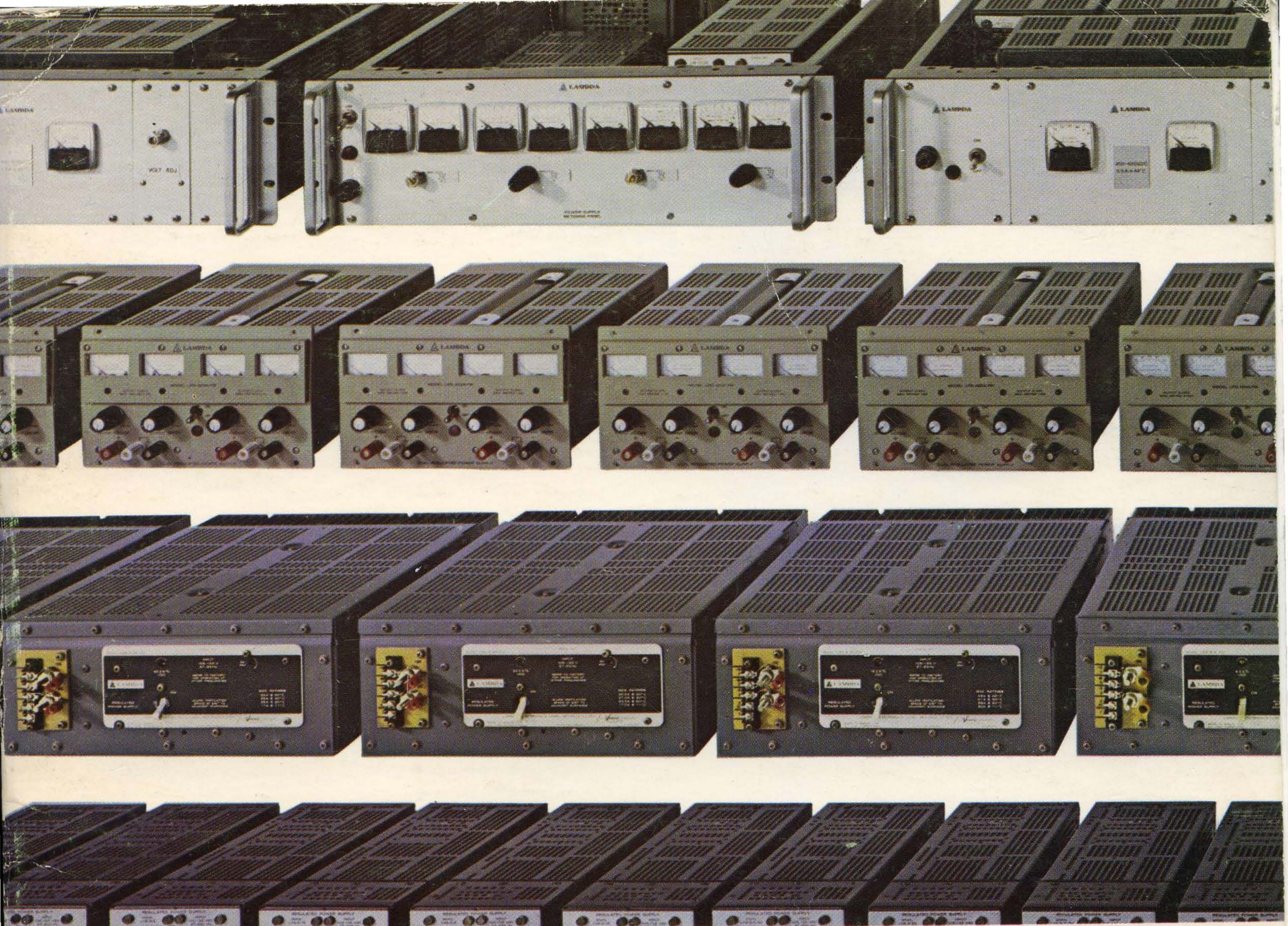
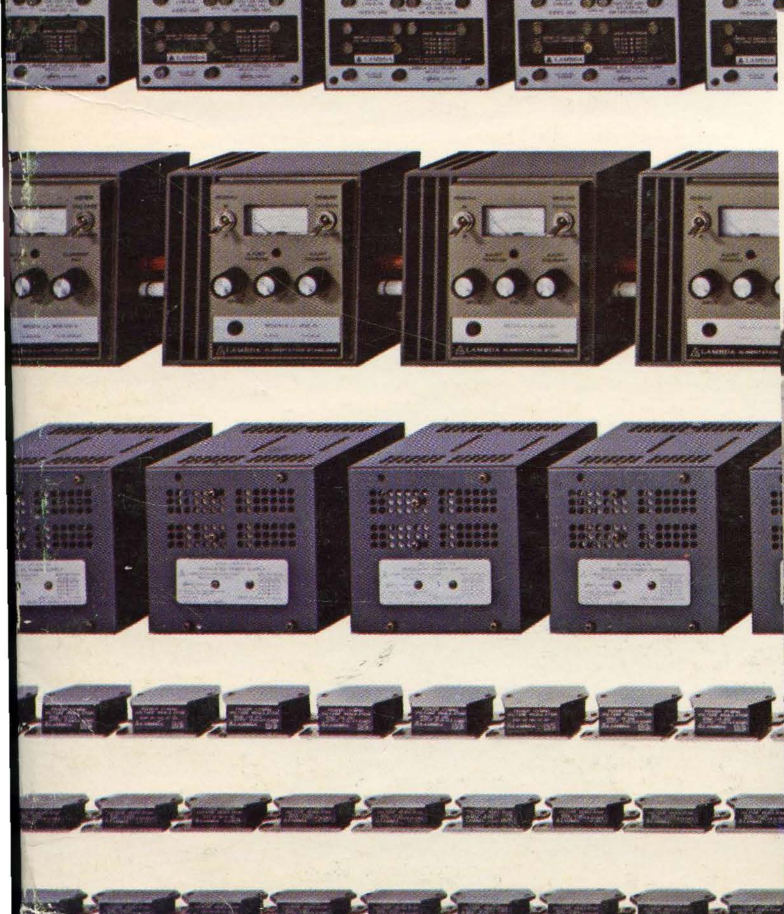




LAMBDA POWER SUPPLY CATALOG & APPLICATION HANDBOOK 1974

LAMBDA'S 5-YEAR GUARANTEE THAT INCLUDES LABOR... NOW IN EFFECT FOR 21 YEARS

Lambda's 5-Year Guarantee has proven itself four times over. It has covered every Lambda manufactured power component, power instrument and power system sold since 1953. It is another proof of Lambda's high caliber engineering, product design, quality control and production techniques which result in exceptional reliability.

Labor and Materials
The Lambda Five-Year Guarantee covers labor and all materials (except fuses) when returned to the factory. It also includes all semi-conductor components. It does not include non-magnetic components supplied with power kits, the LZ Series low cost power supplies or the Power Hybrid Voltage Regulator when purchased as a separate component.

Components Free of Charge, If You Repair
It the customer chooses to perform the maintenance, Lambda will supply all replacements for defective components without cost.

Performance to Published Specifications
The Lambda 5-Year Guarantee covers the operation of the power unit for five years to published specifications. If, at any time during the five-year period, a power product does not meet the published specification when used *within* specified ratings, it can be returned to the factory for calibration. Contact the factory or the nearest Lambda office before returning equipment. Shipments must be prepaid and include reason for return.

Transferable If You Sell Unit
If the unit is sold to a manufacturer who is using it in a system, which he is reselling, the complete guarantee is transferable—as long as the Lambda power product is sold as original equipment.

All Lambda Modifications
The 5-Year Guarantee covers most Lambda products, including units which have been modified by Lambda to fit customer's specific requirements.

HOW TO USE THE CATALOG

This is Lambda's 1974 general catalog. It is the complete selection and reference guide to the world's largest and broadest line of standard, off-the-shelf power supplies.

Selection References can be used to quickly locate the proper power supply to meet your specific application.

1. VOLTAGE REQUIREMENTS

Selection Guides are given on the pages listed.

From these quick reference tables, select the power supply model that most meets your specific requirements.

2. PRODUCT CLASSIFICATIONS

3. TABLE OF CONTENTS

Use the Table of Contents on Pages 2-3 where complete listing of catalog contents are given.

4. PRODUCT INDEX

Use the Product Index on Pages 185-188 where complete listing of Lambda product models are given.

If you are unable to find the power supply to meet your specific needs, call your local Lambda field sales engineer. Field offices are listed on the inside back cover.

LAMBDA POWER SUPPLY CATALOG

TABLE OF CONTENTS
GENERAL INFORMATION

POWER COMPONENTS

POWER KITS

POWER SUPPLIES, STANDARD

See also Power Supply Selection Guides on pages 14-18 and
Product Index on Pages 185-188

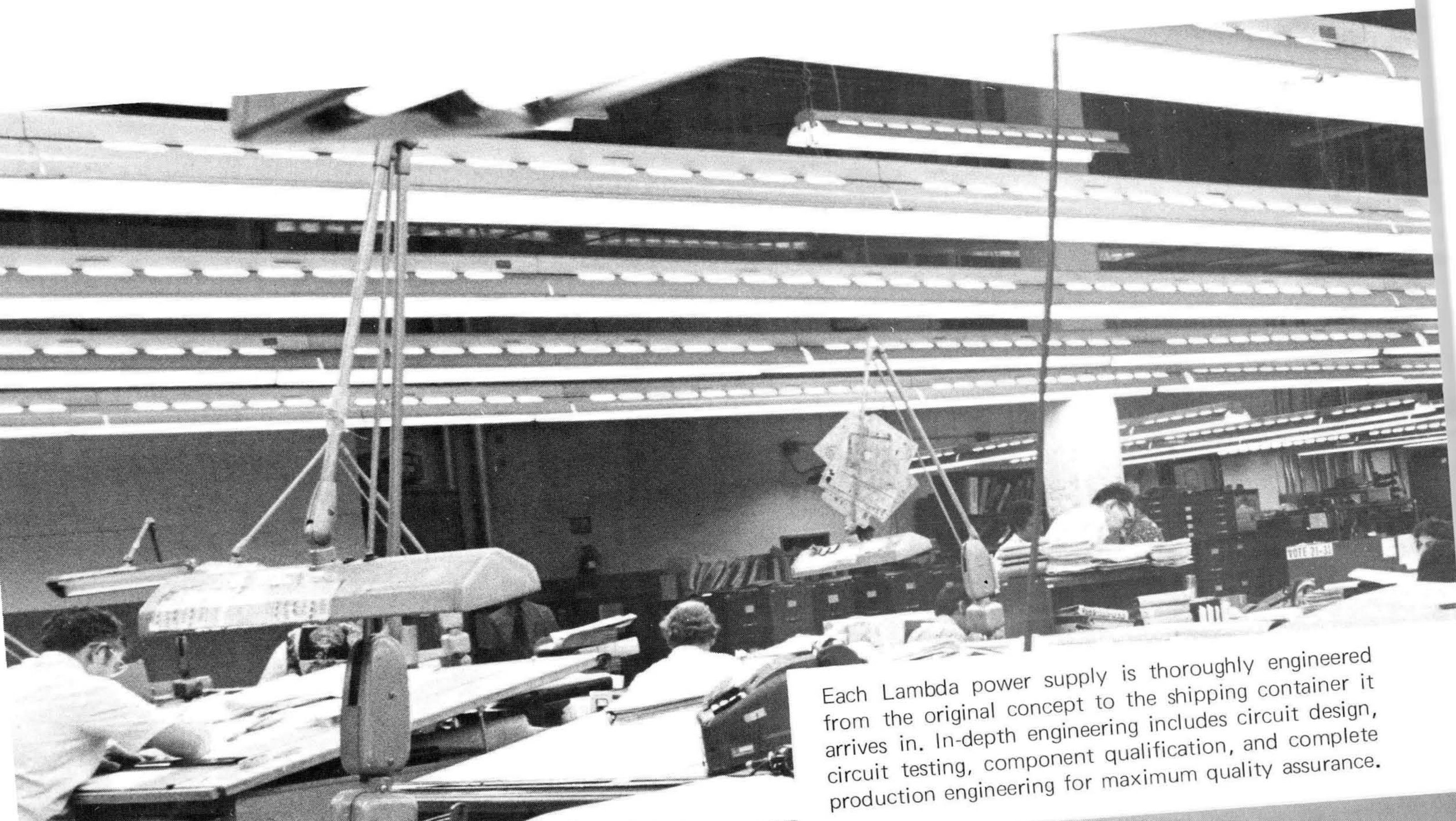
TABLE OF CONTENTS CONT'D.
POWER SUPPLIES, STANDARD CONT'D.

POWER SUPPLIES, CUSTOM

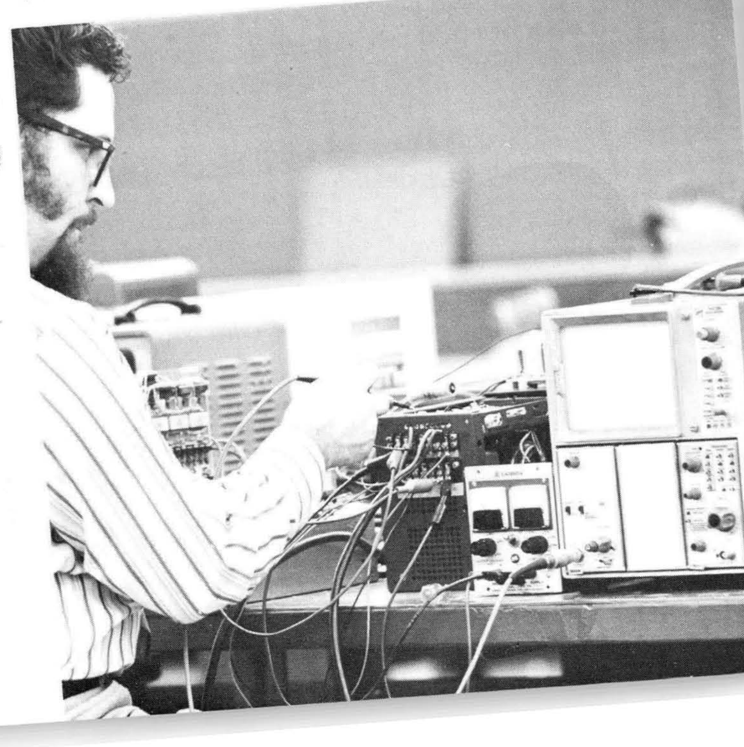
POWER INSTRUMENTS

APPLICATIONS

LAMBDA FACILITIES MANUFACTURING

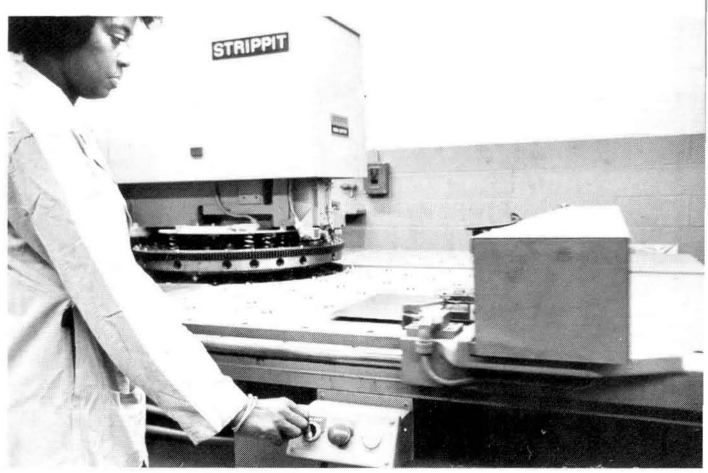


Each Lambda power supply is thoroughly engineered from the original concept to the shipping container it arrives in. In-depth engineering includes circuit design, circuit testing, component qualification, and complete production engineering for maximum quality assurance.



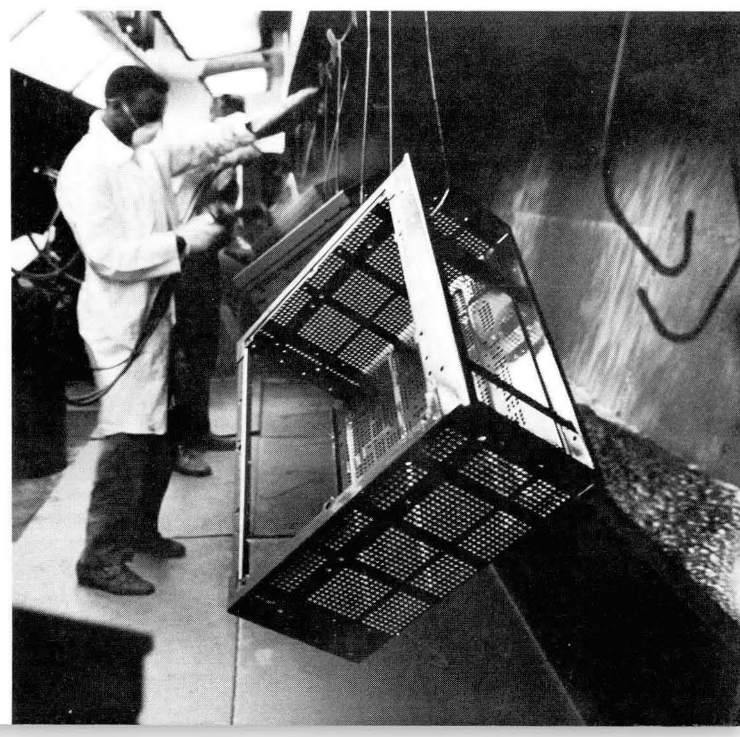
MANUFACTURING

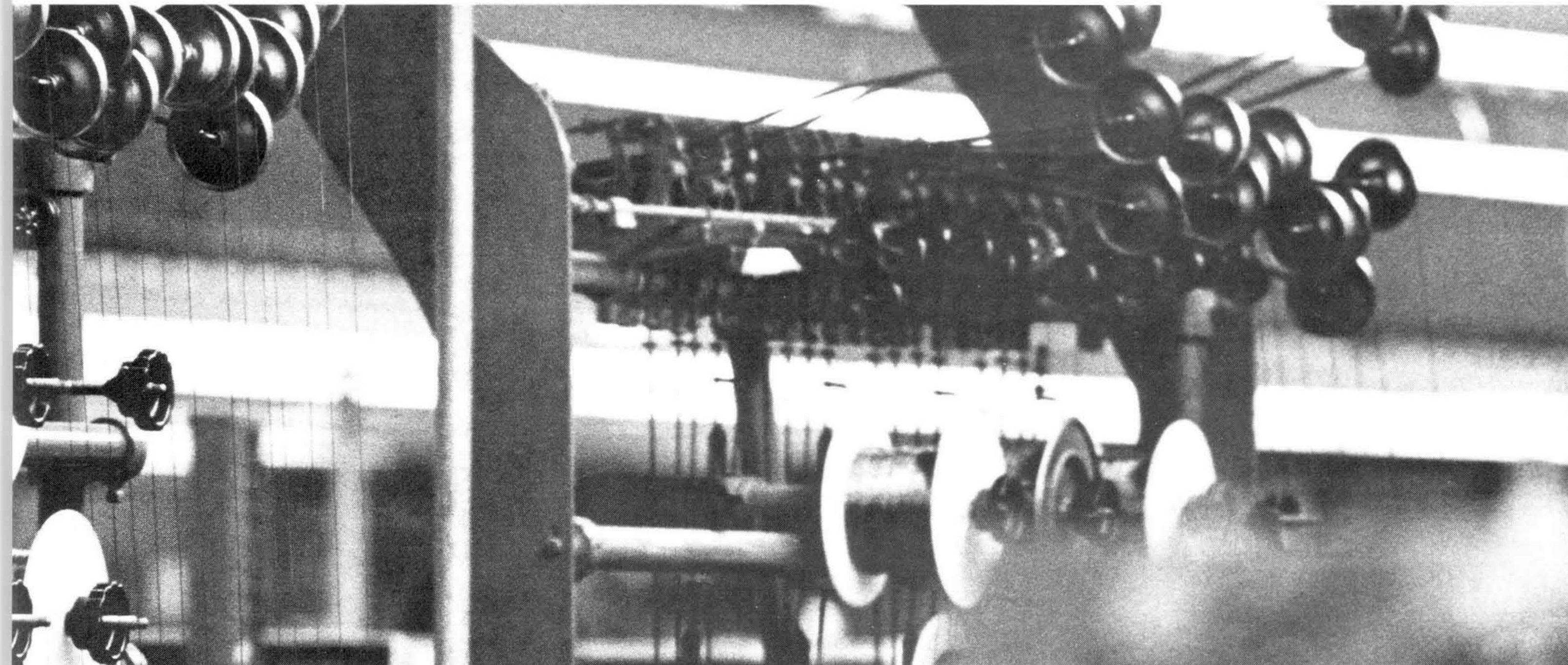
Lambda manufacturing is almost wholly self sufficient. Lambda produces all its own metal parts from sheet . . . stamping, coining, drawing, and bending . . .



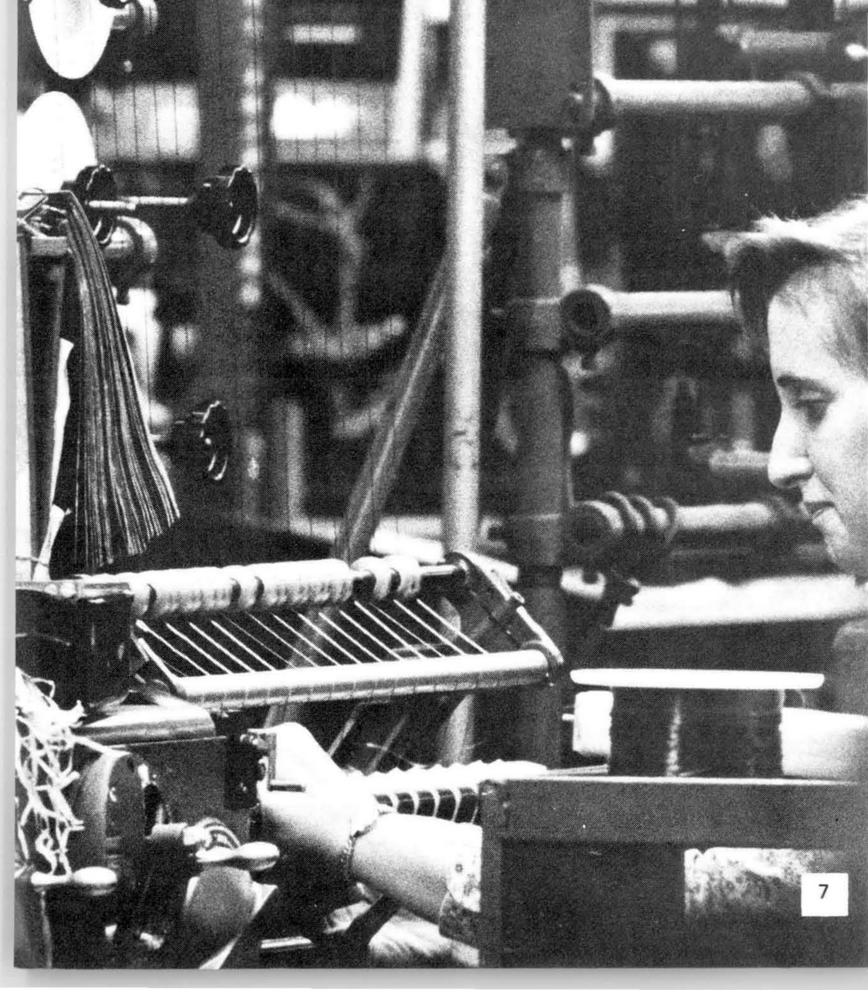
MANUFACTURING

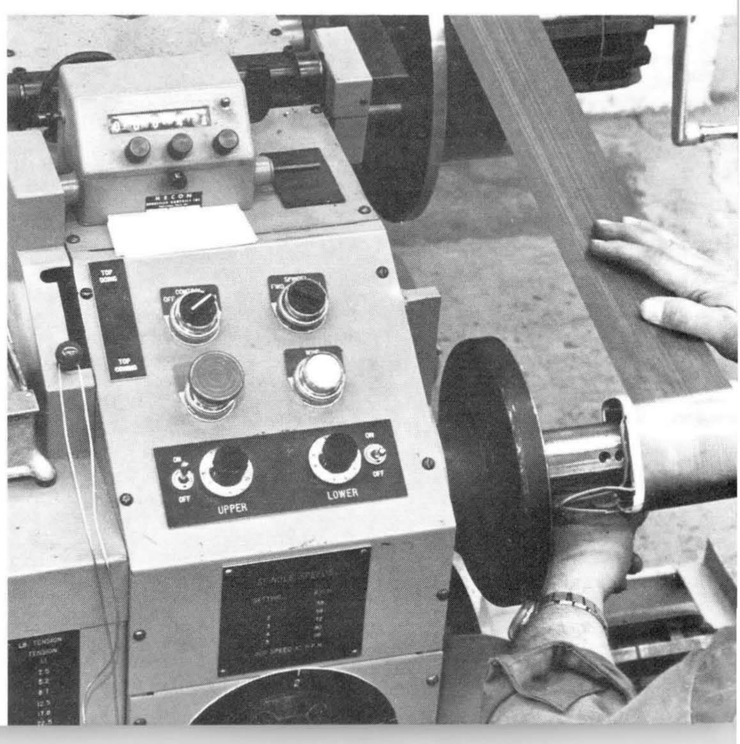
All sheet metal parts pass through Lambda's completely automated painting facility . . . from metal cleaning, rinsing and drying through paint spraying and baking ovens.





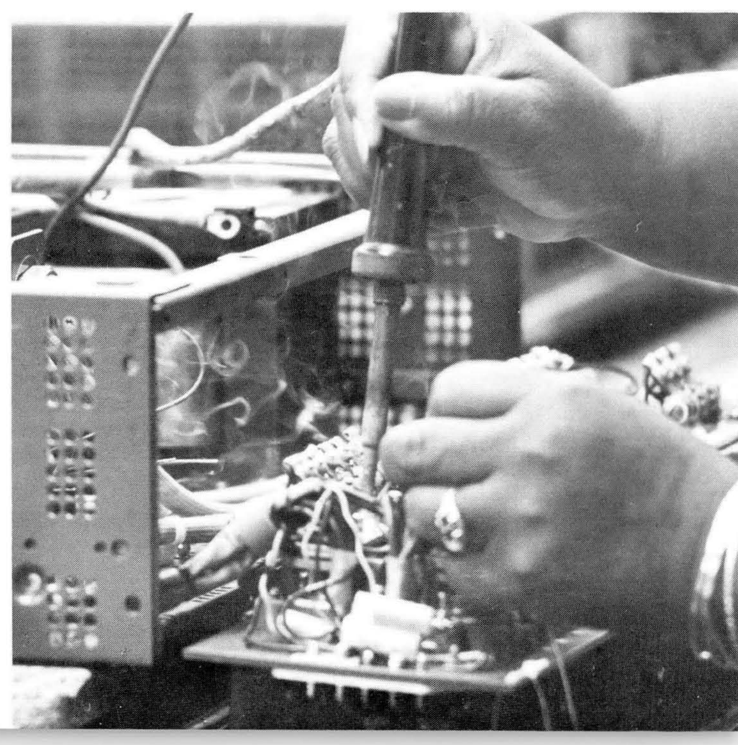
All Lambda magnetic components are manufactured in Lambda's own transformer plant to Lambda designs.





MANUFACTURING

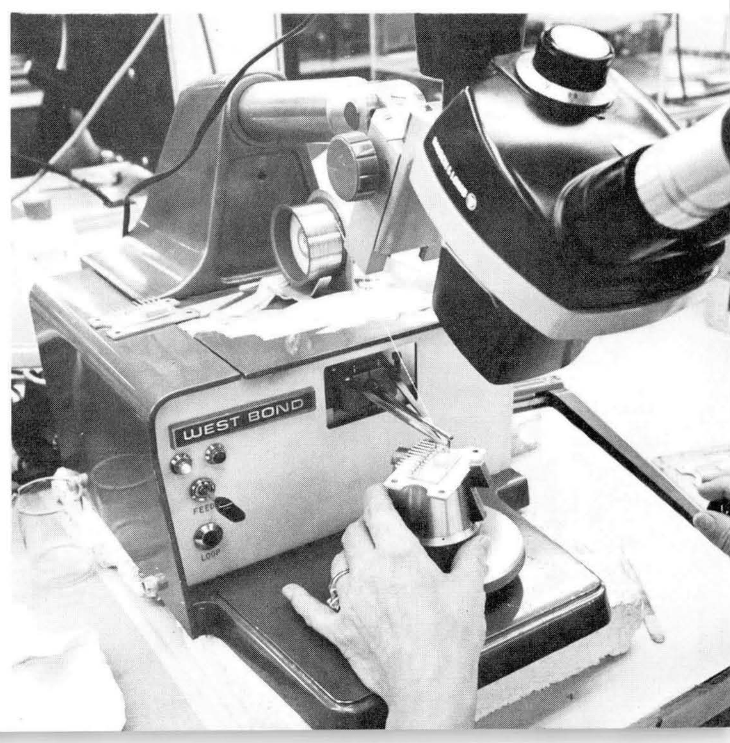
PC boards or complete supplies are assembled and wave soldered for 100% testing with computer-programmed, automated test equipment.



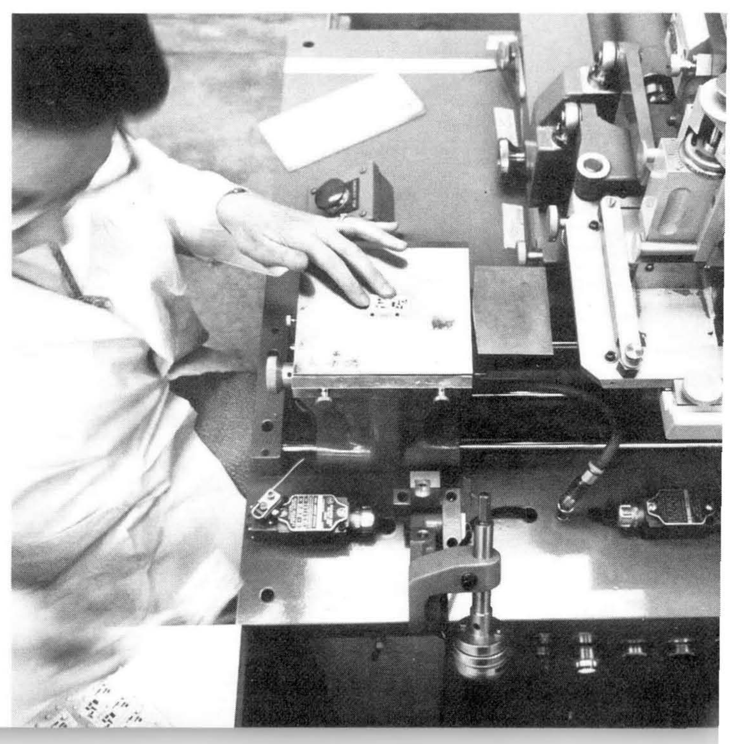

decpack

MICROELECTRONIC FACILITY FOR POWER HYBRID VOLTAGE REGULATOR PRODUCTION

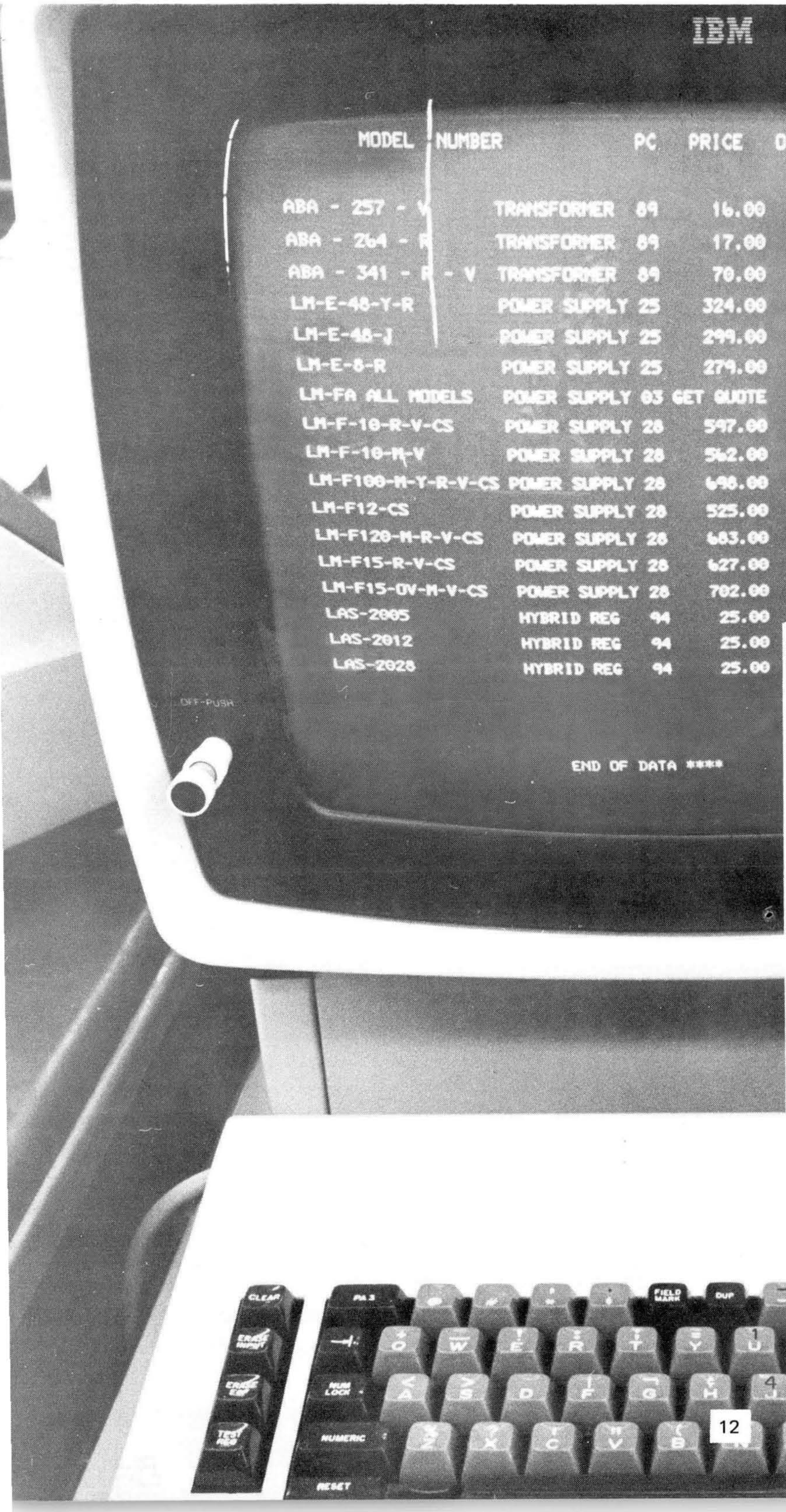
We not only developed the Power Hybrid Voltage Regulator; we build it too—from basic material to finished product. The most modern equipment for the manufacture of microelectronic circuitry has been installed in a new facility at our Melville, New York plant.



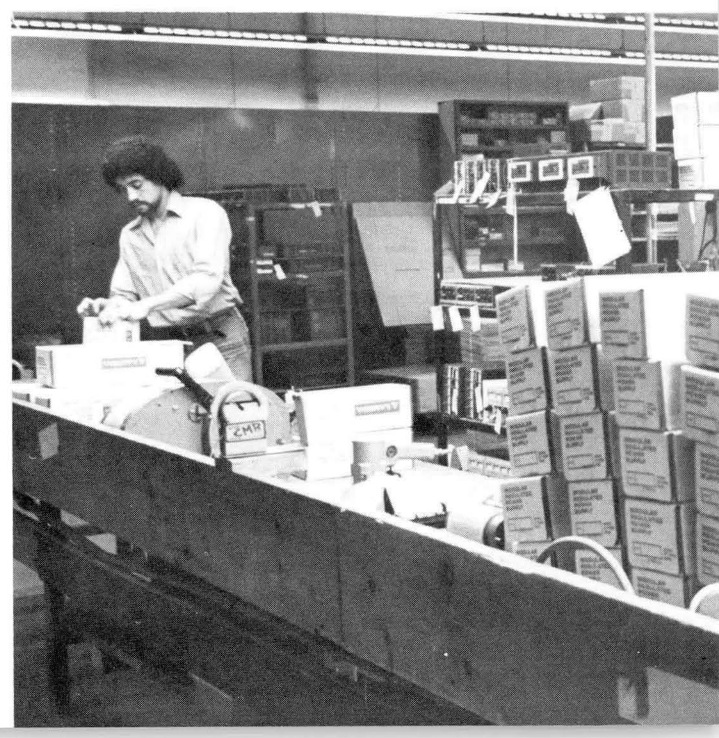
Staffed by experienced engineers and with its own Quality Assurance group, this new Lambda facility will supply Power Hybrid Voltage Regulators for our own requirements and for customers who build their own power supplies.



INVENTORY CONTROL



Lambda's complete power supply stock, available off-the-shelf in 1-day delivery, is processed by the very latest in computerized inventory control.



LAMBDA'S
WORLD WIDE FACILITIES

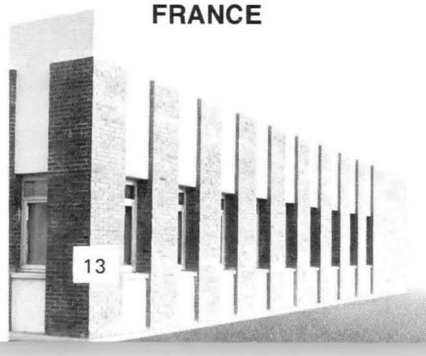

LOS ANGELES

GERMANY

Lambda maintains a stock of well over $2,000,000 in power supplies representing over 10,000 units. The chances are 90% that we have the power supply you need in stock and can ship it to you **1 day** after we receive your order. Lambda's Distributor Division maintains inventories in Los Angeles, Montreal, and New York to reduce shipping time.

