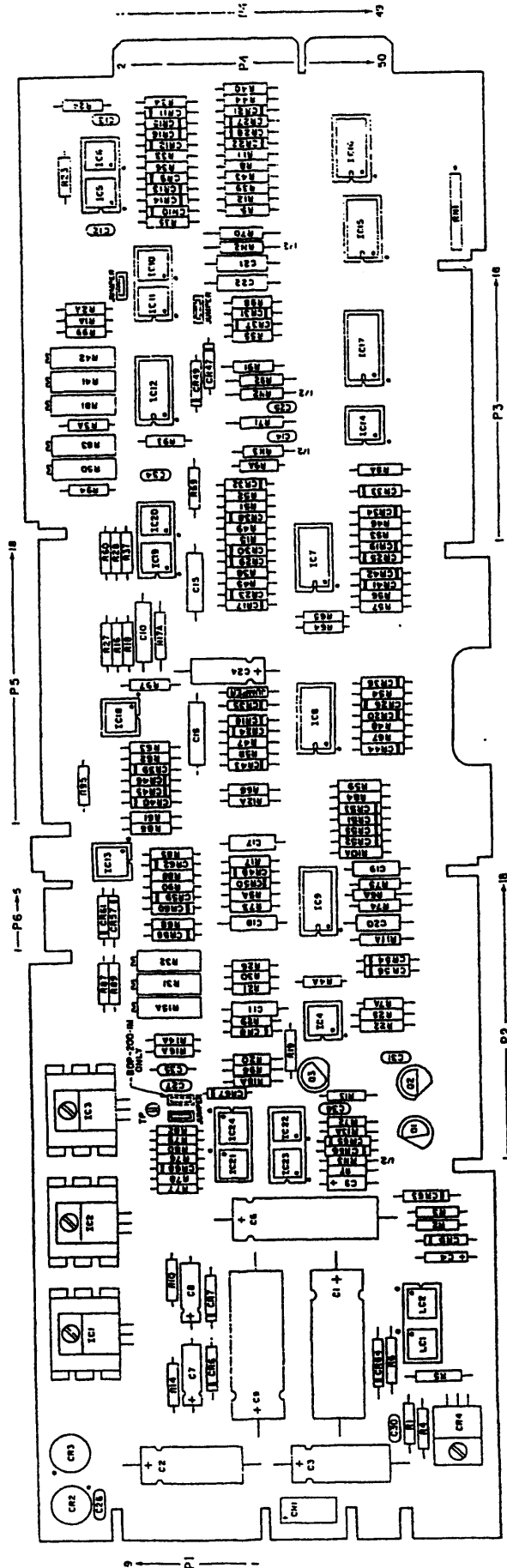
Q401 thru 406	6	Transistor, Si., NPN Power, TO-3	Kepeco Inc. 119-0091	119-0091	2
Q407 thru 412	6	Transistor, Si., PNP Power, TO-3	Motorola 2N6609	119-0128	2
R401 thru 412	12	Res., Fxd., W.W., Ax. Leads 0.8 ohms, 3%, 3W	Tepro Type TS-3W	115-2460	2
R413 thru 416	4	Res., Fixed, Molded 100 ohms 10%, 1/4W	TRW Type GBT-1/4	115-2231	1
S401	1	Switch, Thermostat N.O., 260°F, ± 10°F, ΔF = 30°	Texas Instruments Type 20700	127-0248	1

ASSEMBLY A5 CONTAINS:

Q501 thru 506	6	Transistor, Si., NPN Power, TO-3	Kepeco Inc. 119-0091	119-0091	2
Q507 thru 512	6	Transistor, Si., PNP Power, TO-3	Motorola 2N6609	119-0128	2
R501 thru 512	12	Res., Fxd., W.W., Ax. Leads 0.8 ohms, 3%, 3W	Tepro Type TS-3W	115-2460	2
R513 thru 516	4	Res., Fixed, Molded 100 ohms 10%, 1/4W	TRW Type GBT-1/4	115-2231	1
S501	1	Switch, Thermostat N.O., 260°F, ± 10°F, ΔF = 30°	Texas Instruments Type 20700	127-0248	1

