TRANSISTORIZED POWER SUPPLY, TRYGON MODEL L3R5-40

BY COMMAND OF THE DEFENCE COUNCIL

L T Dunnett

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PREFACE

The subject matter of this publication may be affected by Servicing Schedules or 'General Orders and Modifications' leaflets in this AP, in the associated publications listed in Chap.1-1 of AP 101S-0132-1A or even in some others. If possible, Amendments are issued to correct this publication accordingly, but it is not always practicable to do so. When a Servicing schedule, or leaflet contradicts any portion of this publication, the Servicing schedule, or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf in the original issue, except the preliminaries is undated. New or amended technical matter will be indicated by black triangles positioned in the text thus:- ▶ ◀ to show where text has been added, amended or deleted. When a chapter is issued in a completely revised form, the triangles will not appear.

Instruction Manual

MODEL-L3R5-40 OVS2626

LIBERATOR SERIES

TRANSISTORIZED POWER SUPPLY

TRYGON Power Supplies

WIDE RANGE LABORATORY & SYSTEMS POWER SUPPLIES • DUAL LAB • TRIPLE LAB PRECISION LAB • QUARTER RACK • HALF RACK • LOW PROFILE • INTERMEDIATE REGULATION • SUPER MERCURY • SLOT RANGE SYSTEMS POWER SUPPLIES • SUPER TRYPACK • LIBERATOR SUB RACK • LIBERATOR RACK • VALUPOWER • DIGITAL PROGRAMMERS • FERRORESONANT • MODUPANEL ASSEMBLIES • OEM SPECIAL DESIGNS
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TRYGON ELECTRONICS
SUBSIDIARY
SYSTRON DONNER
CORPORATION
1200 Shames Drive, Westbury, N.Y. 11590 (516) 997-6200

NOTICE

This Instruction Manual provides general characteristics, operating procedures, theory of operation, maintenance and calibration procedures and includes a complete schematic, and parts list pages for the model(s) listed on the front cover.

Any questions concerning this documentation should be directed to the Publications Dept., Trygon Electronics Inc., 1200 Shames Drive, Westbury, N.Y. 11590

Questions concerning the operation and application of Trygon power supplies should be directed to the Applications Engineering Dept., at the above address.

MEASUREMENT OF REGULATION AND RIPPLE

The specifications cited herein for regulation and ripple can be readily attained on every Trygon power supply, provided the proper method of measurement is employed. The major consideration is that the highly stable meter and oscilloscope, specified in the calibration section test procedures, must be connected to the sensing terminals and not at the load terminals. The reason for this precaution is that the voltage drop between the load terminals and sensing terminals will yield an inaccurate regulation and ripple measurement.

CAUTION

Primary output power should be taken from the rear mounted studs. Front panel jack and rear panel barrier strip connections are for test and control functions only. They are not rated for full output power.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

APPENDICES

DESCRIPTION

1.1 INTRODUCTION

The Liberator series power supplies are flexible and dependable sources of DC power, which can be used to meet a variety of needs. These needs may range in scope from inspection and production testing, to laboratory bench testing, IC and systems applications.

The wide voltage adjustment range makes these units well suited for specific systems applications. The ability to provide power packaged in minimum space with high reliability and performance meets the demands of most systems requirements.

All components used in the construction of the Liberator series units are of the highest quality available, and have been subjected to 100% incoming inspection.

Each electrolytic filter capacitor is of computer grade, and has been quoted by the manufacturer as having a life expectancy exceeding ten years. All silicon transistors have been derated and temperature aged to provide high reliability. All rectifiers are hermetically sealed silicon units and all zener diodes have been temperature stabilized.

1.2 GENERAL FEATURES

Output, sensing, automatic "Load Share" paralleling and remote programming terminals are located on a barrier strip mounted on the rear panel of the unit. The AC power switch, AC pilot lamp, overload indicator lamp, current and voltage controls and appropriate metering devices are all located on the front panel.

Constant Voltage Mode

A constant voltage is maintained across the output terminals at any preset value within the rated slot voltage range, provided that the load does not draw more than either the rated output current or more than the preset limiting current value determined by the front panel current control setting.

Automatic Foldback Current Limiting

Short circuit protection is provided by the automatic current limiting circuit which limits the maximum output current under all load conditions. The point at which automatic current limiting occurs is variable and may be selected anywhere between 10% of the rated output current and maximum rated output current of the unit. In the event of an overload, the current and voltage fold back into a safe operating region. In the event of a short circuit, the output current is limited to approximately 10% of the rated current.

Remote Programming

Remote programming is provided in the voltage mode of operation and may be utilized over the entire voltage range of the unit. The scale factor for remote voltage programming is approximately 100 ohms per volt.

Automatic "Load Share" Paralleling

Automatic "Load Share" paralleling permits interconnection of up to four supplies so that each supply in parallel delivers an equal amount of current to the load, with single knob control of all units.

Adjustable Overvoltage Protection (Optional Feature)

Adjustable overvoltage (OV) protection is available as an option wherein special circuitry prevents the output from exceeding a preset voltage. An external adjustment control (mounted on the rear panel) is provided to vary the point at which the OV circuit will activate.

1.3 PRECAUTIONARY MEASURES

Wire Size

To assure proper regulation under all load conditions and to prevent severe distortions of the AC line voltage, it is very important to take into consideration the physical size and current handling capabilities of the input power line. Serious losses in regulation and an increase in ripple may result from underrated or overloaded AC input lines. The maximum AC impedance from the breaker box to the power supply should not exceed 0.75 ohms.

Systems Considerations

In systems applications it is recommended that each power supply input power line be run separately to the AC distribution box in order to minimize cross coupling and interaction between equipment. Do not run sensitive signal leads such as the remote sensing leads in the same cable as the AC input without shielding. To keep the AC ripple in the output to a minimum, it is recommended that the AC input cables should be run in close proximity to the output load cables.

Terminal Post Resistance

All terminals and shorting links serving outputs, sensing and programming must be securely tightened before use. Serious loss of regulation and an increase in ripple can result due to a voltage drop caused by loose terminals and shorting links. (See warning note on title page).