CANADA

FRANCE



ENGLAND

NEW YORK

STANDARD POWER SUPPLIES SELECTION GUIDE FIXED VOLTAGE MODELS

SINGLE OUTPUT

2 VOLTS ± 5%

Models below found on page 81

Model	Current (AMPS) @ 40°C
LCS-A-2	3.0
LCS-B-2	6.5
LCS-C-2	9.0
LCS-CC-2	16.0
LCS-D-2	27.5
LCS-E-2	35.0
LCS-EE-2	45.0
LM-F-2-R	48.0
LCS-7-2-OV	65.0
LM-G-2-R	95.0
LM-H-2-OV-Y-M	150.0

5 VOLTS ± 5%

Models below found on page 81

Model	Current (AMPS) @ 40°C
LCS-A-5	2.7
LM-B-5	3.7
LXS-A-5-OV-R	4.0
LCS-4-5	4.4
LM-C-5	5.1
LXS-B-5-OV-R	5.8
LCS-B-5-OV	5.8
LXS-4-5-OV-R	7.4
LXS-C-5-OV-R	9.0
LCS-C-5-OV	9.0
LM-CC-5	10.5
LM-D-5	12.6
LXS-CC-5-OV-R	16.0
LCS-CC-5-OV	16.0
LM-E-5	20.0
LXS-D-5-OV-R	27.5
LCS-D-5-OV	27.5
LYS-5-5-OV	30.0
LM-EE-5	31.0
LXS-E-5-OV-R	35.0
LCS-E-5-OV	35.0
LXS-EE-5-OV-R	45.0
LCS-EE-5-OV	45.0
LM-F-5-R	48.0
LXS-7-5-OV-R	65.0
LCS-7-5-OV	65.0
LV-EE-5-A-OV	74.0
LM-G-5-R	80.0
LXS-8-5-OV-R	85.0
LW-EE-5-A	91.0
LM-H-5-OV-Y-M	130.0
LV-G-5-A-OV	130.0
LW-G-5-A	150.0

6 VOLTS ± 5%

Models below found on page 82

Model	Current (AMPS) @ 40° C
LCS-A-6	2.6
LM-B-6	3.2
LXS-A-6-R	3.7
LCS-4-6	4.0
LM-C-6	4.8
LXS-B-6-R	5.5
LCS-B-6	5.5
LXS-4-6-R	6.6
LXS-C-6-R	8.8
LCS-C-6	8.8
LM-CC-6	9.0
LM-D-6	12.4
LXS-CC-6-R	15.2
LCS-CC-6	15.2
LM-E-6	19.0
LYS-5-6	25.0
LXS-D-6-R	26.5
LCS-D-6	26.5
LM-EE-6	30.0
LXS-E-6-R	34.0
LCS-E-6	34.0
LXS-EE-6-OV-R	42.0
LCS-EE-6-OV	42.0
LM-F-6-R	47.0
LXS-7-6-OV-R	59.0
LCS-7-6-OV	59.0
LV-EE-6-A-OV	64.0
LXS-8-6-OV-R	70.0
LW-EE-6	78.0
LV-G-6-A-OV	110.0
LW-G-6-A	128.0

8 VOLTS ± 5%

Models below found on page 82

Model	Current (AMPS) @ 40° C
LCS-A-8	2.4

10 VOLTS ± 5%

Models below found on page 82

Model	Current (AMPS) @ 40° C
LCS-A-10	2.1
LW-D-10-A	27.0
LV-EE-10-A-OV	41.0

12 VOLTS ± 5%

Models below found on page 83

Model	Current (AMPS) @ 40° C
LCS-A-12	1.9
LM-B-12	2.5
LXS-A-12-R	2.7

12 VOLTS ± 5% (cont'd)

Model	Current (AMPS) @ 40°C
LCS-4-12	3.1
LXS-B-12-R	3.8
LCS-B-12	3.8
LM-C-12	4.0
LXS-4-12-R	4.4
LXS-C-12-R	6.5
LCS-C-12	6.5
LM-CC-12	7.3
LM-D-12	10.0
LXS-CC-12-R	10.5
LCS-CC-12	10.5
LM-E-12	15.0
LXS-D-12-R	16.0
LCS-D-12	16.0
LYS-5-12	21.0
LXS-E-12-R	21.0
LCS-E-12	21.0
LM-EE-12	21.0
LW-D-12-A	26.5
LXS-EE-12-R	32.0
LCS-EE-12	32.0
LM-F-12-R	33.0
LV-EE-12-A-OV	34.0
LXS-7-12-OV-R	40.0
LCS-7-12-OV	40.0
LW-EE-12A	42.0
LXS-8-12-OV-R	50.0
LM-G-12-R	56.0
LW-G-12-A	75.0

15 VOLTS ± 5%

Models below found on page 83, 84

Model	Current (AMPS) @ 40°C
LCS-A-15	1.8
LM-B-15	2.2
LXS-A-15-R	2.4
LCS-4-15	2.8
LXS-B-15-R	3.2
LCS-B-15	3.2
LM-C-15	3.5
LXS-4-15-R	4.0
LXS-C-15-R	6.0
LM-CC-15	6.0
LCS-C-15	6.0
LM-D-15	9.0
LXS-CC-15-R	9.5
LCS-CC-15	9.5
LXS-D-15-R	14.0
LM-E-15	14.0
LCS-D-15	14.0

SINGLE OUTPUT

15 VOLTS ±5% (cont'd)

Model	Current (AMPS) @ 40°C
LYS-5-15	17.0
LXS-E-15-R	19.0
LCS-E-15	19.0
LM-EE-15	19.0
LW-D-15-A	22.5
LXS-EE-15-R	28.0
LV-EE-15-A-OV	28.0
LCS-EE-15	28.0
LM-F-15-R	28.0
LW-EE-15-A	35.0
LXS-7-15-OV-R	36.0
LCS-7-15-OV	36.0
LXS-8-15-OV-R	45.0
LM-G-15-R	45.0
LW-G-15-A	60.0

18 VOLTS ± 5%

Models below found on page 84

Model	Current (AMPS) @ 40°C
LCS-A-18	1.6
LW-D-18-A	19.0

20 VOLTS ± 5%

Models below found on page 84

Model	Current (AMPS) @ 40°C
LCS-A-20	1.4
LM-B-20	1.8
LCS-4-20	2.4
LCS-B-20	2.7
LM-C-20	3.1
LCS-C-20	4.2
LM-CC-20	5.0
LM-D-20	7.4
LXS-CC-20-R	7.7
LCS-CC-20	7.7
LXS-D-20-R	11.5
LCS-D-20	11.5
LM-E-20	12.0
LYS-5-20	13.2
LXS-E-20-R	15.0
LCS-E-20	15.0
LM-EE-20	15.2
LW-D-20-A	17.5
LXS-EE-20-R	22.0
LCS-EE-20	22.0
LM-F-20-R	23.0

20 VOLTS ±5% (cont'd)

Model	Current (AMPS) @ 40°C
LXS-7-20-OV-R	28.0
LCS-7-20-OV	28.0
LXS-8-20-OV-R	32.0
LM-G-20-R	35.0

24 VOLTS ± 5%

Models below found on page 85

Model	Current (AMPS) @ 40°C
LCS-A-24	1.1
LM-B-24	1.4
LCS-B-24	2.1
LCS-4-24	2.2
LM-C-24	2.5
LCS-C-24	3.6
LM-CC-24	4.0
LM-D-24	6.7
LXS-CC-24-R	6.8
LCS-CC-24	6.8
LXS-D-24-R	10.0
LCS-D-24	10.0
LYS-5-24	11.0
LM-E-24	11.0
LXS-E-24-R	13.0
LCS-E-24	13.0
LM-EE-24	14.0
LW-D-24-A	14.7
LXS-EE-24-R	19.0
LCS-EE-24	19.0
LM-F-24-R	20.0
LXS-7-24-OV-R	25.0
LCS-7-24-OV	25.0
LW-EE-24-A	26.0
LXS-8-24-OV-R	30.0
LM-G-24-R	32.0
LW-G-24-A	48.0

28 VOLTS ± 5%

Models below found on pages 85, 86

Model	Current (AMPS) @ 40°C
LCS-A-28	1.0
LM-B-28	1.3
LCS-B-28	1.8
LCS-4-28	2.0
LM-C-28	2.3
LCS-C-28	3.0
LM-CC-28	3.5

28 VOLTS ± 5% (cont'd)

Model	Current (AMPS) @ 40°C
LXS-CC-28-R	6.0
LCS-CC-28	6.0
LM-D-28	6.0
LXS-D-28-R	9.0
LCS-D-28	9.0
LYS-5-28	9.5
LM-E-28	10.0
LXS-E-28-R	11.0
LCS-E-28	11.0
LW-D-28-A	12.5
LM-EE-28	13.0
LXS-EE-28-R	17.0
LCS-EE-28	17.0
LM-F-28-R	19.0
LW-EE-28A	22.0
LXS-7-28-OV-R	22.0
LCS-7-28-OV	22.0
LXS-8-28-OV-R	28.0
LM-G-28-R	28.0
LW-G-28-A	39.0

36 VOLTS ±5%

Models below found on page 86

Model	Current (AMPS) @ 40°C
LCS-A-36	0.90
LCS-B-36	1.4
LCS-C-36	2.3

48 VOLTS ± 5%

Models below found on page 86

Model	Current (AMPS) @ 40°C
LCS-A-48	0.60
LCS-B-48	1.1
LCS-4-48	1.2
LCS-C-48	1.8
LM-CC-48	2.5
LCS-CC-48	3.7
LM-D-48	4.1
LCS-D-48	5.2
LM-E-48	6.0
LCS-E-48	6.7
LW-D-48-A	7.6
LCS-EE-48	10.0
LCS-7-48-OV	12.0
LW-EE-48-A	15.0
LW-G-48-A	24.0

STANDARD POWER SUPPLIES SELECTION GUIDE FIXED VOLTAGE AND WIDE RANGE MODELS

SINGLE OUTPUT

100 VOLTS ± 5%

Models below found on page 87

Model	Current (AMPS) @ 40°C
LCS-A-100	0.18
LCS-B-100	0.46
LCS-C-100	0.65
LM-D-200	1.7

120 VOLTS ± 5%

Models below found on page 87

Model	Current (AMPS) @ 40°C
LCS-A-120	0.15
LCS-B-120	0.40
LCS-C-120	0.55
LM-D-120	1.5

150 VOLTS ± 5%

Models below found on page 87

Model	Current (AMPS) @ 40°C
LCS-A-150	0.10
LCS-B-150	0.32
LCS-C-150	0.42
LM-D-150	1.1

DUAL OUTPUT

± 6 VOLTS TO ± 3 VOLTS

Models below found on page 88

Model	Volt Range VDC	Current (AMPS) @ 40°C
LXD-B-062-R	±6	2.7
	to	
	±3	2.1
LXD-C-062-R	±6	3.5
	to	
	±3	2.6
LYD-5-062	± 6 to ± 3	12.5

± 15 VOLTS TO ± 12 VOLTS

Models below found on page 88

Model	Volt Range VDC	Current (AMPS) @ 40°C
LXD-3-152-R	±15 to ±12	0.40
Can also be used as	24-30	0.40
LXD-A-152-R	±15	1.0
	to	
	±12	0.8
LXD-B-152-R	±15	1.6
	to	
	±12	1.4
LXD-C-152-R	±15	2.5
	to	
	±12	2.0

DUAL OUTPUT

±15V TO ±12V (cont'd)

Model	Volt Range VDC	Current (AMPS) @ 40° C
LXD-CC-152-R	±15	4.0
	to	
	±12	3.0
LXD-D-152-R	±15	6.2
	to	
	±12	4.5
LYD-5-152	±15 to ±12	8.5
LXD-EE-152-R	±15	12.5
	to	
	±12	10.0

15 VOLTS DUAL OUTPUT

Models below found on page 88

Model	Volt Range VDC	Current (AMPS) @ 40° C
LCD-4-152	15 ± 5%	1.5
	15 ± 5%	1.5

TRIPLE OUTPUT

5V, ± 15V TO ± 12V

Models below found on page 89

Model	Volt Range VDC	Current (AMPS) @ 40° C
LXT-D-5152-R	5V ± 5%	12.0
	±15	3.1
	to	
	±12	2.3
LYT-5-5152	5V ±5%	18.0
	±15	2.0
	to	
	±12	1.6

QUADRUPLE OUTPUT

5V, ± 15V TO ± 12V, 24 - 28V

Models below found on page 89

Model	Volt Range VDC	Current (AMPS) @ 40° C
LYQ-5-5153	5V ±5%	16.0
	±15	1.5
	to	
	±12	1.2
	24-28	1.0

SINGLE OUTPUT, WIDE RANGE

0-7 VOLTS

Models below found on page 77

Model	Current (AMPS) @ 40°C
LCS-1-01A	0.275
LCS-2-01	0.550
LCS-3-01	1.20
LCS-A-01	2.0
LM-B-O-7	2.8
LCS-4-01	3.3
LCS-B-01	3.7
LM-225	4.0
LCS-C-01	4.5
LM-234	8.3
LCS-CC-01	9.2
LM-E-0-7	12.0
LCS-D-01	12.5
LM-EE-0-7	16.0
LCS-E-01	17.0
LCS-EE-01	23.4
LM-F-O-7-OV-M-R	25.0
LCS-7-01-OV	28.0
LM-G-O-7-OV-M-R	35.0

8.5-14 VOLTS

Models below found on page 77

Model	Current (AMPS) @ 40°C
LM-217	2.1
LM-235	7.7

0-14 VOLTS

Models below found on page 77

Model	Current (AMPS) @ 40°C
LM-B-O-14	1.6
LM-C-O-14	2.2
LM-D-O-14	4.9
LM-E-O-14	7.4
LM-EE-O-14	10.2

13-23 VOLTS

Models below found on page 77

Model	Current (AMPS) @ 40°C
LM-218	1.5
LM-227	2.3
LM-236	5.8

0-18 VOLTS

Models below found on page 77

Model	Current (AMPS) @ 40°C
LCS-1-02A	0.130
LCS-2-02	0.330
LCS-3-02	0.750
LCS-A-02	1.1
LCS-4-02	1.8
LCS-B-02	2.0
LCS-C-02	2.3
LCS-CC-02	3.8
LCS-D-02	5.2
LCS-E-02	7.2
LCS-EE-02	11.0
LCS-7-02-OV	12.5

STANDARD POWER SUPPLIES SELECTION GUIDE WIDE RANGE MODELS AND OPEN-FRAME MODELS

SINGLE OUTPUT

Model	Current (AMPS) @40°C
22-32 VOLTS	
Models below found on page 78	
LM-219	1.2
LM-228	2.0
LM-237	5.0
0-32 VOLTS	
Models below found on page 78	
LCS-1-03A	0.09
LCS-2-03	0.24
LCS-3-03	0.40
LCS-A-03	0.69
LM-B-O-32	0.8
LCS-4-03	1.0
LCS-B-03	1.1
LM-C-O-32	1.1
LCS-C-03	1.6
LCS-CC-03	2.3
LM-D-O-32	2.5
LCS-D-03	3.1
LM-E-O-32	3.7
LCS-E-03	4.4
LM-EE-O-32	5.2
LCS-EE-03	6.5
LCS-7-03-OV	7.5
30-60 VOLTS	
Models below found on page 78	
LM-220	0.7
LM-229	1.1
LM-238	2.6
0-60 VOLTS	
Models below found on page 78	
LCS-1-04A	0.050
LCS-2-04	0.145
LCS-3-04	0.240
LCS-A-04	0.370
0-120 VOLTS	
Models below found on page 78	
LCS-1-05A	0.018
LCS-2-05	0.050
LCS-A-05	0.100

DUAL OUTPUT

Model	Adj Volt Range Each Side	Current (AMPS) @ 40°C
0-7/0-7 VOLTS		
Models below found on page 79		
LCD-2-11	0-7	0.300
	0-7	0.300
0-7/0-7 V (cont'd)		
LCD-3-11	0-7	0.7
	0-7	0.7
LCD-A-11	0-7	1.0
	0-7	1.0
LCD-4-11	0-7	1.8
	0-7	1.8
0-7/0-18 VOLTS		
Models below found on page 79		
LCD-2-12	0-7	0.30
	0-18	0.16
LCD-3-12	0-7	0.70
	0-18	0.40
LCD-A-12	0-7	1.0
	0-18	0.5
LCD-4-12	0-7	1.8
	0-18	1.0
0-7/0-32 VOLTS		
Model below found on page 79		
LCD-4-13	0-7	1.8
	0-32	0.6
0-18/0-18 VOLTS		
Models below found on page 79		
LCD-2-22	0-18	0.16
	0-18	0.16
LCD-3-22	0-18	0.40
	0-18	0.40
LCD-A-22	0-18	0.5
	0-18	0.5
LCD-4-22	0-18	1.0
	0-18	1.0
0-32/0-32 VOLTS		
Models below found on page 79		
LCD-2-33	0-32	0.120
	0-32	0.120
LCD-3-33	0-32	0.225
	0-32	0.225
LCD-A-33	0-32	0.35
	0-32	0.35
LCD-4-33	0-32	0.6
	0-32	0.6
0-60/0-60 VOLTS		
Models below found on page 79		
LCD-2-44	0-60	0.065
	0-60	0.065
0-60/0-60 V (cont'd)		
LCD-A-44	0-60	0.2
	0-60	0.2
0-120/0-120 VOLTS		
Models below found on page 79		
LCD-2-55	0-120	0.03
	0-120	0.03

OPEN FRAME MODELS

SINGLE OUTPUT

Models below found on page 72

Model	Current (AMPS) @ 40°C
5 VOLTS ± 1%	
LTS-CA-5-OV	7.0
LTS-DB-5-OV	12.0
LTS-DC-5-OV	17.0
6 VOLTS ± 1%	
LTS-CA-6	6.6
LTS-DB-6	11.0
LTS-DC-6	16.0
12 VOLTS ± 1%	
LTS-CA-12	4.4
LTS-DB-12	7.6
LTS-DC-12	11.0
15 VOLTS ± 1%	
LTS-CA-15	4.0
LTS-DB-15	7.2
LTS-DC-15	10.0
20 VOLTS ± 1%	
LTS-CA-20	3.1
LTS-DB-20	6.0
LTS-DC-20	8.0
24 VOLTS ± 1%	
LTS-CA-24	2.6
LTS-DB-24	5.5
LTS-DC-24	7.1
28 VOLTS ± 1%	
LTS-CA-28	2.2
LTS-DB-28	4.0
LTS-DC-28	6.0

POWER INSTRUMENTS AND OPEN FRAME MODELS SELECTION GUIDE

DUAL OUTPUT

Model	Current (AMPS) @ 40°C
Models below found on page 72	
±12 VOLTS ±1%	
LTD-CA-122	2.0
LTD-DB-122	4.0
±15 VOLTS ±1%	
LTD-CA-152	2.0
LTD-DB-152	3.8

OPEN FRAME FERRORESONANT MODELS – SINGLE OUTPUT*

Model	Current (AMPS)
Models below found on page 69	
5 VOLTS	
LQS-DA-6105	25
LQS-DA-6305	40
6 VOLTS	
LQS-DA-5106	25
12 VOLTS	
LQS-DA-6112	12
LQD-DA-6112	12
LQD-DA-6312	24
15 VOLTS	
LQS-DA-6115	10
LQD-DA-6115	10
LQD-DA-6315	20
24 VOLTS	
LQS-DA-5124	5
LQS-DA-6124	5
LQS-DA-5324	10
LQS-DA-6324	10
28 VOLTS	
LQS-DA-5128	5
LQS-DA-6128	5
LQS-DA-5328	10
LQS-DA-6328	10
48 VOLTS	
LQS-DA-5248	2.5
LQS-DA-5348	5
DUAL OUTPUT	
± 12 VOLTS	
LQD-DA-6112	6
LQD-DA-6312	12
± 15 VOLTS	
LQD-DA-6115	5
LQD-DA-6315	10

*Voltage listed for LQ-6000 Series is for use with Power Hybrid Voltage Regulator.

INSTRUMENTS

SINGLE OUTPUT

Model	Current (AMPS)	Page
0-7.5 VOLTS		
LB-701-FM-OV	300.0	136
LB-721-FM-OV	500.0	136
0-10 VOLTS		
LL-901-OV	1.0	128
LP-410A-FM	2.0	131
LR-611-DM	2.8	139
LP-520-FM	5.0	131
LP-530-FM	10.0	131
0-15 VOLTS		
LB-702-FM-OV	180.0	136
LB-722-FM-OV	300.0	136
0-20 VOLTS		
LL-902-OV	0.65	128
LR-602A-FM	1.1	139
LP-411-AFM	1.2	131
LR-612A-FM	1.8	139
LR-612-DM	1.8	139
LP-521-FM	3.3	131
LP-531-FM	5.7	131
LK-340A-FM	8.0	134
LK-341A-FM	13.5	134
LK-350-FM	35.0	134
LK-360-FM	66.0	134
0-36 VOLTS		
LK-342A-FM	5.2	134
LK-343A-FM	9.0	134
LK-351-FM	25.0	134
LK-361-FM	48.0	134
LB-703-FM-OV	80.0	136
LB-723-FM-OV	135.0	136
0-40 VOLTS		
LL-903-OV	0.35	128
LR-603A-FM	0.60	139
LP-412A-FM	1.0	131
LR-613A-FM	1.0	139
LR-613-DM	1.0	139
LP-522-FM	1.8	131
LP-532-FM	3.0	131
0-60 VOLTS		
LP-413A-FM	0.45	131
LP-523-FM	0.90	131
LP-533-FM	2.4	131
LK-344A-FM	4.0	134
LK-345A-FM	6.0	134
LK-352-FM	15.0	134
LK-362-FM	25.0	134
LB-704-FM-OV	50.0	136
LB-724-FM-OV	80.0	136

SINGLE OUTPUT

Model	Current (AMPS)	Page
0-120 VOLTS		
L L-905	0.065	128
LP-414A-FM	0.20	131
LR-615A-FM	0.33	139
LR-615-DM	0.33	139
LP-524-FM	0.50	131
LP-534-FM	1.2	131
LB-705-FM	25.0	136
LB-725-FM	40.0	136
0-250 VOLTS		
LP-415A-FM	80 ma	131
LR-616AFM	100 ma	139
LR-616-DM	100 ma	139
0-300 VOLTS		
LB-706-FM	10.0	136
LB-726-FM	16.0	136
DUAL OUTPUT		
0-±20 VOLTS		
LPD-421A-FM	1.7A	131
0-±40 VOLTS		
LPD-422A-FM	1.0A	131
0-±60 VOLTS		
LPD-423A-FM	0.7A	131
0-±120 VOLTS		
LPD-424A-FM	0.38A	131
0-±250 VOLTS		
LPD-425A-FM	0.13A	131

LZ SERIES OF P.C. BOARD MOUNTABLE POWER SUPPLIES:

- up to 28V DC, up to 1400 ma
- 3 package sizes
- Single, dual & triple output models

see pages 66—67

LAMBDA POWER KITS

pre-designed power supply circuits and selected components for building your own power supply using standard and voltage regulating transformers. See pages 42-61.

WHY IS LAMBDA THE WORLD'S LARGEST MANUFACTURER OF POWER SUPPLIES?

LAMBDA
maintains the industry's largest stock inventory of standard power supplies with one day delivery on 90% of all models.

LAMBDA
is its own distributor with a total inventory of over 10,000 power supply units located in Los Angeles, Montreal, New York, France, Germany, Israel, and England.

LAMBDA
has the most comprehensive power supply 5-year guarantee in the industry. . .in effect for 21 years.

LAMBDA
has a DIRECT field sales organization for world-wide sales and service.

LAMBDA
maintains regional calibration and repair centers for servicing customers.

LAMBDA
has the largest in-depth engineering department of any power supply manufacturer.

LAMBDA
has a completely integrated facility with products thoroughly engineered from the original concept to the shipping container.

LAMBDA
has its own transformer plant for specialized production of all magnetic components.

LAMBDA
power supplies are listed in Underwriters' Laboratories Recognized Component Index.

LAMBDA
fulfills military specification requirements.

LAMBDA
guarantees reproducibility of design, unit after unit.

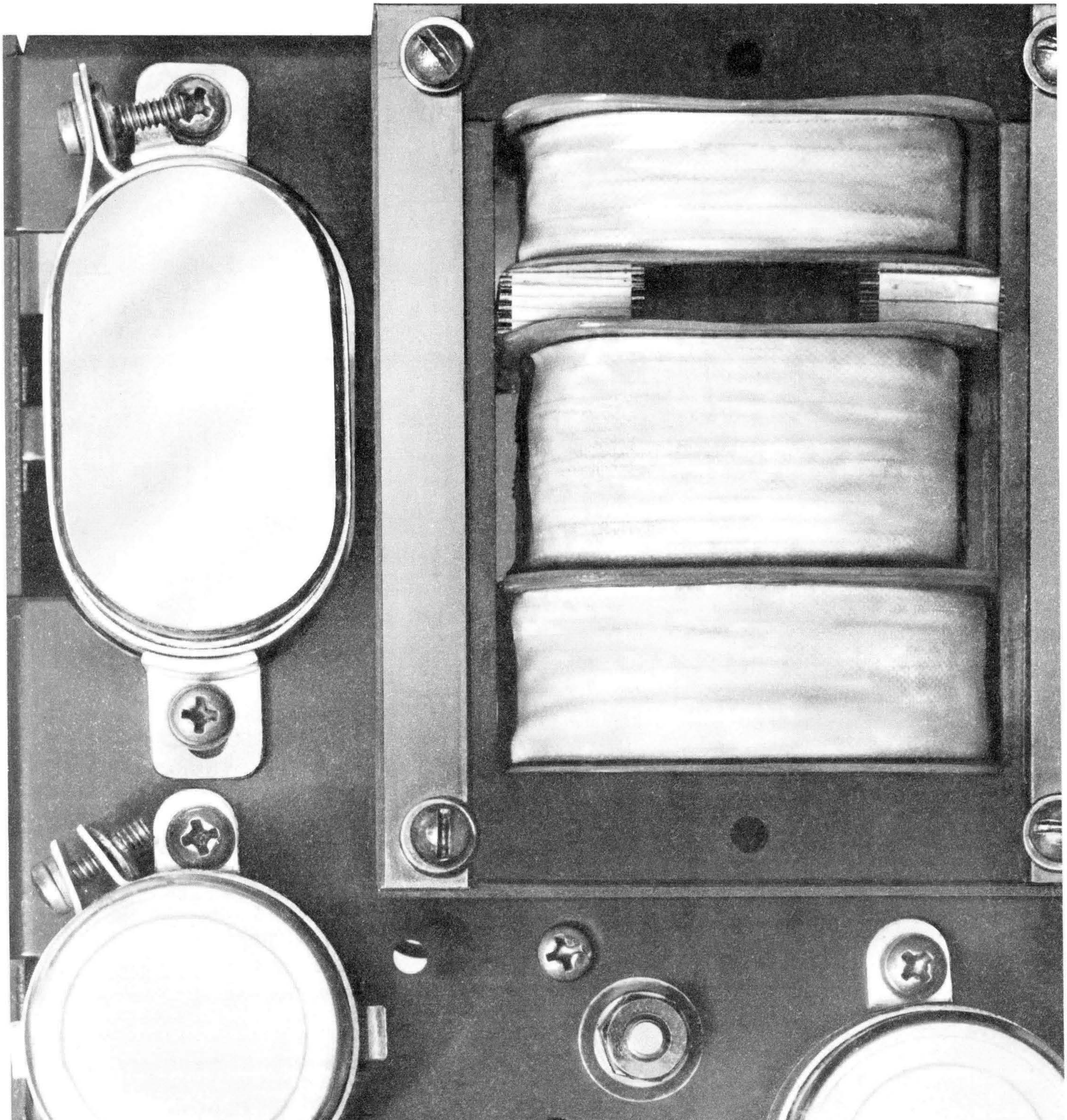
LAMBDA
is the RECOGNIZED leader in power supply design, engineering, manufacturing and quality assurance.

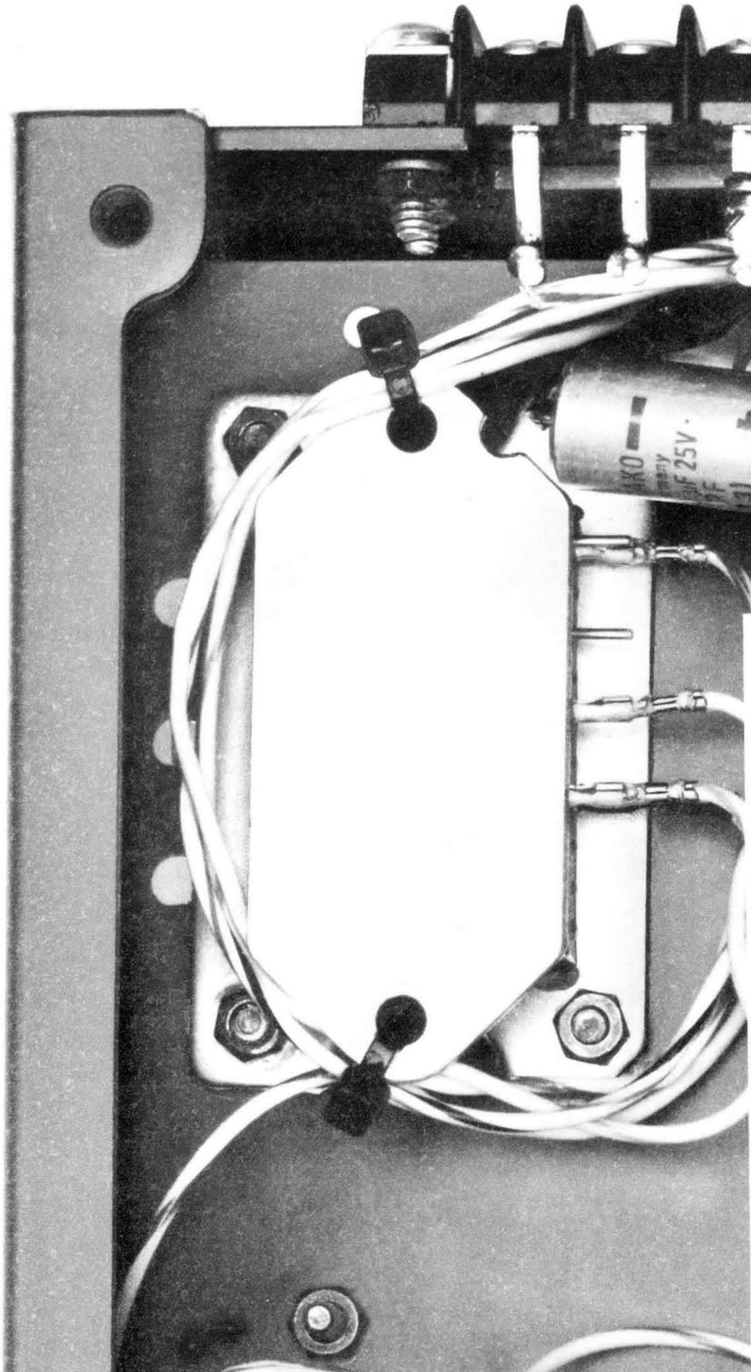
ONE COMPANY
TOTALLY CAPABLE OF:

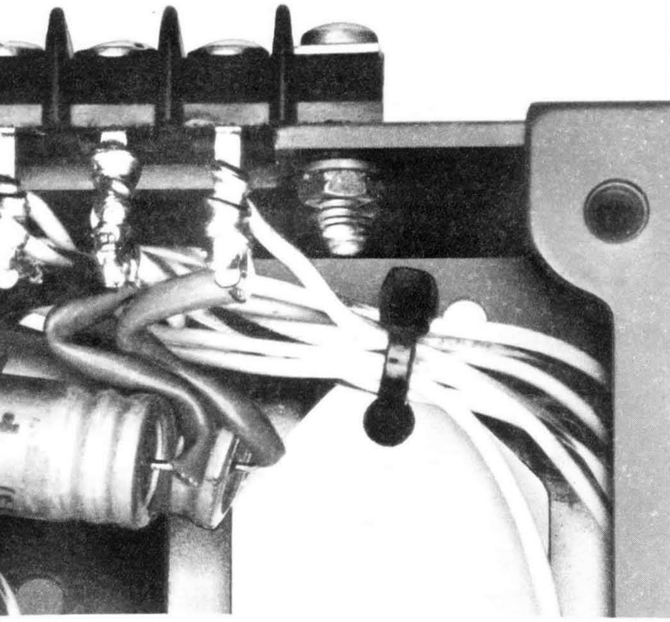
Developing
Engineering
Designing
Packaging
Manufacturing
Testing
and
Delivering

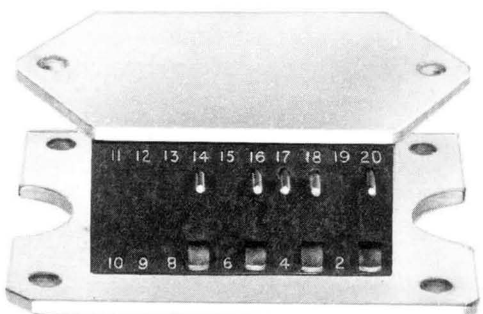
...from the largest inventory of standard power supplies and Power Hybrid Voltage Regulators in the world.

LAMBDA POWER COMPONENTS









Power Hybrid Voltage Regulators for building your own power supplies

DO YOU FACE A "MAKE OR BUY" DECISION ON POWER SUPPLIES?

A revolutionary development by Lambda offers you improved power supply performance at lower cost whether you "make" OR "buy." It is the Series LAS2000, and the Series LAS4000 Power Hybrid Voltage Regulator, which provide 0.2% line or load regulation for any DC power supply with output ratings up to 28V DC and up to 15A.

The Power Hybrid Voltage Regulator replaces all discrete components of conventional regulator circuitry. It converts any source of filtered dc into a regulated power supply. Designed and built by Lambda in a new microelectronic facility, the Power Hybrid Voltage Regulator is available as a separate component for the buyer or builder of custom power supplies. It is also incorporated in many of Lambda's off-the-shelf supplies and in Lambda's power kits.

What it is

The Series LAS2000, and the Series LAS-4000 Power Hybrid Voltage Regulator utilize cermet thick-film resistors, capacitors and monolithic integrated circuits, and power transistors in chip form, to achieve regulator performance at minimum cost.

A key feature of its construction is the high degree of thermal isolation between the heat generating power elements and the heat sensitive control and reference elements. This thermal isolation results in extremely low thermal drift characteristics for changes in power levels. In addition, a unique thermal power limiting circuit is built into the power section of the unit for increased operational reliability.

What it offers

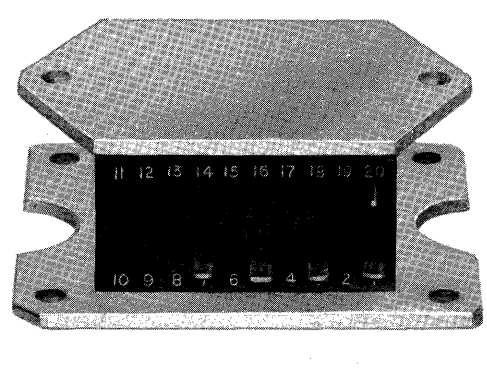
The Power Hybrid Voltage Regulator allows the power supply builder to achieve rockbottom simplicity in his design. This is one of its major advantages. The regulator package, occupying about 2.8 cubic inches of space for the LAS2000 Series, and about 4.9 cubic inches of space for the LAS4000 Series, replaces all of the transistors, diodes, resistors, capacitors and circuit boards of present-day voltage regulators. 79 electrical configurations provide exceptional versatility to meet specific design requirements. Individual female pin receptacles are supplied with all models of the LAS2000 Series in KT-7 or KT-8 kits for 4 pin or 14 pin units respectively and Amp Tool No. 90033 can be used for attaching receptacle to wire. For the LAS4000 Series individual female pins receptacles are supplied in kits KT-26 or KT-27 for 5 pin or 9 pin units respectively, and Amp Tool No. 90287-1 can be used for attaching receptacle to wire.

For the builder of power supplies...

This means lower cost at every stage of production: lower engineering costs, simpler incoming inspection, smaller and simpler parts inventory, lower manufacturing costs. Of course, these same benefits accrue to us as a manufacturer of regulated power supplies. This is why we can offer a wide range of high-performance packaged supplies at moderate cost.

For the user of power supplies...

The Power Hybrid Voltage Regulator means, above all, unequaled reliability. The advantages of ICs over discrete circuitr need no elaboration. Moreover, this ruggedly packaged unit is less susceptible to physical damage than exposed IC or discrete components, thus, longer MTBF is achieved (100,000 hours MTBF demonstrated). If a malfunction should occur, the low cost of the Power Hybrid Voltage Regulator makes it economically practical to simply replace entire unit.



DEFINITION OF TERMS

V_{in} (maximum)
the instantaneous maximum allowable input voltage to the regulator between pin 1 and pin 3.

V_{in} (minimum)
the instantaneous minimum allowable voltage to the regulator betwwen pin 1 and pin 3.

V_{in} (average)
the steady state or average input voltage to the regulator, between pin 1 and pin 3.

V_{in} (ripple)
the peak to peak ripple voltage applied to the input of the regulator between pin 1 and pin 3.

V_o
the steady state or average output voltage between pin 7 and pin 4 (pin 5 on 2100, 2300, 2600, 2800, 4100, 4200, 4300, and 4400 models).

Input-output differential (V_{in} average-V_o average)
the maximum steady state voltage between pin 1 and pin 7.

Saturation voltage (V_{in} minimum-V_o)
the minimum instantaneous voltage between pin 1 and pin 7.

V_{in} (control amplifier)
the voltage available to the control amplifier (pin 20).

Line regulation
the maximum amount of change in the output voltage as the result of a change in the input voltage with load current and ambient temperature held constant.

Load regulation
the maximum amount of output voltage change due to a change in the load from, or for a specified load change with line voltage and ambient temperature held constant.

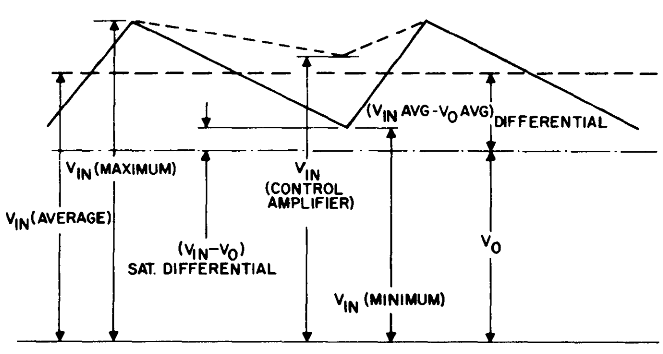
Temperature coefficient
the percent change in the output voltage averaged over the operating ambient temperature range expressed in percent per °C. This assumes constant DC input voltage, constant load and internal voltage programming.

Ripple attenuation
the ratio of the AC component of the rectified and filtered power line voltage to the AC component of the output voltage.

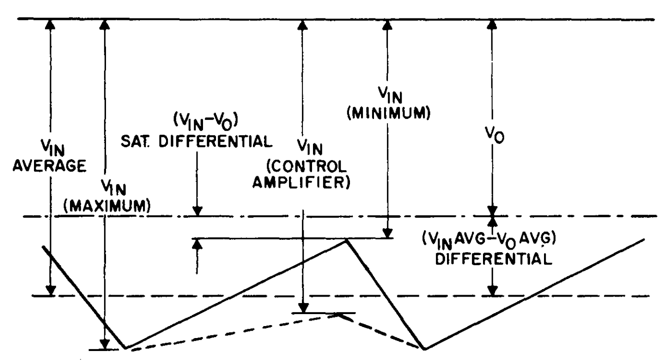
Standby Current
the input current drawn by the regulator with no output load.

Programming resistance
the change in resistance value required at the program control terminals of the regulator per unit change in output voltage.

Programming voltage
the change in voltage applied to the program control terminals of the regulator per unit change in output voltage.



POSITIVE REGULATOR



NEGATIVE REGULATOR

FIG. 1. DEFINITION OF TERMS

LAMBDA'S POWER HYBRID VOLTAGE REGULATORS

Offer You These Features in a Small Package

GENERAL FEATURES OF LAMBDA'S LINE OF POSITIVE REGULATORS

1
0.2% regulation, line or load

2
0.007%/°C temperature coefficient

3
short circuit and overload protection

4
thermal protection

5
remote programming

6
remote sensing

7
electrically isolated case

8
dual tracking connection

LAS 2000 SERIES

1
up to 5 Amp DC output

2
up to 85 Watts dissipation

3
output voltages, 2.5 to 28 VDC

4
increased power handling capability with external regulation transistors

5
Increased current output when used as a driver for series regulation transistor

6
29 models available

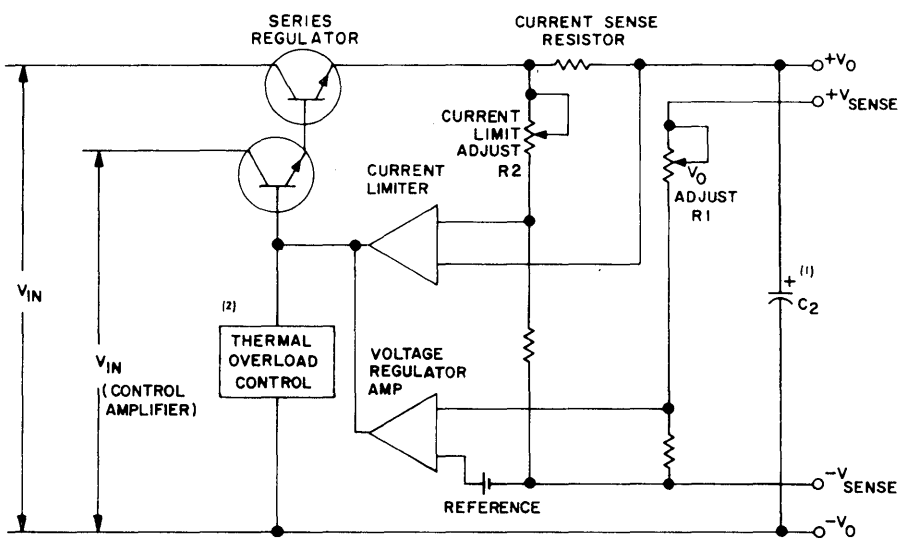
LAS 4000 SERIES

1
up to 15 Amp DC output

2
up to 240 Watts dissipation

3
output voltages 5.0 to 28 VDC

4
28 models available



NOTES:
1. External C2 required for LAS 2000, 2200, 2400, 4200, and 4400 series.
2. All except LAS 2000 series.

FIG. 2. BLOCK DIAGRAM, POWER HYBRID VOLTAGE REGULATOR, MODELS LAS 2005-LAS 2415 and LAS 4105-4428

GENERAL FEATURES OF LAMBDA'S LINE OF NEGATIVE REGULATORS

1
up to 5 Amperes DC output

2
up to 28 Volts DC output

3
up to 85 Watts dissipation

4
0.2% regulation, line or load

5
0.007%/°C temperature coefficient

6
short circuit and overload protection

7
thermal protection

8
remote programming

9
remote sensing

10
electrically isolated case

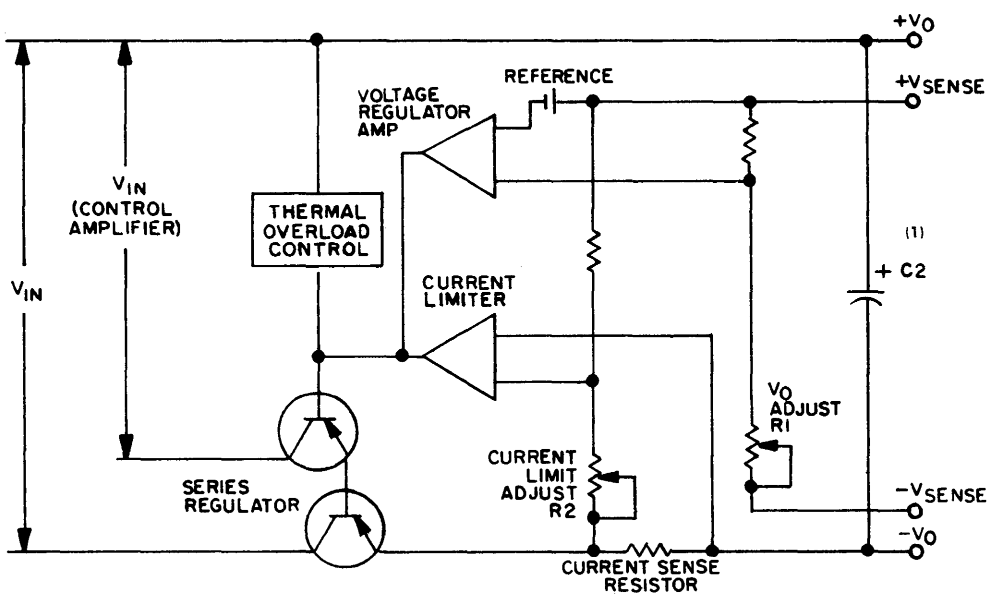
11
increased power handling capability with external regulation transistor

12
increased current output when used as a driver for series regulation transistors

13
negative regulator

14
plus and minus voltage regulation from single transformer output

15
22 models available



NOTES:
1. External C2 required for LAS 2700 and 2900 series.