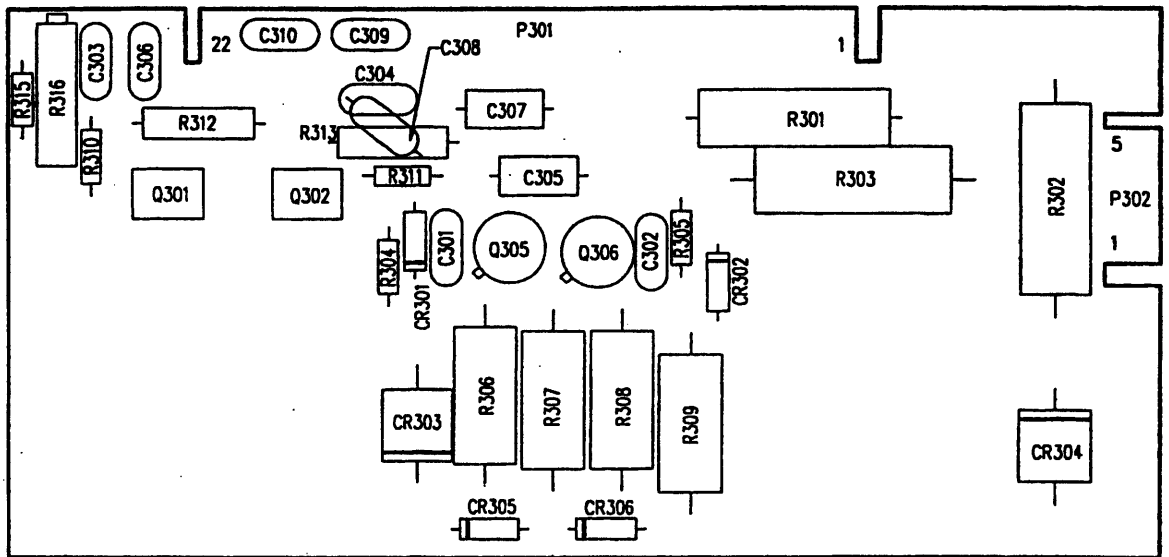
NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES.	KEPCO, INC.
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NOTE: NOT ALL COMPONENTS USED IN ALL MODELS.
SEE PARTS LIST.

FIG. 6-1 COMPONENT LOCATION, CONTROL ASSEMBLY (A1).



NOTE: NOT ALL COMPONENTS USED IN ALL MODELS, SEE PARTS LIST.

FIGURE 6-3 COMPONENT LOCATION, DRIVER ASS'Y. (A3)