SECTION 2

INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

When the Liberator series power supply is used in a rack or bench type configuration, no special mechanical installation is required. However, integral slide mount provisions are made for rapid mounting of commonly specified centerline mounting, slide assemblies (in-line screw centers).

2.2 ELECTRICAL CONNECTIONS

Input Power

A three-terminal barrier strip mounted on the rear panel provides AC input connections to the unit.

The power handling ability of the AC power lines feeding AC power to the unit must be considered, as serious losses in regulation and substantial increase in ripple may occur as a result of insufficient power capacity of these lines. All AC power line connections must be securely tightened and any movable electric contact surface (such as the wiper arm of a variable transformer) should be kept clear of impedance producing oxide coatings.

Care should be exercised in selecting the proper wire size for the AC input lines. The AC wire size should be sufficient so that the line drop does not exceed a value which will allow the input voltage to drop below the specified lower limit of 105 VAC.

A AWG #14 should be adequate for most short runs of 20 ft. or less. Increase wire size to #12 for up to 50 feet, and to #10 for up to 100 feet.

Output, Rear Panel

A ten (10) terminal barrier strip mounted on the rear panel provides sensing, programming, automatic "Load Share" paralleling and ground connections. A heavy duty block containing two (2) stud type terminals is provided for output connections.

Output, Front Panel

Three (3way jack) binding post terminals mounted on the front panel provide output and ground connections. These terminals are provided primarily for convenience purposes and for easy monitoring of the output. They should not be used to draw Load Current. To achieve optimum regulation, load current should be extracted from the output block mounted on the rear panel.

2.3 OPERATING CONFIGURATIONS

The Liberator series power supplies are designed to operate as highly regulated constant voltage sources with automatic fold-back current limiting. There are various operating configurations that can be used by proper application of shorting links and wiring The following paragraphs describe the various operating configurations and their connections.

Local Voltage Programming

To adjust the output voltage from the power supply, connect a shorting link across terminals 10 and 11. With this shorting link installed, the voltage adjust controls provide adjustment of the output over the rated slot voltage range.

Marginal Voltage Programming

Provisions are amde within the supply for externally controlled marginal voltage programming, by external relay contacts. A short circuit by this relay, across terminals MV1 and 2 will cause the supply to increase to its maximum output of 5.4 VDC. A short circuit between terminals MV3 and 4 will cause the supply to produce its minimum output voltage of 5.0 VDC.

Status Indicator

An internal automatic status indicator is provided to continually monitor the output voltage for under or overvoltage conditions. Relay contacts are available on the rear terminal block TB2. For relay contact arrangement, refer to schematic.

Sensing Connections

Local Sensing

Local sensing connections are made when rated regulation is not required directly at a remote load.

Connect the load to output studs +V and -V and ascertain that shorting links are connected between terminals 11 and 12 and 13 and 14.

Remote Sensing

Remote sensing is used when rated regulation is required at a remote load.

Remove the shorting links between terminals 11 and 12 and 13 and 14. Using a twisted, shielded pair of wires, connect the -S (11) and +S (14) sensing terminals to the load. To prevent damage to the power supply, correct polarity of both the remote sensing and output leads must be observed.

The negative remote sensing lead (-S) and negative output lead (-V) must be connected to one side of the load and the positive remote sensing lead (+S) and positive output lead (+V) connected to the other side of the load. The shield should be grounded at the power supply end of the cable.

2.4 CONTROLS

Front Panel

All front panel controls are listed in Table 2-1.

TABLE 2-1 FRONT PANEL CONTROLS

Name	Function
AC ON	Toggle switch, controls input power.
VOLTAGE ADJUST (coarse)	Potentiometer, adjusts voltage output.
VOLTAGE ADJUST (vernier)	Potentiometer, adjusts voltage output.
CURRENT ADJUST	Potentiometer, adjusts current.

Internal

All internal control settings have been factory preset and require no additional adjusting. However, if it should become necessary to adjust any of the internal controls due to circuit changes caused by component aging or replacement, refer to the calibration section of this manual.

2.5 OPERATION

Controls Settings

Set all front panel controls fully CW.

Shorting Links

Prior to tne application of power, connect all loads, external wiring and shorting links required for the mode of operation desired.

Grounding

Either side of the output may be grounded, or the output may be used in a floating condition.

Power On

Connect the unit to a nominal AC input power source. Set AC power ON switch to on, and observe that pilot lamp DS1 glows.

Warm-Up

No warm-up time is necessary to place the unit into operation. However, a 30-minute warm-up period is recommended to reach rated stability. The unit is now ready for operation.

2.6 AUTOMATIC LOAD SHARE PARALLELING

General

To operate two or more power supplies in the automatic load share paralleling mode, select one unit as a master and the other units as slaves. Set the front panel controls on the slaves fully CW. Refer to schematic diagram for interconnection information.

Use leads of approximately equal resistance for connecting load to +V terminals, or strap +V terminals directly together if near each other and use a single lead from the master terminal.

Remote sensing need only be done with the master terminals. Remove jumpers from between 11 and 12, and terminals 13 and 14 on master and run leads from 11 to - side of load and from 14 to + side of load. Leave jumpers inplace on slave unit.

To balance the load sharing, rotate R42 on rear panels, ("current balance") CCW. Turn units on and adjust load to maximum. For units indicating larger currents, rotate R42 CW until the currents balance. The master unit will now control the output voltage of all the units.

SPECIFICATIONS ADDENDUM

Except for the changes mentioned below, the electrical specifications for this power supply are the same as those for the standard L3R and L5R Liberator power supply series.

Regulation	line:	1mv	
	load:	1mv	
	ripple:	1mv rms	15mv p-p

Output: 5.0 to 5.4 VDC @ 40A

SECTION 3

THEORY OF OPERATION

3.1 GENERAL

The purpose of the Liberator series power supplies is to transform and rectify the AC input into a well regulated, stable and adjustable DC output. The following paragraphs describe the major circuits used in the power supply. As each circuit is described, reference should be made to both the Block Diagram, Figure 3-1 and the Schematic Diagram in the rear of this manual.