FIG. 2A. POWER HYBRID VOLTAGE REGULATOR, MODELS LAS 2605-2915

79 REGULATOR MODELS PROVIDE ALL THESE CAPABILITIES

5 VOLTS

Model	Pins	Reg. Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2005[8A]	4	0.2%	2	62.5	3.0	$25[10]	$14	$11
LAS 2105[8A]	4	0.2%	2	85	5.0	30[11]	18	15
LAS 2205[7,8]	14	0.2%	2	85	5.0	30[11]	18	15
LAS 2305[8A]	4	0.2%	2	85	3.3	30[11]	18	15
LAS 2405[7,8]	14	0.2%	2	85	3.3	30[11]	18	15
LAS 4105[8A]	5	0.2%	2	240	15.0	75[13]	46	38
LAS 4205[7,9]	9	0.2%	2	240	15.0	75[13]	46	38
LAS 4305[8A]	5	0.2%	2	170	10.0	60[14]	35	32
LAS 4405[7,9]	9	0.2%	2	170	10.0	60[14]	35	32

6 VOLTS

Model	Pins	Reg. Line & Load[1,2]	Ripple (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2006[8A]	4	0.2%	2	62.5	3.0	$25[10]	$14	$11
LAS 2106[8A]	4	0.2%	2	85	5.0	30[11]	18	15
LAS 2206[7,8]	14	0.2%	2	85	5.0	30[11]	18	15
LAS 2306[8A]	4	0.2%	2	85	3.2	30[11]	18	15
LAS 2406[7,8]	14	0.2%	2	85	3.2	30[11]	18	15
LAS 4106[8A]	5	0.2%	2	240	15.0	75[13]	46	38
LAS 4206[7,9]	9	0.2%	2	240	15.0	75[13]	46	38
LAS 4306[8A]	5	0.2%	2	170	10.0	60[14]	35	32
LAS 4406[7,9]	9	0.2%	2	170	10.0	60[14]	35	32

12 VOLTS

Model	Pins	Reg. Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2012[8A]	4	0.2%	2	62.5	3.0	$25[10]	$14	$11
LAS 2112[8A]	4	0.2%	2	85	5.0	30[11]	18	15
LAS 2212[7,8]	14	0.2%	2	85	5.0	30[11]	18	15
LAS 2312[8A]	4	0.2%	2	85	2.5	30[11]	18	15
LAS 2412[7,8]	14	0.2%	2	85	2.5	30[11]	18	15
LAS 4112[8A]	5	0.2%	2	240	15.0	75[13]	46	38
LAS 4212[7,9]	9	0.2%	2	240	15.0	75[13]	46	38
LAS 4312[8A]	5	0.2%	2	170	10.0	60[14]	35	32
LAS 4412[7,9]	9	0.2%	2	170	10.0	60[14]	35	32

15 VOLTS

Model	Pins	Reg. Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2015[8A]	4	0.2%	2	62.5	3.0	$25[10]	$14	$11
LAS 2115[8A]	4	0.2%	2	85	5.0	30[11]	18	15
LAS 2215[7,8]	14	0.2%	2	85	5.0	30[11]	18	15
LAS 2315[8A]	4	0.2%	2	85	2.3	30[11]	18	15
LAS 2415[7,8]	14	0.2%	2	85	2.3	30[11]	18	15
LAS 4115[8A]	5	0.2%	2	240	15.0	75[13]	46	38
LAS 4215[7,9]	9	0.2%	2	240	15.0	75[13]	46	38
LAS 4315[8A]	5	0.2%	2	170	10.0	60[14]	35	32
LAS 4415[7,9]	9	0.2%	2	170	10.0	60[14]	35	32

20 VOLTS

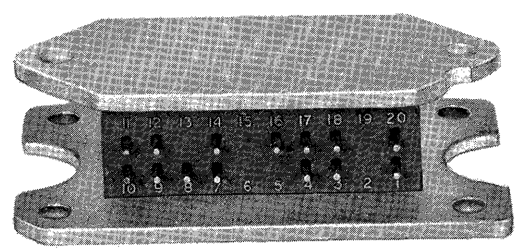
Model	Pins	Reg. Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2020[8A]	4	0.2%	4	62.5	2.0	$25[10]	$14	$11
LAS 2120[8A]	4	0.2%	4	85	4.0	30[11]	18	15
LAS 2220[7,8]	14	0.2%	4	85	4.0	30[11]	18	15
LAS 4120[8A]	5	0.2%	4	240	12.0	75[13]	46	38
LAS 4220[7,9]	9	0.2%	4	240	12.0	75[13]	46	38
LAS 4320[8A]	5	0.2%	4	170	8.0	60[14]	35	32
LAS 4420[7,9]	9	0.2%	4	170	8.0	60[14]	35	32

24 VOLTS

Model	Pins	Reg. Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2024[8A]	4	0.2%	4	62.5	2.0	$25[10]	$14	$11
LAS 2124[8A]	4	0.2%	4	85	3.0	30[11]	18	15
LAS 2224[7,8]	14	0.2%	4	85	3.0	30[11]	18	15
LAS 4124[8A]	5	0.2%	4	240	9.0	75[13]	46	38
LAS 4224[7,9]	9	0.2%	4	240	9.0	75[13]	46	38
LAS 4324[8A]	5	0.2%	4	170	6.0	60[14]	35	32
LAS 4424[7,9]	9	0.2%	4	170	6.0	60[14]	35	32

28 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Price Qty 100	Price Qty 1000
LAS 2028[8A]	4	0.2%	4	62.5	2.0	$25[10]	$14	$11
LAS 2128[8A]	4	0.2%	4	85	2.0	30[11]	18	15
LAS 2228[7,8]	14	0.2%	4	85	2.0	30[11]	18	15
LAS 4128[8A]	5	0.2%	4	240	6.0	75[13]	46	38
LAS 4228[7,9]	9	0.2%	4	240	6.0	75[13]	46	38
LAS 4328[8A]	5	0.2%	4	170	4.0	60[14]	35	32
LAS 4428[7,9]	9	0.2%	4	170	4.0	60[14]	35	32



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–5 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2705[7,8]	14	0.2%	2	85	5.0	\$35[12]	\$20	\$18
LAS 2905[7,8]	14	0.2%	2	85	3.3	35[12]	20	18

–5.2 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2605[8A]	4	0.2%	2	85	5.0	\$35[12]	\$20	\$18
LAS 2805[8A]	4	0.2%	2	85	3.3	35[12]	20	18

–6 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2606[8A]	4	0.2%	2	85	5.0	\$35[12]	\$20	\$18
LAS 2706[7,8]	14	0.2%	2	85	5.0	35[12]	20	18
LAS 2806[8A]	4	0.2%	2	85	3.2	35[12]	20	18
LAS 2906[7,8]	14	0.2%	2	85	3.2	35[12]	20	18

–12 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2612[8A]	4	0.2%	2	85	5.0	\$35[12]	\$20	\$18
LAS 2712[7,8]	14	0.2%	2	85	5.0	35[12]	20	18
LAS 2812[8A]	4	0.2%	2	85	2.5	35[12]	20	18
LAS 2912[7,8]	14	0.2%	2	85	2.5	35[12]	20	18

–15 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2615[8A]	4	0.2%	2	85	5.0	\$35[12]	\$20	\$18
LAS 2715[7,8]	14	0.2%	2	85	5.0	35[12]	20	18
LAS 2815[8A]	4	0.2%	2	85	2.3	35[12]	20	18
LAS 2915[7,8]	14	0.2%	2	85	2.3	35[12]	20	18

–20 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2620[8A]	4	0.2%	4	85	4.0	\$35[12]	\$20	\$18
LAS 2720[7,8]	14	0.2%	4	85	4.0	35[12]	20	18

–24 VOLTS

Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2624[8A]	4	0.2%	4	85	3.0	\$35[12]	\$20	\$18
LAS 2724[7,8]	14	0.2%	4	85	3.0	35[12]	20	18

–28 VOLTS

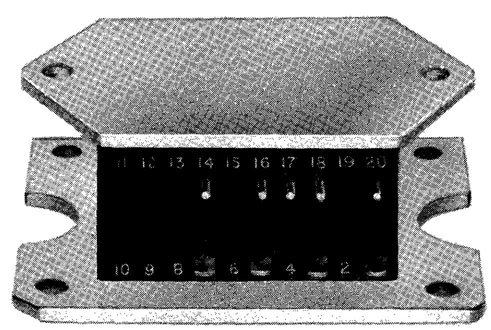
Model	Pins	Reg Line & Load[1,2]	Ripple[3] (mv rms)	Pwr Disip. (Wts)	I_O (Amps)[4,5,6]	Price Qty 1	Qty 100	Qty 1000
LAS 2628[8A]	4	0.2%	4	85	2.0	\$35[12]	\$20	\$18
LAS 2728[7,8]	14	0.2%	4	85	2.0	35[12]	20	18

NOTES:

1. For line variations from 105-132 VAC.
2. For load variations from 0 to full load.
3. Applies for 2 volt rms ripple voltage at input. For other input ripple voltages, see Regulator Performance Specifications.
4. See curves for limitations imposed by heat sink thermal resistance and input-output differential.
5. Maximum foldback current is 140% of current rating shown in table for positive regulators, and 170% for negative regulators.
6. For LAS 2300, 2400, 2800, and 2900 Series the foldback characteristic knee (fig. 10) is preset to a lower current value than for the LAS 2100, 2200, 2600 and 2700 Series, so that power handling capabilities are consistent with input voltage ranges.
7. External components required for adjustments of output voltage (see circuit diagrams).
8. Output voltage adjust of LAS 2200, 2400, 2700, and 2900 Series, is ± 5% except for LAS 2205, 2405, 2705, and 2905 which can operate from –50% to + 5% of 5V. For current ratings at other than 5V ± 5% consult factory.

8A. Output voltage of LAS 2000, 2100, 2300, 2600, 2800, 4100, 4300 SERIES is fixed ± 1%.

9. Output voltage adjust of LAS 4200 and 4400 Series is ± 5%.
10. For quantities 1-24, \$25.00; for quantities 25-49, \$22.00; for quantities 50-99, \$18.00; consult factory for other quantities.
11. For quantities 1-24, \$30.00; for quantities 25-49, \$25.00; for quantities 50-99, \$22.00; consult factory for other quantities.
12. For quantities 1-24, \$35.00; for quantities 25-49, \$30.00; for quantities 50-99, \$25.00; consult factory for other quantities.
13. For quantities 1-24, \$75.00; for quantities 25-49, \$65.00; for quantities 50-99, \$55.00; consult factory for other quantities.
14. For quantities 1-24, \$60.00; for quantities 25-49, \$50.00; for quantities 50-99, \$45.00; consult factory for other quantities.



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REGULATOR PERFORMANCE SPECIFICATIONS

62.5 and 85 watt positive and negative regulator

PARAMETER [11]	SYMBOL	CONDITIONS	MIN.	MAX.	UNITS
Input voltage	V_{IN}		9.6	40.0	volts
Output voltage[1]	V_O		2.5(5.0)	28.0	volts
Input-output differential[2,9]	$V_{IN} - V_O$		4.6[10]	37.5V(35.0)	volts
* Input-output differential[3,9]	$V_{IN} - V_O$		2.5	37.5V	volts
Output current[1]	I_O		0	5.0(3.0)	amps
Standby current	I_S			10.0	mA
Power dissipation	P_D	Plate #1 @25°C		85(62.5)	watts
Power dissipation[8]	P_D	Free Air @25°C		9.0(8.0)	watts
Thermal resistance junction—case #1	$\theta j - C1$			2.0	°C/watt
Thermal resistance junction-free air	$\theta j - FA$			15.0	°C/watt
Storage temperature[4]	T_S		−55	+125	°C
Power transistor junction temperature	T_J			+200(+150)	°C
Regulation line[5]				0.01	%/ΔV_{IN}
Regulation load[6]				0.2	%
*Programming resistance				1000 nominal	ohms/volt
*Programming voltage				one/one	volt/volt
Temperature coefficient	T.C.			0.007	%/°C
Ripple attenuation[7]		V_{IN} minimum I_O maximum	60		dB

NOTES:

1. Varies with model number.
*2. Single DC input voltage (see figures 23 and 31).
*3. Separate DC input voltages for power circuit (pin 1) and control circuit (pin 20) (see figures 26 and 35.) V_{IN} minimum = 9.5 volts at pin 20.
4. Maximum storage temperature limited by tantalum capacitor.
5. Io constant for entire range from 0 to full load.
6. V_{IN} constant for entire range from V_{IN} minimum to V_{IN} maximum.
7. Ripple attenuation is 54dB minimum for 20V, 24V, and 28V models.
8. See figures on following pages.
9. Minimum input-output differential based on $T_J \geq 25°C$.
10. 5.2 for Model LAS 2600, LAS 2700, LAS 2800 and LAS 2900 series.
11. Voltages and currents are negative for models LAS 2600, LAS 2700, LAS 2800 and LAS 2900 series.

*This parameter or note applies only to LAS 2200, 2400, 2700, and 2900 series.
Values in ( ) only apply to Models LAS 2005-2028.

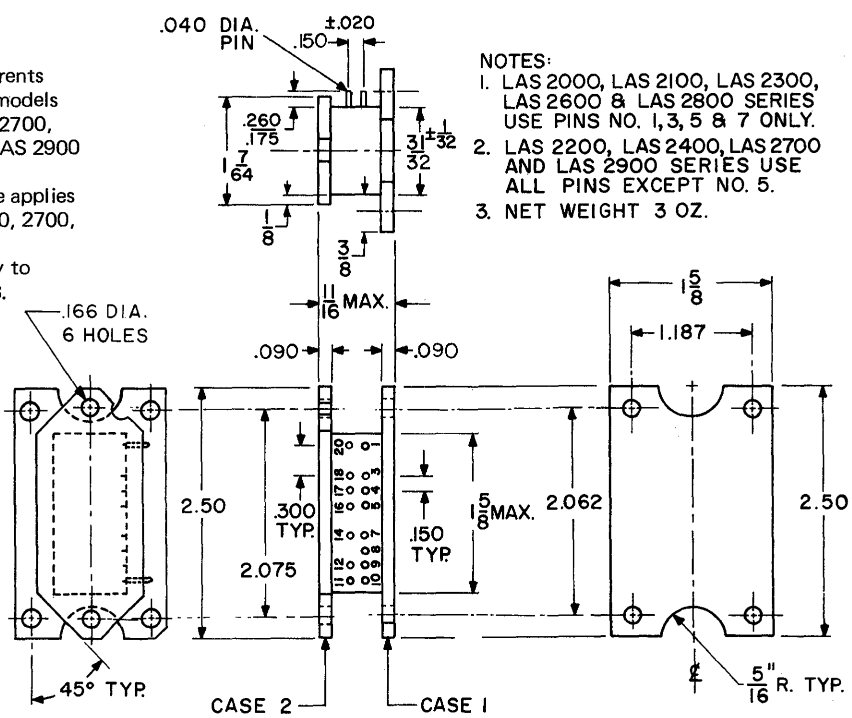


FIG. 3. OUTLINE DRAWING, POWER HYBRID REGULATOR, LAS 2000 SERIES

240 and 170 watt positive regulator

PARAMETER	SYMBOL	CONDITIONS	MIN.	MAX.	UNITS
Input voltage to pin (1) (A)	V_{IN} (1)		7.8	40.0	volts
Input voltage to pin (20) (A) (G)	V_{IN} (20)		12.0	40.0	volts
Output voltage	V_O		5.0	28.0	volts
Input output differential (A)(F)	(V_{IN} (1) − V_O)		2.8	35.0	volts
Input output differential (B)(F)	(V_{IN} (20) − V_O)		7.0	35.0	volts
Output current	I_O		0	15.0 (10.0)*	amps
Standby current	I_S (1)			20 (15)*	ma
Standby current	I_S (20)			10	ma
Standby current	I_S			30(25)*	ma
Power dissipation	P_D	Plate #@25°C		240(170)*	watts
Power dissipation	P_D	Free Air @25°C Amb		11	watts
Thermal resistance junction—Case 1	θj − C1			0.7(1.0)*	°C/watt
Thermal resistance junction to Free Air	θj − FA			12.0	°C/watt
Storage temperature	T_S		−55	+125°C	°C
Power transistor junction temperature	T_j			200	°C
Regulation line (C)				0.01	%ΔV_{IN}
Regulation load (D)				0.2	%
**Programming resistance				1000 nominal	ohms/volt
**Programming voltage				one/one	volt/volt
Temperature coefficient				0.007	%/°C
Ripple attenuation (E)		V_{IN} (1) Minimum I_O Minimum	60		dB

NOTES:

A. Separate DC input voltages for power circuit (pin 1) and control circuit pin (20).
B. Common input voltages for power circuit (pin 1) and control pin (20).
C. Io constant for entire input voltage range from (V_{IN}(1) & V_{IN}(20) min. to (V_{IN}(1)(20) max.
D. V_{IN} constant for entire range from 0 to full load.
E. Ripple attenuation is 54 DB. min. for 20v, 24v, and 28v models.
F. Minimum input-output differential based on T_j, ≥ 25°C.
G. For AC source to Pin 20 with source resistance less than 10 ohms, minimum VAC = 12V RMS. For other conditions consult factory.

* Values in ( ) apply to LAS 4300, LAS-4400 series

**Apply to LAS 4200, LAS 4400 Series only.

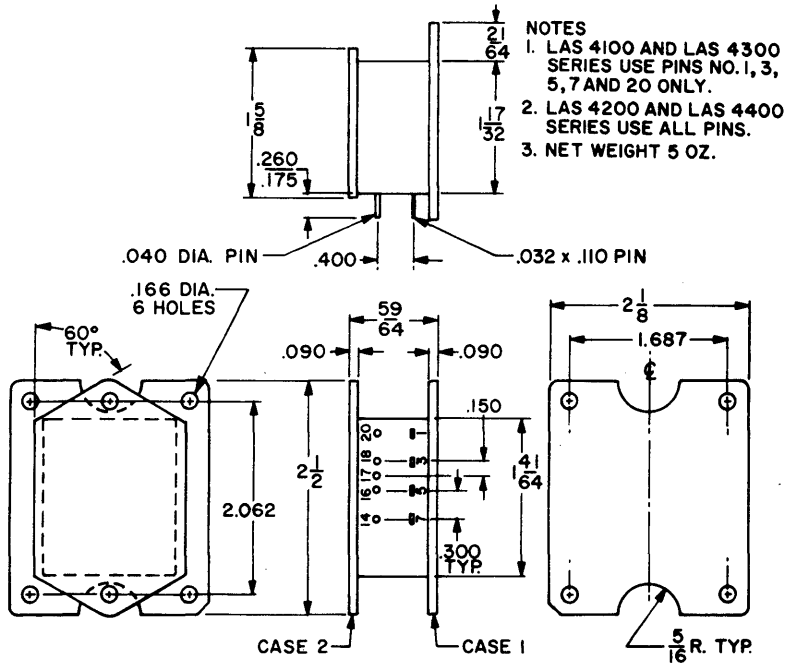


FIG. 4. OUTLINE DRAWING, POWER HYBRID VOLTAGE REGULATOR, LAS 4000 SERIES

OPERATIONAL DATA LAS 2000 SERIES

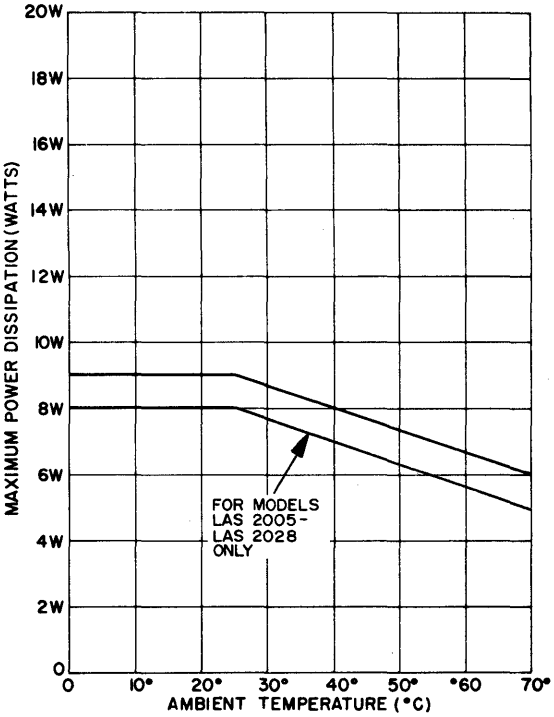


Fig. 5 Free air derating curve

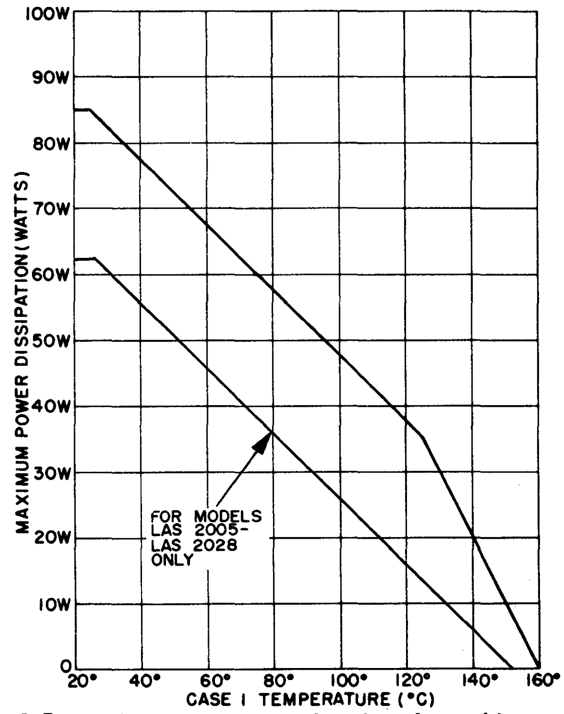


Fig. 6 Power derating curve as a function of case 1 temperature

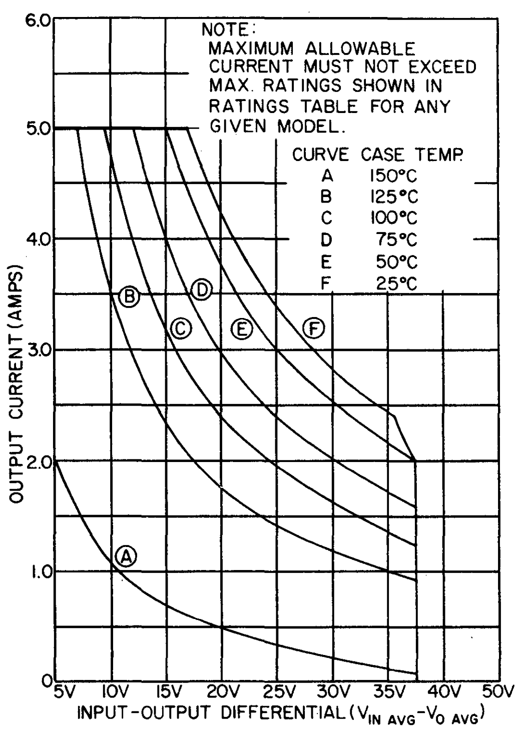


Fig. 7 DC safe operating area as a function of module case temperature, for LAS 2100, LAS 2200, LAS 2300, LAS 2400, LAS 2600, LAS 2700, LAS 2800 and LAS 2900 models.

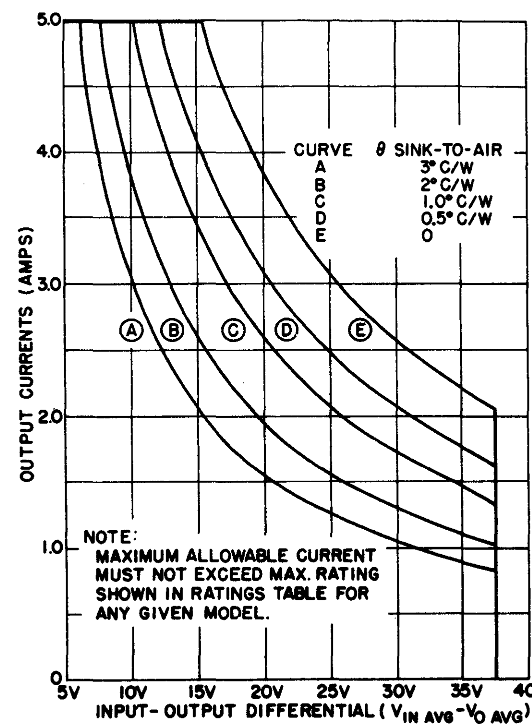


Fig. 7A DC safe operating area as a function of heatsink thermal resistance to air at 40°C ambient temperature, for LAS 2100, LAS 2200, LAS 2300, LAS 2400, LAS 2600, LAS 2700, LAS 2800 and LAS 2900 models.

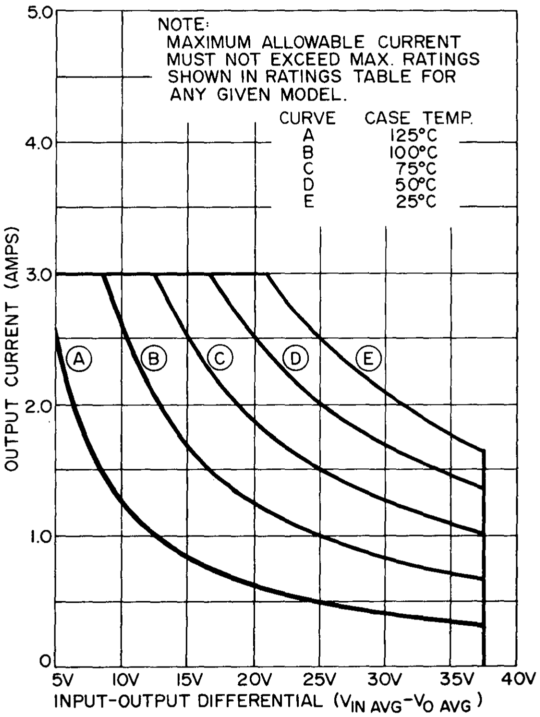


Fig. 8 DC safe operating area as a function of module case temperature, for LAS 2005-2028 models.

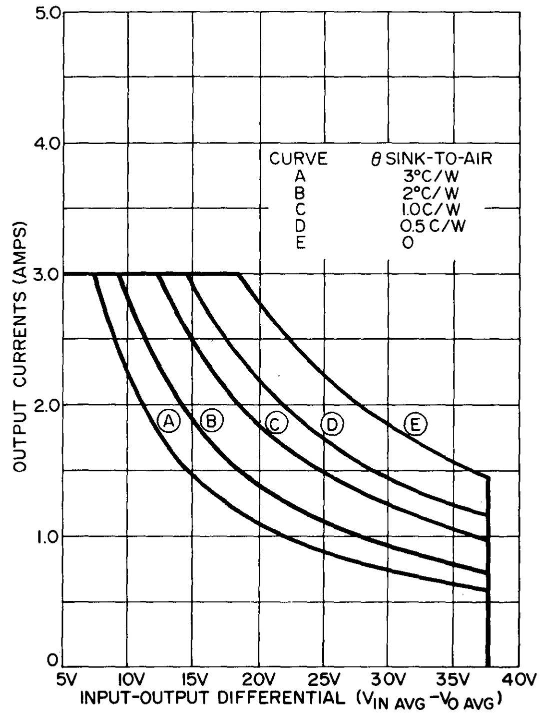
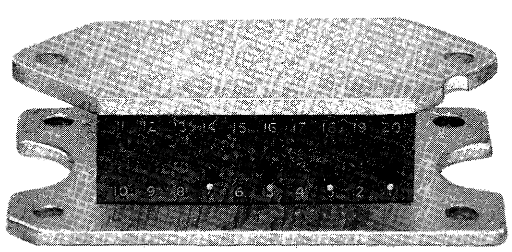
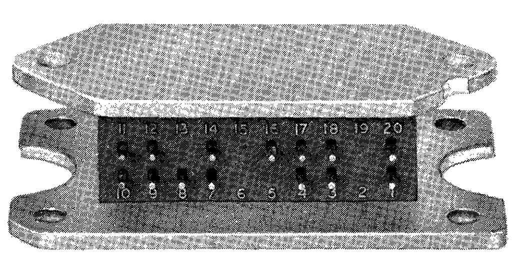


Fig. 9 DC safe operating area as a function of heatsink thermal resistance to air at 40°C ambient temperature, for LAS 2005-2028 models.





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OPERATIONAL DATA LAS 2000 SERIES

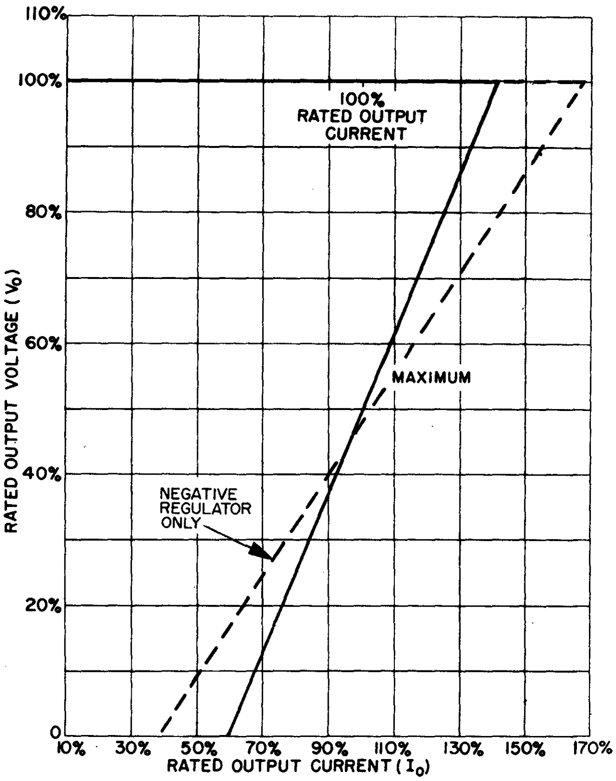


Fig. 10 Short circuit protection characteristic, LAS 2000 series

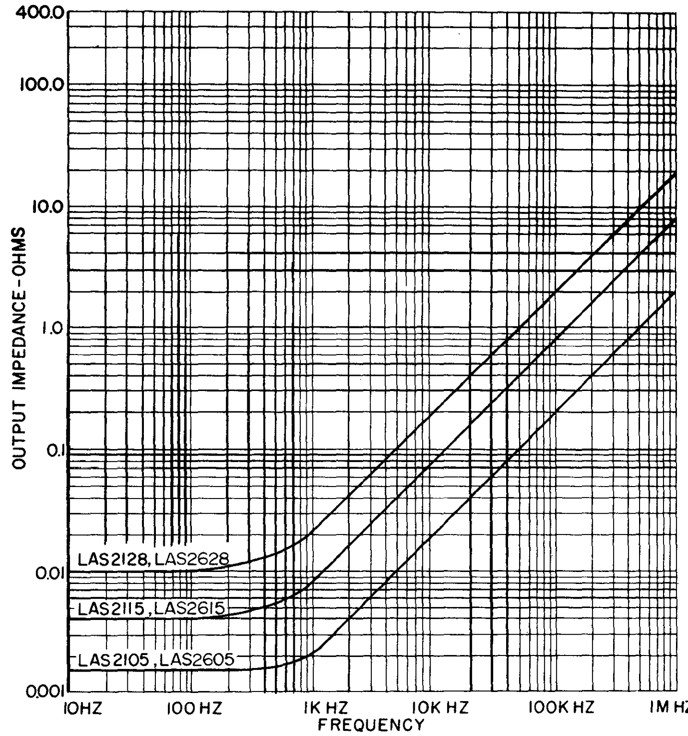


Fig. 11 Typical output impedance vs. frequency

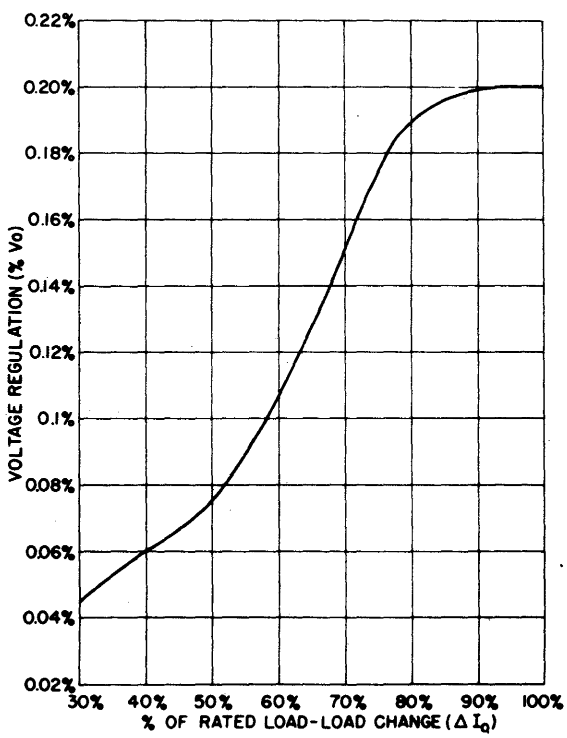


Fig. 12 Load regulation in % (volt) vs. load change

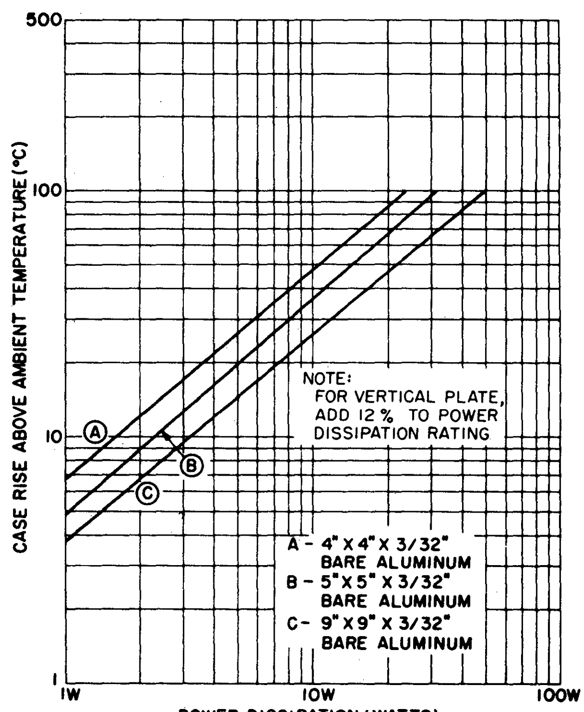


Fig. 13 Typical heat sinking data for horizontal plate

OPERATIONAL DATA LAS 4000 SERIES

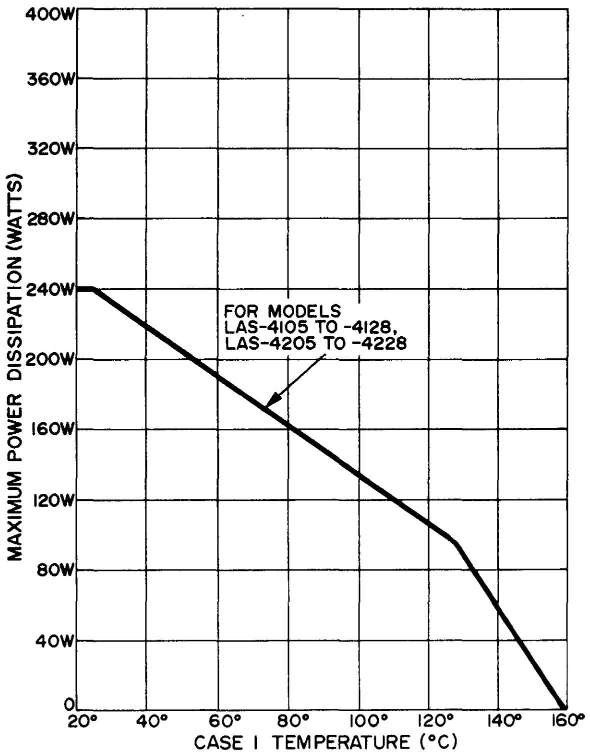


Fig. 14 Power derating curve as a function of case 1 temperature

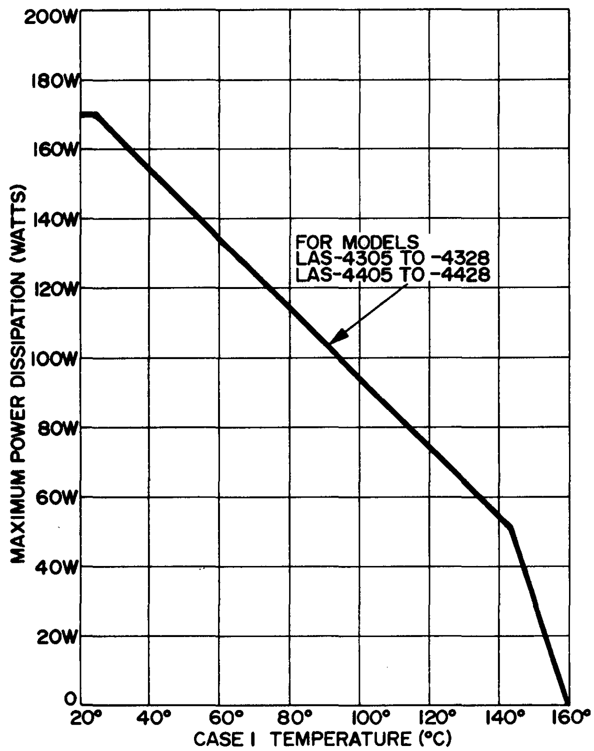
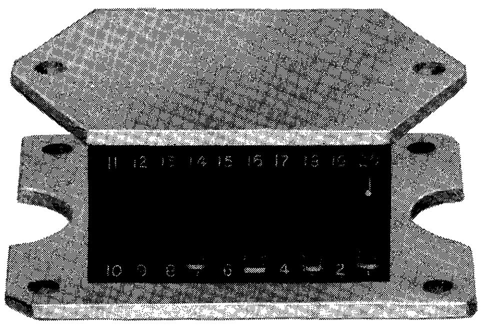
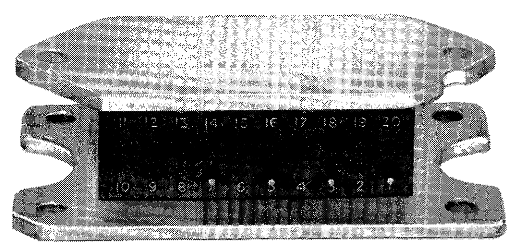


Fig. 14A Power derating curve as a function of case 1 temperature





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OPERATIONAL DATA LAS 4000 SERIES

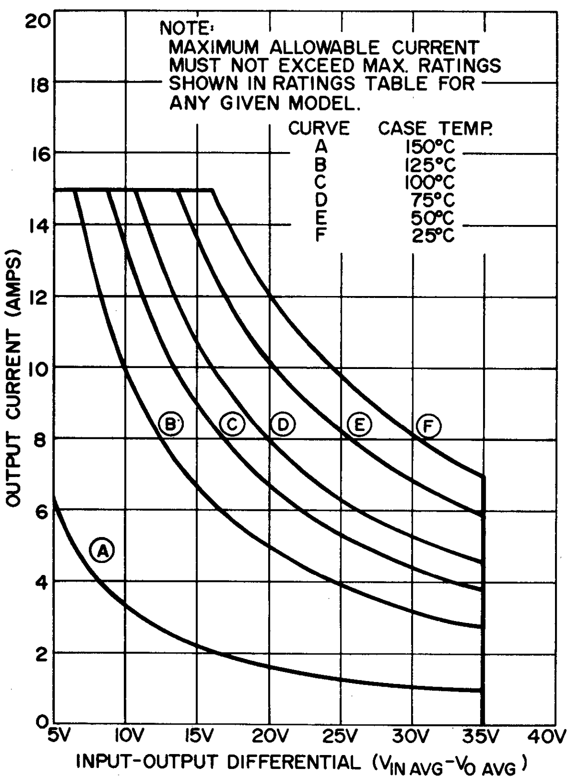


Fig. 15 DC safe operating area as a function of module case temperature for LAS 4105-4128 and LAS 4205-4228

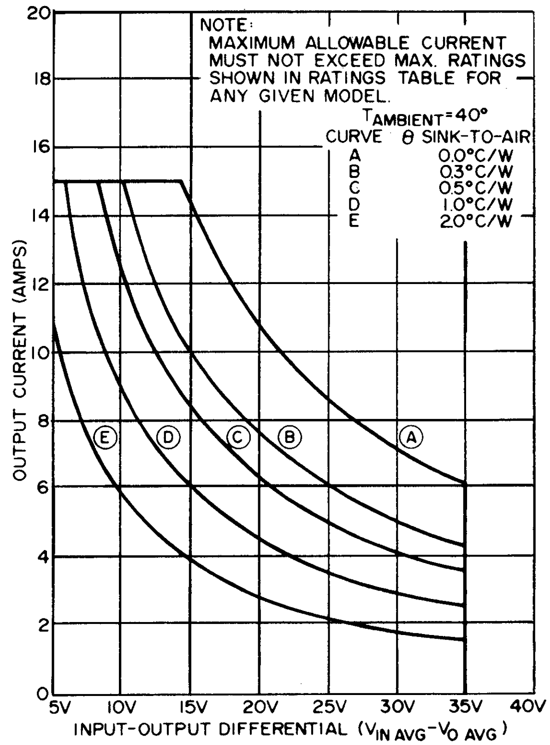


Fig. 16 DC safe operating area as a function of heatsink thermal resistance to air at 40°C ambient temperature for LAS 4105-4128 and LAS 4205-4228

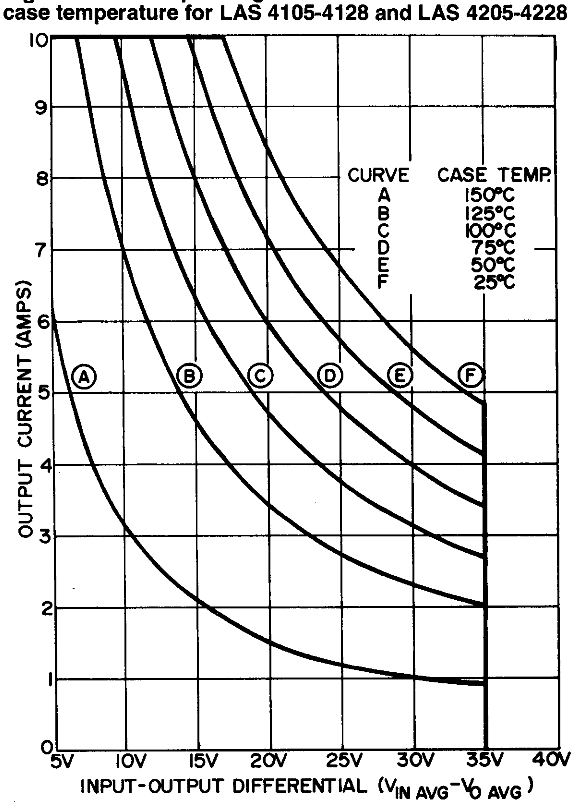


Fig. 17 DC safe operating area as a function of module case temperature for LAS 4305-4328 and LAS 4405-4428