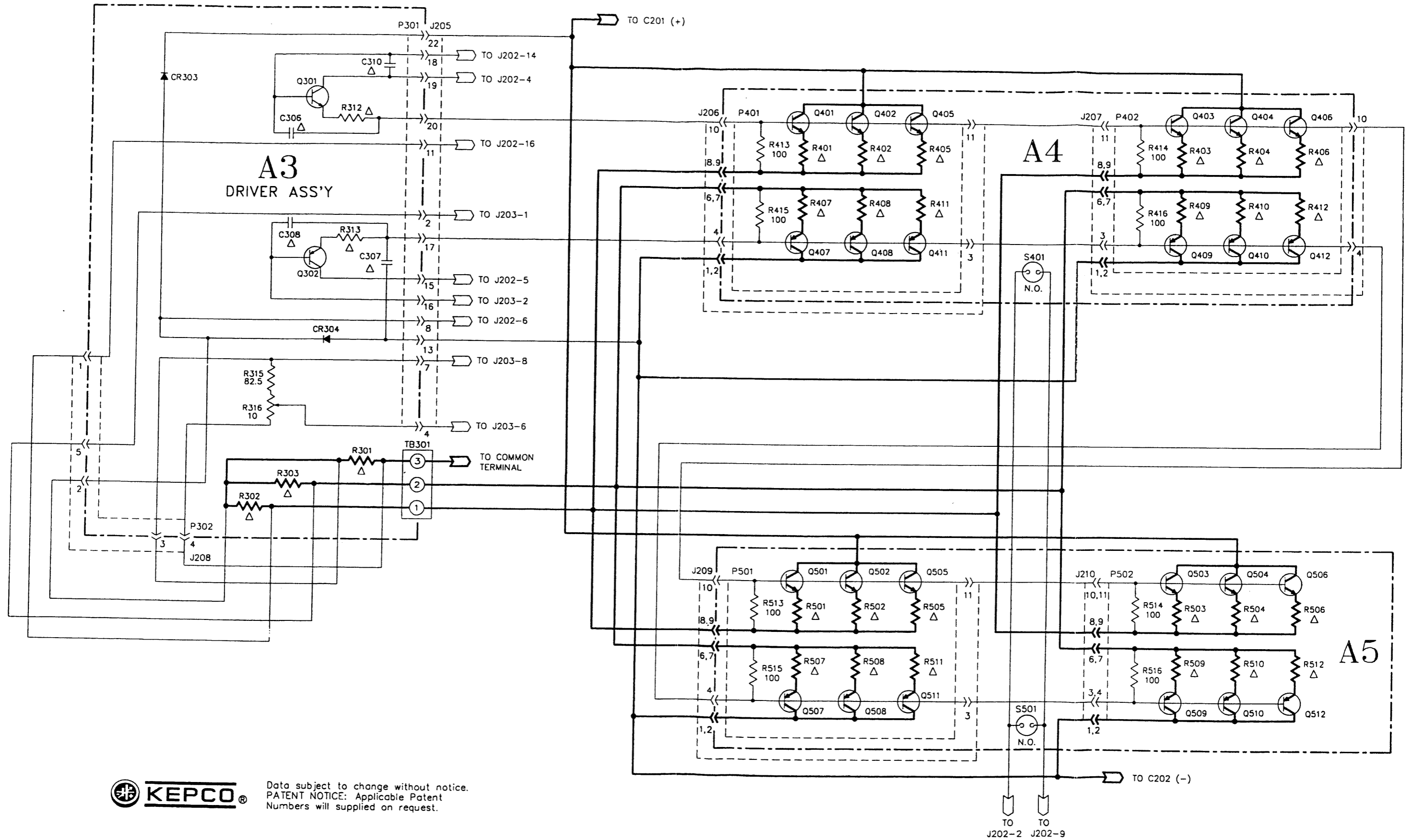
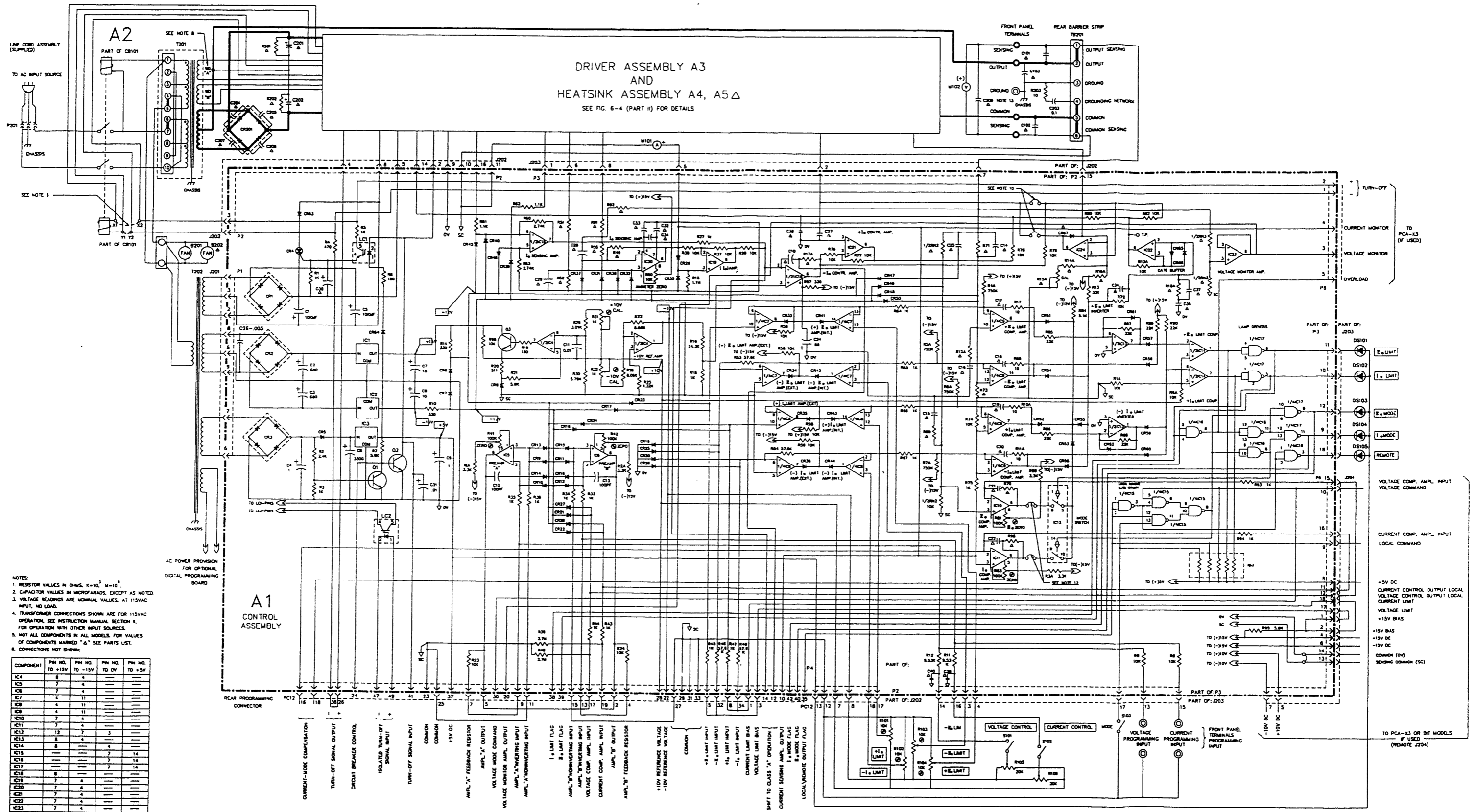