Primary Input

Input power is obtained through power transformer T1, diodes CR5-CR6, CR7-CR8, and filter capacitors C3 and C9. When power switch S1 is set to ON, AC pilot lamp DS1 glows and AC power is applied to T1 and cooling fan B1. Regulated DC output voltage is immediately available from the power supply.

Reference Supply

The purpose of the reference supply is to provide a stable reference voltage for the Comparator and Error Sensing amplifier. Integrated reference amplifier Q13 acts as a reference and comparator, sensing any difference in the voltage developed across R24 and its internal zener diode, and the voltage divider composed of R22 and R23 across the output of the reference supply. The error signal is amplified by Q13 and sent on via Q9 and Q12 to vary the sensitivity of Q11 so as to keep the reference voltage across C2 constant.

Series Regulator

The rectified voltage from CR7-CR8 and filter capacitor C9 is directed through the Series Pass transistors. The conduction of these transistors is controlled by circuitry which causes them to act as variable resistors. Their overall resistance varies in accordance with the need of the power supply to increase or decrease its output voltage or current. The Series Pass transistors are controlled by several driver stages which amplify signals from the Error Amplifier.

Comparator and Error Amplifier

The voltage sensing and comparison is accomplished by matched differential amplifier Q1. A sample of the output voltage on the base of one side of Q1 is compared to the stable reference voltage on the base of the other side of Q1. An unbalance caused by a change in voltage at either the negative sensing terminal or across voltage adjustment controls R39 and R40 will appear as a voltage change in the collector of Q1.

This difference voltage is amplified by error amplifier Q10, and is used to regulate the Series Pass transistors via the Series Pass drivers. Error amplifier Q10 has two diode inputs to its base which form an OR gate for error signals. CR1 supplies error signals from the comparator and an error signal in the event of a short circuit, or if the power supply is driven into Foldback Current Limiting.

When operating in the Foldback Current Limiting mode, differential amplifier Q4 and Q5 become balanced, causing diode CR1 to conduct and in turn drives Error Amplifier Q10 toward cut-off. This signal also causes Q3 to conduct, thereby causing overload indicator lamp DS2 to glow.

Overvoltage Circuit (optional)

The OV circuitry consists of a two transistor amplifier connected between the reference supply, power supply output, and voltage divider R107, R108 and R109. Since the voltage divider is in series with the reference supply and output, any change in output voltage will cause a voltage change across the voltage divider. R109 is adjusted so that when the output voltage reaches a certain value, the drop across R108 and R109 will cause Q102 and Q101 to conduct, triggering CR102 (SCR) and causing CR101 to conduct. If automatic recovery OV is employed, the power supply will cycle until the OV condition is removed at which time the power will operate normally.

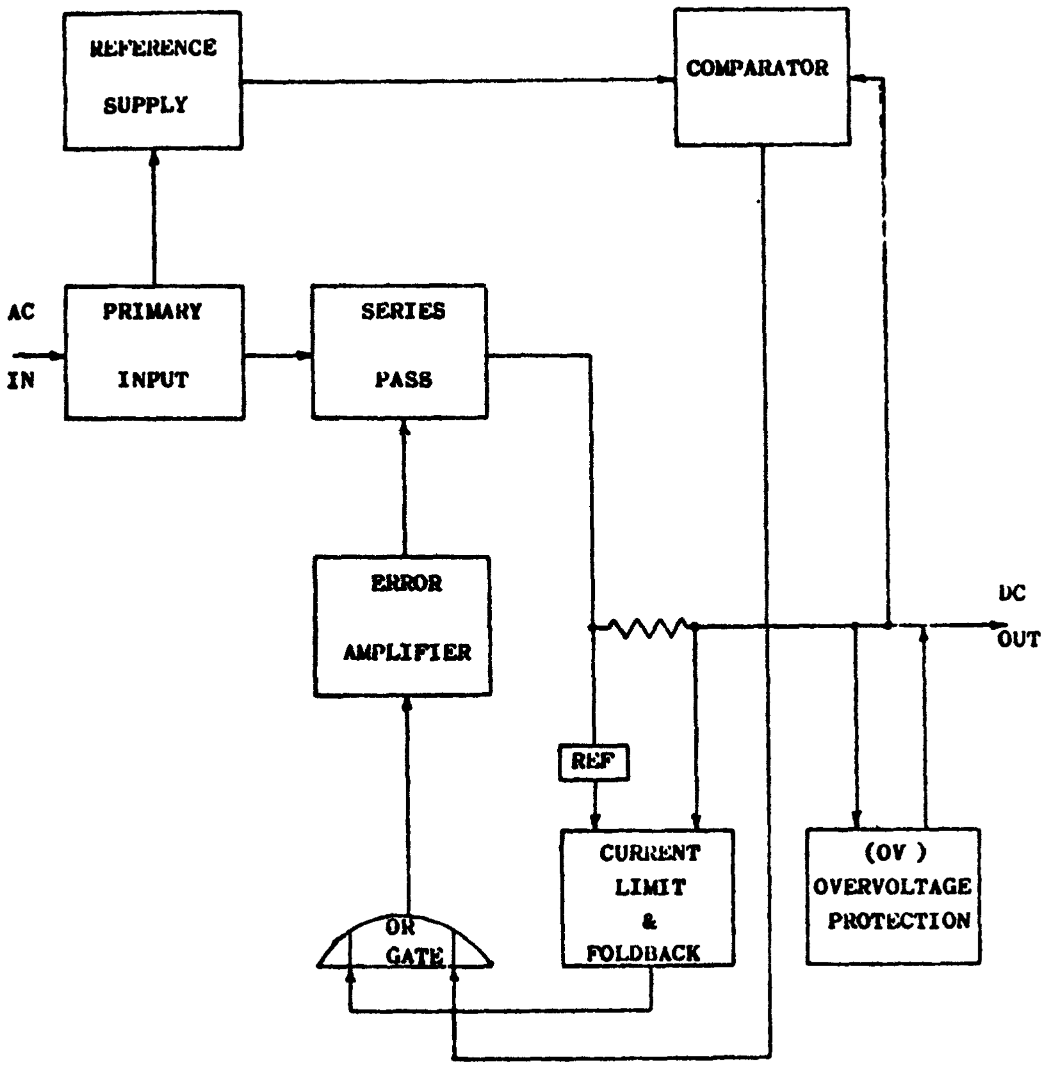


Figure 3-1 Block diagram

SECTION 4

CALIBRATION AND MAINTENANCE

4.1 GENERAL

The following adjustments should be made when necessary to assure optimum operating characteristics and maximum efficiency of the Liberator series power supplies.