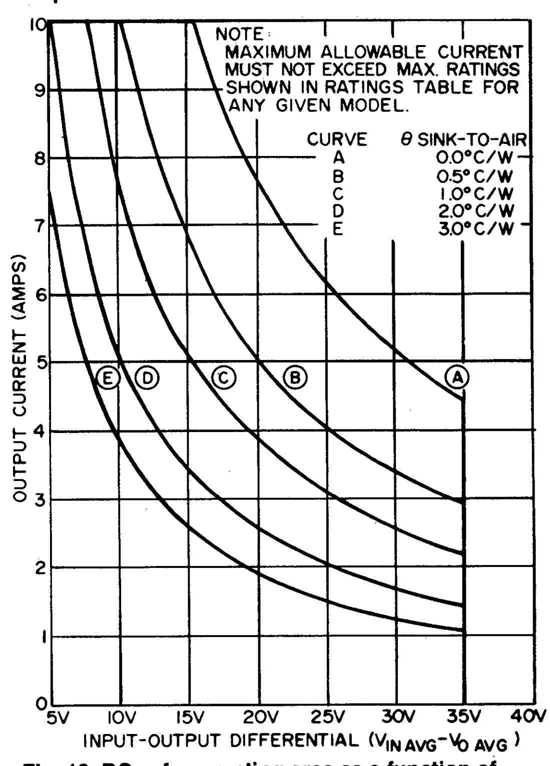


Fig. 18 DC safe operating area as a function of heatsink thermal resistance to air at 40°C ambient temperature for LAS 4305-4328 and LAS 4405-4428

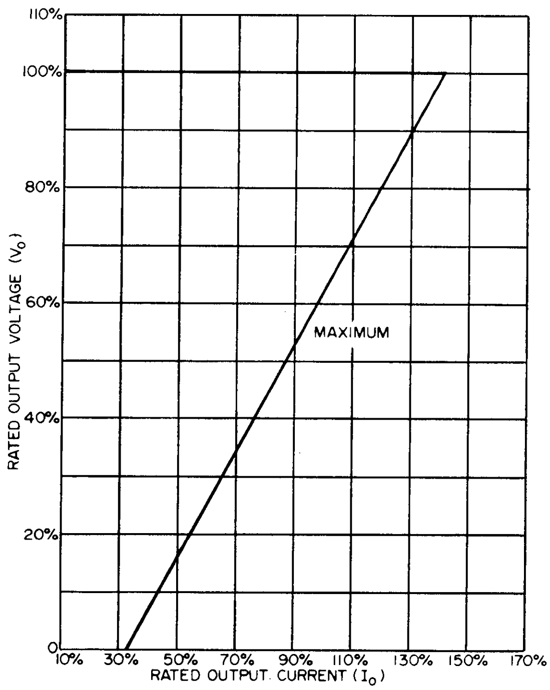


Fig. 19 Short circuit protection characteristic, LAS 4000 series

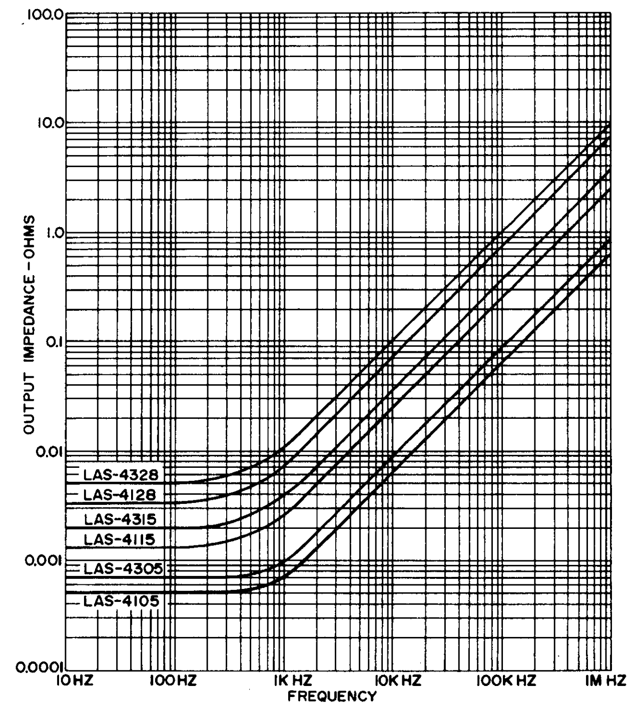
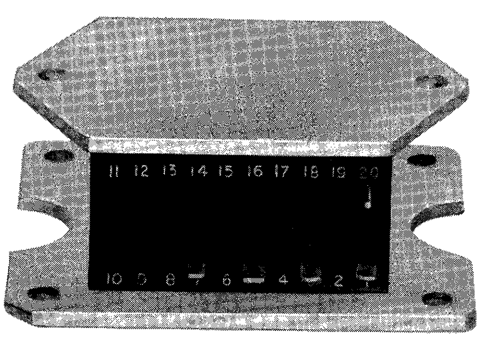
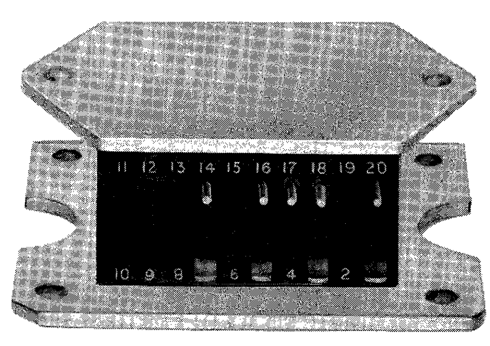


Fig. 19A Typical output impedance vs. frequency





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NEGATIVE REGULATOR CONNECTION DIAGRAMS

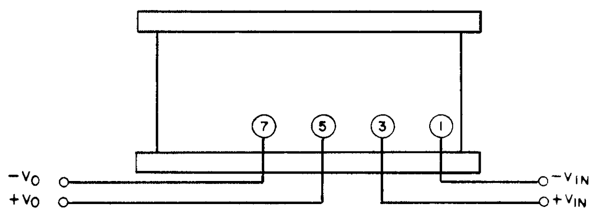


Fig. 20 4 pin Power Hybrid Voltage Regulator

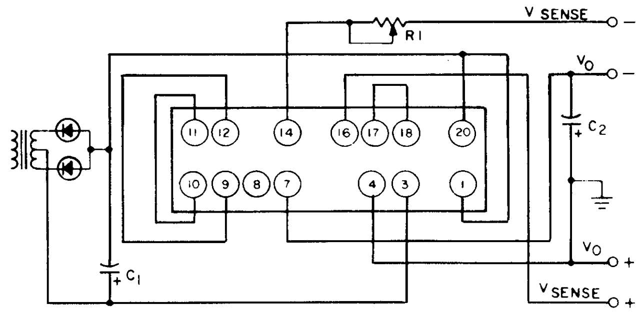


Fig. 23 Negative power hybrid voltage regulator circuit

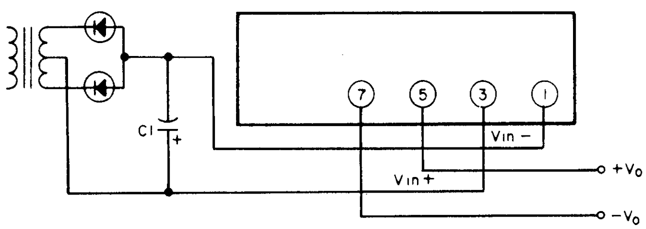


Fig. 21 4 pin power hybrid voltage regulator circuit

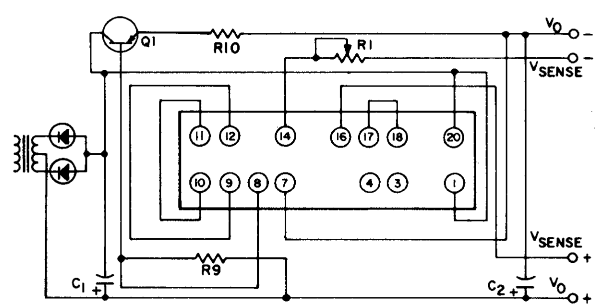


Fig. 24 Power Hybrid Voltage Regulator used with parallel pass transistor for higher output current

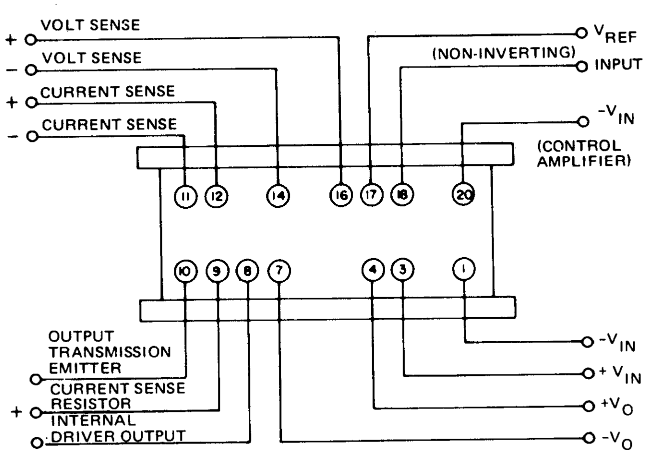


Fig. 22 14 pin power hybrid voltage regulator

NOTES FOR DETERMINING VALUES OF EXTERNAL COMPONENTS IN FIGURES 20 THROUGH 27

1. Minimum value of input filter capacitors C1 and C3 is determined by: C1, C3 = I_o(1000 mfd/amp) recommended.
2. Minimum value of output capacitors C2 and C4 is determined by: C2, C4 = I_o(100 mfd/amp).
3. Minimum value of output voltage adjust resistors R1 and R3 for LAS 2705 and LAS 2905 is 3K ohms. See note 4 to determine value for all other models.
4. Minimum value of output voltage adjust resistors R1 and R3 is determined by: R1, R3 = ($0.25V_O$ x 1000Ω/V) ohms wirewound. Use next highest standard value.
5. Values of current sharing resistors R5 and R6 are determined by: R5, R6 = (N x 0.5V)/MAX I_o ohms ± 3% wirewound where N = number of emitter current sharing resistor required.
6. Nominal value of the current sharing resistor R10 for Fig. 24 is determined from following table.

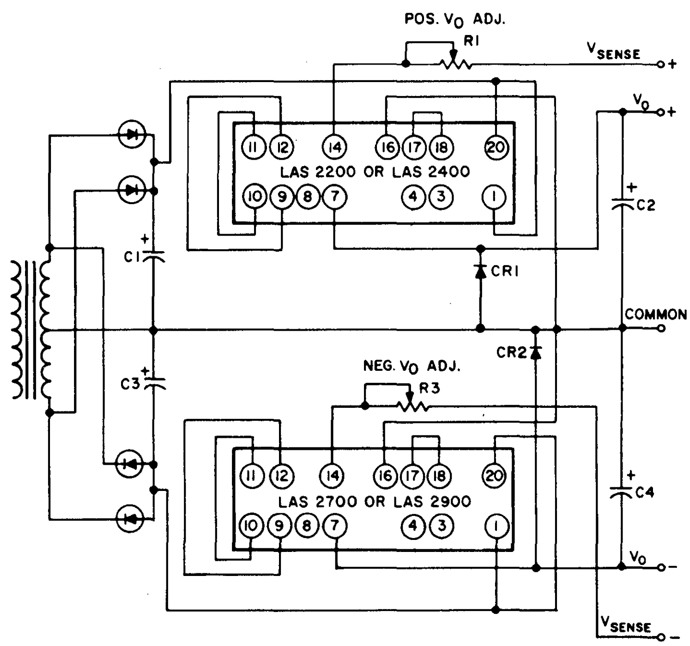


Fig. 25 Dual, pos/neg regulator using complementary regulator with common input

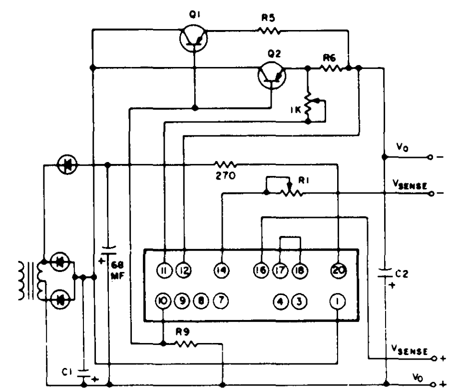


Fig. 26 Power Hybrid Voltage Regulator used as a driver for higher current outputs using peak detector for control amplifier input voltage

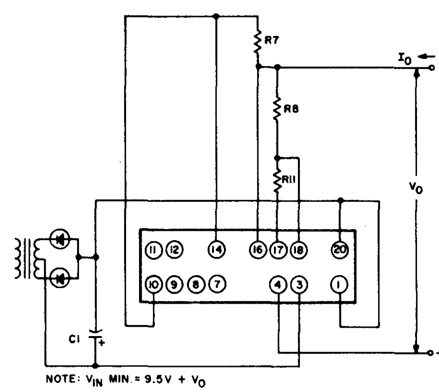


Fig. 27 Power hybrid current regulator circuit

R10	Model
.100Ω	LAS 2705, 2706, 2712, 2715
.150Ω	LAS 2720
.200Ω	LAS 2905, 2906, 2724
.250Ω	LAS 2728, 2912, 2915

7. Value of current sensing resistor R7 is determined by $R7 = (2.4V)/I_o$ ohms, nominal, wirewound.
8. Nominal values of R8 and R11 ½W film resistors (Fig. 27):

R8 Ohms	R11 Ohms	Model
∞(open)	0 (short)	LAS 2705, LAS 2905
15,500	4,500	LAS 2706, LAS 2906
9,700	12,300	LAS 2712, LAS 2912
9,700	11,700	LAS 2715, LAS 2915
9,700	11,000	LAS 2720
9,700	10,700	LAS 2724
9,700	10,300	LAS 2728

9. Rectifiers CR1 and CR2 should be rated at peak inverse voltage of 50V and forward current equal at least to maximum rated I_o.
10. Value of I_{cbo} drain resistor R9, is determined by: $R9 = (V_o)/(N \times MAX\ I_{cbo})$ ohms, ± 5% composition where N = number of external series pass transistors.
11. All fixed resistors shown on diagrams with given value in ohms are ½W composition.
12. Temperature rise of case 2, ΔTC_2, is given by the following:
    a) For no external heat sink on case 2,
    $$\Delta TC_2 = 0.25 P_D\, \theta_{J1-A}$$
    b) For an external heat sink on case 2 with thermal resistance θ
    $$\Delta TC_2 = \frac{\theta \cdot HS_2}{50^\circ C/W + \theta HS_2} \times P_D\, \theta_{J1-A}$$

POSITIVE REGULATOR 3 AND 5 AMP CONNECTION DIAGRAMS

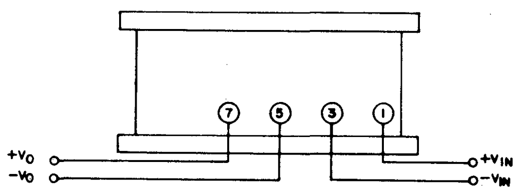


Fig. 28 4 pin Power Hybrid Voltage Regulator

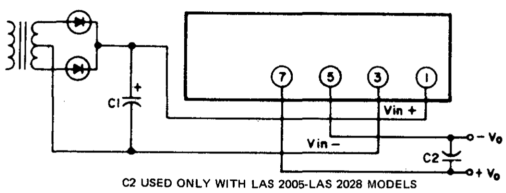


Fig. 29 4 pin power hybrid voltage regulator circuit

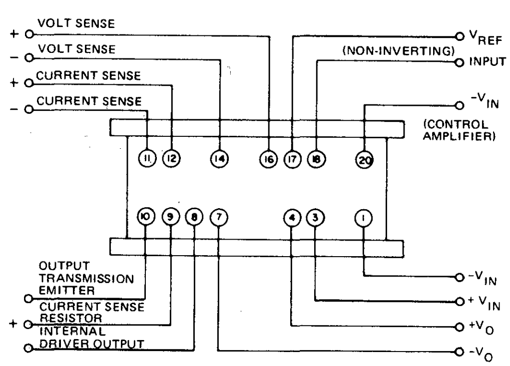


Fig. 30 14 pin Power Hybrid Voltage Regulator

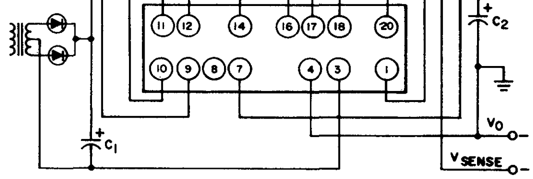


Fig. 31 Positive power hybrid voltage regulator circuit

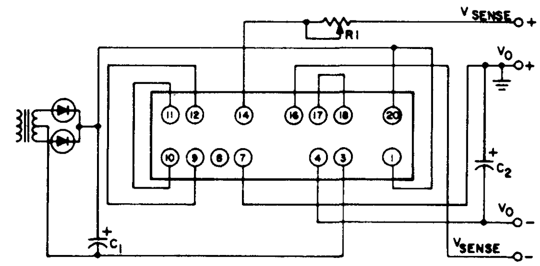


Fig. 32 Negative power hybrid voltage regulator circuit

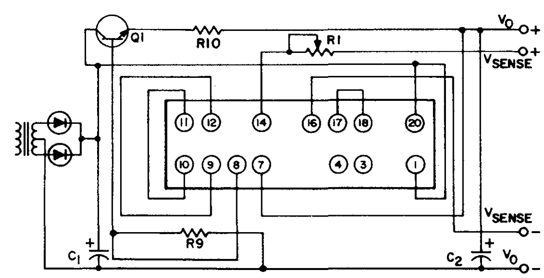


Fig. 33 Power hybrid voltage regulator used with parallel pass transistor for higher output current

NOTES FOR DETERMINING VALUES OF EXTERNAL COMPONENTS IN FIGURES 28 THROUGH 36

1. Minimum value of input filter capacitors C1 and C3 is determined by: C1, C3 = I_O (1000 mfd/amp) recommended.
2. Minimum value of output capacitors C2 and C4 is determined by: C2, C4 = I_O(100 mfd/amp).
3. Minimum value of output voltage adjust resistors R1 and R3 for LAS 2205 and LAS 2405 is 3K ohms. See note 4 to determine value for all other models.
4. Minimum value of output voltage adjust resistors R1 and R3 is determined by: R1, R3 = $(0.25V_O \times 1000\Omega/V)$ ohms wirewound. Use next highest standard value.
5. Values of tracking reference voltage divider resistors R2 and R4 for all models except LAS 2205, 2405, 2206, and 2406 are determined by:
   a) R2 = $(2000V_O - 7150)$ ohms, ± 1%, ½W film
   b) R4 = 7.15K ohms, ± 1%, ½W film
6. Value of tracking reference voltage divider resistor R2 and R4 for LAS 2205 and LAS 2405 is:

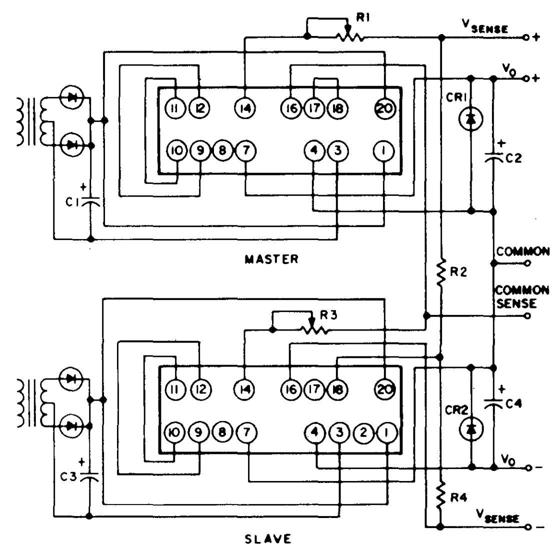


Fig. 34 Dual tracking power hybrid voltage regulator circuit

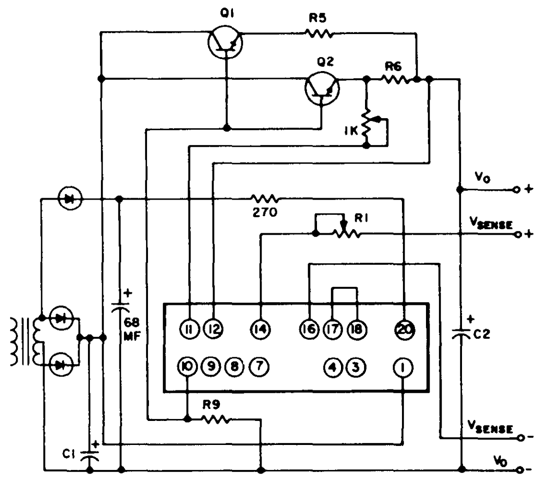
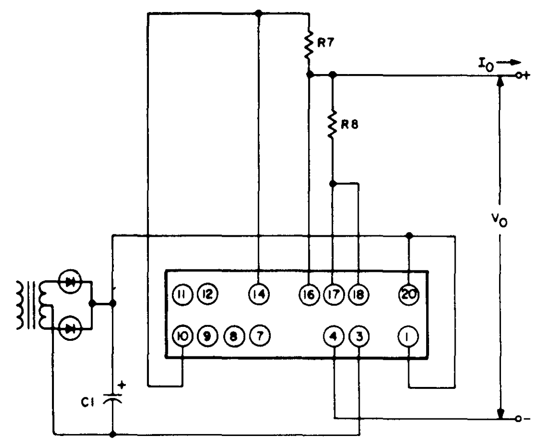


Fig. 35 Power Hybrid Voltage Regulator used as a driver for higher current outputs using peak detector for control amplifier input voltage



NOTE: V_{IN} MIN = 9.5V + V_O

Fig. 36 Power hybrid current regulator circuit

a) R2 = 7.50K ± 1% ½W film
b) R4 = 2.43K ± 1% ½W film

7. Value of tracking reference voltage divider resistor R2 and R4 for LAS 2206 and LAS 2406 is:
   a) R2 = 8.06K ± 1% ½W film
   b) R4 = 4.02K ± 1% ½W film
8. Values of current sharing resistors R5 and R6 are determined by: R5, R6 = (N x 0.5V)/MAX Io ohms ± 3% wirewound where N = number of emitter current sharing resistors required.
9. Nominal value of the current sharing resistor R10 for Fig. 33 is determined from table below:

R10	Model
.100Ω	LAS 2205, 2206, 2212, 2215
.150Ω	LAS 2220
.200Ω	LAS 2405, 2406, 2224
.250Ω	LAS 2228, 2412, 2415

10. Value of current sensing resistor R7 is determined by R7 = $(2.4V)/I_O$ ohms, nominal, wirewound.
11. R8 (part of reference voltage divider) = 750 ohms nominal, ½W film resistor for all models except LAS 2205, 2405, 2206, and 2406.
12. R8 for LAS 2206 and 2406 is 3.2K nominal, ½W film.
13. R8 for LAS 2205 and 2405 is not required.
14. Rectifiers CR1 and CR2 should be rated at peak inverse voltage of 50 V and forward current equal at least to maximum rated Io.
15. Value of I_{cbo} drain resistor R9, is determined by: R9 = $(V_O)/(N \times MAX\ I_{cbo})$ ohms, ±5% composition where N = number of external series pass transistors.
16. All fixed resistors shown on diagrams with given values in ohms are ¼W composition.
17. Temperature rise of case 2, ΔTC_2, is given by the following:
   a) For no external heat sink on case 2.
   $\Delta TC_2 = 0.25 P_D \theta_{J1-A}$
   b) For an external heat sink on case 2 with thermal resistance θ

$$\Delta TC_2 = \frac{\theta - HS_2}{50^\circ C/W + \theta HS_2} \times P_D\, \theta_{J1-A}$$

POSITIVE REGULATOR
10 AND 15 AMP CONNECTION
DIAGRAMS

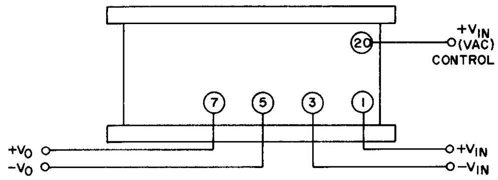


Fig. 37 5-Pin Power Hybrid Voltage Regulator

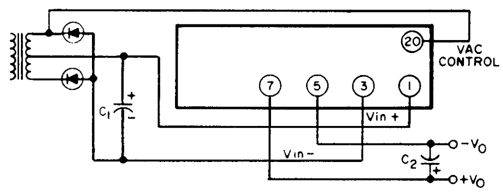


Fig. 38 5-Pin power hybrid voltage regulator circuit

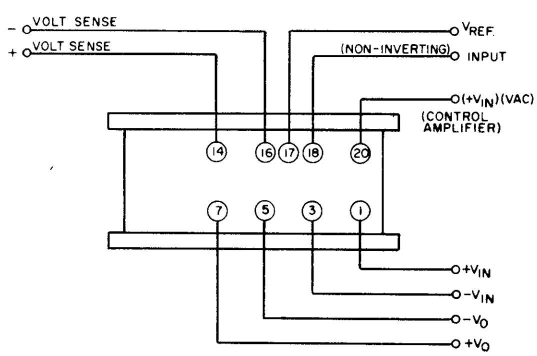


Fig. 39 9-Pin Power Hybrid Voltage Regulator

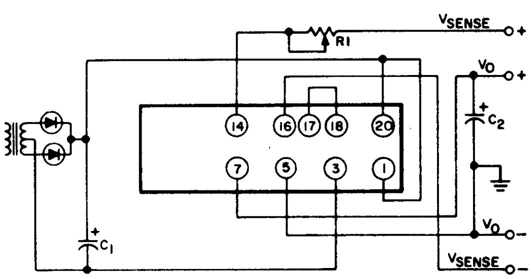


Fig. 40 Positive power hybrid voltage regulator circuit

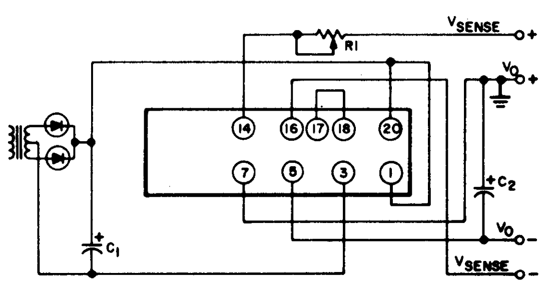


Fig. 41 Negative power hybrid voltage regulator circuit

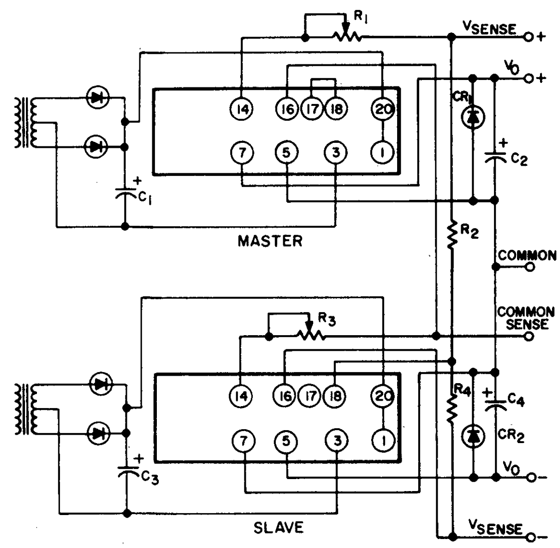


Fig. 42 Dual tracking power hybrid voltage regulator circuit

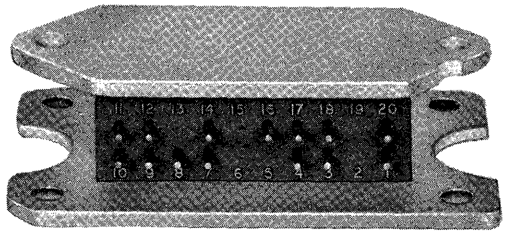
NOTES:

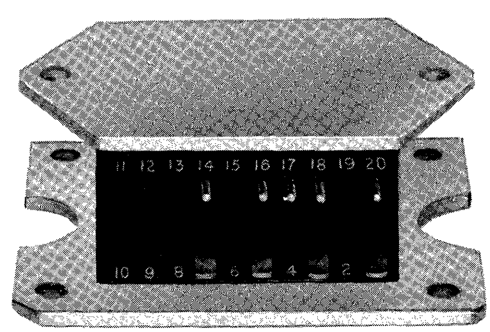
1. Minimum value of input filter capacitors C1 and C3 is determined by: C1, C3 = I_O (1000 mfd/amp) recommended.
2. Minimum value of output capacitors C2 and C4 is determined by: C2, C4 = I_O (100 mfd/amp).
3. Minimum value of output voltage adjust resistors R1 and R3 for LAS 4205 and LAS 4405 is 3K ohms. See note 4 to determine value for all other models.
4. Minimum value of output voltage adjust resistors R1 and R3 is determined by: R1, R3 = ($0.25 V_O \times 1000\Omega/V$) ohms wirewound. Use next highest standard value.
5. Values of tracking reference voltage divider resistors R2 and R4 for all models except LAS 4205, 4405, 4206, and 4406 are determined by:
   a) R2 = ($2000 V_O - 7150$) ohms, ± 1%, ½W film
   b) R4 = 7.15K ohms, ± 1%, ½W film
6. Value of tracking reference voltage divider resistor R2 and R4 for LAS 4205 and LAS 4405 is:
   a) R2 = 7.50K ± 1% ½W film
   b) R4 = 2.43K ± 1% ½W film
7. Value of tracking reference voltage divider resistor R2 and R4 for LAS 4206 and LAS 4406 is:
   a) R2 = 8.06K ± 1% ½W film
   b) R4 = 4.02K ± 1% ½W film
8. Rectifiers CR1 and CR2 should be rated at peak inverse voltage of 50V and forward current equal at least to maximum rated I_O.

LAMBDA'S POWER HYBRID VOLTAGE REGULATORS ARE USED IN STANDARD LAMBDA POWER SUPPLIES

The Power Hybrid Voltage Regulator provides any manufacturer with simplicity of design, reliability, and cost reduction in manufacturing. Lambda is the largest user of the Power Hybrid Voltage Regulator in its standard lines of off-the-shelf power supplies such as in the LX and LT series. Lambda utilizes the Power Hybrid Voltage Regulator to increase reliability of its own power supplies by replacing over '30' discrete components with this one 100,000 hour MTBF proven component. Reliability is further enhanced because the Power Hybrid Voltage Regulator is a self protected unit. It contains thermal, as well as, overload and overcurrent protection circuitry. High performance is obtained by thermal isolation of power section from the pass section of the hybrid. By having complete regulating circuitry in module form, with input and output pins available, design time is greatly reduced allowing design engineers to concentrate on other aspects of product design. By stocking this one modular item Lambda reduces inventory costs. The Power Hybrid Voltage Regulator, delivered from one source instead of many components from many sources, eliminates delivery problems and costs. Through ease of connection and elimination of many discrete components, Lambda's production assembly time and costs are minimized.

Through the use of the Power Hybrid Voltage Regulator in its power supplies, Lambda continues to offer its customers a high quality power product at the lowest possible cost. Other manufacturers will also be able to derive the same cost advantage while maintaining high quality standards through the use of the Power Hybrid Voltage Regulator.

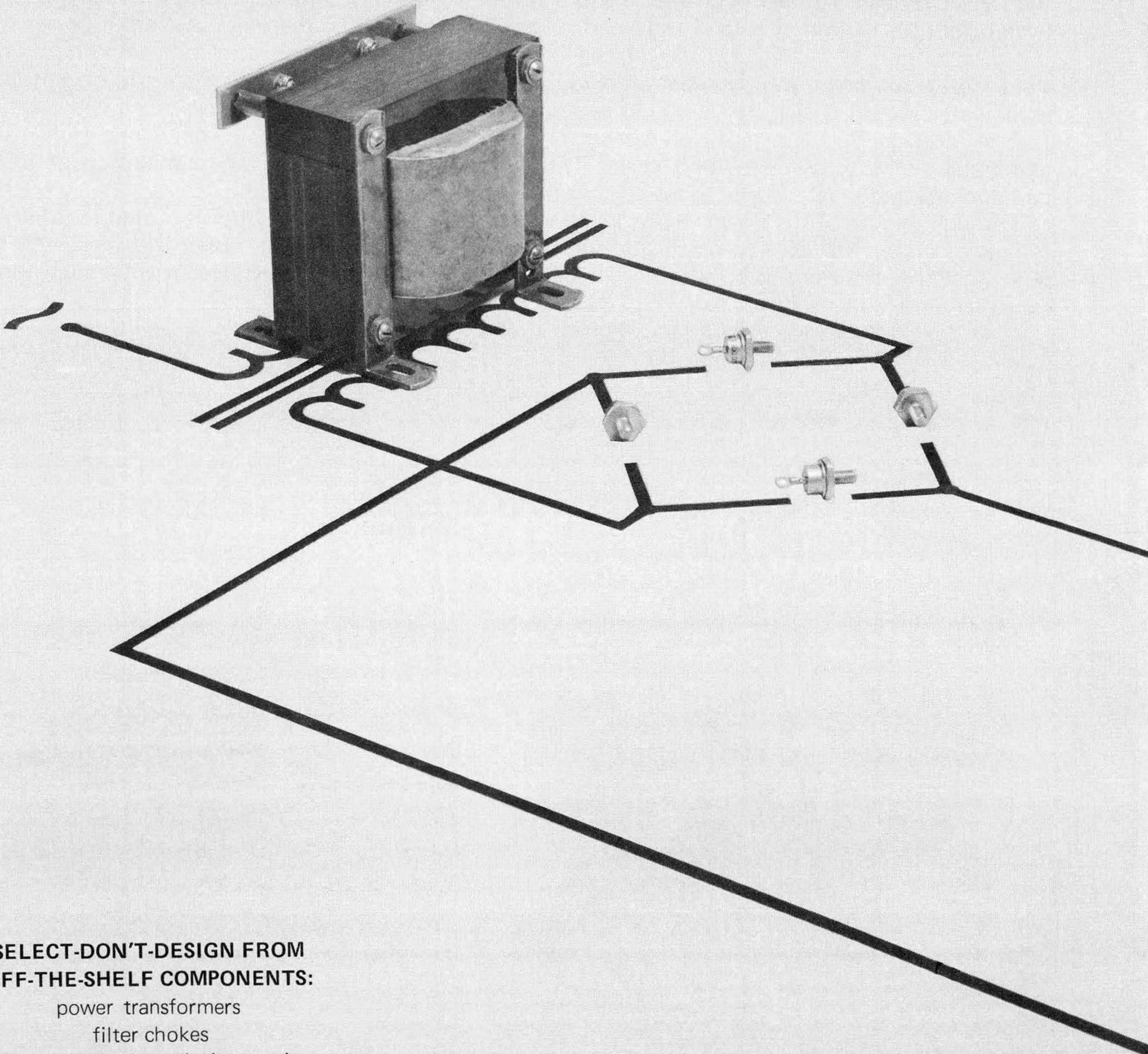




"actual size"

LAMBDA POWER KITS

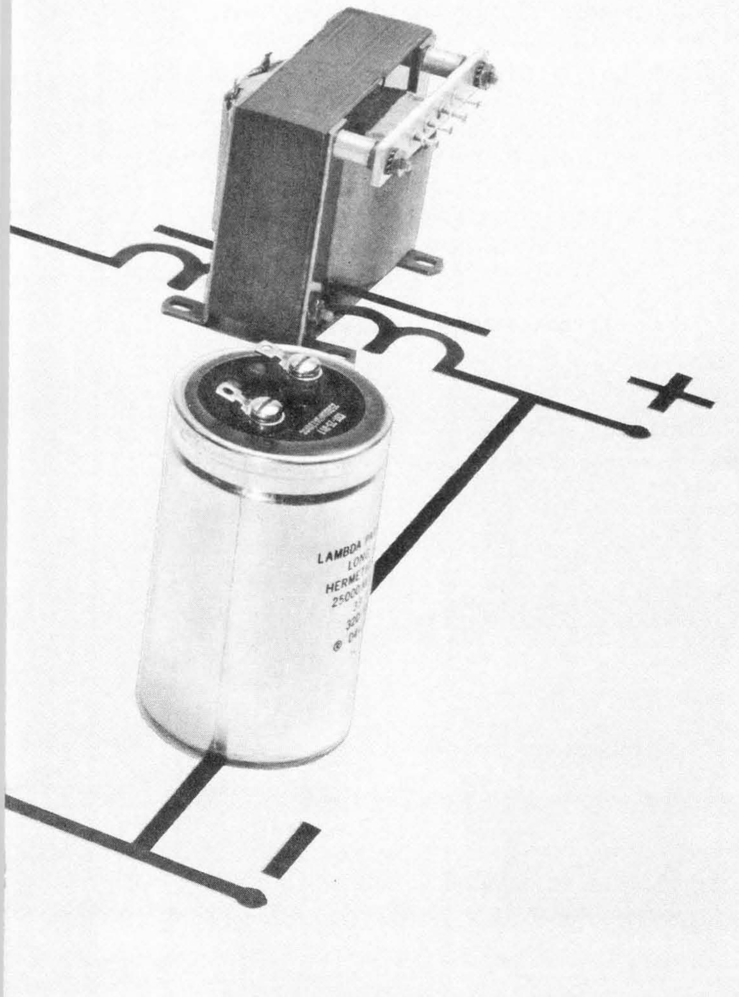
pre-designed power supply circuits and selected components for building



SELECT-DON'T-DESIGN FROM OFF-THE-SHELF COMPONENTS:

power transformers
filter chokes
computer grade electrolytic capacitors
silicon rectifiers
Power Hybrid Voltage Regulators
voltage regulating transformers

your own power supply using standard and voltage regulating transformers



LAMBDA POWER KITS

pre-designed power supply circuits and selected components providing five levels of regulation and ripple ... 175 circuits

1. Define parameters

- output voltage
- current
- regulation
- ripple

2. Select power kits

All the major components you need . . . pre-designed to meet your specific requirements and delivered off-the-shelf from a single source of supply

Everything you need for a pre-designed power supply

Lambda power kits are comprised of components selected for a pre-designed power supply circuit so that you can build your own dc power supply. The components vary depending upon the circuit selected, as well as the dc voltage and dc current required.

Major components supplied are:

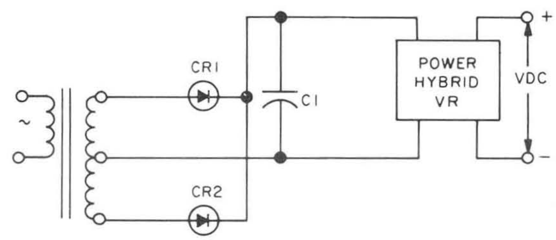
- power and ferroresonant transformers
- ac capacitors
- filter chokes
- computer grade electrolytic capacitors
- silicon rectifiers
- Power Hybrid Voltage Regulators

Designed for breadboard, pre-production and production models

Lambda, with the introduction of standard power kits, leaves you free to design your circuit without having to bother with the power supply. Lambda now offers a wide selection of power supply kits to provide you with all the major components needed to build a power supply. At the same time, Lambda stocks these items so you get off-the-shelf delivery from 3 regional distribution points.

Wide selection of circuits for regulation and ripple

Lambda offers a selection of pre-designed groups of circuits from which you can select the regulation and ripple characteristics required for your application. Specifications are available from 0.02% regulation 1.5mV, RMS ripple to 20% regulation at 2V RMS ripple.



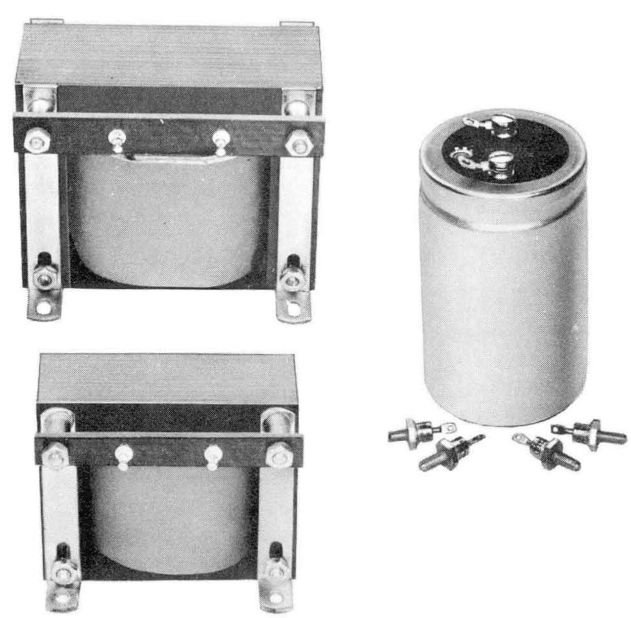
Wide selection of output voltages and currents

in each group of circuits Lambda offers a wide selection of voltages and currents to meet your needs... both single and dual outputs. Voltage ranges up to 48 VDC and current ranges up to 50 amperes DC are provided.

Simply select what you need... no calculations or design necessary

All the circuits supplied with the Power Kits are complete showing all components, and have been predesigned, proved and tested by Lambda Engineering to assure you the same quality and performance achieved by Lambda's standard line of power supplies. In addition, thermal properties of rectifiers and transistors for heat sinking are provided. Lambda transformers and chokes carry the same 5 year guarantee as Lambda power supplies. Lambda transformers and chokes are fully varnish-impregnated.