FIGURE 6-4 (PART II) MAIN SCHEMATIC DIAGRAM, MODELS BOP 20-20M, BOP 36-12M AND BOP 50-8M



DRIVER ASSEMBLY A3
AND
HEATSINK ASSEMBLY A4, A5 Δ
SEE FIG. 6-4 (PART II) FOR DETAILS

A1
CONTROL
ASSEMBLY

- NOTES:
1. RESISTOR VALUES IN OHMS, K=10³, M=10⁶.
 2. CAPACITOR VALUES IN MICROFARADS, EXCEPT AS NOTED.
 3. VOLTAGE READINGS ARE NOMINAL VALUES, AT 115VAC INPUT, NO LOAD.
 4. TRANSFORMER CONNECTIONS SHOWN ARE FOR 115VAC OPERATION, SEE INSTRUCTION MANUAL SECTION 4, FOR OPERATION WITH OTHER INPUT SOURCES.
 5. NOT ALL COMPONENTS IN ALL MODELS, FOR VALUES OF COMPONENTS MARKED "Δ" SEE PARTS LIST.
 6. CONNECTIONS NOT SHOWN:

COMPONENT	PIN NO. TO +15V	PIN NO. TO -15V	PIN NO. TO 0V	PIN NO. TO +5V
IC4	8	4		
IC5	7	4		
IC6	7	4		
IC7	4	11		
IC8	4	11		
IC9	4	11		
IC10	7	4		
IC11	7	4		
IC13	12	7	3	
IC14	8	4		
IC15		7	14	
IC16		7	14	
IC17		7	14	
IC18	7	4		
IC19	7	4		
IC20	7	4		
IC21	7	4		
IC22	7	4		
IC23	7	4		
IC24	7	4		

7. SC-SIGNALING COMMON
8. WINDINGS (NO) "A" AND "B" ON T201 USED ON 200V BOP MODELS ONLY
9. CONNECTIONS "Y1"-"Y2" AND "Y1"-"Y2" ON C8101, USED ON ALL BOP MODELS, EXCEPT 200V MODELS.
10. JAMPER (DASHED) BOP 200 ONLY. JAMPER (SOLID) ALL OTHER BOP MODELS. FOR OPERATION ON OTHER INPUT SOURCES.
11. PINS 21, 23, 44, 45, 46, 48 & 50 ON REAR PROGRAMMING CONNECTOR (P4-PC-13) ARE NOT USED.
12. JAMPERS ARE CONNECTED IN ALL MODELS ONLY FOR TESTING PURPOSES.
13. C104 ON BOP 200-1M, C208 ON ALL OTHER MODELS.