4.2 TEST EQUIPMENT REQUIRED (or equivalent)

1) DVM Trymetrics Model 4243
2) AC VTVM, Hewlett Packard Model 400D
3) VOM, Simpson Model 260
4) Variable Auto transformer, Powerstat Type 3PN136 (20 Ampere rating)

Shorting Link Application

For test purposes shorting links should be connected across rear panel barrier strip terminals 11 and 12, 13 and 14 to provide local sensing operation.

To reduce pickup, shielded wire must be used for all connections between test equipment and the power supply being tested. To prevent ground loops, it is important that only one ground connection be made, as shown in Fig. 4-1. Tighten all terminals as securely as possible and set all front panel controls CW.

4.3 CALIBRATION PROCEDURE

Current Limit

1) Establish nominal output voltage
2) Set Foldback control R33 and the front panel voltage adjust controls fully CW.
3) Set Maximum Current control R32 fully CCW.
4) Using an external load, apply a 20% current overload to the unit under test.
5) Adjust Maximum Current control R32 until the overload, as indicated on ammeter M1, is limited to between 5% and 10% (1.05 to 1.10 maximum rated current).

Foldback Current Limiting

1) Set the front panel Voltage Adjust controls to the minimum rated voltage.
2) Apply a load of sufficient size to cause the unit to operate at its maximum rated current output.
3) Slowly rotate Foldback control R33 until overload indicator lamp DS2 just begins to glow.
4) Back off Foldback control R33 until overload indicator lamp DS2 no longer glows.

5) Increase the load to a short circuit condition. Observe that the current folds back, indicating proper operation of the Foldback Current Limiting circuit.

Ammeter Adjustment

1) Using a standard ammeter in series with an external load, adjust the load so the unit will operate at its maximum rated current (as indicated on the standard ammeter) and voltage output.

2) Adjust ammeter adjust control R43 until ammeter M1 indicates the same current as the standard meter.

Constant Voltage Operation

Load Regulation

With the equipment connected as shown in Figure 4-1, connect a suitable load resistance across the output terminal connections. The load resistance selected must be able to dissipate the rated power of the unit (P=IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Note the voltage indicated on the Differential VTVM. Disconnect the resistive load from the output. The maximum change in output DC voltage indicated on the Differential VTVM should not exceed by more than 1mv that of the output voltage indicated with the load resistance applied across the output terminals.

Line Regulation

Place the resistive load across the output and note the voltage indicated on the Differential VTVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum change in output voltage should not exceed by more than 1mv measured at either extreme of the AC input.

Ripple Voltage

In order to reduce pickup, shielded test leads should be used in making ripple measurements. With the resistive load connected across the output terminals, measure the AC ripple with the AC VTVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum ripple amplitude should not exceed 1mv.

Overvoltage Sensitivity

The trigger point of the OV protection circuit is determined by the setting of the OV control R109, located on the rear panel. To set the OV circuit to trigger within the output range of the power supply, set R109 CCW. Turn on the supply and adjust it for the desired OV firing point. Turn R109 CW until the output voltage drops to zero as indicated by the front panel voltmeter.

To set the OV circuit to fire at a higher output voltage than the output voltage of the supply, a second current

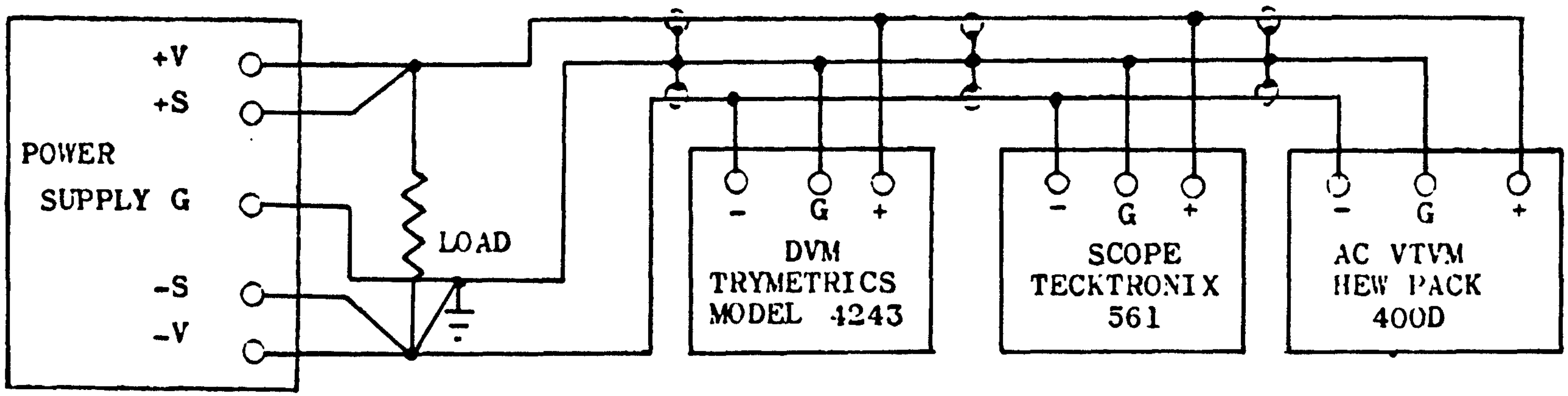


Figure 4-1 Constant voltage operation

limiting type power supply is needed. With the supply under test, set its output voltage to any value. Turn R109 CCW and connect the second supply across its output terminals. Set the second supply's output voltage to the desired OV firing point. Turn R109 CW until the output of the supply drops to zero as indicated on its voltmeter. This indicates that the OV circuit has fired.

4.4 MAINTENANCE

General

This power supply is a precision instrument. It is strongly recommended that only experienced troubleshooting personnel perform troubleshooting operations or attempt to repair the unit. If the power supply appears to be malfunctioning at all, the following procedure is recommended for isolating possible defects.