TYPICAL POWER KIT COMPONENTS



CIRCUIT SPECIFICATIONS POWER KITS

Circuit specifications

SERIES 1000 — Capacitor-input filter power supply circuits

regulation, line	1.2% per % @ full load
regulation, load	20% from ½ load to full load
output voltage tolerance	±5% @ nominal line of 115 VAC at full load
ripple	1 v RMS, up to 12 VDC 2 v RMS, 15 to 48 VDC
dc output voltages	5 to 48 VDC (eleven ranges)
dc output currents	0.25 to 50 amps (seven ranges)
input voltages	105-132 VAC, 57-63 Hz

SERIES 2000 — Choke-input filter power supply circuits

regulation, line	1% per % @ full load
regulation, load	10% from ½ load to full load
output voltage tolerance	±5% @ nominal line of 115 VAC at full load
ripple	2% (RMS) of DC output voltage
dc output voltages	5 to 48 VDC (eleven ranges)
dc output currents	1.0 amp to 50 amps (five ranges)
input voltages	105-132 VAC, 57-63 Hz

SERIES 3000 — Regulated power supply circuits using Power Hybrid Voltage Regulator

regulation, line	0.2% for line changes from 105 to 132 VAC or 132 to 105 VAC for any load between 0 and 100% of full load
regulation, load	0.2% for 0 to 100% of full load for any line between 105 and 132 VAC
ripple	5 mV pk-pk
dc output voltages	5 to ±15 VDC (six ranges)
dc output currents	2 to 50 amps (five ranges)
input voltages	105-132 VAC, 57-63 Hz
temperature coefficient	0.01%/°C
remote sensing	available on some models
automatic current limiting	on all models

SERIES 5000 — Ferroresonant power supply circuits

Input

105-132 Vac — 59-61 Hz

Output

regulation, line	2% for line changes from 105 to 132 VAC or 132 to 105 VAC for any load between 25% and 100% of full load
regulation, load	5% from ½ load to full load for output voltages above 6V. 500 mV from ½ load to full load for 5V and 6V units
output voltage tolerance	±2% @ 25°C, 115 VAC 60 Hz input and 100% load
ripple	100 mV RMS or 1% RMS whichever is greater (200 mV RMS for LPKT-5031-1 and LPKT 5081-1)
current limit	transformer automatically limits short circuit current to less than 200% of rated current
effect of line frequency on output voltage	the output changes less than 2.4% for each cycle change in line frequency
dc output voltages	5 to 48 VDC (eight ranges)
dc output currents	1 to 50A (five ranges)

SERIES 6000— Ferroresonant power supply circuits using Power Hybrid Voltage Regulator

Input

105-132 Vac — 59-61 Hz

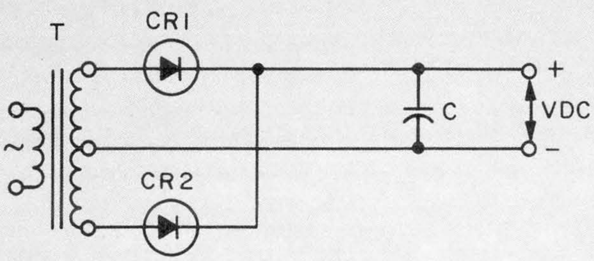
Output

regulation, line	0.02% for line changes from 105 to 132 VAC or 132 to 105 VAC for any load between 0 and 100% of full load
regulation, load	0.2% for 0 to 100% of full load for any line between 105 and 132 VAC
output voltage tolerance	±1% @ 25°C, 115 VAC and 100% load
ripple	1.5 mV RMS, 5 mV pk-pk
current limit	regulator circuit has automatic fold-back current limiting to protect the supply as well as the load
temperature coefficient	0.01%/°C
dc output voltages	5 to 28 VDC (seven ranges)
dc output currents	1 to 25A (four ranges)
remote sensing	available on some models

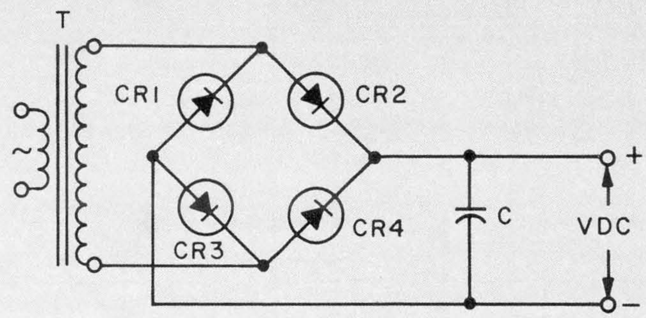
LAMBDA POWER KITS 1000 SERIES

transformers, capacitors, rectifiers and circuits

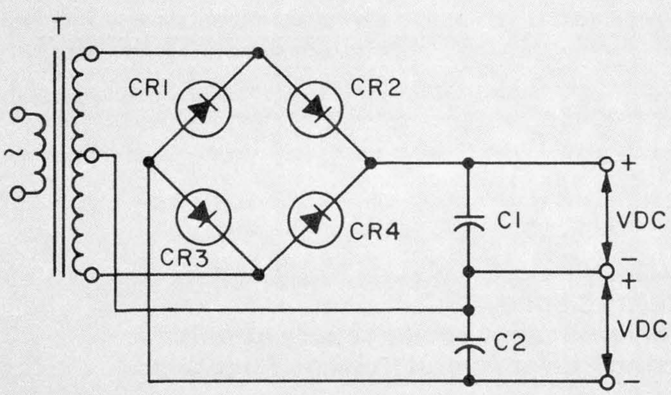
CAPACITOR-INPUT FILTER POWER SUPPLY CIRCUITS



CIRCUIT 1

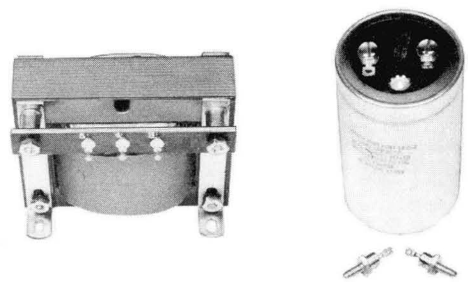


CIRCUIT 2

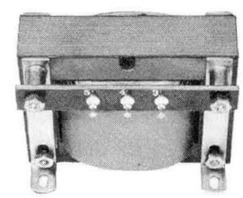


CIRCUIT 3

Lambda transformers
are guaranteed for five years.



LPKT
LAMBDA POWER KIT



LPTX
LAMBDA POWER TRANSFORMER

Regulation

line: 1.2% per % at full load
load: 20% from ½ load to full load
output voltage tolerance: ±5% at nominal line of 115 VAC at full load

Ripple

1 V RMS, up to 12 VDC
2 V RMS, 15 to 48 VDC

DC output voltages

5 to 48 Vdc (eleven ranges)

DC output currents

0.25 to 50 amps (seven ranges)

AC input

105-132 VAC, 57-63 Hz

POWER KIT AND TRANSFORMER SELECTION CHART

DC OUTPUT CURRENT AND STOCK NUMBERS

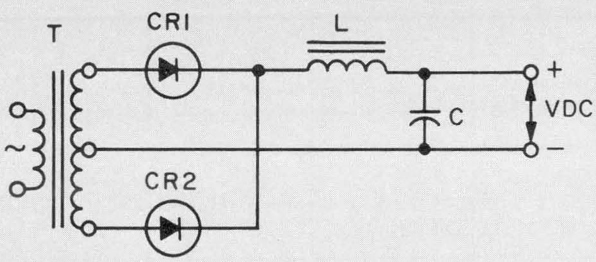
DC OUTPUT VOLTAGE	STOCK NUMBER PREFIX	0.25 AMP 1-9 10-24	0.5 AMP 1-9 10-24	1.0 AMP 1-9 10-24	5.0 AMPS 1-9 10-24	10.0 AMPS 1-9 10-24	25.0 AMPS 1-9 10-24	50.0 AMPS 1-9 10-24
		1003-1	1005-1	1007-1	1011-1	1015-1	1025-1	1031-1
5 VDC	LPKT	$11.00 $9.50	$11.00 $9.50	$13.00 $11.00	$22.00 $19.00	$34.00 $30.00	$67.00 $58.00	$100.00 $82.00
	LPTX	8.00 7.00	8.00 7.00	10.00 8.00	16.00 13.00	23.00 19.00	46.00 37.00	62.00 50.00
		1053-1	1055-1	1057-1	1061-1	1065-1	1075-1	1081-1
6 VDC	LPKT	$11.00 $9.50	$11.00 $9.50	$13.00 $11.00	$22.00 $19.00	$34.00 $30.00	$69.00 $59.00	$102.00 $84.00
	LPTX	8.00 7.00	8.00 7.00	10.00 8.00	16.00 13.00	24.00 19.00	48.00 38.00	63.00 50.00
		1103-1	1105-1	1107-1	1111-1	1115-1	1125-1	1131-1
12 VDC	LPKT	$11.00 $9.50	$11.00 $9.50	$13.00 $11.00	$31.00 $27.00	$43.00 $36.00	$87.00 $72.00	$102.00 $84.00
	LPTX	8.00 7.00	8.00 7.00	10.00 8.00	25.00 21.00	37.00 30.00	75.00 60.00	90.00 73.00
		1133-1	1135-3	1137-3	1141-3			
±12 VDC	LPKT	$13.00 $11.00	$16.00 $13.00	$17.00 $14.00	$49.00 $42.00			
	LPTX	10.00 8.00	13.00 10.00	14.00 11.00	37.00 30.00			
		1153-2	1155-2	1157-2	1161-2	1165-2	1175-1	1181-1
15 VDC	LPKT	$11.50 $10.00	$11.50 $10.00	$14.00 $12.00	$31.00 $27.00	$45.00 $38.00	$91.00 $77.00	$104.00 $86.00
	LPTX	8.50 7.50	8.50 7.50	12.00 10.00	24.00 19.00	37.00 30.00	75.00 61.00	89.00 71.00
		1203-3	1205-3	1207-3	1211-3			
±15 VDC	LPKT	$13.00 $11.00	$16.00 $13.00	$17.00 $14.00	$49.00 $42.00			
	LPTX	10.00 8.00	13.00 10.50	14.00 11.00	37.00 30.00			
		1253-2	1255-2	1257-2	1261-2	1265-2	1275-1	
18 VDC	LPKT	$11.50 $10.00	$11.50 $10.00	$14.00 $12.00	$31.00 $27.00	$46.00 $39.00	$91.00 $77.00	
	LPTX	8.50 7.50	8.50 7.50	12.00 10.00	24.00 19.00	39.00 31.00	78.00 62.00	
		1303-3	1305-3	1307-3	1311-3			
±18 VDC	LPKT	$13.00 $11.00	$16.00 $13.00	$18.50 $16.00	$52.00 $44.00			
	LPTX	10.00 8.00	13.00 10.50	15.00 13.50	40.00 32.00			
			1355-2	1357-2	1361-2	1365-2	1375-2	
24 VDC	LPKT		$12.00 $11.00	$14.00 $12.00	$39.00 $33.00	$50.00 $42.00	$100.00 $82.00	
	LPTX		10.00 9.00	12.00 10.00	31.00 25.00	42.00 34.00	84.00 66.00	
			1455-2	1457-2	1461-2	1465-2	1475-2	
28 VDC	LPKT		$12.00 $11.00	$17.00 $14.00	$41.00 $35.00	$58.00 $48.00	$100.00 $82.00	
	LPTX		10.00 9.00	14.00 11.00	33.00 27.00	50.00 40.00	84.00 66.00	
				1507-2	1511-2	1515-2		
48 VDC	LPKT			$20.00 $17.00	$47.00 $40.00	$90.00 $76.00		
	LPTX			17.00 14.00	40.00 32.00	80.00 64.00		

NOTES:
1. All prices F.O.B. Gouldsboro, Pa. All prices and specifications are subject to change without notice.
2. For quantities of 25 and over, please consult factory.

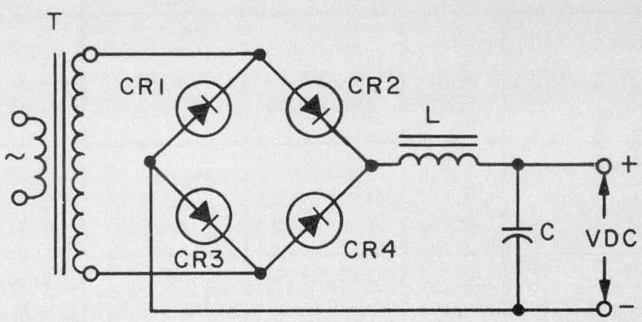
LAMBDA
POWER KITS
2000 SERIES

transformers, chokes, capacitors, rectifiers and circuits

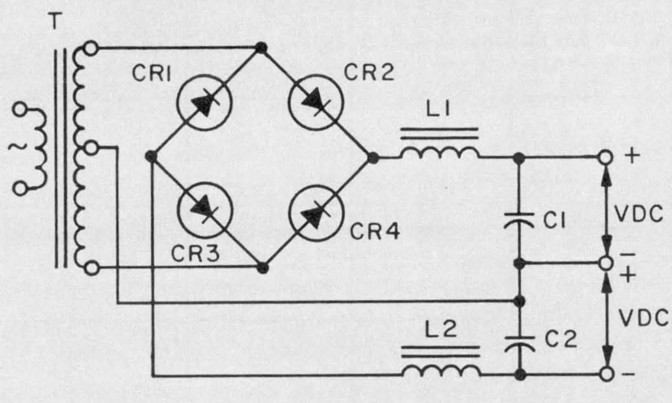
CHOKE-INPUT FILTER POWER SUPPLY CIRCUITS



CIRCUIT 1

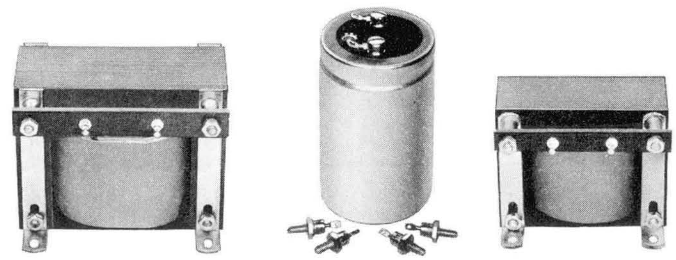


CIRCUIT 2

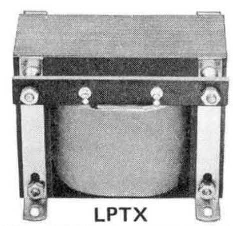


CIRCUIT 3

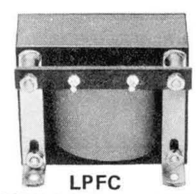
Lambda transformers and chokes are guaranteed for five years.



LPKT
LAMBDA POWER KIT



LPTX
LAMBDA POWER TRANSFORMER



LPFC
LAMBDA FILTER CHOKE

Regulation
line: 1% per % at full load
load: 10% from ½ load to full load
output voltage tolerance: ±5% at nominal line of 115 VAC at full load

Ripple
2% (RMS) of DC output voltage

DC output voltages
5 to 48 VDC (eleven ranges)

DC output currents
1.0 to 50 amps (five ranges)

AC input
105-132 VAC, 57-63 Hz

POWER KIT, TRANSFORMER AND CHOKE SELECTION CHART

DC OUTPUT CURRENT AND STOCK NUMBERS

DC OUTPUT VOLTAGE	STOCK NUMBER PREFIX	1.0 AMP		5.0 AMPS		10.0 AMPS		25.0 AMPS		50.0 AMPS	
		1-9	10-24	1-9	10-24	1-9	10-24	1-9	10-24	1-9	10-24
		2007-1		2011-1		2015-1		2025-1		2031-1	
5 VDC	LPKT	$23.00	$19.50	$41.00	$36.00	$74.00	$61.00	$121.00	$100.00	$150.00	$124.00
	LPTX	8.00	7.00	14.00	12.00	24.00	19.00	37.00	30.00	50.00	39.00
	LPFC	12.00	10.00	21.00	18.00	43.00	35.00	72.00	58.00	80.00	64.00
		2057-1		2061-1		2065-1		2075-1		2081-1	
6 VDC	LPKT	$23.00	$19.50	$41.00	$36.00	$74.00	$61.00	$121.00	$100.00	$150.00	$124.00
	LPTX	8.00	7.00	14.00	12.00	24.00	19.00	37.00	30.00	50.00	39.00
	LPFC	12.00	10.00	21.00	18.00	43.00	35.00	72.00	58.00	80.00	64.00
		2107-1		2111-1		2115-1		2125-1		2131-1	
12 VDC	LPKT	$23.00	$19.50	$46.00	$40.00	$86.00	$71.00	$132.00	$108.00	$184.00	$152.00
	LPTX	8.00	7.00	19.00	16.00	36.00	29.00	48.00	38.00	83.00	67.00
	LPFC	13.00	10.00	21.00	18.00	43.00	35.00	72.00	58.00	80.00	64.00
		2137-3		2141-3							
±12 VDC	LPKT	$44.00	$37.00	$89.00	$75.00						
	LPTX	12.00	10.00	35.00	27.00						
	LPFC	26.00	20.00	42.00	36.00						
		2157-2		2162-2		2165-2		2175-1		2181-1	
15 VDC	LPKT	$25.00	$21.50	$46.00	$40.00	$88.00	$72.00	$138.00	$113.00	$187.00	$154.00
	LPTX	8.00	7.00	19.00	16.00	34.00	27.00	54.00	43.00	86.00	69.00
	LPFC	14.00	12.50	21.00	18.00	42.00	33.00	72.00	58.00	80.00	64.00
		2207-3		2211-3							
±15 VDC	LPKT	$47.00	$40.00	$90.00	$76.00						
	LPTX	13.00	10.00	36.00	28.00						
	LPFC	28.00	25.00	42.00	36.00						
		2257-2		2261-2		2265-2		2275-1			
18 VDC	LPKT	$25.00	$21.50	$61.00	$50.00	$88.00	$72.00	$160.00	$131.00		
	LPTX	8.00	7.00	18.00	15.00	34.00	27.00	74.00	59.00		
	LPFC	15.00	13.00	37.00	30.00	42.00	33.00	72.00	58.00		
		2307-3		2311-3							
±18 VDC	LPKT	$48.00	$41.00	$108.00	$89.00						
	LPTX	13.00	10.00	26.00	21.00						
	LPFC	30.00	26.00	74.00	60.00						
		2357-2		2361-2		2365-2		2375-2			
24 VDC	LPKT	$28.00	$24.00	$74.00	$61.00	$90.00	$75.00	$162.00	$133.00		
	LPTX	10.00	9.00	31.00	25.00	43.00	34.00	73.00	60.00		
	LPFC	16.00	13.00	37.00	30.00	39.00	33.00	72.00	58.00		
		2457-2		2461-2		2465-2		2475-2			
28 VDC	LPKT	$29.00	$24.50	$77.00	$63.00	$90.00	$75.00	$171.00	$141.00		
	LPTX	10.50	9.00	34.00	27.00	43.00	34.00	77.00	61.00		
	LPFC	16.50	13.50	37.00	30.00	39.00	33.00	72.00	58.00		
		2507-2		2511-2		2515-2					
48 VDC	LPKT	$33.00	$27.00	$88.00	$72.00	$104.00	$86.00				
	LPTX	13.00	10.00	43.00	34.00	54.00	43.00				
	LPFC	17.00	14.00	37.00	30.00	37.00	30.00				

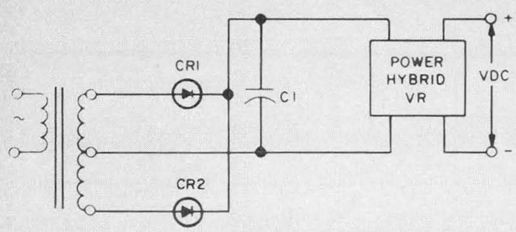
NOTES:

1. All prices F.O.B. Gouldsboro, Pa. All prices and specifications are subject to change without notice.
2. For quantities of 25 and over, please consult factory.

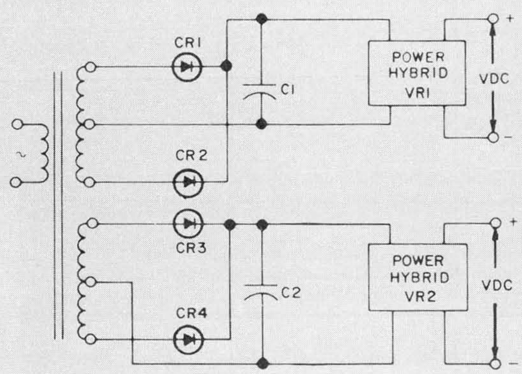
LAMBDA POWER KITS 3000 SERIES

transformers, capacitors, rectifiers, Power Hybrid Voltage Regulators, and circuits

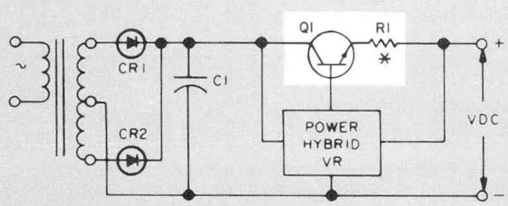
REGULATED POWER SUPPLY CIRCUITS WITH POWER HYBRID VOLTAGE REGULATOR (SIMPLIFIED DIAGRAMS)



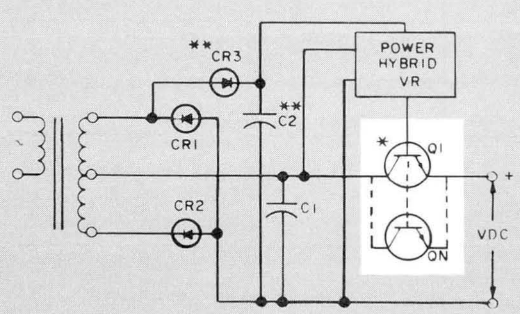
CIRCUIT 1



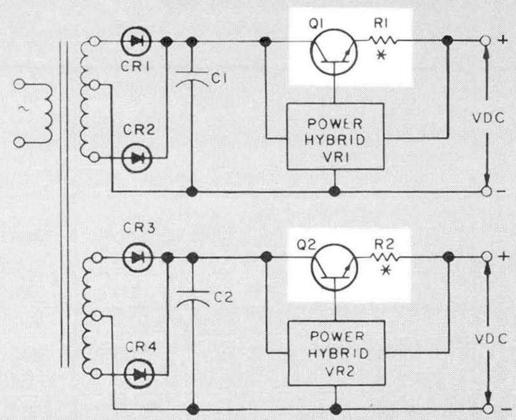
CIRCUIT 2



CIRCUIT 3

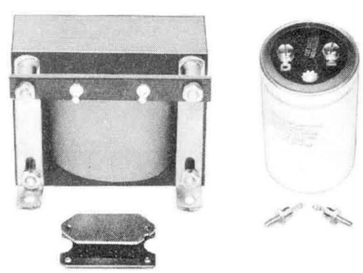


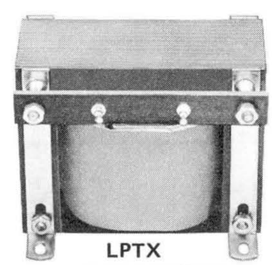
CIRCUIT 4



CIRCUIT 5

*Complete circuit diagrams are provided with kits and components. Lambda does not supply those components shown in unshaded areas.
**CR3 and C2 not required on all circuits
Lambda transformers are guaranteed for 5 years


LPKT
LAMBDA POWER KIT


LPTX
LAMBDA POWER TRANSFORMER

Regulation

line: 0.1% for changes from 105 to 132 VAC or 132 to 105 VAC for any load between 0% and 100% of full load
load: 0.2% for no load to full load and full load to no load

Ripple

5 mV pk-pk

DC output voltage

5 to ± 15 VDC (six ranges)

DC output currents

2 to 50 amps (five ranges)

AC input

105-132 VAC, 57-63 Hz

Temperature coefficient

0.03%/°C

Remote sensing on some models

Automatic current limiting

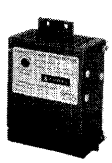
POWER KIT AND TRANSFORMER SELECTION CHART 3000 SERIES

PWR KITS

DC OUTPUT CURRENT AND STOCK NUMBERS

DC OUTPUT VOLTAGE	STOCK NUMBER PREFIX	2.0 AMPS		5.0 AMPS		10.0 AMPS		25.0 AMPS		50.0 AMPS	
		1-9	10-24	1-9	10-24	1-9	10-24	1-9	10-24	1-9	10-24
		3008-1		3011-3		3015-4		3025-4		3031-4	
5 VDC	LPKT	$52.00	$46.50	$64.50	$56.50	$72.50	$63.50	$96.00	$83.00	$134.00	$104.00
	LPTX	18.50	15.00	28.50	23.00	33.50	27.00	52.50	42.00	80.00	63.50
		3058-1		3061-3		3065-4		3075-4		3081-4	
6 VDC	LPKT	$53.00	$47.00	$65.00	$57.00	$73.00	$64.00	$98.00	$85.00	$136.00	$106.00
	LPTX	19.00	15.50	29.00	23.50	34.00	27.50	53.00	42.50	81.00	64.00
		3108-1		3111-3							
12 VDC	LPKT	$56.00	$50.00	$69.00	$61.00						
	LPTX	22.50	18.50	33.00	26.50						
		3138-2		3141-5							
±12 VDC	LPKT	$101.00	$90.00	$117.00	$104.00						
	LPTX	33.50	26.50	45.00	36.00						
		3158-1		3161-3							
15 VDC	LPKT	$57.00	$51.00	$71.00	$62.00						
	LPTX	23.00	19.00	35.00	28.00						
		3208-2		3211-5							
±15 VDC	LPKT	$103.00	$92.00	$119.00	$106.00						
	LPTX	34.00	27.00	47.00	38.00						

OVERVOLTAGE PROTECTOR ACCESSORIES



MODEL	ADJ. VOLT RANGE VDC	POWER KIT CURRENTS	PRICE
LM-OV-1	3-8	2, 5 and 10 amps	**$30.00**
LM-OV-2	6-20	2, 5 and 10 amps	**30.00**
LM-OV-7	3-8	25 and 50 amps	**75.00**
LM-OV-8	6-20	25 and 50 amps	**75.00**

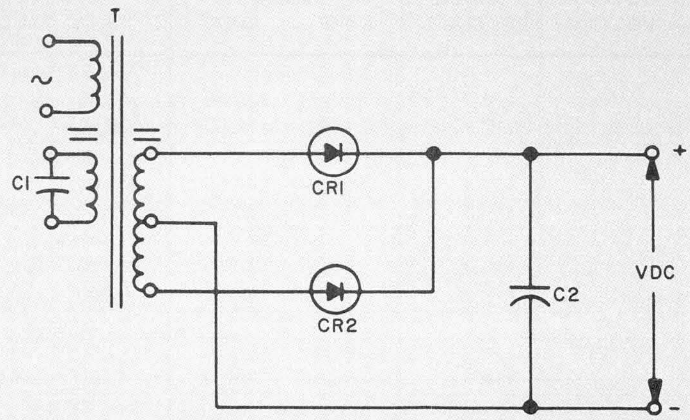
NOTES:
1. All prices F.O.B. Gouldsboro, Pa. All prices and specifications are subject to change without notice.
2. For quantities of 25 and over, please consult factory.

LAMBDA POWER KITS 5000 SERIES

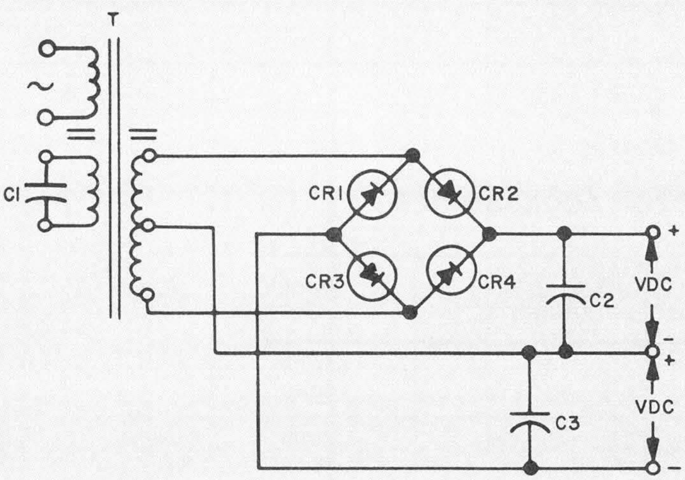
ferroresonant transformers, AC and DC capacitors, rectifiers and circuits

FERRORESONANT CAPACITOR INPUT FILTER POWER SUPPLY CIRCUITS

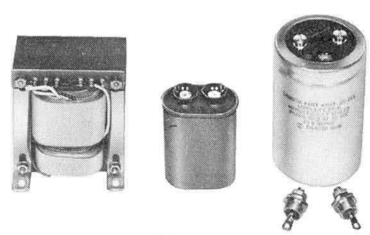
Lambda transformers are guaranteed for five years.



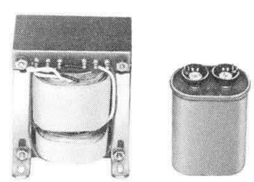
CIRCUIT 1



CIRCUIT 3



LPKT
LAMBDA POWER KIT



LPTX
LAMBDA FERRO TRANSFORMER AND AC CAPACITOR

Regulation

line: 2% for line changes from 105 to 132 VAC or 132 to 105 VAC for any load between 25% and 100% of full load

load: 5% from ½ load to full load for output voltages avove 6V, 500 mV from ½ load to full load for 5V and 6V units

Ripple

100 mV RMS or 1% whichever is greater

POWER KIT AND TRANSFORMER SELECTION CHART 5000 SERIES

DC OUTPUT CURRENT AND STOCK NUMBERS

DC OUTPUT VOLTAGE	STOCK NUMBER PREFIX	1.0 AMP 1-9	1.0 AMP 10-24	5.0 AMPS 1-9	5.0 AMPS 10-24	10.0 AMPS 1-9	10.0 AMPS 10-24	25.0 AMPS 1-9	25.0 AMPS 10-24	50.0 AMPS 1-9	50.0 AMPS 10-24
				5011-1		5015-1		5025-1		5031-1	
5 VDC	LPKT			$42.50	$36.00	$ 61.00	$ 53.00	$114.00	$102.50	$136.00	$121.00
	LPTX			31.50	25.00	40.00	32.00	58.00	46.50	76.00	61.00
				5061-1		5065-1		5075-1		5081-1	
6 VDC	LPKT			$48.00	$41.00	$ 69.00	$ 59.50	$120.00	$107.00	$139.00	$123.00
	LPTX			37.00	30.00	48.00	38.50	64.00	51.00	79.00	63.00
				5111-1		5115-1		5125-1			
12 VDC	LPKT			$65.00	$55.00	$ 94.00	$ 82.00	$154.00	$139.00		
	LPTX			48.00	38.00	60.00	48.00	74.00	59.00		
				5161-1		5165-1					
15 VDC	LPKT			$73.00	$62.00	$ 94.00	$ 82.00				
	LPTX			56.00	45.00	60.00	48.00				
		5207-3		5211-3							
±15 VDC	LPKT	$47.00	$40.50	$99.50	$86.50						
	LPTX	33.50	27.00	65.00	52.00						
		5357-1		5361-1		5365-1					
24 VDC	LPKT	$34.50	$29.00	$75.00	$63.00	$107.00	$ 92.00				
	LPTX	27.50	22.00	58.00	46.00	72.00	57.00				
		5457-1		5461-1		5465-1					
28 VDC	LPKT	$34.50	$29.50	$75.00	$63.00	$107.00	$ 92.50				
	LPTX	27.50	22.00	58.00	46.00	73.00	58.00				
		5507-1		5511-1		5515-1					
48 VDC	LPKT	$41.50	$34.50	$87.50	$73.50	$136.00	$115.00				
	LPTX	35.00	28.00	71.00	57.00	102.00	81.00				

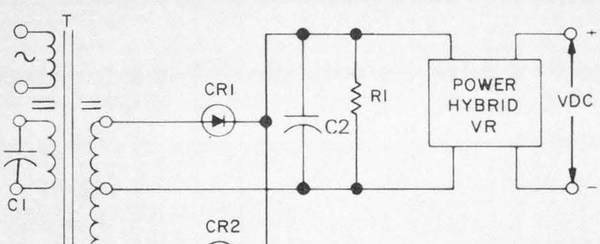
NOTES:

1. All prices F.O.B. Gouldsboro, Pa. All prices and specifications are subject to change without notice.
2. For quantities of 25 and over, please consult factory.

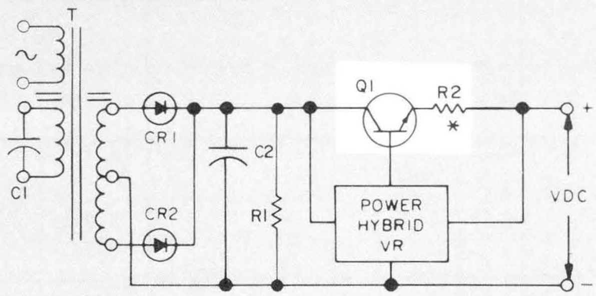
LAMBDA
POWER KITS
6000 SERIES

ferroresonant transformers, AC and DC capacitors, pre-load resistors, Power Hybrid Voltage Regulators and circuits

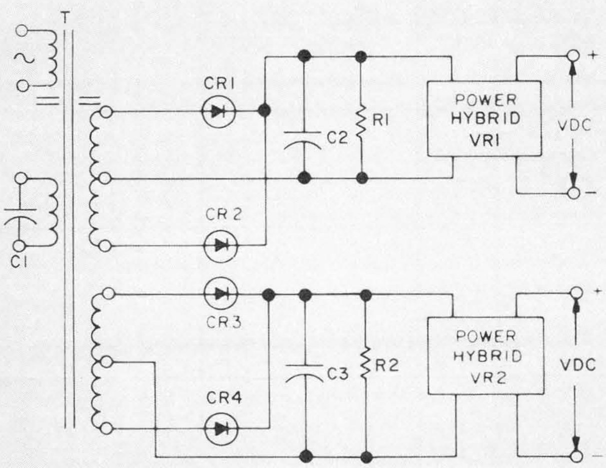
FERRORESONANT TRANSFORMER WITH POWER HYBRID VOLTAGE REGULATOR POWER SUPPLY CIRCUITS (SIMPLIFIED DIAGRAMS)



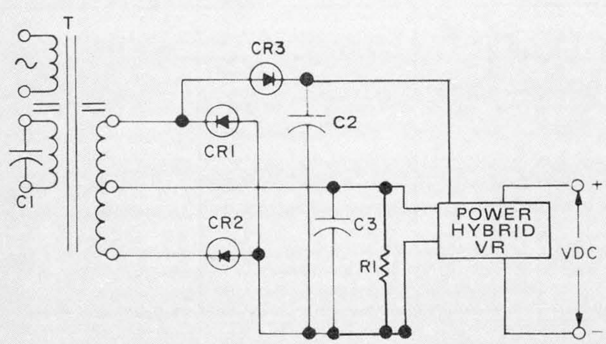
CIRCUIT 1



CIRCUIT 5



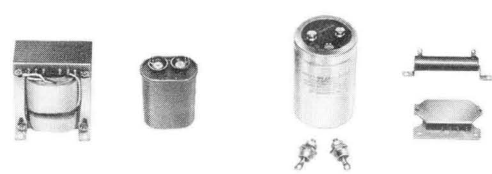
CIRCUIT 2



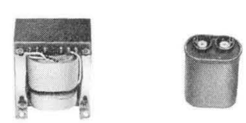
CIRCUIT 3

*Complete circuit diagrams are provided with kits and components. Lambda does not supply those components shown in unshaded areas.

Lambda transformers are guaranteed for five years;



LPKT
LAMBDA POWER KIT



LPTX
LAMBDA FERRO TRANSFORMER
AND AC CAPACITOR

Regulation

line: 0.02% for line changes from 105 to132 VAC or 132 to 105 VAC for any load between 0% and 100% of full load

load: 0.2% for no load to full load and full load to no load

Ripple

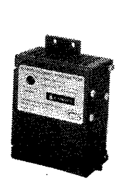
1.5 mV RMS, 5 mV pk—pk

POWER KIT AND TRANSFORMER SELECTION CHART 6000 SERIES

DC OUTPUT CURRENT AND STOCK NUMBERS

DC OUTPUT VOLTAGE	STOCK NUMBER PREFIX	1.0 AMP 1-9	1.0 AMP 10-24	5.0 AMPS 1-9	5.0 AMPS 10-24	10.0 AMPS 1-9	10.0 AMPS 10-24	25 AMPS 1-9	25 AMPS 10-24
				6011-1		6015-3		6025-3	
5 VDC	LPKT			$ 87.50	$76.00	$121.00	$100.00	$127.00	$109.00
	LPTX			47.50	38.00	58.00	46.00	78.00	62.00
				6061-1		6065-3		6075-3	
6 VDC	LPKT			$ 87.50	76.00	$121.00	$100.00	$152.00	$130.00
	LPTX			47.50	38.00	58.00	46.00	103.00	83.00
				6111-1		6115-1			
12 VDC	LPKT			$ 97.00	$84.00	$139.00	$113.00		
	LPTX			57.00	46.00	71.00	57.00		
		6157-1		6161-1					
15 VDC	LPKT	$ 63.50	$56.00	$ 97.00	$ 84.00				
	LPTX	27.50	22.00	57.00	46.00				
		6207-2		6211-2					
±15 VDC	LPKT	$108.50	$97.00	$154.00	$135.00				
	LPTX	37.50	30.00	75.00	60.00				
		6357-1		6361-1		6365-5			
24 VDC	LPKT	$ 74.00	$65.00	$130.00	$105.00	$150.00	$122.00		
	LPTX	34.00	27.00	64.00	51.00	78.00	63.00		
		6457-1		6461-1		6465-5			
28 VDC	LPKT	$ 74.00	$65.00	$143.00	$117.00	$130.00	$105.00		
	LPTX	34.00	27.00	64.00	51.00	78.00	63.00		

OVERVOLTAGE PROTECTOR ACCESSORIES



MODEL	ADJ. VOLT RANGE VDC	POWER KIT CURRENTS	PRICE
LC-OV-10	3-24	0.25, 0.5 and 1 amp	**$20.00**
LM-OV-1	3-8	5 and 10 amps	**30.00**
LM-OV-2	6-20	5 and 10 amps	**30.00**
LM-OV-3	18-70	5 and 10 amps	**30.00**
LM-OV-7	3-8	25 and 50 amps	**75.00**
LM-OV-8	6-20	25 and 50 amps	**75.00**

NOTES:
1. All prices F.O.B. Gouldsboro, Pa. All prices and specifications are subject to change without notice.
2. For quantities of 25 and over, please consult factory.

LAMBDA POWER KIT COMPONENT DIMENSIONS

TRANSFORMERS & CAPACITORS

STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE	STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE	STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE
1003-1	A	1b	1157-2	C	1b	1465-2	N	1d
1005-1	A	1b	1161-2	H	1d	1475-2	S	2d
1007-1	B	2b	1165-2	L	1d	1507-2	G	1c
1011-1	E	1d	1175-1	R	2d	1511-2	M	1d
1015-1	H	2d	1181-1	S	4d	1515-2	R	1e
1025-1	N	4d	1203-3	B	2a	2007-1	B	1c
1031-1	Q	8d	1205-3	C	2a	2011-1	D	1d
1053-1	A	1b	1207-3	E	2b	2015-1	G	1d
1055-1	A	1b	1211-3	L	2d	2025-1	L	2d
1057-1	B	2b	1253-2	A	1a	2031-1	O	4d
1061-1	E	1d	1255-2	B	1a	2057-1	B	1c
1065-1	H	2d	1257-2	C	1b	2061-1	D	1d
1075-1	N	4d	1261-2	H	1d	2065-1	G	1d
1081-1	Q	8d	1265-2	M	1d	2075-1	M	2d
1103-1	B	1a	1275-1	R	2d	2081-1	O	4d
1105-1	B	1b	1303-3	B	2a	2107-1	C	1c
1107-1	C	1b	1305-3	C	2a	2111-1	G	1d
1111-1	H	1d	1307-3	F	2b	2115-1	I	1d
1115-1	L	1d	1311-3	L	2d	2125-1	N	2d
1125-1	R	2d	1355-2	B	1a	2131-1	S	4d
1131-1	S	4d	1357-2	D	1b	2137-3	C	2c
1133-3	B	2a	1361-2	J	1d	2141-3	H	2d
1135-3	B	2b	1365-2	N	1d	2157-2	C	1c
1137-3	D	2b	1375-2	S	2d	2161-2	G	1d
1141-3	J	2d	1455-2	B	1a	2165-2	I	2d
1153-2	A	1a	1457-2	D	1b	2175-1	O	2d
1155-2	B	1a	1461-2	J	1d	2181-1	T	4d

PWR KITS

TRANSFORMERS & CAPACITORS

STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE	STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE	STOCK NO.	TRANSFORMER SIZE	CAPACITORS QTY. & SIZE
2207-3	D	2c	**3075-4**	O	1l, 2d	**5365-1**	DD	2i, 6d
2211-3	I	2d	**3081-4**	S	1l, 4d	**5457-1**	V	1i, 1d
2257-2	D	1b	**3108-1**	E	1g	**5461-1**	BB	1i, 3d
2261-2	G	1h	**3111-3**	H	1d	**5465-1**	EE	2i, 6d
2265-2	L	1d	**3138-2**	H	2g	**5507-1**	X	1i, 1d
2275-1	R	1f	**3141-5**	N	2d	**5511-1**	DD	2i, 3d
2307-3	D	2b	**3158-1**	G	1g	**5515-1**	GG	2k, 6d
2311-3	I	2h	**3161-3**	K	1d	**6011-1**	Y	1i, 1d
2357-2	D	1b	**3208-2**	H	2g	**6015-3**	BB	1i, 1l, 1d
2361-2	I	1h	**3211-5**	N	2d	**6025-3**	FF	2i, 1l, 2d
2365-2	M	1d	**5011-1**	V	1i, 1f	**6061-1**	Y	1i, 1d
2375-2	R	2f	**5015-1**	X	1i, 2f	**6065-3**	BB	1l, 1i, 1d
2457-2	D	1c	**5025-1**	BB	1i, 6f	**6075-3**	GG	1l, 1i, 1k, 2d
2461-2	I	1h	**5031-1**	EE	2i, 6f	**6111-5**	Z	1k, 1d
2465-2	N	1d	**5061-1**	W	1k, 1f	**6115-5**	DD	1k, 1d
2475-2	S	2f	**5065-1**	Y	1k, 2f	**6157-1**	V	1i, 1b
2507-2	D	1g	**5075-1**	CC	1k, 6f	**6161-5**	AA	1i, 1d
2511-2	N	1d	**5081-1**	FF	2i, 6f	**6207-2**	X	1i, 2b
2515-2	P	2d	**5111-1**	Y	1k, 3d	**6211-6**	DD	1k, 2d
3008-1	G	1g	**5115-1**	AA	1i, 1l, 6d	**6357-1**	W	1k, 1d
3011-3	I	1d	**5125-1**	EE	2i, 15d	**6361-5**	CC	1k, 1d
3015-4	K	1d	**5161-1**	Z	1k, 3d	**6365-1**	FF	2i, 2d
3025-4	O	1l, 2d	**5165-1**	BB	1i, 6d	**6457-1**	W	1k, 1d
3031-4	S	1l, 4d	**5207-3**	W	1k, 2d	**6461-5**	CC	1k, 1d
3058-1	G	1g	**5211-3**	BB	1i, 6d	**6465-1**	FF	2i, 2d
3061-3	I	1d	**5357-1**	V	1i, 1d			
3065-4	K	1d	**5361-1**	AA	1i, 3d			

LAMBDA POWER KIT COMPONENT DIMENSIONS

CHOKES

STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE	STOCK NO. LPFC	SIZE
2007-1	F	2057-1	F	2107-1	F	2157-2	F	2207-3	F	2275-1	S	2265-2	M	2475-2	S
2011-1	U	2061-1	U	2111-1	U	2161-2	U	2211-3	U	2307-3	G	2375-2	S	2507-2	G
2015-1	M	2065-1	M	2115-1	M	2165-2	M	2257-2	G	2311-3	M	2457-2	G	2511-2	M
2025-1	S	2075-1	S	2125-1	S	2175-1	S	2261-2	M	2357-2	G	2461-2	M	2515-2	M
2031-1	S	2081-1	S	2131-1	S	2181-1	S	2265-2	M	2361-2	M	2465-2	M		

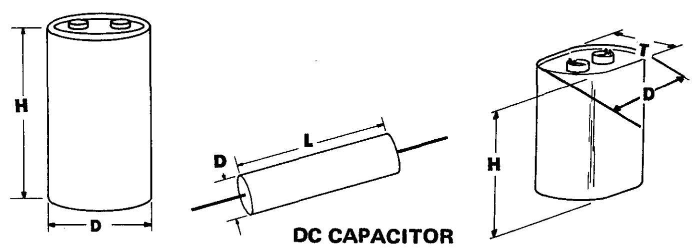
DIMENSIONS OF LAMBDA TRANSFORMERS & CHOKES

SIZE	CASE DIMENSIONS			MOUNTING DIMENSIONS	
	H	W	D	MW	MD
A	1 11/16"	2 7/8"	1 15/16"	2 3/8"	
B	2"	3 5/16"	2 5/16"	2 13/16"	
C	2 5/16"	3 3/4"	2 3/8"	3 1/8"	
D	2 5/8"	4 1/16"	2 5/8"	3 9/16"	
E	2 7/8"	3 1/16"	3 5/8"	2 1/2"	2 1/2"
F	3 3/16"	3 7/16"	3 1/8"	2 13/16"	2 1/8"
G	3 9/16"	3 13/16"	3 3/8"	3 1/8"	2 1/4"
H	3 13/16"	4 3/16"	3 3/4"	3 7/16"	2 5/8"
I	4 1/8"	4 9/16"	3 7/8"	3 3/4"	2 1/2"
J	4 1/8"	4 9/16"	4 1/4"	3 3/4"	2 3/4"
K	4 1/8"	4 9/16"	4 11/16"	3 3/4"	3 1/8"
L	4 13/16"	5 5/16"	4 7/16"	4 3/8"	2 5/8"
M	4 13/16"	5 5/16"	4 11/16"	4 3/8"	2 7/8"
N	5 13/16"	5 5/16"	5 7/16"	4 3/8"	3 1/4"
O	5 13/16"	5 5/16"	6 1/4"	4 3/8"	4"
P	4 13/16"	5 5/16"	6 3/16"	4 3/8"	4 1/8"
Q	6 1/16"	6 7/16"	5 3/16"	5 5/16"	3 1/2"
R	6 3/4"	6 7/16"	5 7/8"	5 5/16"	3 3/4"
S	6 3/4"	6 7/16"	6 9/16"	5 5/16"	4 1/2"
T	7 1/4"	6 7/16"	6 3/4"	5 5/16"	4 7/8"
U	3 1/2"	4 3/16"	3 5/8"	3 7/16"	2 3/8"
V	4 1/16"	3 3/16"	2 15/16"	2 5/8"	1 15/16"
W	4 1/16"	3 3/16"	3 3/8"	2 5/8"	2 1/8"
X	4 1/16"	3 3/16"	3 9/16"	2 5/8"	2 3/8"
Y	5 3/16"	3 11/16"	3 7/8"	3"	2 11/16"
Z	5 3/16"	3 11/16"	4 1/2"	3"	3 1/2"
AA	5 7/8"	5 5/16"	3 15/16"	4 3/8"	2 1/8"
BB	5 7/8"	5 5/16"	4 1/4"	4 3/8"	2 3/8"
CC	5 7/8"	5 5/16"	5"	4 3/8"	3 1/8"
DD	5 7/8"	5 5/16"	5 1/4"	4 3/8"	3 1/4"
EE	6 3/16"	5 5/16"	5 5/16"	4 5/8"	3 1/4"
FF	6 3/16"	5 5/16"	5 1/8"	4 3/8"	3 3/4"
GG	6 3/16"	5 5/16"	6 3/8"	4 3/8"	4 5/8"

*Equals maximum depth of transformer, either feet, winding or terminal board.