Data subject to change without notice.
PATENT NOTICE: Applicable Patent
Numbers will be supplied on request.

FIGURE 6-4 (PART II) MAIN SCHEMATIC DIAGRAM, BOP 3/4 AND BOP (400W) FULL RACK SERIES.



INSTRUCTION MANUAL CORRECTION

Please note the following corrections to the Manual material as indicated:

PAR. 5-4

Add following note:

NOTE: Ground strap connected to cover may be removed for convenience by removing attaching screw. Be sure to reconnect ground strap before reinstalling cover.

BOP 50-8M/042497/ECN7882 R17

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INSTRUCTION MANUAL CORRECTION

Please note the following corrections to the Manual Material as indicated:
Parts List and Schematic Diagram:

1. CHANGE:	R50	Res.Variable,W.W.	10K ohm,10%,1/2W	Kepco #115-2266
To:	R50	Res.,Variable,Cermet	10K ohm,10%,3/4W	Kepco #115-2481
CHANGE:	C16	Cap.,Film,Ax. Leads	1000pF, 10%,200V	Kepco #117-0670
To:	C16	Cap.,Film,Ax. Leads	1000pF, 10%,200V	Kepco #117-0570
3. CHANGE:	C30	Cap.,Cer.,Monolithic	0.1μF,50V,± 20%	Kepco #117-0967
To:	C30	Cap.,Cer.,Monolithic	0.47μF,50V,± 20%	Kepco #117-1038
4. CHANGE:	T202	REF. Transformer		Kepco #100-2167
To:	T202	AUX. Transformer		Kepco #100-2354
5. CHANGE:	R301	Res.,Sensing,4-Terminal	0.0625 ohm,1%,25W	Kepco #115-2665
To:	R301	Res.,Sensing,4-Terminal	0.0625 ohm,1%,50W	Kepco #115-2354
6. CHANGE:	LC2	Opto-Coupler (Photo Darlington) 4N33, 6 Pin DIP		Kepco #119-0133
To:	LC2	Opto-Coupler (Photo Transistor) 6 Pin DIP		Kepco #119-0106
7. CHANGE:	R49,52	Res.,Fxd.,M.F.,Ax. Lds.	499K ohm,1%,1/8W	Kepco #115-2309
To:	R49,52	Res.,Fxd.,M.F.,Ax. Lds.	57.6K ohm,1%,1/8W	Kepco #115-2466
8. CHANGE:	R51,55	Res.,Fxd.,M.F.,Ax. Lds.	23.2K ohm,1%,1/8W	Kepco #115-2447
To:	R51,55	Res.,Fxd.,M.F.,Ax. Lds.	2.74K ohm,1%,1/8W	Kepco #115-2439
9. DELETE:	C29	Cap.,Ceramic,Ax. Lds.	1000pF,10%,200V	Kepco #117-1084
10. ADD:	C306,308	Cap.,Ceramic,Ax. Lds.	100pF,10%,200V	Kepco #117-1085
	Note: C306 is added to Assembly (A3) between the base of Q301 and P301, Pin 20			
	C308 is added to Assembly (A3) between the base of Q302 and P301, Pin 17			
11. CHANGE:	B201,202	Motor,Fan	115Vac,50/60Hz	Kepco #148-0027
To:	B201,202	Motor,Fan	115Vac,50/60Hz	Kepco #148-0049
12. CHANGE:	Blade,Fan,CW Rotation		4.25" Dia.,5 Blade,Nylon	Kepco #149-0023
To:	Blade,Fan,CW Rotation		4.25" Dia.,5 Blade,7/32 HUB	Kepco #149-0031
13. CHANGE:	R69	Res.,Fxd.,Molded,Carbon	8.2K ohm,10%,0.25W	Kepco #115-2482
To:	R69	Res.,Fxd.,Precision,M.F.	3.16K ohm,1%,0.13W	Kepco #115-2673
14. CHANGE:	R12A	Res.,Fxd.,Molded,Carbon	4.7K ohm,10%,0.25W	Kepco #115-2383
To:	R12A	Molded Jumper		Kepco #172-0298
15. DELETE:	R19	Res.,Fxd.,Molded,Ax. Lds.	180 ohm,10%,0.25W	Kepco #115-2385
16. ADD:	CR69	Diode,Switching,Ax. Lds.	75V,0.4A	Kepco #124-0437
	Note: CR69 replaces R19 on the A1 Ass'y. The anode of CR69 is connected to Pin 7 of IC4.			