Loads and Interconnections

1) Disconnect all loads and interconnections.

2) Connect a resistive load across the output terminals, and operate the unit to determine whether the fault lies within the unit or externally. Observe that shorting links are in place across terminals 11 and 12 and 13 and 14 to provide local sensing operation.

3) Set input voltage to nominal value (115 VAC) and operating controls for rated output. Satisfactory operation at this time would indicate that any malfunction previously encountered, is external in nature. All interconnections and loads normally used in conjunction with this power supply should then be carefully checked for electrical defects.

Troubleshooting

1) The Block Diagram, Schematic Diagram and appropriate sections of the Theory of Operation will prove helpful in any troubleshooting work.

2) With AC power disconnected proceed with point-to-point resistance checks across pots, switches, diodes, resistors, transistors, in that order.

Semi-conductors commonly used in Trygon power supplies are available for replacement or spare parts use under the following Trygon, commercial manufacturer or JEDEC part number

TRANSISTORS

SEMI - CONDUCTOR PART NUMBERS		
TRYGON IBM NO.	TRYGON OR MFR P/N	JEDEC EQUIVALENT
700000	TR1132	2N1132
700001	2N3638A	2N3638A
700010	TR346	2N1556
700020	TR360	2N360
700030	TR361	2N652
700040	TR375	2N1533
700045	TR496	2N497A
700050	TR656	2N656
700060	TR890	
700070	TR951	2N2527
700080	TR1490	2N3055
700083	TR1493	2N1490
700085	TR1495	2N3442
700090	TR2060A	2N2060A
700110	TR2195	
700115	TR2905	2N3644
700180	16A507	2N2712
700181	2N3566	2N3566
700191	TR1591	2N3054
700193	TR1593	2N3441
700200	TR1512	2N2139
700205	TR1690	2N3440
700411	2N3569	2N3569
705018	2N3416	2N3416
705030	16J1	2N3605
705031	2N3691	2N3691
720055	TR83	
720145	UJ25	2N2647
720328	720328	

Semi-conductors commonly used in Trygon power supplies are available for replacement or spare parts use under the following Trygon, commercial manufacturer or JEDEC part number

RECTIFIERS

SEMI - CONDUCTOR PART NUMBER		
TRYGON IBM NO.	TRYGON OR MFR P/N	JEDEC EQUIVALENT
720060	E016	
720110	SV515	1N821
720144	UZ750	
720150	UZ815	
720181	1N751A	1N751A
720151	UZ806	
720182	1N754A	1N754A
720192	1N753B	1N753B
720196	1N755A	1N755A
720200	40108	1N1431
720210	40109	1N1342
720220	40110	1N1343
720230	40111	1N1344
720241	1N1360A	1N1360A
720260	TR2620A	1N2620A
720262	1N2163A	1N2163A
720273-720277	SCR285-2 thru SCR285-7	
720280	SCR93-2	2N2572
720290	SCR93-3	2N2573
720300	SCR93-4	2N2574
720301	SCR93-5	2N2575
720303	SCR93-7	2N2577
720330	70H10	
720340	70H15	
720350	70H20	
720384	1N4384	1N4384
720390	SSD708	
720393	1N972B	1N972B
720397	1N2165A	1N2165A
720394	1N964B	1N964B
720395	1N965A	1N965A
720440	TR4148	1N4148
720454	MR1031A	
720455	MR1032A	
720456	MR1034A	
720459	1N758	1N758
720464	1N968	1N968
720466	1N983A	1N983A
725016	1N702	1N702
725047	MR211 5B	
725048	MR211SBR	
725076	1N3616	1N3616
725130	2N3670	2N3670
720263	Z0132	

MANUFACTURER'S CODE LISTING - ELECTRICAL PARTS

1) The numbers designated in the SPARES column of the following ELECTRICAL PARTS LISTING indicate the recommended spare parts requirement for support of this equipment for a period of one year.

2) The code designations listed in the MFR column of the ELECTRICAL PARTS LISTING have been assigned to the following manufacturers:

CODE	MANUFACTURER	CODE	MANUFACTURER
A-B	ALLEN BRADLEY	LEE	LEECRAFT
ARN	ARNOLD	MILW	MILWAUKEE
BUSS	BUSS	MOTO	MOTOROLA
CARL	CARLING	PHAO	PHAOSTRON
CD	CORNELL DUBILIER	RCA	RADIO CORPORATION OF AMERICA
CLAR	CLAROSTAT	ROT	ROTRON
CORN	CORNISH	SAGE	SAGE
CTS	CHICAGO TELEPHONE SUPPLY	SANG	SANGAMO
ERIE	ERIE	SPRA	SPRAGUE
GE	GENERAL ELECTRIC	STEV	STEVENS
GI	GENERAL INSTRUMENTS	TRAN	TRANSITRON
HOYT	HOYT	TRY	TRYGON
IREC	INTERNATIONAL RECTIFIER CORP.	UNI	UNITRODE
IRES	INTERNATIONAL RESISTOR CORP.	WILG	WILGREEN
OHM	OHMITE	WL	WARD LEONARD
SCHW	SCHWEBER	SEMC	SEMCOR