DIMENSIONS OF FILTER CAPACITORS

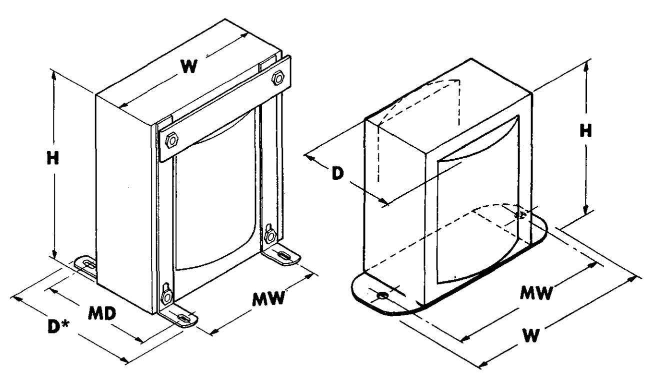
SIZE	H	L	D	T
a		2 13/16"	1"	
b		2 13/16"	1 1/8"	
c		3 13/16"	1 1/8"	
d	4 5/8"		2 5/8"	
e	6 7/16"		2 5/8"	
f	6 1/8"		3 1/16"	
g	4 1/2"		1 15/32"	
h	4"		1 15/32"	
i	3 13/16"		2 7/32"	1 3/8"
k	4 7/16"		2 15/32"	1 15/16"
l		1"	7/16"	



DC CAPACITOR

DC CAPACITOR

AC CAPACITOR



HOW TO ORDER LAMBDA POWER KITS

HOW TO SELECT LAMBDA POWER KITS

1.
Determine the regulation and ripple requirement for the circuit you wish to supply.

2.
Select one of the five series of circuits that best satisfies your needs — 1000, 2000, 3000, 5000 or 6000 series.

3.
Turn to the table for that series and select the power supply kit that meets your DC output voltage and current requirements. No need to design the power supply or to calculate voltage drops across components. This has already been done for you.

4.
You may purchase either the entire kit, the transformer, or the filter choke.

5.
Number System—The Lambda part number is an alpha-numeric designation in three parts:

Stock No. Prefix	Stock No.	Suffix
LPKT	**2311**	**-3**

The stock number prefix defines the kit or transformer you wish to purchase and the suffix identifies the circuit to be used within that series.

LPKT = Lambda Power Kit
LPTX = Lambda Power Transformer*
LPFC = Lambda Filter Choke

*AC capacitors included in 5000 & 6000 Series

The stock number defines the circuit series (which identifies the regulation and ripple) in addition to output voltage and current. For stock numbers in the:

1000 series, see pages 46-47
2000 series, see pages 48-49
3000 series, see pages 50-51
5000 series, see pages 52-53
6000 series, see pages 54-55

ORDERING:

1.
Turn to the page listing the circuit series that meets your requirement for regulation and ripple

2.
Select the voltage you need along the vertical axis of the selection chart.

3.
Select the current you need along the horizontal axis of the selection chart.

4.
Pick the stock number directly off the chart at the intersection of the axes.

5.
You select the stock number prefix to the number depending upon whether you want the entire kit or just individual components. The price for each item is also listed in the same section of the chart. Prices for 1 to 9 units are listed in the left-hand column and prices for 10-24 units are listed in the right-hand column under each current rating.

6.
Send all transformer and other component orders directly to Lambda Electronics Corp., 515 Broad Hollow Rd., Melville, N. Y. 11746.

EXAMPLE

If you were to order part number LPKT 2311-3, you would be ordering (from the Power Kit and Component Selection chart on Page 49) a complete Lambda Power Kit in the 2000 series, a power supply with a choke input filter, which provides a dual + and -18 volts DC output at 5 amps each, as shown in series 2000 circuit 3. The kit price on the chart is $108.00. If, on the other hand you only wanted the transformer, you would order LPTX 2311-3 at $26.00 or LPFC 2311-3 at $74.00 if you only wanted the filter chokes, etc.

LAMBDA CUSTOM POWER KITS

Single or multiple outputs... Designed to your specifications... Delivered in 3-4 weeks.

If your application requires custom power supplies, you can save time, money and compromises by assembling them yourself from Lambda Custom Power Kits designed to your electrical specifications. These kits utilize Lambda's revolutionary Power Hybrid Voltage Regulator, the biggest advance in power supply design since the silicon power transistor. They can be supplied in single or multiple outputs with regulating (ferroresonant) or non-regulating transformers.

You write the specs. Lambda's engineers, who are power specialists, design a circuit and select components to meet those specs. All the electrical parts, including the circuit diagram and thermal data, are delivered in 3 to 4 weeks after receipt of your order.

YOU BENEFIT 12 WAYS

Consider these time and money saving advantages of building your own power supplies from Lambda's designed-to-order power kits. You get...

1.
A power supply designed expressly to your electrical specifications and guaranteed to meet them.

2.
A wide choice of regulated or unregulated single or multiple outputs up to 100 VDC, up to 50 amps DC.

3.
Complete circuit and thermal data for heat sinking and mounting.

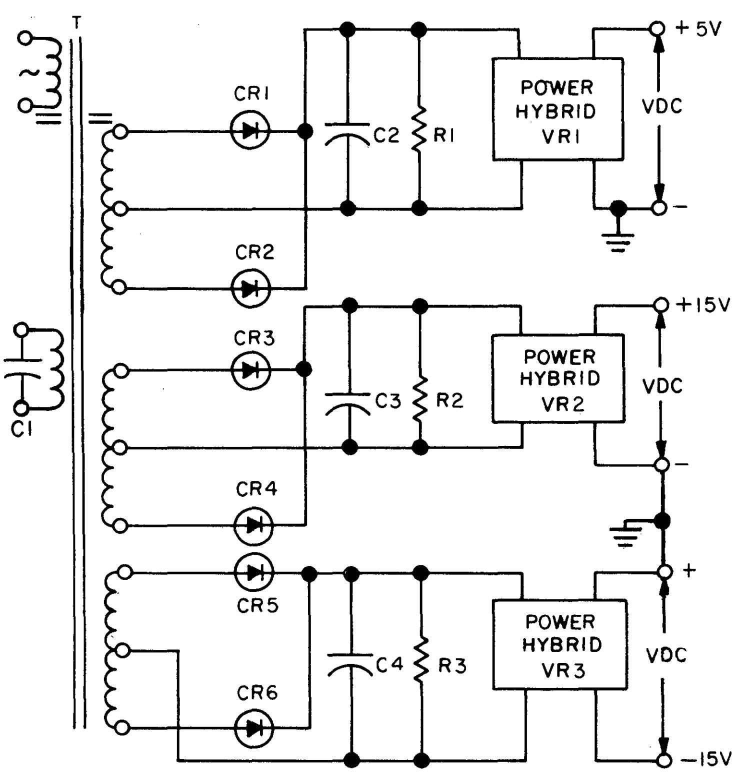
4.
The same quality components used in Lambda's standard supplies (example: Sprague 85°C, 3500-hr. computer grade electrolytic capacitors).

5.
Simplicity of assembly by use of Lambda's exclusive Power Hybrid Voltage Regulator which replaces discrete components, reducing parts count and inventory substantially.

6.
Low cost by use of your existing labor force and factory overhead.

7.
Low cost because production set-up costs are minimized.

8.
Low cost because you save on engineering design cost.



Typical circuit with regulating (ferroresonant) transformer

9.
Full control of quality and production scheduling.

10.
Complete flexibility to meet your form factor requirements.

11.
Sharply reduced lead time. Lambda gives you 3 to 4 weeks delivery on design and parts.

12.
5-year guarantee on magnetics.

GUARANTEED PERFORMANCE

Lambda guarantees to meet your electrical specifications when components are properly assembled and heat sinked in accordance with the circuit and data supplies. In addition, Lambda guarantees all magnetic components for five years when operated within specified ratings.

HOW TO ORDER

To obtain a firm quotation on Lambda Custom Power Kits, submit your specifications to any Lambda sales representative or direct to the factory. A form for this purpose has been included in this catalog for your use. **See page 189.**

This is the information we need:

1.
AC input voltage and frequency.

2.
DC output voltage and current.

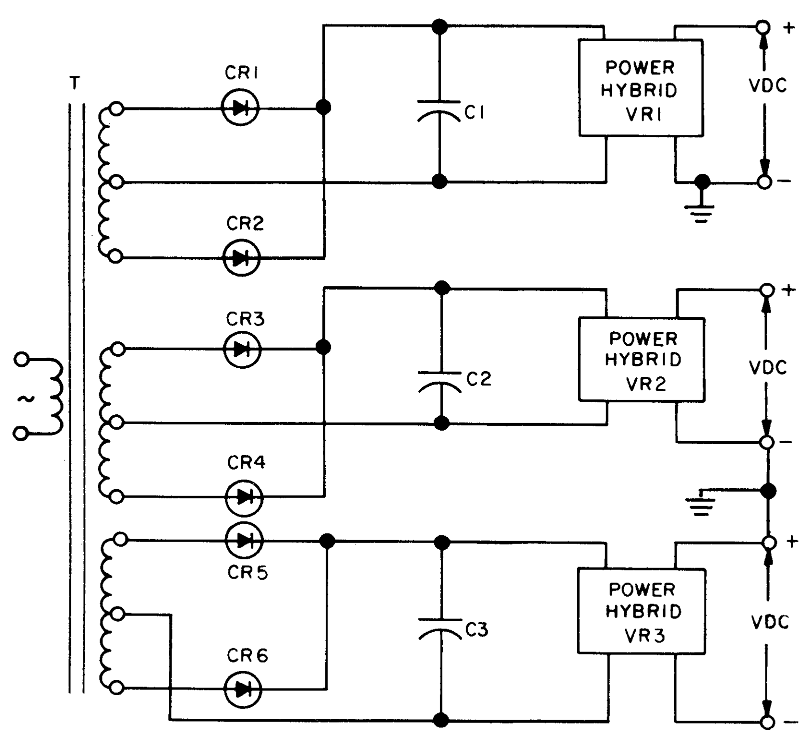
3.
Number of outputs and voltage/current ratings for each.

4.
Regulation requirements.

5.
Ripple requirements.

6.
Additional requirements.

7.
Number of kits to be supplied.



Typical circuit with non-regulating transformer

LAMBDA TRANSFORMERS & MAGNETIC COMPONENTS

5-year guaranteed for industrial, military and commercial use.

Lambda offers its customers through its Industrial Transformer Division at Gouldsboro, Pa.:

- Highest quality transformers *fully* guaranteed for 5 years for both materials and labor.
- Custom-engineered transformers to meet military, commercial and industrial applications, including a UL-approved 180°C system (Class H)
- An in-house QPL capability.
- A total of 180,000 square feet of modern manufacturing facilities offering a single source of supply for high reliability Power Components, Power Instruments and Power Systems.

Lambda's experienced, nationally-based field sales and service organization is able to offer immediate assistance to customers in meeting their specific transformer requirements.

MILITARY PERFORMANCE SPECIFICATIONS

Military grade transformers are designed and qualified to meet all parameters of MIL-T-27C, all grades, all classes, all groups.
Lambda is a qualified QPL vendor of MIL-T-27C transformers

ORDERING TRANSFORMERS

Direct all transformer inquiries to Sales Department,
Industrial Transformer Corp.
3rd & Lake St.,
Gouldsboro, Pennsylvania 18424
Telephone 717-842-7611, TWX 510-656-3717

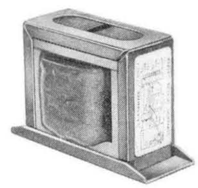
GRADE

Grade 4 Metal Cased	Grade 5 Encapsulated	Grade 6 Open-Type

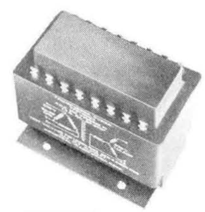
CLASSES

Symbol	Q	R	S	V	T	U
Max. Operating Temp.°C	85	105	130	155	170	above 170 as specified

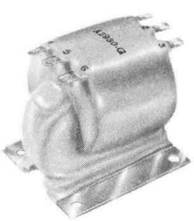
TYPICAL LAMBDA TRANSFORMERS



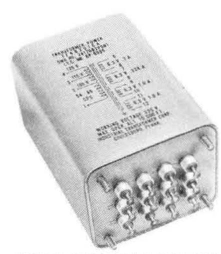
OPEN FRAME



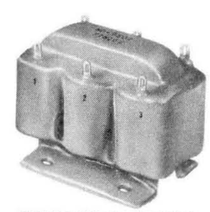
POWER



HIGH TEMPERATURE



HERMETICALLY CASED



ENCAPSULATED

MOLDED

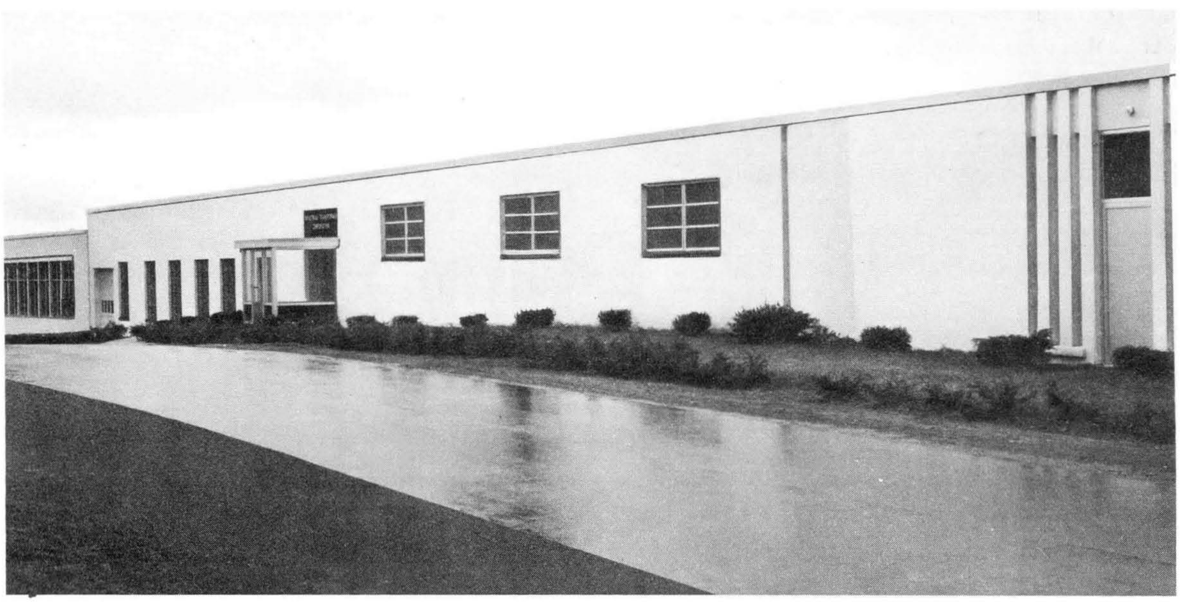
FERRORESONANT TRANSFORMERS

Features: 1 Lambda announces – "Varihertz"®. All constant voltage type transformers can be designed with "Varihertz"® an exclusive Lambda frequency switch. This allows for operation at 50 or 60 Hz by merely opening or closing two leads. This eliminates the wiring changes necessary in normal multi-output, constant-voltage type transformers.

2 MIL-T-27C parameters
3 Single and multiple output capability
4 Vacuum varnish impregnated
5 Up to 2 KVA, custom design capability
6 Inherent overvoltage protection
7 Inherent current limiting
8 High reliability at lowest possible costs
9 Regulation – line: 2%, load: 5%
10 Lambda is a qualified QPL vendor

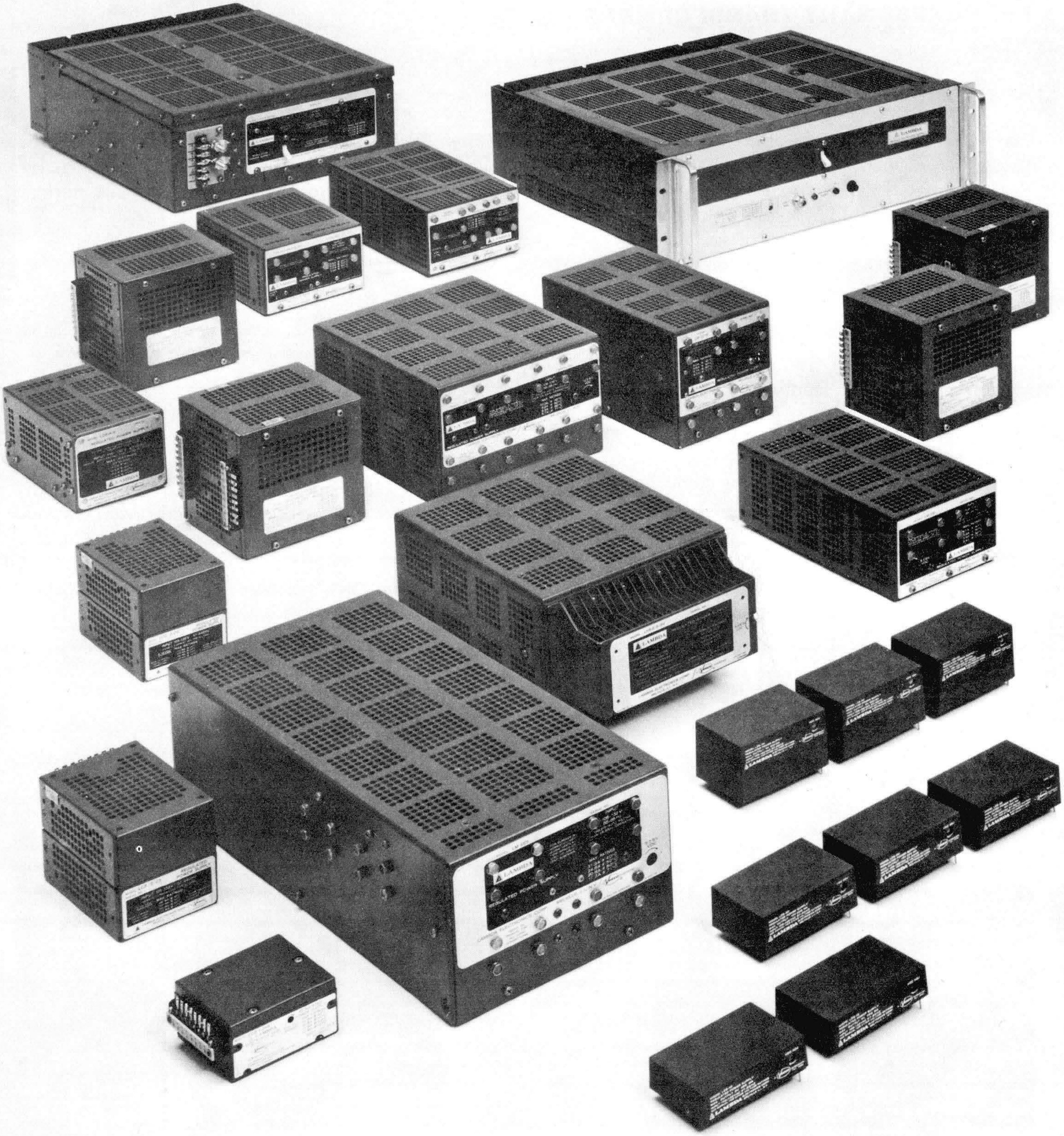
Lambda manufactures both linear and constant voltage type transformers. Lambda has a 180°C UL approved insulation system applicable to any type transformer. All essential manufacturing operations in transformer design, production and testing are conducted entirely within our plant which includes a complete A.S.E.S.A. approved Q.P.L. laboratory, composed of modern environmental and electrical testing equipment, such as constant temperature and humidity chambers, shock and vibration machines, and calibration equipment traceable to the National Bureau of Standards.

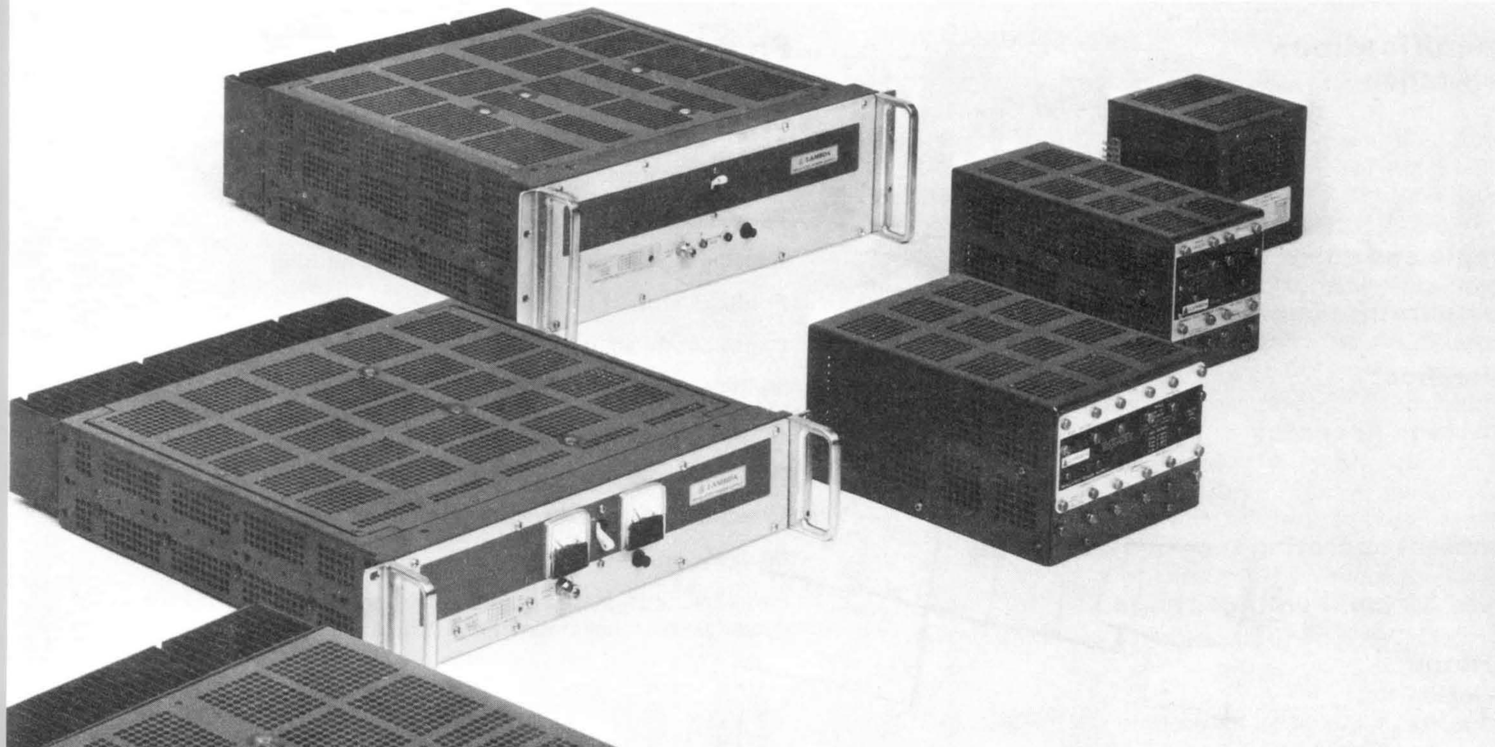
Lambda's experienced, nationally based field sales and service organization is able to offer immediate assistance to customers in meeting their specific transformer requirements.

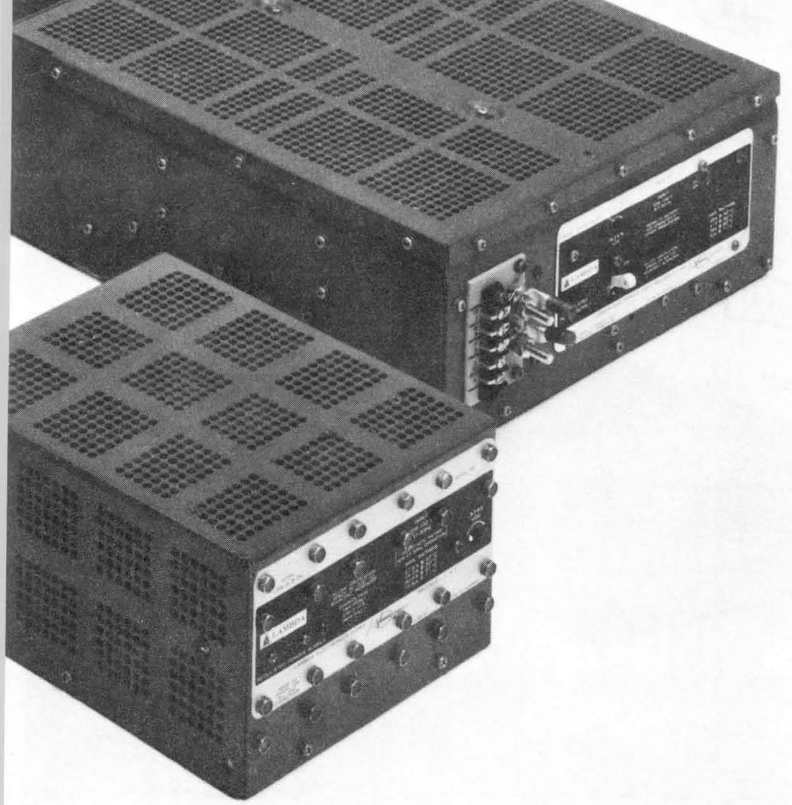


Lambda's Industrial Transformer Division at Gouldsboro, Pa.

LAMBDA POWER MODULES







PWR SUPPLIES, STD

LAMBDA POWER MODULES
standard, modular AC to DC power supplies for rack or chassis mounting—industrial, military and commercial

LAMBDA-PAK ™ SPECIFICATIONS & FEATURES, LZ SERIES

Specifications

Regulation
0.15%—line or load; models LZS-10, LZS-30, LZS-34, LZD-21 and LZD-31 have load regulation of 0.15% + 5mV; model LZD-12 has line or load regulation of 0.25%; LZT-36 line regulation 0.15% (+5V) 0.25% (±15V) load regulation 0.15% + 10mV (+5V). 0.25% (±15V).

Ripple and noise
1.5mV RMS, 5mV, pk-pk

Temperature coefficient
0.03%/°C

Overshoot
no overshoot on turn-on, turn-off, or power failure

Tracking accuracy
2% absolute voltage difference for dual output models only and only for the ±15V output in LZT-36; 0.2% change for all conditions of line, load and temperature

Ambient operating temperature range
continuous duty from 0°C to +50°C

Wide AC input voltage range
105 to 132 VAC, 57-63 Hz

Options

AC input
add suffix "V" to model for operation at 187-242 VAC, 47-63 Hz and add $5.00 to LZ-10 and LZ-20 series prices and $10.00 to LZ-30 series prices. Derate current 10%. "V" option is available for models LZS-10, LZS-30, LZS-33, LZS-34, LZD-12, LZD-32, LZD-35, and LZT-36.

Storage temperature range
−25°C to +85°C

Overload protection
fixed automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for load as well as power supply.

Input & output connections
printed circuit solder pins on lower surface of unit. For model LZT-36 the ±15V outputs are independent from the 5V output

Controls
screwdriver voltage adjustment over entire voltage range.

Mounting
two 4 x 40 tapped holes on lower surface of LZ-10 series; three 4 x 40 tapped holes on lower surface of LZ-20 and LZ-30 series.

Physical data

Size	Weight
see tables (pg. 67)	LZ-10 series 10 oz. net 18 oz. ship.
and outline drawing	LZ-20 series 17 oz. net 25 oz. ship.
(pg. 105)	LZ-30 series 24 oz. net 32 oz. ship.

60-day guarantee
60-day guarantee includes labor as well as parts.
See page 102 for overvoltage protector accessories.

Features, LZ series

Three power packages

Single, dual tracking, and triple outputs

Fully repairable

Impact resistant, flame retardant plastic housing

Foldback current limiting

Continuoutly adjustable output voltage

Multi-voltage rated

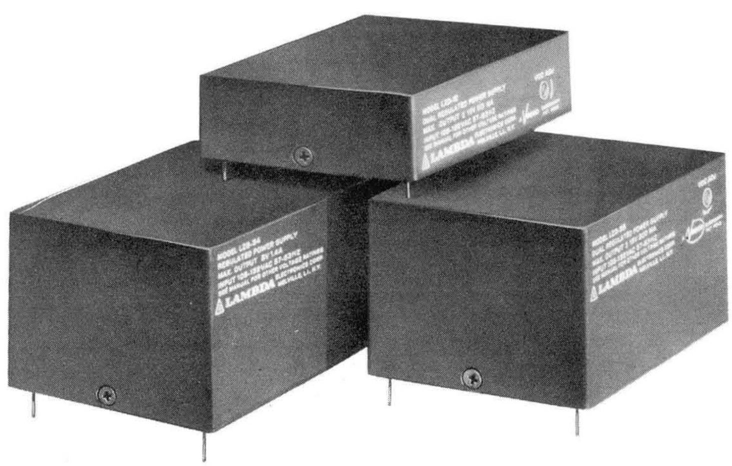
Ambient operating temperature

continuous duty from 0°C to +50°C

Vacuum-impregnated transformer

60-day guarantee

only repairable, plastic power supply offering 60-day guarantee that includes material and labor.



VOLTAGE AND CURRENT RATINGS LZ SERIES

LZ-10 SERIES SINGLE OUTPUT MODELS

2½" x 3½" x ⅞"

MODEL	VOLTAGE (1) VDC	CURRENT mA	PRICE (2)
LZS-10	3	317	**$35**
LZS-10	4	384	**35**
LZS-10	5	450	**35**
LZS-11	10	225	**35**
LZS-11	12	195	**35**
LZS-11	15	150	**35**

LZ-10 DUAL TRACKING OUTPUT MODEL

2½" x 3½" x ⅞"

LZD-12	±15	50	**$35**

LZ-20 SERIES SINGLE OUTPUT MODELS

2½" x 3½" x 1¼"

LZS-20	10	247	**$55**
LZS-20	12	268	**55**
LZS-20	15	300	**55**
***LZD-22**	24	73	**40**
***LZD-23**	24	129	**55**
***LZD-22**	28	84	**40**
***LZD-23**	28	143	**55**

LZ-20 SERIES DUAL TRACKING OUTPUT MODELS

2½" x 3½" x 1¼"

LZD-21	± 3	217	**$55**
LZD-21	± 4	258	**55**
LZD-21	± 5	300	**55**
LZD-22	±10	61	**40**
LZD-23	±10	114	**55**
LZD-22	±12	73	**40**
LZD-23	±12	129	**55**
LZD-22	±15	90	**40**
LZD-23	±15	150	**55**

LZ-30 SERIES SINGLE OUTPUT MODELS

2½" x 3½" x 1⅞"

LZS-30	3	633	**$65**
LZS-30	4	767	**65**
LZS-30	5	900	**65**
LZS-33	10	293	**65**
LZS-33	12	336	**65**
LZS-33	15	400	**65**
LZS-34	3	950	**95**
LZS-34	4	1180	**95**
LZS-34	5	1400	**95**
***LZD-32**	24	186	**65**
***LZD-32**	28	208	**65**
***LZD-35**	24	240	**95**
***LZD-35**	28	280	**95**

*Single output ratings for dual output models connected in series.

LZ-30 SERIES DUAL TRACKING OUTPUT MODELS

2½" x 3½" x 1⅞"

MODEL	VOLTAGE (1) VDC	CURRENT mA	PRICE (2)
LZD-31	± 3	333	**$65**
LZD-31	± 4	417	**65**
LZD-31	± 5	500	**65**
LZD-32	±10	163	**65**
LZD-32	±12	186	**65**
LZD-32	±15	220	**65**
LZD-35	±10	200	**95**
LZD-35	±12	240	**95**
LZD-35	±15	300	**95**

LZ-30 SERIES TRIPLE OUTPUT MODEL

2½" x 3½" x 1⅞"

LZT-36	5	500	**$70**
	±15	50	

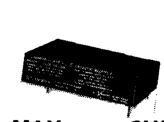
OVERVOLTAGE PROTECTOR ACCESSORIES

MODEL	FIXED VOLT RANGE VDC	FOR USE WITH	PRICE (2)
LZ-OV-13	6.8 ± 10%	All 5V units*	**$10**
LZ-OV-14	16.8 ± 1.3V	All 15V units*	**10**

*LZ dual units require 1 overvoltage accessory for each output. LZ triple unit requires LZ-OV-13 for 5V output and two LZ-OV-14 for the ± 15V output.

UNREGULATED POWER SUPPLY

2½" x 3½" x ⅞"



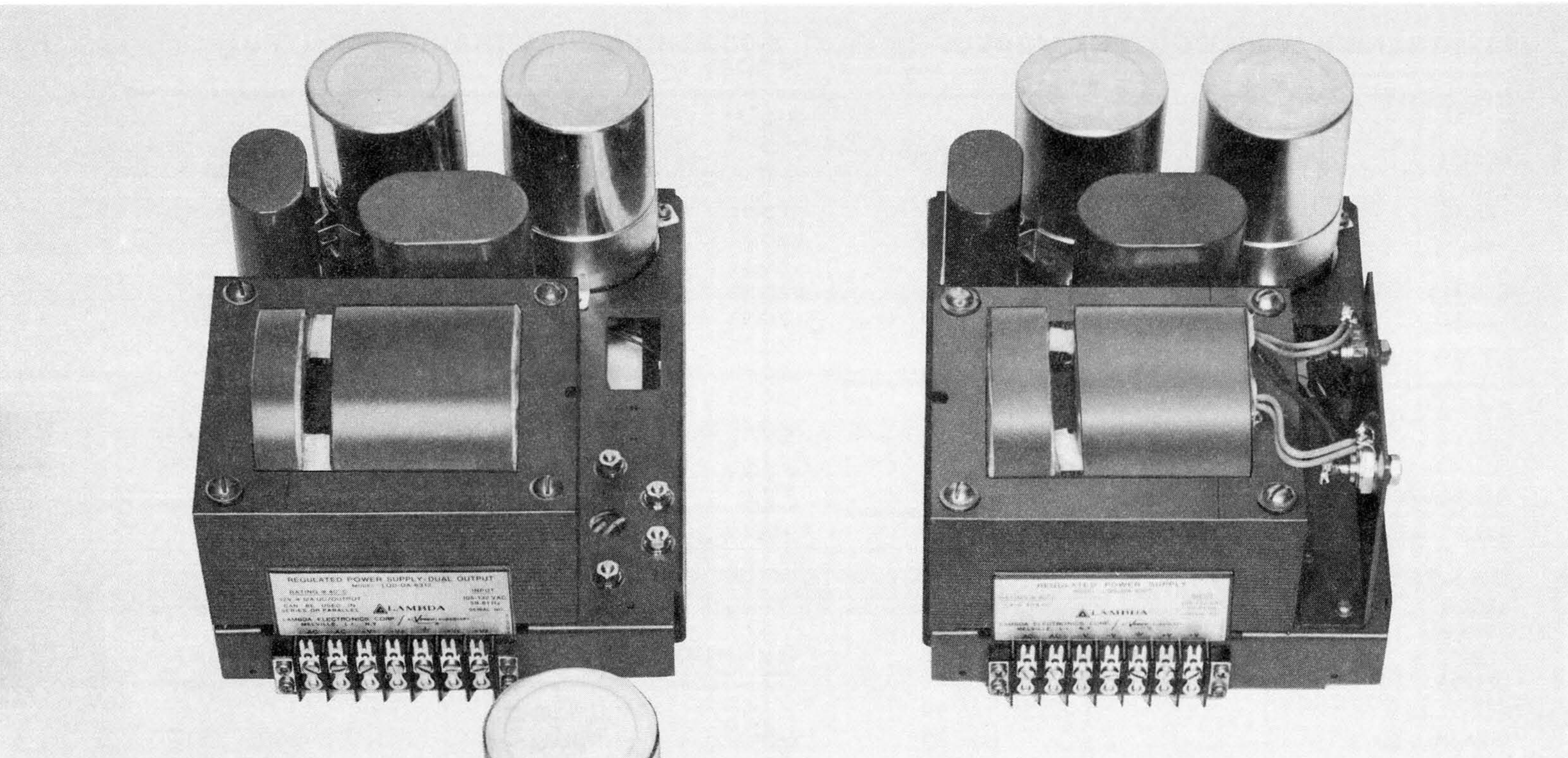
UNREGULATED INPUT POWER: 105-132 VAC
47-440 Hz
11.6 Watts

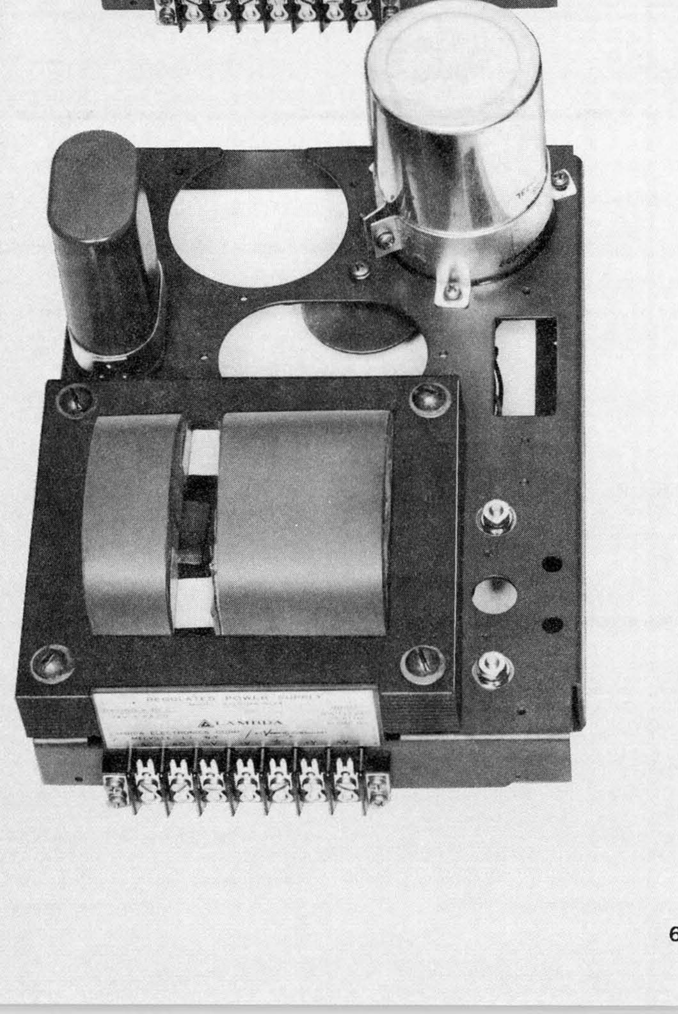
MODEL	VOLT., MAX.	CURRENT RANGE	PRICE (2)
LUS-10-06	330 VDC	25 ma up to 71°C at nominal line voltage for use with up to 7 Nixie® tubes.	**$35**

(Nixie is trademark of Burroughs Corp.)