BOP50-8(M)/11-1388/r8	C6076	BOP50-8(M)(D)/02-1195/r13	C7063
BOP50-8(M)/07-0991/r8	Errata	BOP50-8(M)(D)/05-1395/r13	BMC(C7063)
BOP50-8(M)/05-2493/r9	C6560	BOP50-8(M)(D)/05-3195/r13	BMC(C7063)
BOP50-8(M)(D)/01-0494/r10	C6647	BOP50-8(M)(D)/08-2995/r14	C7240
BOP50-8(M)(D)/02-2394/r11	C6759	BOP50-8(M)(D)/02-1696/r15	C7538
BOP50-8(M)(D)/08-1994/r12	C6917	BOP50-8(M)(D)/02-2096/r16	C7410



INSTRUCTION MANUAL CORRECTION

Please note the following corrections to the Manual Material as indicated:
Parts List and Schematic Diagram:

17. CHANGE:	R91	Res.,Fxd.,Carbon Film	10 ohm,0.25W,5%	Kepeco #115-2643
To:	R91	Res.,Fxd.,Carbon Film	10 ohm,0.25W,5%	Kepeco #115-2230
18. CHANGE:	R4	Res.,Fxd.,Molded	470 ohm,10%,1/2W	Kepeco #115-0608
To:	R4	Res.,Carbon Film	470 ohm,5%,1/2W	Kepeco #115-0919
19. CHANGE:	R9A	Res.,Fxd.,Molded	10K ohm,10%,1/4W	Kepeco #115-2211
To:	R9A	Res.,Fxd.,Metal Film	3.92K ohm,1%,1/8W	Kepeco #115-2179
20. CHANGE:	R49,52	Res.,Fxd.,M.F.,Ax. Lds.	57.6K ohm,1%,1/8W	Kepeco #115-2466
To:	R49,52	Res.,Fxd.,M.F.,Ax. Lds.	93.1K ohm,1%,1/8W	Kepeco #115-2553
21. CHANGE:	R51,55	Res.,Fxd.,M.F.,Ax. Lds.	2.74K ohm,1%,1/8W	Kepeco #115-2439
To:	R51,55	Res.,Fxd.,M.F.,Ax. Lds.	887 ohm,1%,1/8W	Kepeco #115-2468
22. CHANGE:	R91	Res.,Fxd.,Carbon Film	10 ohm,0.25W,5%	Kepeco #115-2230
To:	R91	Res.,Fxd.,Carbon Film	2.7 ohm,0.5W,10%	Kepeco #115-1595
23. CHANGE:	R92	Res.,Fxd.,Carbon Film	2Mohm,5%,1/4W	Kepeco #115-2659
To:	R92	Res.,Fxd.,Carbon Film	2.2Mohm,5%,1/2W	Kepeco #115-0257
24. CHANGE:	R301	Res.,Shunt,4-Term	0.0625 ohm,1%,50W	Kepeco #115-2354
To:	R301	Res.,Shunt,4-Term	0.02 ohm,1%.10W	Kepeco #115-3047
25. CHANGE:	C2,C3	Cap.,Elect.,Ax. Leads	680 μ F,10%,40V	Kepeco #117-0937
To:	C2,C3	Cap.,Elect.,Ax. Leads	1000 μ F,20%,35V	Kepeco #117-1047

BOP50-8(M)(D)/05-3196/r16
BOP50-8(M)(D)/01-2197/r16
BOP50-8(M)(D)/03-1997/r17

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C7882

BOP50-8(M)(D)/04-2299/r18 C8572
BOP50-8(M)(D)/12-0199/r19 C8915