LIST OF ELECTRICAL PARTS - MODEL L3R5-40 OV S2626

Designation	Component	MFR	Part Number	Spares	TRYGON STOCK NO.
B1	Fan 3" Sprite	ROT	MODEL SP2A2	1	890025
C1	Capacitor, 250 MFD, 6V	SPRA	40D257F006DH4	2	810170
C2	Capacitor, 35 MFD, 25V	SPRA	40D356F025DD4	1	810060
C3	Capacitor, 450 MFD, 50V	SPRA	39D	1	810212
C4	Capacitor, .01 MFD, 600V	ERIE	811Z5V103P	2	800090
C5	Capacitor, .001 MFD, 600V	-	-	2	800060
C6	Capacitor, .022 MFD, 500V	ERIE	811Z5V13P	1	800129
C8	Capacitor, 40000 MFD, 10V	SANG	539-2939-02	1	820410
C9	Capacitor, 72000 MFD, 25V	GE	86F144	1	820460
C10	Capacitor, 1 MFD, 200V	-	-	1	800300
C11	Capacitor, 2430 MFD, 25V	SANG	500-1381-02	1	820145
C12	Capacitor, .05 MFD, 200V	-	-	1	800168
C14	Capacitor, .15 MFD, 200V	GOOD	X663F	1	800226
C15	Capacitor, .47 MFD, 200V	GOOD	X663F	2	800269
C17	Capacitor, .0047 MFD, 600V	-	-	1	800050
C19	Capacitor, .022 MFD, 500V	-	-	1	800129
C20, C21	Capacitor, 250 MFD, 6V	SPRA	40D257F006DH4	2	810170
C22	Capacitor, .022 MFD, 500V	-	-	1	800129
C101	Capacitor, .1 MFD, 200V	GOOD	X663F	1	800182
C200	Capacitor, .22 MFD, 200V	-	-	1	800231
C201	Capacitor, 10 MFD, 50V	MALL	TTXE	1	810010
C202	Capacitor, 250 MFD, 12V	-	-	1	810164
CR1A, B	Diode, Dual	-	1N4148	2	720440
CR2	Diode, Zener	TRAN	1N765-1	1	725019
CR3	Diode, Zener	TRAN	1N751A	1	720181
CR4,5,6,30,201	Diode	-	1N4384	4	720384
CR7, 8	Diode	IREC	70H10	1	720330
CR9	Diode, 12A, 50V	-	-	1	720129
CR10,31	Diode, Zener	IREC	1N4384	2	720384
CR13	Diode, 12A, 100V	-	-	1	720132
CR101	Diode	-	-	1	725086
CR102	Rectifier, Silicon, controlled	GE	C50F	1	720050

LIST OF ELECTRICAL PARTS - MODEL L3R5-40 OV S2626

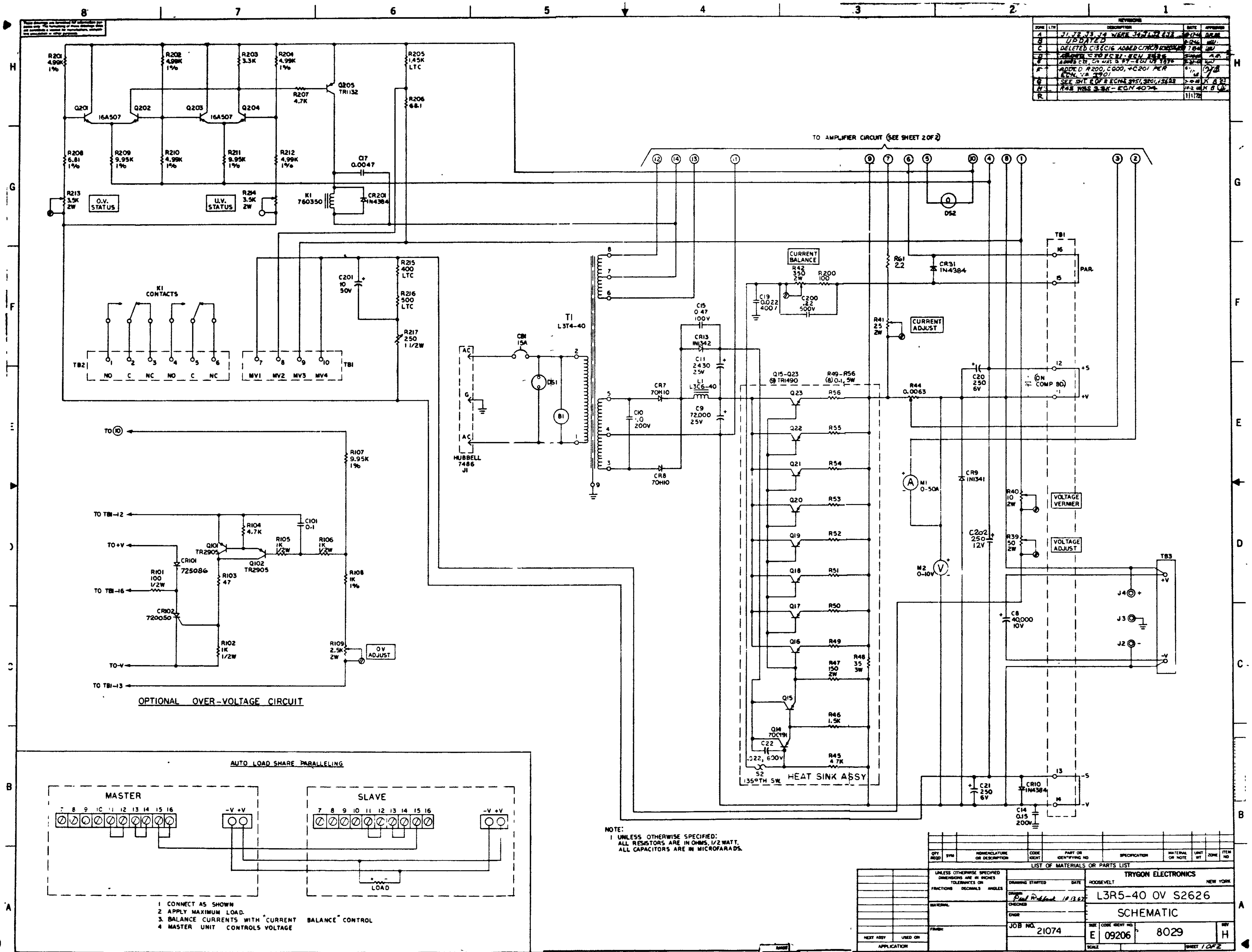
Designation	Component	MFR	Part Number	Spares	TRYGON STOCK NO.
CB1	Circuit Bkr. 15A	HEIN	JA1-A3-15-250-2A	1	760107
DS1	Pilot Light	IND.DEV.	1040A87	1	770020
DS2	Light Ind.	IND.	2190A87	1	770023
K1	Relay	ALLIED	TS154-2C5.8M ADC	1	760350
L1	Choke	TRY	L3C6-40	1	501371
Q1	Transistor, Dual Silicon	MOTO	TR1000	1	700071
Q2,3,4,5,7,8,9	Transistor	GE	16A507	4	700180
Q6	Transistor	-	2N4238	1	700047
Q10,12	Transistor	FAIR	2N3638A	4	700001
Q11,101,102,205	Transistor	-	2N2905A	2	705067
Q13	Transistor	MOTO	MCA 1912N	1	705065
Q14	Transistor	RCA	TR1591	1	700191
Q15,16,17,18,19, 20,21,22,23	Transistor	RCA	TR1490	5	700080
Q201,202,203,204	Transistor	GE	16A507	2	700180
M1	Meter, 50A	DIX	200R	1	754500
M2	Meter, 10V	DIX	200R	1	755101
R3	Resistor, 1KΩ, 3W, 3%	SAGE	1300S1000-3	1	630390
R4,25	Resistor, 3KΩ, 3W, 3%	SAGE	1300S3000-3	2	630460
R5,6,21	Resistor, 3.92KΩ, 1%	IRES	TYPE CECTO	2	620497
R7,8	Resistor, 100Ω, .5W, 1%	IRES	TYPE CECTO	1	620030
R9	Resistor, 750Ω, .5W, 1%	IRES	TYPE CECTO	1	620250
R10,17,101,200	Resistor, 100Ω, .5W, 10%	AB	RC20GF101K	2	610070
R11,18	Resistor, 100KΩ, .5W, 10%	AB	RC20GF104K	2	610350
R12	Resistor, 560Ω, .5W, 10%	AB	RC20GF561K	1	610150
R13	Resistor, 604Ω, .5W, 1%	-	-	1	620210
R14	Resistor, 9.95KΩ, .5W, 1%	IRES	TYPE CECTO	1	620600