NOTES: (1) LZ models are adjustable between the following limits: LZS-10 2.5 to 6V LZS-11 8 to 15V LZS-20 8 to 15V LZS-30 2.5 to 6V LZS-33 8 to 15V LZS-34 2.5 to 6V LZD-12 ± 14.5 to ±15.5V LZD-21 ± 2.5 to ± 6V LZD-22 ± 8 to ± 15V LZD-23 ± 8 to ± 15V LZD-31 ±2.5 to ± 6V LZD-32 ± 8 to ± 15V LZD-35 ± 8 to ± 15V LZT-36 2.5V-6V for+5V output only, ±14.5 to ± 15.5 for ± 15V output only. Contact factory for current ratings at voltage settings not indicated in the tables. (2) All prices and specifications are subject to change without notice.

STANDARD POWER SUPPLIES LQ SERIES





low cost ferroresonant DC power supplies

FEATURES

LQ series 5000...
designed to power transistors and relays directly.

LQ series 6000...
designed to drive Lambda Power Hybrid Voltage Regulators and other microelectronic regulators.

Guaranteed for 5 years

LQ Series listed in Underwriters' Laboratories Recognized Components Index.

VOLTAGE & CURRENT RATINGS LQ SERIES

MODEL	REGULATION (1)	RIPPLE	OUTPUT VDC OF LAS 2000*	OUTPUT VDC OF LQ	MAX. AMPS AT AMB. OF 40°C OF LQ	PKG. SIZE	DIMENSIONS	PRICE
5 VOLTS								
LQS-DA-6105	2% line, 0.5V load	4V p-p	5	12	25	DA	7½" x 10" x 5"	**$135**
LQS-DA-6305	2% line, 0.5V load	2V p-p	5	11.5	40	DA	7½" x 10" x 5"	**$160**
6 VOLTS								
LQS-DA-5106	2% line, 0.5V load	500 mV RMS		6	25	DA	7½" x 10" x 5"	**$125**
12 VOLTS								
LQS-DA-6112	2% line, 5% load	4V p-p	12	18.5	12	DA	7½" x 10" x 5"	**$110**
† LQD-DA-6112	2% line, 5% load	2V p-p	±12	±19	6	DA	7½" x 10" x 5"	**120**
† LQD-DA-6312	2% line, 5% load	4V p-p	±12	±18.5	12,(24)††	DA	7½" x 10" x 5"	**135**
15 VOLTS								
LQS-DA-6115	2% line, 5% load	4V p-p	15	23.5	10	DA	7½" x 10" x 5"	**$110**
† LQD-DA-6115	2% line, 5% load	2V p-p	±15	±23.5	5	DA	7½" x 10" x 5"	**120**
† LQD-DA-6315	2% line, 5% load	4V p-p	±15	±22.5	10,(20)††	DA	7½" x 10" x 5"	**135**
24 VOLTS								
LQS-DA-5124	2% line, 5% load	2% RMS		24	5	DA	7½" x 10" x 5"	**$100**
LQS-DA-5324	2% line, 5% load	2% RMS		24	10	DA	7½" x 10" x 5"	**125**
LQS-DA-6124	2% line, 5% load	2V p-p	24	32.5	5	DA	7½" x 10" x 5"	**110**
LQS-DA-6324	2% line, 5% load	2V p-p	24	31	10	DA	7½" x 10" x 5"	**135**
28 VOLTS								
LQS-DA-5128	2% line, 5% load	2% RMS		28	5	DA	7½" x 10" x 5"	**$100**
LQS-DA-5328	2% line, 5% load	2% RMS		28	10	DA	7½" x 10" x 5"	**125**
LQS-DA-6128	2% line, 5% load	2V p-p	28	36	5	DA	7½" x 10" x 5"	**110**
LQS-DA-6328	2% line, 5% load	2V p-p	28	35	10	DA	7½" x 10" x 5"	**135**
48 VOLTS								
LQS-DA-5148	2% line, 5% load	2% RMS		48	2.5	DA	7½" x 10" x 5"	**$100**
LQS-DA-5348	2% line, 5% load	2% RMS		48	5	DA	7½" x 10" x 5"	**125**

(1) See LQ specifications, page 70. for full regulation specification.

*Ratings as measured at output terminals of LAS 2000 series Power Hybrid Voltage Regulators and other regulators. See pages 26 and 27 for specific LAS 2000 series model(s) needed and output current of each.

†Same supply is used as single or dual by paralleling output terminals.

††Current rating with output terminals paralleled.

SPECIFICATIONS OF LQ SERIES

DC output

voltage range: refer to tables

Regulated voltage

regulation line	2% for line changes from 105 to 132 VAC for any load between 25% and 100% of full load.
regulation load	5% from 1/2 load to full load (LQS-DA-6105, LQS-DA-6305 and LQS-DA-5106 are 0.5V).
ripple and noise, 6000 Series	2V p-p except LQS-DA-6105, LQS-DA-6112, LQS-DA-6115, LQD-DA-6312, and LQD-DA-6315 which are 4V p-p.
ripple and noise, 5000 Series	2% RMS (LQS-DA-5106 is 500 mV).

AC input

line	105 to 132 VAC; 59 to 61 Hz.
power	LQS-DA-5106 (230W), LQS-DA-5124 (160W), LQS-DA-5128 (140W), LQS-DA-5148 (164W), LQS-DA-5324 (306W), LQS-DA-5328 (345W), LQS-DA-5348 (300W), LQS-DA-6105 (472W), LQS-DA-6112 (310W), LQS-DA-6115 (300W), LQS-DA-6124 (220W), LQS-DA-6128 (240W), LQS-DA-6305 (650W), LQS-DA-6324 (395W), LQS-DA-6328 (430W), LQD-DA-6112 (310W), LQD-DA-6115 (330W), LQD-DA-6312 (590W), LQD-DA-6315 (550W).
efficiency	75%, minimum.

Ambient operating temperature range

0°C to 60°C; consult factory for operations above 40°C.

Storage temperature range

–55°C to 85°C.

Overload protection

all units automatically limit output current upon external overloads, including short circuit, protecting load as well as supply.

Overvoltage protection

5000 series only – supply is inherently overvoltage protected; any internal component failure results in loss of power supply output voltage at power supply terminals.

6000 series only – standard adjustable overvoltage modules are available. See page 102. Consult factory for application information.

Input and output connections

heavy duty terminal block on rear of chassis.

Mounting

one mounting surface (three mounting positions) designed to mount in the following Lambda standard rack adapters: LRA-6, LRA-7, LRA-10, LRA-11 and LRA-13.

Size

7 1/2" x 10" x 5"

Weight

LQS-DA-6305, 24, 28, LQD-DA-6315, 30 lbs. net, 33 lbs. ship; LQS-DA-6112, 15, 24, 28, 15 lbs. net, 18 lbs. ship; LQD-DA-6112 15, 24 lbs. net, 27 lbs. ship; LQS-DA-5324, 28, 48, 30 lbs. net, 33 lbs. ship; LQS-DA-5106, 24, 28, 48, 15 lbs. net, 18 lbs. ship.

Finish

gray, FED. STD. 595 No. 26081.

Specifications of LQ 6000 Series Applications

these specifications apply to output of a Lambda LAS 2000 series Power Hybrid Voltage Regulator connected to the LQ series power supply.

Regulated voltage

regulation, line	0.02% for line changes from 105 to 132 VAC or 132 to 105 VAC for load between 0 to 100%.
regulation, load	0.2% for 0 to 100% of full load for any line between 105 and 132 VAC.
remote programming resistance	1000 ohms per volt/nominal only when used with 14-pin Power Hybrid Voltage Regulators LAS-2205 through LAS-2228, and LAS-2405 through LAS-2415.
remote programming voltage	volt per volt only when used with 14-pin Power Hybrid Voltage Regulators LAS-2205 through LAS-2228, and LAS-2405 through LAS-2415.
ripple and noise	1.5 mV RMS, 5 mV p-p.
temperature coefficient	0.007%/°C.

AC input

line	105 to 132 VAC; 59 to 61 Hz.

Ambient operating temperature range

0°C to 60°C; consult factory for operation above 40°C.

Storage temperature range

–55°C to 85°C.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

STANDARD POWER SUPPLIES LT SERIES

Ferroresonant DC power supplies utilizing Power Hybrid Voltage Regulator

FEATURES

Low cost
Single and dual output models
Outputs up to 28 VDC, up to 17A
Guaranteed for 5 years

LT Series listed in Underwriters' Recognized Components Index.

VOLTAGE & CURRENT RATINGS LT SERIES

SINGLE OUTPUT MODELS

5 VOLTS ± 1%

MODEL	REGULATION	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF: 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS	PRICE
LTS-CA-5-OV*	0.02% - line, 0.15% - load	1.5 mV	7.0	6.5	5.8	4.8	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-5-OV*	0.02% - line, 0.15% - load	1.5 mV	12.0	10.8	9.0	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-5-OV*	0.02% - line, 0.15% - load	1.5 mV	17.0	14.5	12.0	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

6 VOLTS ± 1%

LTS-CA-6	0.02% - line, 0.15% - load	1.5mV	6.6	6.2	5.5	4.6	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-6	0.02% - line, 0.15% - load	1.5mV	11.0	9.9	8.2	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-6	0.02% - line, 0.15% - load	1.5mV	16.0	14.0	12.0	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

12 VOLTS ± 1%

LTS-CA-12	0.02% - line, 0.15% - load	1.5mV	4.4	4.1	3.8	3.2	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-12	0.02% - line, 0.15% - load	1.5mV	7.6	6.7	5.7	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-12	0.02% - line, 0.15% - load	1.5mV	11.0	9.7	8.6	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

15 VOLTS ± 1%

LTS-CA-15	0.02% - line, 0.15% - load	1.5mV	4.0	3.7	3.4	3.1	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-15	0.02% - line, 0.15% - load	1.5mV	7.2	6.4	5.4	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-15	0.02% - line, 0.15% - load	1.5mV	10.0	8.8	7.7	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

20 VOLTS ± 1%

LTS-CA-20	0.02% - line, 0.15% - load	1.5mV	3.1	2.9	2.7	2.4	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-20	0.02% - line, 0.15% - load	1.5mV	6.0	5.3	4.5	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-20	0.02% - line, 0.15% - load	1.5mV	8.0	7.1	6.0	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

24 VOLTS ± 1%

LTS-CA-24	0.02% - line, 0.15% - load	1.5mV	2.6	2.4	2.2	2.0	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-24	0.02% - line, 0.15% - load	1.5mV	5.5	4.9	4.1	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-24	0.02% - line, 0.15% - load	1.5mV	7.1	6.4	5.4	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

28 VOLTS ± 1%

LTS-CA-28	0.02% - line, 0.15% - load	1.5mV	2.2	2.2	2.0	1.8	CA	4 29/32" x 4 15/16" x 9 5/16"	**$ 80**
LTS-DB-28	0.02% - line, 0.15% - load	1.5mV	4.0	4.0	3.7	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**130**
LTS-DC-28	0.02% - line, 0.15% - load	1.5mV	6.0	6.0	5.0	–	DC	4 29/32" x 7 1/2" x 10 1/2"	**150**

DUAL OUTPUT MODELS

±12 VOLTS ± 1%

LTD-CA-122	0.02% - line, 0.15% - load	1.5mV	2.0	1.8	1.7	1.5	CA	4 29/32" x 4 15/16" x 9 5/16"	**$110**
LTD-DB-122	0.02% - line, 0.15% - load	1.5mV	4.0	3.4	2.8	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**160**

±15 VOLTS ± 1%

LTD-CA-152	0.02% - line, 0.15% - load	1.5mV	2.0	1.8	1.7	1.5	CA	4 29/32" x 4 15/16" x 9 5/16"	**$110**
LTD-DB-152	0.02% - line, 0.15% - load	1.5mV	3.8	3.2	2.6	–	DB	4 29/32" x 7 1/2" x 10 1/2"	**160**

*Includes fixed overvoltage protection at 6.8V ± 10%

See page 102-104 for overvoltage protectors and other accessories.

SPECIFICATIONS OF LT SERIES

DC output

voltage range: refer to tables

Regulated voltage

regulation, line	0.02%
regulation, load	0.15% or 20mV whichever is greater for LT-CA models, 0.15% for LT-DB and LT-DC models.
ripple and noise	1.5mV RMS, 5mV pk-pk with either positive or negative terminal grounded
temperature coefficient	0.01%/°C

AC input

line	105-132 VAC, 59.7 to 60.3 Hz. (STD) Comm'l. Line Frequency Spec.), LT-CA 125 watts max., LT-DB 225 watts max., LT-DC 300 watts max., consult factory for operation at other frequencies.

Efficiency

Approximately 33% for all 5 V and 6 V models
Approximately 48% for all 12 V and 15 V models
Approximately 55% for all 20 V, 24 V, and 28 V models
Approximately 50% for all duals

Ambient operating temperature range

Continuous duty from 0° to +71°C for LT-CA models, and 0 to 60°C for LT-DB and LT-DC models with corresponding load current ratings for all modes of operation.

Power Hybrid Voltage Regulator

All models have Power Hybrid Voltage Regulator providing complete regulation system.

Overload protection

Electrical

external overload protection; automatic electronic current limiting circuit limits the output current to a preset value, thereby providing protection for the load as well as the power supply.

Thermal

Thermal overload protection is incorporated in Power Hybrid Voltage Regulator.

Remote sensing

provision is made for remote sensing to eliminate effects of power output lead resistance on DC regulation, except for LT-CA units.

Storage temperature range

–40°C to +85°C

Overshoot

no overshoot on turn-on, turn-off or power failure.

Input and output connections

through terminal block on chassis

Convection cooled

no external heat sinking or forced air required.

Mounting

two mounting surfaces, two mounting positions for LT-CA units; one mounting surface; two mounting positions for LT-DB and LT-DC units.

Physical data

Weight

LT-CA– 6 lbs. net– 7 lbs. ship
LT-DB–12 lbs. net–14 lbs. ship
LT-DC–17 lbs. net–19 lbs. ship

Size

4 29/32" x 4 15/16" x 9 5/16" –LT-CA; 4 29/32" x 7 1/2" x 10 1/2"–LT-DB and LT-DC units.

Finish

gray, FED. STD. 595 No. 26081

Accessories

rack adapters blank panels. Overvoltage protectors, are available for all models except 5V single output models which have built-in fixed overvoltage protection at 6.8 volts ±10%. See pages 102-103.

LAMBDA MODULA POWER SUPPLIES FEATURES

17 package sizes

Over 500 single and dual output models

Wide-range and fixed-voltage models

up to 150 VDC, up to 150 amperes

Underwriters' Laboratories listed

LX, LV-A, LW-A, LY, LC, and LM series power supplies listed in Underwriters' Laboratories Recognized Components Index

Commercial Contract Plan

available for O.E.M. and large-volume users

5-year guarantee

to full performance specifications, includes parts and labor

Increased reliability

on some LY models and most LX models through use of Power Hybrid Voltage Regulator to provide complete regulation system. On LC series and some LX models reliability is increased through use of integrated circuit to provide regulation system, except for input and output capacitors, rectifiers and series regulation transistors.

Five levels of regulation

0.01% – LC series
0.03% – LM series
0.1% – LX, LY series
0.15% – LV-A series
2.0% – LW-A series

Convection-cooled

no external heat sinking or forced air required

Programmable

remote programming available on most models

Remote sensing

remote sensing on all models

Multi-surface mounting

mounting in up to 3 planes and in any position

Efficiency

LV, LW and LY series is greater than 50%

Wide operating temperature range

LC, LM series – 20°C to + 71°C
LV-A, LW-A, LX, LY series 0°C to + 71°C

Completely protected

automatic electronic current limiting and self-resetting thermostats (in most models).

Overvoltage protection

available on all series (except LW-A) up to 60 VDC rating

No voltage spikes or overshoot

on turn-on, turn-off, or power failure – for maximum load protection

Meets military environmental specs (LM series only)

RFI: MIL-1-16910, temp. shock: MIL-E-5272C (ASG) Proc. 1 vibration: MIL-T-4807A, altitude: MIL-E-4970A (ASG) Proc. 1 shock: MIL-E-4970A Proc. 1 & 2, marking: MIL-STD-130 humidity: MIL-STD-810 Meth. 507, Proc. 1 quality: MIL-Q-9858, fungus proofing: MIL-V-173

(LX series only)

Altitude: MIL-STD-180B Meth. 500 Procedure I, high temperature: MIL-STD-810B, Meth. 501, Procedures I & II, MIL-E-5272C, Para. 4.1.2, Procedure II, low temperature: MIL-STD-810B, Method 502, Procedure I, temp. shock: MIL-STD-810B, Meth. 503, Procedure I, MIL-E-5272C, Para. 4.3.1, Procedure I, humidity: MIL-STD-810B, Meth. 507, Procedure I, MIL-E-5272C, Para. 4.4.1, Procedure I, shock: MIL-STD-810B, Meth. 516. Procedures I, III, MIL-E-5272C, Para. 4.15.5.1, 4.15.5.2, vibration: MIL-STD-810B, Notice 1, Meth. 514, Procedures X, XI, emi: MIL-I-6181D.

Complete serviceability

all components replaceable

Series/parallel operation

with similar single or dual units

Features of dual-output LC models

Independent operation

Independent remote programming

Independent remote sensing

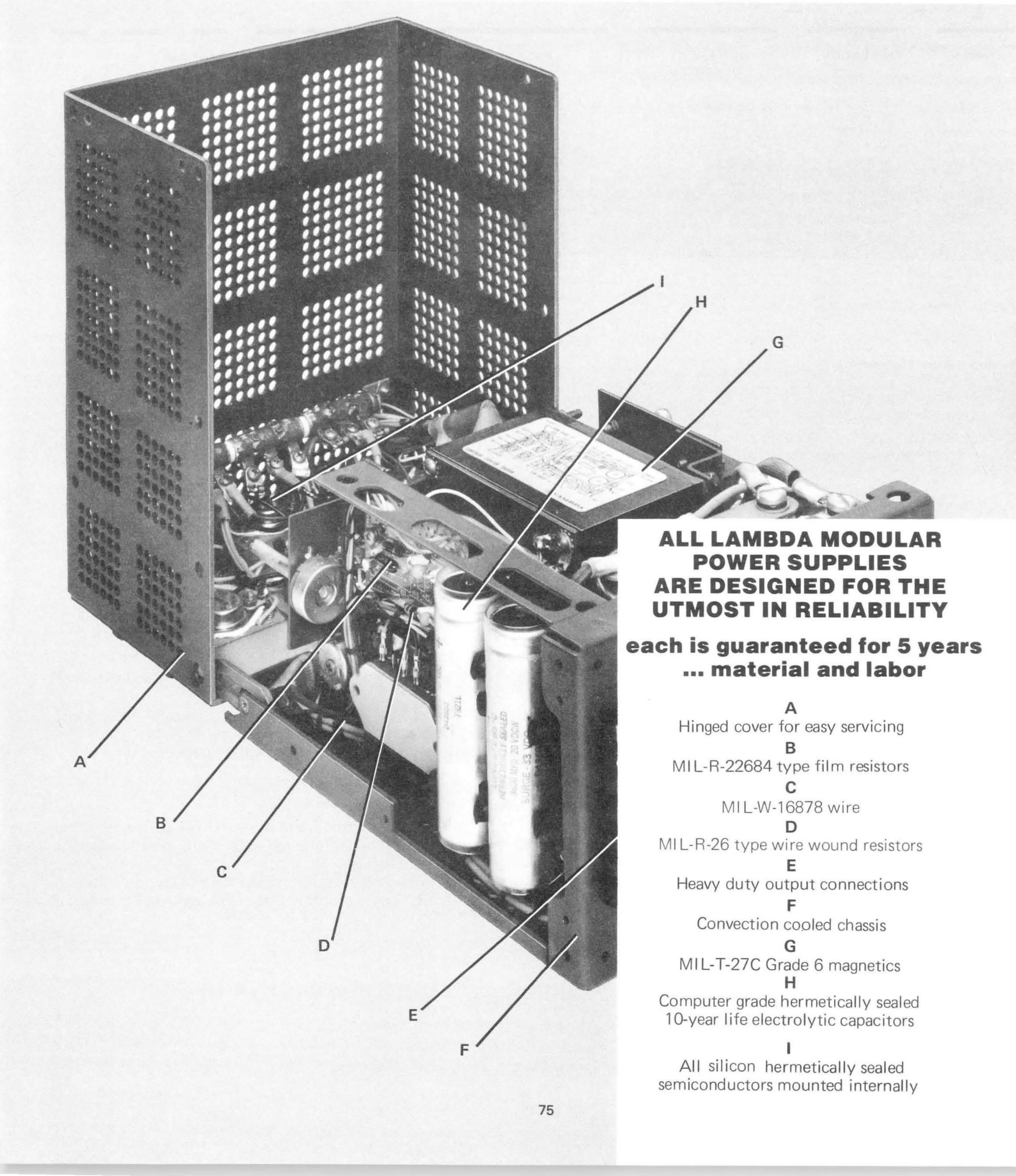
Each supply electrically isolated

and floating with respect to ground

Voltage and current ratings

voltage and current ratings for wide range and fixed voltage, single, and dual output models are given on the following pages. In many series, additional voltage and current ratings are available at a slight surcharge. Consult factory for models available.

LAMBDA MODULAR POWER SUPPLIES



ALL LAMBDA MODULAR POWER SUPPLIES ARE DESIGNED FOR THE UTMOST IN RELIABILITY

each is guaranteed for 5 years ... material and labor

A
Hinged cover for easy servicing

B
MIL-R-22684 type film resistors

C
MIL-W-16878 wire

D
MIL-R-26 type wire wound resistors

E
Heavy duty output connections

F
Convection cooled chassis

G
MIL-T-27C Grade 6 magnetics

H
Computer grade hermetically sealed
10-year life electrolytic capacitors

I
All silicon hermetically sealed
semiconductors mounted internally

HOW TO SPECIFY A LAMBDA MODULAR POWER SUPPLY

(Fill in blanks with appropriate symbols listed)

L — _____ — _____ — _____ — _____ — ___ — ___ — ___

LAMBDA:

The first name in quality power supplies All supplies backed by a firm 5 year guarantee

REGULATION:

C = .01%
M = .03%
X = .1%
Y = .1%
V = .15%
W = 2%
(See Pages 95-100 for full specifications of each series)

NUMBER OF OUTPUTS:

S = Single
D = Dual
T = Triple
Q = Quadruple
(This space skipped for LM, LV-A, LW-A Models)
(All LM, LV-A LW-A are single output models.)

PACKAGE SIZE: (in inches)

1 – 3 5/32 x 3 9/32 x 1 21/32
2 – 3 5/32 x 3 9/32 x 3 9/32
3 – 3 3/16 x 3 5/16 x 5
A – 3 3/16 x 3 3/4 x 6 1/2
B – 3 3/16 x 4 15/16 x 6 1/2
4 – 4 29/32 x 4 29/32 x 5
C – 3 3/16 x 4 15/16 x 9 3/8
CC – 4 15/16 x 4 15/16 x 9 3/8
D – 4 15/16 x 7 1/2 x 9 3/8
5 – 3 3/16 x 4 15/16 x 15
E – 4 15/16 x 7 1/2 x 11 3/4
EE – 4 15/16 x 7 1/2 x 16 1/2
7 – 4 15/16 x 10 1/8 x 16 1/2
8 – 4 15/16 x 12 x 16 1/2
F – 3 1/2 x 19 x 16 1/2
G – 5 3/16 x 19 x 16 1/2
H – 7 x 19 x 18 1/2

OUTPUT VOLTAGE

ONE DIGIT Fixed (± 5%) Output,
Two or more Digits— Range or Multiple Outputs
(See tables for voltages available)

OPTIONS

OV – Overvoltage protector;
Standard on all models listed in voltage tables with – OV following model notation. For models not listed with
– OV and overvoltage protection is desired see page 102 for overvoltage protectors available and order using overvoltage protector model number.
R – fungus proofing
V – AC input – 187-242 VAC
Y – (LM models only)
– (regulation = .01%)
(ripple = .05 mV RMS)
(temp coeff = .01%/°C)

FOR OTHER OPTIONS & ACCESSORIES, See pages 95-100, 102-104 or call nearest Lambda Sales Office listed on inside back cover.

SELECTING THE POWER SUPPLY YOU REQUIRE

Example:

Requirement: 5VDC @ approximately 10 Amps, single output power supply with regulation of 0.1% or better.

Going to the 5V±5% grouping of modular power supplies page 81, we find that the LXS-C-5-OV-R, LCS-C-5-OV, and the LM-CC-5 will meet the above specifications. These pages show the differences in various models listed. Use the chart above for a quick guide to the model notation code used by Lambda for its modular power supplies.

Using model LXS-C-5-OV-R, chosen above, the following explains each digit and letter as used in the chart listings for each model.

1. *L* Stands for Lambda and is the first character of all Lambda model designations.

2. *X* Denotes the series of modular power supplies with 0.1% regulation and all specifications listed on page 96.

3. *S* Denotes a single output model.

4. *C* Designates the package size (3 3/16" x 4 15/16" x 9 3/8" in this example).

5. *5* Indicates the value of voltage chosen, (5 volts in this example).

6. *OV* The OV protection for this model is built in, and is included in model notation and price. If OV does not follow standard model notation, turn to accessory page 102, and choose the overvoltage module required and specify part number on order.

7. *R* Fungus proofing standard, and is included in model notation and price. If R does not follow standard model notation, turn to specification pages 95-100 for the particular model series, and see if, -R, fungus proofing is available and add the notation and price to model.

MODULAR POWER SUPPLIES
SINGLE OUTPUT
WIDE RANGE MODELS

Voltage and current ratings

0-7 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-1-01A †	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.275 (0.250)	0.220 (0.180)	0.165 (0.120)	0.110 (0.075)	1	3 5/32 x 3 9/32 x 1 21/32	**$ 85**
LCS-2-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.550	0.455	0.350	0.240	2	3 5/32 x 3 9/32 x 3 9/32	**85**
LCS-3-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.20	1.00	0.75	0.50	3	3 3/16 x 3 5/16 x 5	**95**
LCS-A-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.0	1.9	1.6	1.1	A	3 3/16 x 3 3/4 x 6 1/2	**105**
LM-B-0-7	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.8	2.6	2.3	1.5	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LCS-4-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.3	3.0	2.3	1.5	4	4 29/32 x 4 29/32 x 5	**135**
LCS-B-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.7	3.3	2.7	1.7	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LM-225	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.0	3.6	3.0	2.4	C	3 3/16 x 4 15/16 x 9 3/8	**149**
LCS-C-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	4.5	4.1	3.8	3.3	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LM-234	0.05% + 4 mV, 0.03% + 3 mV	1 mV	8.3	7.3	6.5	5.5	D	4 15/16 x 7 1/2 x 9 3/8	**210**
LCS-CC-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	9.2	8.3	7.4	6.3	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LM-E-0-7	0.05% + 4 mV, 0.03% + 3 mV	1 mV	12.0	10.5	8.5	6.8	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LCS-D-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	12.5	11.2	9.7	8.0	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LM-EE-0-7	0.05% + 4 mV, 0.03% + 3 mV	1 mV	16.0	13.5	11.2	9.2	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LCS-E-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	17.0	15.6	14.1	11.8	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LCS-EE-01	0.01% + 1 mV, 0.01% + 1 mV	250 uV	23.4	21.9	20.0	16.7	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LM-F-0-7-OV-M-R (1)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	25.0	21.0	17.0	14.0	F	3 1/2 x 19 x 16 1/2	**615**
LCS-7-01-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	28.0	25.5	22.0	18.5	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LM-G-0-7-OV-M-R (1)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	35.0	29.0	24.0	20.0	G	5 3/16 x 19 x 16 1/2	**745**

8.5-14 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LM-217	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.1	1.9	1.7	1.3	B	3 3/16 x 4 15/16 x 6 1/2	**$129**
LM-235	0.05% + 4 mV, 0.03% + 3 mV	1 mV	7.7	6.8	6.0	4.8	D	3 3/16 x 4 15/16 x 9 3/8	**210**

0-14 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LM-B-0-14	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.6	1.5	1.3	1.2	B	3 3/16 x 4 15/16 x 6 1/2	**$119**
LM-C-0-14	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.2	1.0	1.8	1.5	C	3 3/16 x 4 15/16 x 9 3/8	**149**
LM-D-0-14	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.9	4.2	3.4	2.7	D	4 15/16 x 7 1/2 x 9 3/8	**210**
LM-E-0-14	0.05% + 4 mV, 0.03% + 3 mV	1 mV	7.4	6.4	5.2	4.1	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LM-EE-0-14	0.05% + 4 mV, 0.03% + 3 mV	1 mV	10.2	8.6	7.3	6.1	EE	4 15/16 x 7 1/2 x 16 1/2	**355**

13-23 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LM-218	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.5	1.3	1.2	1.0	B	3 3/16 x 4 15/16 x 6 1/2	**$129**
LM-227	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.3	2.1	1.7	1.4	C	3 3/16 x 4 15/16 x 9 3/8	**149**
LM-236	0.05% + 4 mV, 0.03% + 3 mV	1 mV	5.8	5.1	4.5	3.6	D	4 15/16 x 7 1/2 x 9 3/8	**220**

0-18 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-1-02A †	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.130 (0.115)	0.130 (0.115)	0.100 (0.080)	0.085 (0.040)	1	3 5/32 x 3 9/32 x 1 21/32	**$ 85**
LCS-2-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.330	0.275	0.210	0.140	2	3 5/32 x 3 9/32 x 3 9/32	**85**
LCS-3-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.750	0.620	0.480	0.320	3	3 3/16 x 3 5/16 x 5	**95**
LCS-A-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.1	1.0	0.9	0.7	A	3 3/16 x 3 3/4 x 6 1/2	**105**
LCS-4-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.8	1.6	1.2	0.8	4	4 29/32 x 4 29/32 x 5	**135**
LCS-B-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.0	1.8	1.6	1.2	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LCS-C-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.3	2.1	1.9	1.6	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LCS-CC-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.8	3.5	3.2	2.7	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-D-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	5.2	4.7	4.1	3.4	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LCS-E-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	7.2	6.6	6.0	5.0	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LCS-EE-02	0.01% + 1 mV, 0.01% + 1 mV	250 uV	11.0	10.2	9.2	7.5	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LCS-7-02-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	12.5	11.5	10.0	8.5	7	4 15/16 x 10 1/8 x 16 1/2	**560**

† Bracketed Ratings are for 47–53 Hz operation.

(1,2) See page 89.

All outputs continuously adjustable over entire range.

MODULAR POWER SUPPLIES
SINGLE OUTPUT
WIDE RANGE MODELS

Voltage and current ratings

22-32 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LM-219	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.2	1.1	1.0	0.8	B	3 3/15 x 4 15/16 x 6 1/2	$129
LM-228	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.0	1.8	1.5	1.2	C	3 3/16 x 4 15/15 x 9 3/8	149
LM-237	0.05% + 4 mV, 0.03% + 3 mV	1 mV	5.0	4.4	3.9	3.1	D	4 15/16 x 7 1/2 x 9 3/8	230

0-32 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCS-1-03A †	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.090 (0.080)	0.090 (0.080)	0.090 (0.050)	0.050 (0.025)	1	3 5/32 x 3 9/32 x 1 21/32	$ 85
LCS-2-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.240	0.205	0.155	0.095	2	3 5/32 x 3 9/32 x 3 9/32	85
LCS-3-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.400	0.350	0.265	0.170	3	3 3/16 x 3 5/16 x 5	95
LCS-A-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.69	0.64	0.6	0.45	A	3 3/16 x 3 3/4 x 6 1/2	105
LM-B-0-32	0.05% + 4 mV, 0.03% + 3 mV	1 mV	0.8	0.7	0.6	0.5	B	3 3/16 x 4 15/16 x 6 1/2	119
LCS-4-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.0	0.9	0.7	0.5	4	4 29/32 x 4 29/32 x 5	135
LCS-B-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.1	1.0	0.8	0.5	B	3 3/16 x 4 15/16 x 6 1/2	135
LM-C-0-32	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.1	1.0	0.9	0.8	C	3 3/16 x 4 15/16 x 9 3/8	149
LCS-C-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.6	1.5	1.4	1.2	C	3 3/16 x 4 15/16 x 9 3/8	160
LCS-CC-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.3	2.1	1.9	1.6	CC	4 15/16 x 4 15/16 x 9 3/8	210
LM-D-0-32	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.5	2.1	1.7	1.3	D	4 15/16 x 7 1/2 x 9 3/8	210
LCS-D-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.1	2.8	2.4	2.0	D	4 15/16 x 7 1/2 x 9 3/8	290
LM-E-0-32	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.7	3.2	2.6	2.1	E	4 15/16 x 7 1/2 x 11 3/4	280
LCS-E-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	4.4	4.2	3.8	3.1	E	4 15/16 x 7 1/2 x 11 3/4	330
LM-EE-0-32	0.05% + 4 mV, 0.03% + 3 mV	1 mV	5.2	4.4	3.8	3.2	EE	4 15/16 x 7 1/2 x 16 1/2	355
LCS-EE-03	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.5	6.0	5.4	4.4	EE	4 15/16 x 7 1/2 x 16 1/2	440
LCS-7-03-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	7.5	6.8	5.9	4.9	7	4 15/16 x 10 1/8 x 16 1/2	560

30-60 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LM-220	0.05% + 4 mV, 0.03% + 3 mV	1 mV	0.70	0.65	0.60	0.45	B	3 3/16 x 4 15/16 x 6 1/2	$139
LM-229	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.1	1.0	0.8	0.6	C	3 3/16 x 4 15/16 x 9 3/8	159
LM-238	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.6	2.3	2.0	1.6	D	4 15/16 x 7 1/2 x 9 3/8	250

0-60 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCS-1-04A †	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.050 (0.045)	0.050 (0.045)	0.050 (0.045)	0.030 (0.015)	1	3 5/32 x 3 9/32 x 1 21/32	$ 95
LCS-2-04	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.145	0.115	0.087	0.057	2	3 5/32 x 3 9/32 x 3 9/32	95
LCS-3-04	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.240	0.190	0.140	0.085	3	3 3/16 x 3 5/16 x 5	105
LCS-A-04	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.370	0.340	0.310	0.250	A	3 3/16 x 3 3/4 x 6 1/2	105

0-120 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCS-1-05A †	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.018 (0.015)	0.018 (0.015)	0.018 (0.015)	0.018 (0.010)	1	3 5/32 x 3 9/32 x 1 21/32	$ 95
LCS-2-05	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.050	0.050	0.050	0.050	2	3 5/32 x 3 9/32 x 3 9/32	95
LCS-A-05	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.100	0.100	0.100	0.100	A	3 3/16 x 3 3/4 x 6 1/2	115

†Bracketed ratings are for 47–53 Hz operation.

(2) See page 89.

All outputs continuously adjustable over entire range

MODULAR POWER SUPPLIES
DUAL OUTPUT
WIDE RANGE MODELS

Voltage and current ratings

0-7/0-7 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-11	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	0.300	0.240	0.175	0.115	2	3 5/32 x 3 9/32 x 3 9/32	**$130**
			0-7	0.300	0.240	0.175	0.115			
LCD-3-11	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	0.70	0.59	0.48	0.34	3	3 3/16 x 3 5/16 x 5	**150**
			0-7	0.70	0.59	0.48	0.34			
LCD-A-11	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	1.0	0.9	0.7	0.5	A	3 3/16 x 3 3/4 x 6 1/2	**165**
			0-7	1.0	0.9	0.7	0.5			
LCD-4-11	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	1.8	1.5	1.2	0.7	4	4 29/32 x 4 29/32 x 5	**200**
			0-7	1.8	1.5	1.2	0.7			

0-7/0-18 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	0.300	0.240	0.175	0.115	2	3 5/32 x 3 9/32 x 3 9/32	**$130**
			0-18	0.160	0.130	0.100	0.065			
LCD-3-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	0.70	0.59	0.48	0.34	3	3 3/16 x 3 5/16 x 5	**150**
			0-18	0.40	0.35	0.30	0.21			
LCD-A-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	1.0	0.9	0.7	0.5	A	3 3/16 x 3 3/4 x 6 1/2	**165**
			0-18	0.5	0.45	0.4	0.3			
LCD-4-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-7	1.8	1.5	1.2	0.7	4	4 29/32 x 4 29/32 x 5	**200**
			0-18	1.0	0.8	0.65	0.4			

0-7/0-32 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-4-13	0.01% + 1mV, 0.01% + 1 mV	250 uV	0-7	1.8	1.5	1.2	0.7	4	4 29/32 x 4 29/32 x 5	**$200**
			0-32	0.6	0.53	0.4	0.24			

0-18/0-18 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-22	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-18	0.160	0.130	0.100	0.065	2	3 5/32 x 3 9/32 x 3 9/32	**$130**
			0-18	0.160	0.130	0.100	0.065			
LCD-3-22	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-18	0.40	0.35	0.30	0.21	3	3 3/16 x 3 5/16 x 5	**150**
			0-18	0.40	0.35	0.30	0.21			
LCD-A-22	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-18	0.50	0.45	0.40	0.30	A	3 3/16 x 3 3/4 x 6 1/2	**165**
			0-18	0.50	0.45	0.40	0.30			
LCD-4-22	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-18	1.00	0.80	0.65	0.40	4	4 29/32 x 4 29/32 x 5	**200**
			0-18	1.00	0.80	0.65	0.40			

0-32/0-32 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-33	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-32	0.120	0.095	0.070	0.045	2	3 5/32 x 3 9/32 x 3 9/32	**$130**
			0-32	0.120	0.095	0.070	0.045			
LCD-3-33	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-32	0.225	0.190	0.160	0.120	3	3 3/16 x 3 5/16 x 5	**150**
			0-32	0.225	0.190	0.160	0.120			
LCD-A-33	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-32	0.35	0.30	0.25	0.20	A	3 3/16 x 3 3/4 x 6 1/2	**165**
			0-32	0.35	0.30	0.25	0.20			
LCD-4-33	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-32	0.60	0.53	0.40	0.24	4	4 29/32 x 4 29/32 x 5	**200**
			0-32	0.60	0.53	0.40	0.24			

All outputs continuously adjustable over entire range

MODULAR POWER SUPPLIES
DUAL OUTPUT
WIDE RANGE MODELS

Voltage and current ratings

0-60/0-60 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-44	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-60	0.065	0.052	0.037	0.023	2	3 5/32 x 3 9/32 x 3 9/32	$180
			0-60	0.065	0.052	0.037	0.023			
LCD-A-44	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-60	0.20	0.18	0.14	0.12	A	3 3/16 x 3 3/4 x 6 1/2	190
			0-60	0.20	0.18	0.14	0.12			

0-120/0-120 VOLTS

MODEL	REGULATION (line, load)	RIPPLE (RMS)	ADJ. VOLT RANGE VDC (EACH SIDE)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-2-55	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0-120	0.030	0.030	0.022	0.014	2	3 5/32 x 3 9/32 x 3 9/32	$180
			0-120	0.030	0.030	0.022	0.014			

All outputs continuously adjustable over entire range

MODULAR POWER SUPPLIES
SINGLE OUTPUT
FIXED VOLTAGE MODELS

Voltage and current ratings

2 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCS-A-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.0	2.5	2.0	1.4	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LCS-B-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.5	5.3	4.5	3.3	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LCS-C-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	9.0	8.0	6.8	5.3	C	3 3/16 x 4 15/16 x 9 3/8	**170**
LCS-CC-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	16.0	14.5	12.7	10.5	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-D-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	27.5	24.2	20.2	16.5	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LCS-E-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	35.0	30.0	24.0	17.5	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LCS-EE-2	0.01% + 1 mV, 0.01% + 1 mV	250 uV	45.0	39.0	32.0	25.0	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LMF-2-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	48.0	41.0	33.0	25.0	F	3 1/2 x 19 x 16 1/2	**495**
LCS-7-2-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	65.0	63.0	55.0	40.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LMG-2-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	95.0	80.0	62.0	45.0	G	5 3/16 x 19 x 16 1/2	**625**
LMH-2-OV-Y-M (3)	0.01% + 1 mV, 0.02% + 2 mV	0.5 mV	150.0	140.0	125.0	91.0	H	7 x 19 x 18 1/2	**995**