LIST OF ELECTRICAL PARTS - MODEL L3R5-40 OV S2626

Designation	Component	MFR	Part Number	Spares	TRYGON STOCK NO.
R16,28,34,38, 58,102,105,106	Resistor, 1KΩ, .5W, 10%	AB	RC20GF102K	5	610180
R19,203	Resistor, 3.3KΩ, .5W, 10%	AB	RC20GF332K	2	610230
R20,59	Resistor, 4.99KΩ, .5W, 1%	IRES	TYPE CECTO	2	620580
R22	Resistor, 10KΩ, 3W, 3%	SAGE	1300S103K	1	630520
R23	Resistor, 5KΩ, 3W, 3%	SAGE	1300S5000-3	1	630490
R24	Resistor, 40.2KΩ, .5W, 1%	IRES	TYPE CECTO	1	620702
R26	Resistor, 3.01KΩ, .5W, 1%	IRES	TYPE CECTO	1	620480
R27	Resistor, 2.2KΩ, .5W, 10%	AB	RC20GF222K	1	610210
R29	Resistor, 400Ω, 3W, 3%	SAGE	1300S400-3	1	630320
R30	Resistor, 2.49KΩ, .5W, 1%	IRES	TYPE CECTO	1	620450
R31	Resistor, 340Ω, .5W, 1%	IRES	TYPE CECTO	1	620130
R32	Potentiometer, 500Ω, 1.5W, 20%	CTS	TYPE 110	1	600146
R33	Potentiometer, 50Ω, 1.5W, 20%	CTS	TYPE 110	1	600021
R36	Resistor, 2.2Ω, .5W, 10%	–	–	1	610003
R37	Resistor, 8.2KΩ, .5W, 10%	AB	RC20GF822K	1	610280
R39	Potentiometer, 50Ω, 2W, 10%	TRY	B1153	1	600030
R40	Potentiometer, 10Ω, 2W, 10%	TRY	B2816	1	600010
R41	Potentiometer, 25Ω, 2W, 10%	TRY	B7134	1	600014
R42	Potentiometer, 350Ω, 2W, 10%	TRY	B1649	1	600110
R43	Potentiometer, 150Ω, 1.5W, 20%	CTS	TYPE 110	1	600071
R44	Meter Shunt	TRY	081928	1	081928
R46	Resistor, 1.5KΩ, .5W, 10%	AB	RC20GF152K	1	610195
R47	Resistor, 150Ω, 2W, 10%	IRES	TYPE BWH	1	640380
R48	Resistor, 35Ω, 3W, 3%	SAGE	1300S35-3	1	630200
R49,50,51,52,53 54,55,56	Resistor, .1Ω, 5W, 10%	CLAR	TYPE CC5E	4	640011
R57	Resistor, 10KΩ, .5W, 10%	AB	RC20GF103K	1	610290
R60	Resistor, 33Ω, .5W, 10%	AB	RC20GF330K	1	610020
R61	Resistor, 511Ω, .5W, 1%	–	–	1	620180
R103	Resistor, 47Ω, .5W, 10%	AB	RC20GF470K	1	610030
R104,207,45	Resistor, 4.7KΩ, .5W, 10%	AB	RC20GF472K	2	610250
R107,209,211	Resistor, 9.95KΩ, .5W, 1%	IRES	TYPE CECTO	2	620600
R108	Resistor, 1KΩ, .5W, 1%	IRES	TYPE CECTO	1	620300
R109	Potentiometer, 2.5KΩ, 2W, 10%	TRY	B3725	1	600230

LIST OF ELECTRICAL PARTS - MODEL L3R5-40 OV S2626

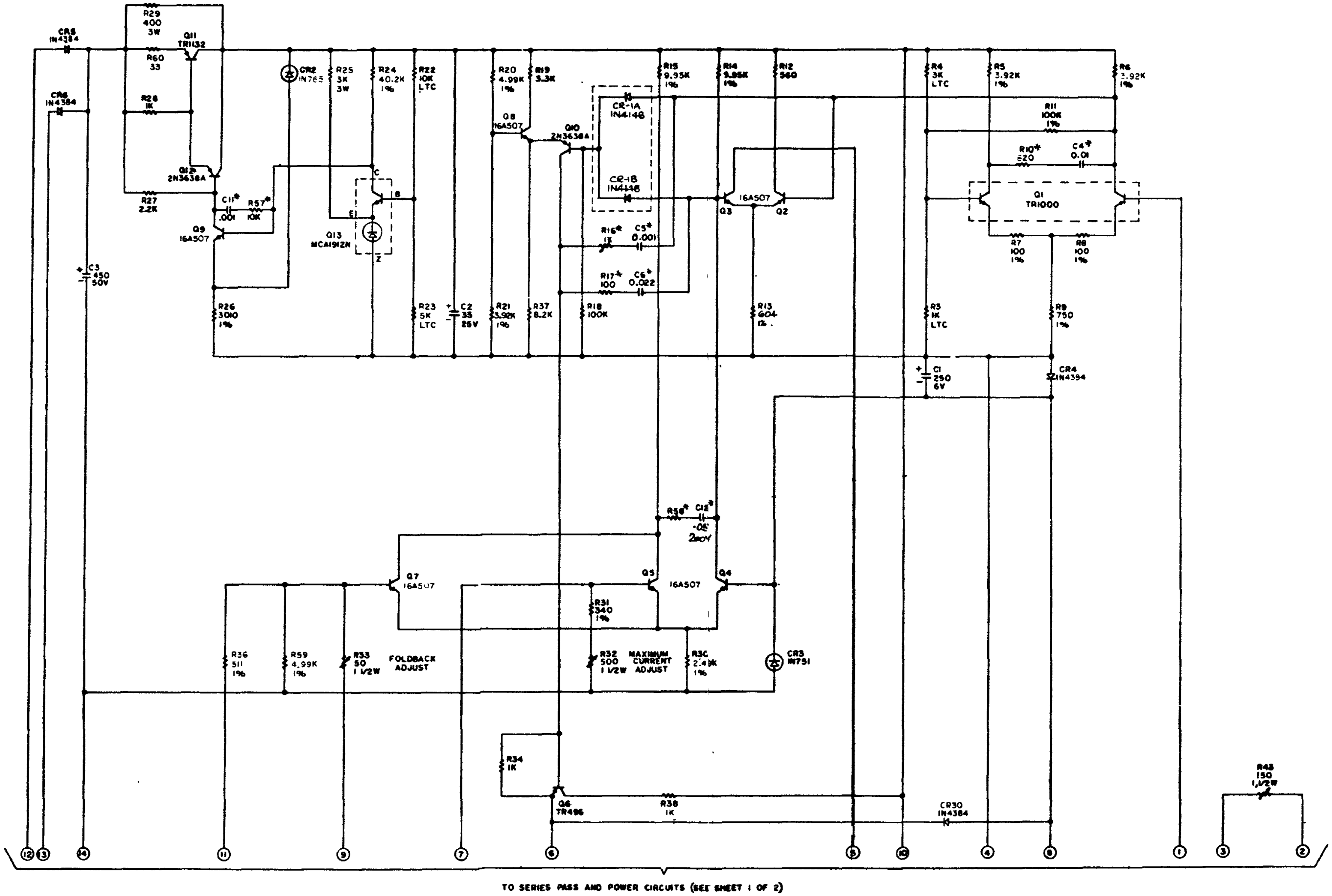
Designation	Component	MFR	Part Number	Spares	TRYGON STOCK NO.
R201,202,204,210 212	Resistor, 4.99K, 0.5W, 1%	-	-	3	620530
R205	Resistor, 1.45KΩ, 3W, 3%	SAGE	1300S1450-3	1	630410
R206	Resistor, 68.1Ω, .5W, 1%	IRES	TYPE CECTO	1	620000
R208	Resistor, 6.81KΩ, .5W, 1%	IRES	TYPE CECTO	1	620596
R213,214	Potentiometer, 3.5KΩ, 2W, 10%	-	-	2	600260
R215	Resistor, 400Ω, 3W, 3%	SAGE	1300S400-3	1	630320
R216	Resistor, 500Ω, 3W, 3%	SAGE	1300S500-3	1	630340
R217	Potentiometer, 250Ω, 1.5W, 20%	CTS	TYPE 110	1	600102
S2	Switch, Therm N.C. 135°C	STEV	-	1	880007
T1	Transformer	TRY	L3T4-40	1	501211



TO AMPLIFIER CIRCUIT (SEE SHEET 2 OF 2)
K1 CONTACTS
O.V. STATUS
U.V. STATUS
CURRENT BALANCE
CURRENT ADJUST
VOLTAGE VERNIER
VOLTAGE ADJUST
OV ADJUST
HEAT SINK ASSY
OPTIONAL OVER-VOLTAGE CIRCUIT
AUTO LOAD SHARE PARALLELING
MASTER
SLAVE
LOAD
1 CONNECT AS SHOWN
2 APPLY MAXIMUM LOAD.
3 BALANCE CURRENTS WITH "CURRENT BALANCE" CONTROL
4 MASTER UNIT CONTROLS VOLTAGE
NOTE:
1 UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS, 1/2 WATT.
ALL CAPACITORS ARE IN MICROFARADS.
LIST OF MATERIALS OR PARTS LIST
TRYGON ELECTRONICS
ROOSEVELT NEW YORK
L3R5-40 OV S2626
SCHEMATIC
JOB NO. 21074
E 09206 8029 H

Mar.78 (Amdt.1)

A	REV SEE - REV 4 - SEE SHT 1 OF 2
B	UPDATED
C	SEE SHT 1 OF 2 - ECN
D	SEE SHT 1 OF 2 - ECN
E	SEE SHT 1 OF 2 - ECN
F	SEE SHT 1 OF 2 - ECN NO 3701
G	ADDED CR 30, CR 4,5,6,7,10 WERE ... WERE TR ... WAS TR ..., CR7,8 WERE ..., CR201 WAS S100B ECNS 3951, 3201, 3623
H	SEE SHT 1 OF 2 - ECN 4C74
R	



NOTE:

1 UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS, 1/2 WATT, ALL CAPACITORS ARE IN MICROFARADS.

* 2 SELECT AT TEST

LIST OF MATERIALS OR PARTS LIST

TRYGON ELECTRONICS INC
ROOSEVELT NEW YORK

L3R5-40 OV S2626

SCHEMATIC, COMPONENT BOARD

E 8029 H

Mar.78 (Amdt.1)