5 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCS-A-5	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.7	2.3	1.8	1.2	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.7	3.2	2.5	1.5	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LXS-A-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	4.0	3.4	2.7	2.0	A	3 3/16 x 3 3/4 x 6 1/12	**95**
LCS-4-5	0.01% + 1 mV, 0.01% + 1 mV	250 uV	4.4	3.7	2.9	1.8	4	4 29/32 x 4 29/32 x 5	**135**
LM-C-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	5.1	4.3	3.4	2.4	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LXS-B-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	5.8	5.0	4.0	3.0	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-B-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	5.8	5.0	4.0	3.0	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LXS-4-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	7.4	6.5	5.4	3.9	4	4 29/32 x 4 29/32 x 5	**145**
LXS-C-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	9.0	8.0	6.8	5.3	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LCS-C-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	9.0	8.0	6.8	5.3	C	3 3/16 x 4 15/16 x 9 3/8	**170**
LM-CC-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	10.5	9.0	8.0	5.5	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LM-D-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	12.6	10.8	9.2	6.1	D	4 15/16 x 7 1/2 x 9 3/8	**220**
LXS-CC-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	16.0	14.5	12.7	10.5	CC	4 15/16 x 4 15/16 x 9 3/8	**220**
LCS-CC-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	16.0	14.5	12.7	10.5	CC	4 15/16 x 4 15/16 x 9 3/8	**220**
LM-E-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	20.0	18.0	16.4	10.0	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LXS-D-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	27.5	24.2	20.5	16.5	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	27.5	24.2	20.5	16.5	D	4 15/16 x 7 1/2 x 9 3/8	**300**
LYS-5-5-OV (5)	0.1%, 0.1%	10 mV	30.0	25.0	20.0	10.0	5	3 3/16 x 4 15/16 x 15	**345**
LM-EE-5	0.05% + 4 mV, 0.03% + 3 mV	1 mV	31.0	24.6	20.8	17.3	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LXS-E-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	35.0	30.0	24.0	17.5	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	35.0	30.0	24.0	17.5	E	4 15/16 x 7 1/2 x 11 3/4	**350**
LXS-EE-5-OV-R (5) (11)	0.1%, 0.1%	1.5 mV	45.0	39.0	32.0	25.0	EE	4 15/16 x 7 1/2 x 16 1/2	**445**
LCS-EE-5-OV (5)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	45.0	39.0	32.0	25.0	EE	4 15/16 x 7 1/2 x 16 1/2	**465**
LM-F-5-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	48.0	41.0	33.0	25.0	F	3 1/2 x 19 x 16 1/2	**495**
LXS-7-5-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	65.0	56.0	46.0	35.0	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-5-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	65.0	56.0	46.0	35.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LV-EE-5-A-OV (2) (7)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	74.0	58.0	65.0	45.0	EE	4 15/16 x 7 1/2 x 16 1/2	**490**
			(62.0)	(58.0)	(54.0)	(45.0)			
LM-G-5-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	80.0	75.0	62.0	45.0	G	5 3/16 x 19 x 16 1/2	**625**
LXS-8-5-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	85.0	77.0	68.0	56.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LW-EE-5-A (7)	2%, 2%	300 mV	91.0	87.0	77.0	62.0	EE	4 15/16 x 7 1/2 x 16 1/2	**400**
			(80.0)	(77.0)	(72.0)	(62.0)			
LM-H-5-OV-Y-M (3)	0.01% + 1 mV, 0.02% + 2 mV	0.5 mV	130.0	110.0	90.0	70.0	H	7 x 19 x 18 1/2	**995**
LV-G-5-A-OV (2)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	130.0	126.0	115.0	100.0	G	5 3/16 x 19 x 16 1/2	**750**
LW-G-5-A	2%, 2%	300 mV	150.0	146.0	135.0	123.0	G	5 3/16 x 19 x 16 1/2	**675**

(2, 3, 4, 5, 7, 11) See page 89

MODULAR POWER SUPPLIES SINGLE OUTPUT FIXED VOLTAGE MODELS

Voltage and current ratings

6 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-6	0.01%+1 mV, 0.01%+1 mV	250 uV	2.6	2.2	1.8	1.2	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.2	2.9	2.4	1.4	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LXS-A-6-R (11)	0.1%, 0.1%	1.5 mV	3.7	3.1	2.5	1.9	A	3 3/16 x 3 3/4 x 6 1/2	**95**
LCS-4-6	0.01% + 1 mV, 0.01% + 1 mV	250 uV	4.0	3.4	2.6	1.5	4	4 29/32 x 4 29/32 x 5	**135**
LM-C-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.8	4.1	3.3	2.4	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LXS-B-6-R (11)	0.1%, 0.1%	1.5 mV	5.5	4.7	3.8	2.9	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-B-6	0.01% + 1 mV, 0.01% + 1 mV	250 uV	5.5	4.7	3.8	2.9	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LXS-4-6-R (11)	0.1%, 0.1%	1.5 mV	6.6	5.8	4.8	3.5	4	4 29/32 x 4 29/32 x 5	**145**
LXS-C-6-R (11)	0.1%, 0.1%	1.5 mV	8.8	7.8	6.7	5.2	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LCS-C-6	0.01% + 1 mV, 0.1% + 1 mV	250 uV	8.8	7.8	6.7	5.2	C	3 3/16 x 4 15/16 x 9 3/8	**170**
LM-CC-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	9.0	8.4	7.7	5.5	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LM-D-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	12.4	10.6	8.9	6.0	D	4 15/16 x 7 1/2 x 9 3/8	**220**
LXS-CC-6-R (11)	0.1%, 0.1%	1.5 mV	15.2	13.8	12.1	10.0	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-CC-6	0.01% + 1 mV, 0.01% + 1 mV	250 uV	15.2	13.8	12.1	10.0	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LM-E-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	19.0	17.3	15.6	10.0	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LYS-5-6	0.1%, 0.1%	10 mV	25.0	21.0	17.0	8.5	5	3 3/16 x 4 15/16 x 15	**325**
LXS-D-6-R (11)	0.1%, 0.1%	1.5 mV	26.5	23.4	19.8	16.0	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-6	0.01% + 1 mV, 0.01% + 1 mV	250 uV	26.5	23.4	19.8	16.0	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LM-EE-6	0.05% + 4 mV, 0.03% + 3 mV	1 mV	30.0	24.6	20.8	17.3	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LXS-E-6-R (11)	0.1%, 0.1%	1.5 mV	34.0	29.0	23.0	16.5	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-6	0.01% + 1 mV, 0.01% + 1 mV	250 uV	34.0	29.0	23.0	16.5	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LXS-EE-6-OV-R (6) (11)	0.1%, 0.1%	1.5 mV	42.0	36.0	30.0	22.0	EE	4 15/16 x 7 1/2 x 16 1/2	**445**
LCS-EE-6-OV (6)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	42.0	36.0	30.0	22.0	EE	4 15/16 x 7 1/2 x 16 1/2	**465**
LM-F-6-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	47.0	40.0	32.0	24.0	F	3 1/2 x 19 x 16 1/2	**495**
LXS-7-6-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	59.0	50.0	41.0	32.0	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-6-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	59.0	50.0	41.0	32.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LV-EE-6-A-OV (2) (7)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	64.0	61.0	56.0	40.0	EE	4 15/16 x 7 1/2 x 16 1/2	**490**
			(53.0)	(50.0)	(47.0)	(40.0)			
LXS-8-6-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	70.0	70.0	68.0	56.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LW-EE-6-A (7)	2%, 2%	300 mV	78.0	75.0	70.0	54.0	EE	4 15/16 x 7 1/2 x 16 1/2	**400**
			(68.0)	(65.0)	(62.0)	(54.0)			
LV-G-6-A-OV (2)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	110.0	107.0	98.0	90.0	G	5 3/16 x 19 x 16 1/2	**750**
LW-G-6-A	2%, 2%	300 mV	128.0	123.0	115.0	105.0	G	5 3/16 x 19 x 16 1/2	**675**

8 VOLTS ±5%

LCS-A-8	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.4	2.0	1.7	1.1	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**

10 VOLTS ±5%

LCS-A-10	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.1	1.8	1.5	1.0	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LW-D-10-A	2%, 2%	300 mV	27.0	25.0	23.0	17.0	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LV-EE-10-A-OV (2) (7)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	41.0	39.0	36.0	25.0	EE	4 15/16 x 7 1/2 x 16 1/2	**415**
			(36.0)	(34.0)	(32.0)	(25.0)			

(2, 4, 6, 7, 11) See page 89

Voltage and current ratings

12 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.9	1.7	1.3	0.9	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.5	2.3	2.1	1.3	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LXS-A-12-R (11)	0.1%, 0.1%	1.5 mV	2.7	2.2	1.8	1.5	A	3 3/16 x 3 3/4 x 6 1/2	**95**
LCS-4-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.1	2.8	2.2	1.3	4	4 29/32 x 4 29/32 x 5	**135**
LXS-B-12-R (11)	0.1%, 0.1%	1.5 mV	3.8	3.6	3.0	2.2	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-B-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.8	3.6	3.0	2.2	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LM-C-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.0	3.5	2.9	1.9	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LXS-4-12-R (11)	0.1%, 0.1%	1.5 mV	4.4	3.8	3.1	2.5	4	4 29/32 x 4 29/32 x 5	**145**
LXS-C-12-R (11)	0.1%, 0.1%	1.5 mV	6.5	6.1	5.5	4.6	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LCS-C-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.5	6.1	5.5	4.6	C	3 3/16 x 4 15/16 x 9 3/8	**170**
LM-CC-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	7.3	6.8	5.9	4.7	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LM-D-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	10.0	9.2	8.3	5.7	D	4 15/16 x 7 1/2 x 9 3/8	**220**
LXS-CC-12-R (11)	0.1%, 0.1%	1.5 mV	10.5	9.4	8.2	5.0	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-CC-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	10.5	9.4	8.2	5.0	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LM-E-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	15.0	13.6	12.3	9.5	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LXS-D-12-R (11)	0.1%, 0.1%	1.5 mV	16.0	14.0	11.9	8.0	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	16.0	14.0	11.9	8.0	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LYS-5-12	0.1%, 0.1%	15 mV	21.0	18.0	14.0	8.0	5	3 3/16 x 4 15/16 x 15	**325**
LXS-E-12-R (11)	0.1%, 0.1%	1.5 mV	21.0	18.0	15.0	12.5	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	21.0	18.0	15.0	12.5	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LM-EE-12	0.05% + 4 mV, 0.03% + 3 mV	1 mV	21.0	19.0	16.1	13.2	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LW-D-12-A	2%, 2%	300 mV	26.5	20.0	13.7	8.8	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LXS-EE-12-R (11)	0.1%, 0.1%	1.5 mV	32.0	27.0	22.0	16.0	EE	4 15/16 x 7 1/2 x 16 1/2	**420**
LCS-EE-12	0.01% + 1 mV, 0.01% + 1 mV	250 uV	32.0	27.0	22.0	16.0	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LM-F-12-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	33.0	28.0	22.0	17.0	F	3 1/2 x 19 x 16 1/2	**495**
LV-EE-12-A-OV (2) (7)	0.15% + 10 mV, 0.15% + 10 mV	10 mV	34.0	32.0	30.0	21.0	EE	4 15/16 x 7 1/2 x 16 1/2	**415**
			(29.0)	(27.0)	(25.0)	(21.0)			
LXS-7-12-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	40.0	36.0	30.0	23.0	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-12-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	40.0	36.0	30.0	23.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LW-EE-12-A (7)	2%, 2%	300 mV	42.0	40.0	37.0	28.0	EE	4 15/16 x 7 1/2 x 16 1/2	**350**
			(37.0)	(35.0)	(33.0)	(28.0)			
LXS-8-12-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	50.0	45.0	40.0	34.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LM-G-12-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	56.0	46.0	37.0	29.0	G	5 3/16 x 19 x 16 1/2	**625**
LW-G-12-A	2%, 2%	300 mV	75.0	72.0	67.0	61.0	G	5 3/16 x 19 x 16 1/2	**675**

15 VOLTS ±5%

LCS-A-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.8	1.5	1.2	0.9	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.2	2.0	1.8	1.3	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LXS-A-15-R (11)	0.1%, 0.1%	1.5 mV	2.4	2.0	1.6	1.3	A	3 3/16 x 3 3/4 x 6 1/2	**95**
LCS-4-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.8	2.6	2.1	1.3	4	4 29/32 x 4 29/32 x 5	**135**
LXS-B-15-R (11)	0.1%, 0.1%	1.5 mV	3.2	2.8	2.5	1.5	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-B-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.2	2.8	2.5	1.5	B	3 3/16 x 4 15/16 x 6 1/2	**135**
LM-C-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.5	3.2	2.8	1.9	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LXS-4-15-R (11)	0.1%, 0.1%	1.5 mV	4.0	3.5	2.8	2.3	4	4 29/32 x 4 29/32 x 5	**145**
LM-CC-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	6.0	5.6	5.1	4.3	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LXS-C-15-R (11)	0.1%, 0.1%	1.5 mV	6.0	5.6	5.1	4.5	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LCS-C-15	0.01% + 1 mV, 0.01% + 1 mV	250 mV	6.0	5.6	5.1	4.5	C	3 3/16 x 4 15/16 x 9 3/8	**170**
LM-D-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	9.0	8.4	7.9	5.3	D	4 15/16 x 7 1/2 x 9 3/8	**230**

15V ± 5% Listing continued next page
(2, 4, 7, 11) See page 89

MODULAR POWER SUPPLIES SINGLE OUTPUT FIXED VOLTAGE MODELS

Voltage and current ratings

15 VOLTS ±5% (cont'd)

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LXS-CC-15-R (11)	0.1%, 0.1%	1.5 mV	9.5	8.6	7.4	4.8	CC	4 15/16 x 4 15/16 x 9 3/8	**$210**
LCS-CC-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	9.5	8.6	7.4	4.8	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LXS-D-15-R (11)	0.1%, 0.1%	1.5 mV	14.0	12.3	10.4	7.5	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	14.0	12.3	10.4	7.5	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LM-E-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	14.0	12.7	11.5	8.6	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LYS-5-15	0.1%, 0.1%	15 mV	17.0	14.5	11.5	6.8	5	3 3/16 x 4 15/16 x 15	**325**
LXS-E-15-R (11)	0.1%, 0.1%	1.5 mV	19.0	17.0	14.0	12.0	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	19.0	17.0	14.0	12.0	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LM-EE-15	0.05% + 4 mV, 0.03% + 3 mV	1 mV	19.0	18.0	15.5	12.7	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LW-D-15-A	2%, 2%	300 mV	22.5	20.0	13.7	8.8	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LM-F-15-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	28.0	22.0	18.0	14.0	F	3 1/2 x 19 x 16 1/2	**495**
LXS-EE-15-R (11)	0.1%, 0.1%	1.5 mV	28.0	24.0	19.5	14.0	EE	4 15/16 x 7 1/2 x 16 1/2	**420**
LCS-EE-15	0.01% + 1 mV, 0.01% + 1 mV	250 uV	28.0	24.0	19.5	14.0	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LV-EE-15-A-OV (2) (7)	0.15% + 10 mV, 0.15% + 10mV	10 mV	28.0 (23.0)	26.0 (22.0)	24.0 (20.0)	18.0 (17.0)	EE	4 15/16 x 7 1/2 x 16 1/2	**415**
LW-EE-15-A (7)	2%, 2%	300 mV	35.0 (31.0)	33.0 (30.0)	31.0 (28.0)	24.0 (24.0)	EE	4 15/16 x 7 1/2 x 16 1/2	**350**
LXS-7-15-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	36.0	32.0	26.0	20.0	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-15-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	36.0	32.0	26.0	20.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LXS-8-15-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	45.0	41.0	36.0	30.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LM-G-15-R (4)	0.05% + 3 mV, 0.03% + 3 mV	1 mV	45.0	42.0	36.0	28.0	G	5 3/16 x 19 x 16 1/2	**625**
LW-G-15-A	2%, 2%	300 mV	60.0	57.0	53.0	49.0	G	5 3/16 x 19 x 16 1/2	**675**

18 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-18	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.6	1.3	1.1	0.8	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LW-D-18-A	2%, 2%	300 mV	19.0	18.3	13.7	8.8	D	4 15/16 x 7 1/2 x 9 3/8	**250**

20 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.4	1.2	1.0	0.8	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.8	1.6	1.5	1.2	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LCS-4-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.4	2.2	1.9	1.1	4	4 29/32 x 4 29/32 x 5	**135**
LCS-B-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.7	2.3	2.0	1.4	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LM-C-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.1	2.9	2.6	1.8	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LCS-C-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	4.2	4.0	3.5	3.0	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LM-CC-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	5.0	4.6	4.2	3.6	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LM-D-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	7.4	6.9	6.5	4.9	D	4 15/16 x 7 1/2 x 9 3/8	**230**
LXS-CC-20-R (11)	0.1%, 0.1%	1.5 mV	7.7	7.2	6.5	4.4	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-CC-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	7.7	7.2	6.5	4.4	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LXS-D-20-R (11)	0.1%, 0.1%	1.5 mV	11.5	10.0	8.6	6.8	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	11.5	10.0	8.6	6.8	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LM-E-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	12.0	10.9	9.8	8.5	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LYS-5-20	0.1%, 0.1%	15 mV	13.2	11.2	9.0	5.4	5	3 3/16 x 4 15/16 x 15	**325**
LXS-E-20-R (11)	0.1%, 0.1%	1.5 mV	15.0	13.0	10.5	7.0	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	15.0	13.0	10.5	7.0	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LM-EE-20	0.05% + 4 mV, 0.03% + 3 mV	1 mV	15.2	13.7	11.8	9.7	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LW-D-20-A	2%, 2%	300 mV	17.5	16.7	13.7	8.8	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LXS-EE-20-R (11)	0.1%, 0.1%	1.5 mV	22.0	18.5	14.5	10.0	EE	4 15/16 x 7 1/2 x 16 1/2	**420**
LCS-EE-20	0.01% + 1 mV, 0.01% + 1 mV	250 uV	22.0	18.5	14.5	10.0	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LM-F-20-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	23.0	20.0	17.0	13.0	F	3 1/2 x 19 x 16 1/2	**495**
LXS-7-20-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	28.0	25.0	20.5	15.5	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-20-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	28.0	25.0	20.5	15.5	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LXS-8-20-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	32.0	29.0	25.0	17.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LM-G-20-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	35.0	32.0	28.0	21.0	G	5 3/16 x 19 x 16 1/2	**625**

(2, 4, 7, 11) See page 89

Voltage and current ratings

24 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.1	1.0	0.85	0.70	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.4	1.3	1.2	1.1	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LCS-B-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.1	2.0	1.8	1.2	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-4-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.2	1.8	1.5	0.95	4	4 29/32 x 4 29/32 x 5	**135**
LM-C-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.5	2.4	2.2	1.5	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LCS-C-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.6	3.4	3.0	2.5	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LM-CC-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.0	3.7	3.4	3.0	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LM-D-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	6.7	6.3	5.8	4.8	D	4 15/16 x 7 1/2 x 9 3/8	**230**
LXS-CC-24-R (11)	0.1%, 0.1%	1.5 mV	6.8	6.4	5.7	4.4	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-CC-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.8	6.4	5.7	4.4	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LXS-D-24-R (11)	0.1%, 0.1%	1.5 mV	10.0	8.8	7.5	6.0	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	10.0	8.8	7.5	6.0	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LYS-5-24	0.1%, 0.1%	15 mV	11.0	9.6	7.5	4.5	5	3 3/16 x 4 15/16 x 15	**325**
LM-E-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	11.0	10.0	9.0	7.6	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LXS-E-24-R (11)	0.1%, 0.1%	1.5 mV	13.0	11.0	9.5	6.0	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	13.0	11.0	9.5	6.0	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LM-EE-24	0.05% + 4 mV, 0.03% + 3 mV	1 mV	14.0	12.5	10.8	9.0	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LW-D-24-A	2%, 2%	300 mV	14.7	14.0	13.2	8.8	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LXS-EE-24-R (11)	0.1%, 0.1%	1.5 mV	19.0	16.5	13.0	9.5	EE	4 15/16 x 7 1/2 x 16 1/2	**420**
LCS-EE-24	0.01% + 1 mV, 0.01% + 1 mV	250 uV	19.0	16.5	13.0	9.5	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LM-F-24-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	20.0	17.0	14.0	11.0	F	3 1/2 x 19 x 16 1/2	**495**
LXS-7-24-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	25.0	22.0	18.0	14.0	7	4 15/16 x 10 1/8 x 16 1/2	**535**
LCS-7-24-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	25.0	22.0	18.0	14.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LW-EE-24-A (7)	2%, 2%	300 mV	26.0 (23.0)	25.0 (22.0)	23.0 (20.0)	17.0 (17.0)	EE	4 15/16 x 7 1/2 x 16 1/2	**350**
LXS-8-24-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	30.0	25.0	23.5	17.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LM-G-24-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	32.0	26.0	21.0	16.0	G	5 3/16 x 19 x 16 1/2	**625**
LW-G-24-A	2%, 2%	300 mV	48.0	46.0	42.0	39.0	G	5 3/16 x 19 x 16 1/2	**675**

28 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.0	0.9	0.75	0.60	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LM-B-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.3	1.2	1.1	1.0	B	3 3/16 x 4 15/16 x 6 1/2	**119**
LCS-B-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.8	1.7	1.6	1.0	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-4-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.0	1.6	1.4	0.85	4	4 29/32 x 4 29/32 x 5	**135**
LM-C-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.3	2.1	2.0	1.4	C	3 3/16 x 4 15/16 x 9 3/8	**139**
LCS-C-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.0	2.7	2.6	2.2	C	3 3/16 x 4 15/16 x 9 3/8	**160**
LM-CC-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	3.5	3.4	3.1	2.8	CC	4 15/16 x 4 15/16 x 9 3/8	**190**
LXS-CC-28-R (11)	0.1%, 0.1%	1.5 mV	6.0	5.6	5.0	4.3	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LCS-CC-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.0	5.6	5.0	4.3	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LM-D-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	6.0	5.6	5.2	4.7	D	4 15/16 x 7 1/2 x 9 3/8	**230**
LXS-D-28-R (11)	0.1%, 0.1%	1.5 mV	9.0	8.0	6.8	5.5	D	4 15/16 x 7 1/2 x 9 3/8	**260**
LCS-D-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	9.0	8.0	6.8	5.5	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LYS-5-28	0.1%, 0.1%	15 mV	9.5	8.4	6.5	3.8	5	3 3/16 x 4 15/16 x 15	**325**
LM-E-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	10.0	9.0	8.0	7.1	E	4 15/16 x 7 1/2 x 11 3/4	**280**
LXS-E-28-R (11)	0.1%, 0.1%	1.5 mV	11.0	10.0	8.5	5.5	E	4 15/16 x 7 1/2 x 11 3/4	**320**
LCS-E-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	11.0	10.0	8.5	5.5	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LW-D-28-A	2%, 2%	300 mV	12.5	12.0	11.1	7.7	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LM-EE-28	0.05% + 4 mV, 0.03% + 3 mV	1 mV	13.0	11.5	9.8	8.2	EE	4 15/16 x 7 1/2 x 16 1/2	**355**
LXS-EE-28-R (11)	0.1%, 0.1%	1.5 mV	17.0	15.0	12.0	9.0	EE	4 15/16 x 7 1/2 x 16 1/2	**420**
LCS-EE-28	0.01% + 1 mV, 0.01% + 1 mV	250 uV	17.0	15.0	12.0	9.0	EE	4 15/16 x 7 1/2 x 16 1/2	**440**
LM-F-28-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	19.0	16.0	13.0	10.0	F	3 1/2 x 19 x 16 1/2	**495**

28 V ± 5% Lists continued next page

(2, 4, 7, 11) See page 89

MODULAR POWER SUPPLIES
SINGLE OUTPUT
FIXED VOLTAGE MODELS

Voltage and current ratings

28 VOLTS ±5% (cont'd)

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LXS-7-28-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	22.0	19.5	16.0	12.5	7	4 15/16 x 10 1/8 x 16 1/2	**$535**
LCS-7-28-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	22.0	19.5	16.0	12.5	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LW-EE-28-A (7)	2%, 2%	300 mV	22.0 (19.0)	21.0 (18.0)	20.0 (17.0)	15.0 (15.0)	EE	4 15/16 x 7 1/2 x 16 1/2	**350**
LM-G-28-R (4)	0.05% + 4 mV, 0.03% + 3 mV	1 mV	28.0	25.0	21.0	16.0	G	5 3/16 x 19 x 16 1/2	**625**
LXS-8-28-OV-R (2) (11)	0.1%, 0.1%	1.5 mV	28.0	25.5	22.5	17.0	8	4 15/16 x 12 1/8 x 16 1/2	**580**
LW-G-28-A	2%, 2%	300 mV	39.0	37.0	34.0	32.0	G	5 3/16 x 19 x 16 1/2	**675**

36 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-36	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.90	0.80	0.70	0.50	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LCS-B-36	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.4	1.3	1.1	0.7	B	3 3/16 x 4 15/16 x 6 1/2	**130**
LCS-C-36	0.01% + 1 mV, 0.01% + 1 mV	250 uV	2.3	2.2	2.1	1.6	C	3 3/16 x 4 15/16 x 9 3/8	**160**

48 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.60	0.55	0.50	0.45	A	3 3/16 x 3 3/4 x 6 1/2	**$ 99**
LCS-B-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.1	1.0	0.90	0.50	B	3 3/16 x 4 15/16 x 6 1/2	**140**
LCS-4-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.2	1.1	0.90	0.75	4	4 29/32 x 4 29/32 x 5	**145**
LCS-C-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	1.8	1.7	1.6	1.3	C	3 3/16 x 4 15/16 x 9 3/8	**175**
LM-CC-48	0.05% + 4 mV, 0.03% + 3 mV	1 mV	2.5	2.4	2.2	1.9	CC	4 15/16 x 4 15/16 x 9 3/8	**200**
LCS-CC-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	3.7	3.4	3.0	2.2	CC	4 15/16 x 4 15/16 x 9 3/8	**210**
LM-D-48	0.05% + 4 mV, 0.03% + 3 mV	1 mV	4.1	3.9	3.6	3.1	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LCS-D-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	5.2	4.7	4.1	3.4	D	4 15/16 x 7 1/2 x 9 3/8	**290**
LM-E-48	0.05% + 4 mV, 0.03% + 3 mV	1 mV	6.0	5.4	4.9	4.3	E	4 15/16 x 7 1/2 x 11 3/4	**310**
LCS-E-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	6.7	6.1	5.3	4.5	E	4 15/16 x 7 1/2 x 11 3/4	**330**
LW-D-48-A	2%, 2%	300 mV	7.6	7.3	6.8	6.2	D	4 15/16 x 7 1/2 x 9 3/8	**250**
LCS-EE-48	0.01% + 1 mV, 0.01% + 1 mV	250 uV	10.0	9.2	8.3	4.5	EE	4 15/16 x 7 1/2 x 11 3/4	**440**
LCS-7-48-OV (2)	0.01% + 1 mV, 0.01% + 1 mV	250 uV	12.0	10.5	8.5	6.0	7	4 15/16 x 10 1/8 x 16 1/2	**560**
LW-EE-48-A (7)	2%, 2%	300 mV	15.0 (13.0)	13.0 (11.0)	12.0 (10.0)	9.0 (9.0)	EE	4 15/16 x 7 1/2 x 16 1/2	**350**
LW-G-48-A	2%, 2%	300 mV	24.0	23.0	21.0	19.0	G	5 3/16 x 19 x 16 1/2	**675**

(2, 4, 7, 11) See page 89.

Voltage and current ratings

100 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-100	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.18	0.18	0.18	0.18	A	3 3/16 x 3 3/4 x 6 1/2	**$109**
LCS-B-100	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.46	0.46	0.46	0.34	B	3 3/16 x 4 15/16 x 6 1/2	**140**
LCS-C-100	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.65	0.65	0.65	0.65	C	3 3/16 x 4 15/16 x 9 3/8	**175**
LM-D-100	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.70	1.50	1.30	1.10	D	4 15/16 x 7 1/2 x 9 3/8	**250**

120 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-120	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.15	0.15	0.15	0.15	A	3 3/16 x 3 3/4 x 6 1/2	**$109**
LCS-B-120	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.40	0.40	0.40	0.30	B	3 3/16 x 4 15/16 x 6 1/2	**140**
LCS-C-120	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.55	0.55	0.55	0.55	C	3 3/16 x 4 15/16 x 9 3/8	**175**
LM-D-120	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.50	1.30	1.10	1.00	D	4 15/16 x 7 1/2 x 9 3/8	**250**

150 VOLTS ±5%

MODEL	REGULATION (line, load)	RIPPLE (RMS)	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (inches)	PRICE
LCS-A-150	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.10	0.10	0.10	0.10	A	3 3/16 x 3 3/4 x 6 1/2	**$109**
LCS-B-150	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.32	0.32	0.32	0.25	B	3 3/16 x 4 15/16 x 6 1/2	**150**
LCS-C-150	0.01% + 1 mV, 0.01% + 1 mV	250 uV	0.42	0.42	0.42	0.42	C	3 3/16 x 4 15/16 x 9 3/8	**175**
LM-D-150	0.05% + 4 mV, 0.03% + 3 mV	1 mV	1.10	1.00	0.90	0.80	D	4 15/16 x 7 1/2 x 9 3/8	**250**

MODULAR POWER SUPPLIES DUAL & DUAL TRACKING MODELS

Voltage and current ratings

±6 VOLTS TO ±3 VOLTS

MODEL	REGULATION (LINE, LOAD)	RIPPLE (RMS)	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LXD-B-062-R (11) †	0.1% , 0.1%	1.5 mV	± 6	2.7	2.4	1.9	1.4	B	3 3/16 x 4 15/16 x 6 1/2	$170
			to							
			± 3	2.1	2.0	1.6	1.2			
LXD-C-062-R (11) †	0.1% , 0.1%	1.5 mV	± 6	3.5	3.3	2.7	1.7	C	3 3/16 x 4 15/16 x 9 3/8	180
			to							
			± 3	2.6	2.4	1.9	1.3			
LYD-5-062	0.1% , 0.1%	15 mV	± 6 to ± 3	12.5	10.5	8.5	4.3	5	3 3/16 x 4 15/16 x 15	440

±15 VOLTS TO ±12 VOLTS

MODEL	REGULATION (LINE, LOAD)	RIPPLE (RMS)	ADJ. VOLT. RANGE VDC	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LXD-3-152-R (11) †	0.1% , 0.1%	1.5 mV	±15 to ±12 can also be used	0.40	0.37	0.34	0.30	3	3 3/16 x 3 5/16 x 5	$ 90
			24 to 30	0.40	0.37	0.34	0.30			
LXD-A-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	1.0	1.0	0.9	0.7	A	3 3/16 x 3 3/4 x 6 1/2	130
			to							
			± 12	0.8	0.8	0.7	0.6			
LXD-B-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	1.6	1.4	1.2	0.7	B	3 3/16 x 4 15/16 x 6 1/2	160
			to							
			± 12	1.4	1.3	1.1	0.6			
LXD-C-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	2.5	2.3	1.9	1.5	C	3 3/16 x 4 15/16 x 9 3/8	170
			to							
			± 12	2.0	1.8	1.5	1.2			
LXD-CC-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	4.0	3.7	3.2	2.4	CC	4 15/16 x 4 15/16 x 9 3/8	255
			to							
			± 12	3.0	2.7	2.3	1.8			
LXD-D-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	6.2	5.6	4.9	4.0	D	4 15/16 x 7 1/2 x 9 3/8	300
			to							
			± 12	4.5	4.1	3.7	3.0			
LYD-5-152	0.1% , 0.1%	15 mV	± 15 to ± 12	8.5	7.2	5.6	3.3	5	3 3/16 x 4 15/16 x 15	440
LXD-EE-152-R (11) †	0.1% , 0.1%	1.5 mV	± 15	12.5	11.0	9.0	7.0	EE	4 15/16 x 7 1/2 x 16 1/2	455
			to							
			± 12	10.0	9.0	7.8	6.0			

15 VOLTS ±5%

MODEL	REGULATION (LINE, LOAD)	RIPPLE (RMS)	ADJ. VOLT. RANGE VDC	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LCD-4-152	0.01% + 1 mV	250 uV	15 ± 5%	1.5	1.3	1.0	0.6	4	4 29/32 x 4 29/32 x 5	$ 230
	0.01% + 1 mV		15 ± 5%	1.5	1.3	1.0	0.6			

† ± 15 to ± 12 Volts and ± 6 to ± 3 Volts are each dual tracking outputs

(11) See page 89

MODULAR POWER SUPPLIES TRIPLE & QUADRUPLE OUTPUT MODELS

Voltage and current ratings

5 VOLTS, ±15 TO ±12 VOLTS (TRIPLE OUTPUT)

MODEL	REGULATION (LINE, LOAD)	RIPPLE (RMS)	ADJ. VOLT. RANGE VDC	MAX AMPS AT AMBIENT OF 40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LXT-D-5152-R (10) (11)	0.1%, 0.1%	1.5 mV	5 ± 5%	12.0	11.5	11.0	9.5	D	4 15/16 x 7 1/2 x 9 3/8	$395
			± 15	3.1	2.7	2.2	1.7			
			to							
			± 12	2.3	2.0	1.7	1.3			
LYT-5-5152 (10)	0.1%, 0.1%	10 mV	5 ± 5%	18.0	15.0	11.0	6.0	5	3 3/16 x 4 15/16 x 15	460
			± 15	2.0	1.8	1.6	1.3			
		3 mV	to							
			± 12	1.6	1.5	1.4	1.2			

5 VOLTS, ±15 TO ±12 VOLTS, 24 TO 28 VOLTS (QUADRUPLE OUTPUT)

MODEL	REGULATION (LINE, LOAD)	RIPPLE (RMS)	ADJ. VOLT. RANGE VDC	40°C	50°C	60°C	71°C	PKG. SIZE	DIMENSIONS (INCHES)	PRICE
LYQ-5-5153 (10)	0.1%, 0.1%	10 mV	5 ± 5%	16.0	13.5	10.0	5.0	5	3 3/16 x 4 15/16 x 15	$520
			± 15	1.5	1.35	1.2	1.0			
		3 mV	to							
			± 12	1.2	1.1	1.0	0.8			
		3 mV	24-28	1.0	0.9	0.8	0.6			

PWR SUPPLIES, STD

NOTES TO VOLTAGE AND CURRENT RATING TABLES

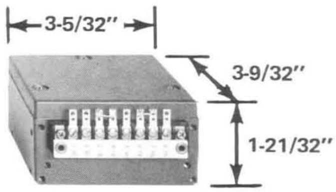
(1) LM-F & LM-G wide range models available only with overvoltage protection, meters, and fungus proofing all of which is included in the price.
(2) Built-in continuously adjustable overvoltage protection crowbars output when trip level is exceeded is included on this model.
(3) LM-H models available only with overvoltage protection, high performance option and meters, all of which are included in the price.
(4) Prices for LM-F & LM-G fixed voltage models are for the non-metered models and fungus proofing, standard. For metered models add Suffix – M to the model and $30.00 to the price.
(5) Includes fixed overvoltage protection at 6.8V ± 10%
(6) Includes fixed overvoltage protection at 7.4V ± 10%.
} overvoltage shudown may occur anywhere within the voltage trip-point range for units with built-in overvoltage protectors.
(7) Bracketed ratings are for 187 – 242 VAC, 47 – 63 Hz ("V" option) – See option section of LV-A & LW-A Series specifications.
(8) LV-G-A & LW-G-A are only available without meters.
(9) Overvoltage protection is not available on the LW-A series.
(10) 5 volt ouput has overvoltage protection fixed at 6.8V ± 10%. ± 15 to ± 12 output is dual tracking output
(11) All LX series models have fungus proofing standard and is included in model notation and price.
(A) Current rating is from zero to I_{max}. With exception of LXD Series, current rating applies over entire output voltage range.
(B) LC, LM and LX Series power modules are available for operation at 360-440 Hz. Consult factory for ratings and specifications. For 50 Hz operation, derate LC Series (except LC-1) by 10%; for LM Series delete 40°C rating; for LX Series delete 40°C rating.
(C) Prices are U.S.A. list prices only, F.O.B. Melville, N.Y.; North Hollywood, Calif.; Montreal, Canada. All prices and specifications are subject to change without notice.
The following charges are applicable for shipment from other than Melville, N.Y.

Value of Order**	Handling Charges*	Value of Order**	Handling Charges*
up to $50.00	$1.00	$301.00 to $500.00	$8.00
$ 51.00 to $180.00	$3.00		
$181.00 to $300.00	$5.00		

See pages 183 and 184 for general ordering information.
*Not applicable when shipped from Montreal to Canadian customers.

**For orders with values in excess of $500.00 add handling charges for the value(s) in the "Value of Order" list needed to cover the total value of the order being placed; for example – with an order value of $1274.00, double the $8.00 handling charge for $500.00 order value and add to it the $5.00 handling charge for the $181.00-$300.00 order value for a total handling charge of $21.00.

LAMBDA PACKAGE SIZES



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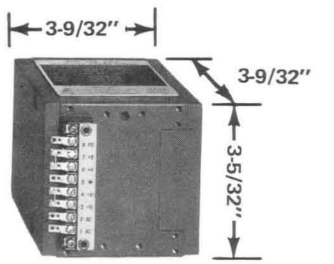
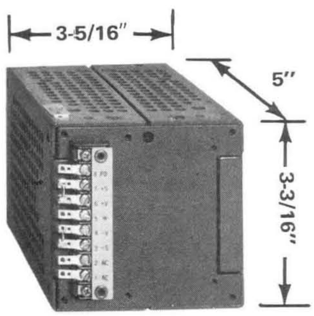
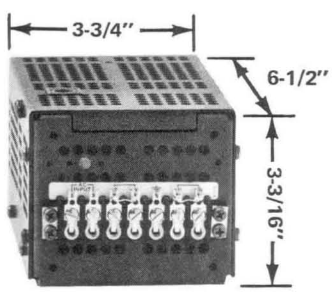


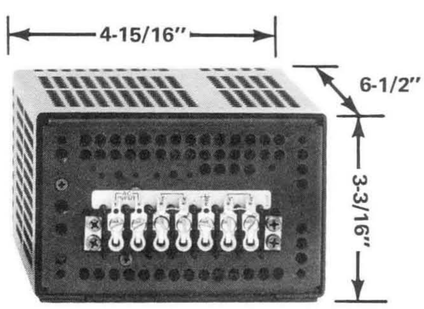
PACKAGE 2
3-5/32" x 3-9/32" x 3-9/32"



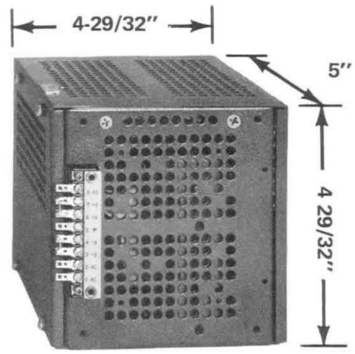
PACKAGE 3
3-3/16" x 3-5/16" x 5"



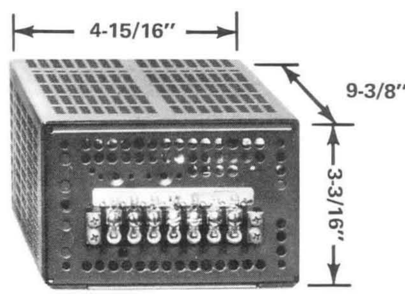
PACKAGE A
3-3/16" x 3-3/4" x 6-1/2"



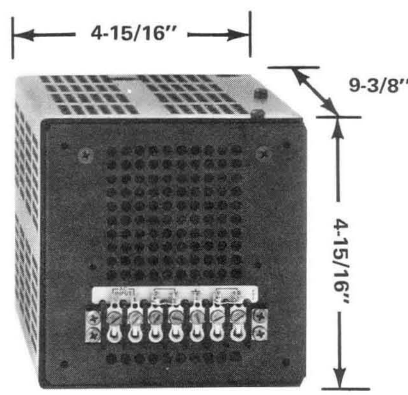
PACKAGE B
3-3/16" x 4 15/16" x 6-1/2"



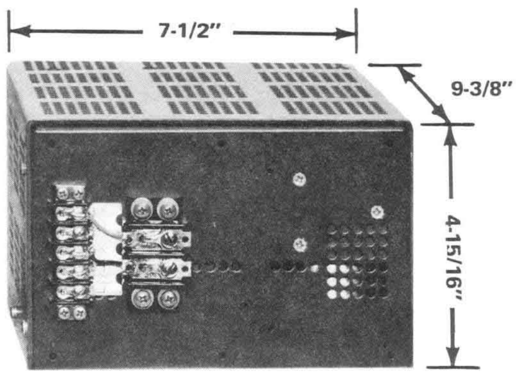
PACKAGE 4 4-29/32" x 4-29/32" x 5"



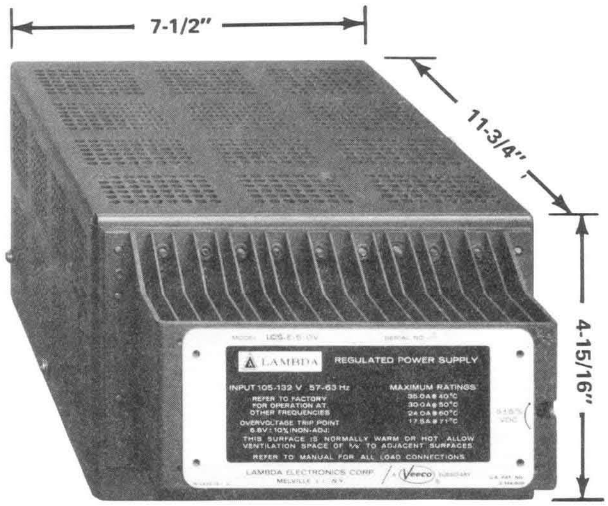
PACKAGE C 3-3/16" x 4-15/16" x 9-3/8"



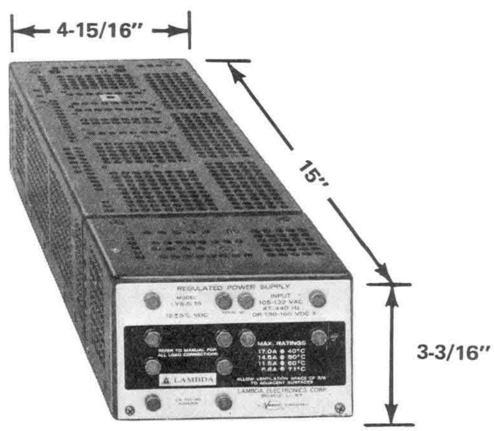
PACKAGE CC 4-15/16" x 4-15/16" x 9-3/8"



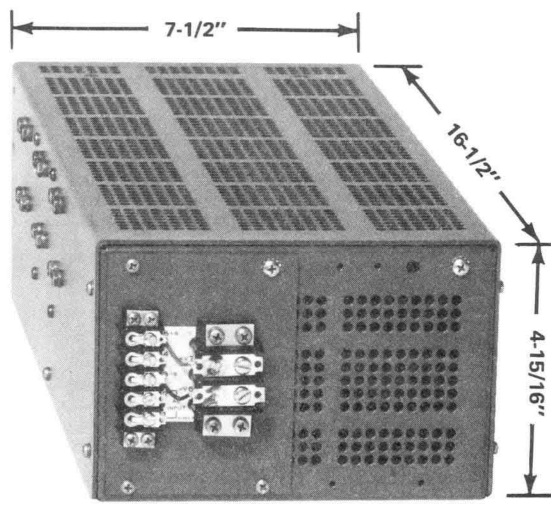
PACKAGE D 4-15/16" x 7-1/2" x 9-3/8"



PACKAGE E 4-15/16" x 7-1/2" x 11-3/4"

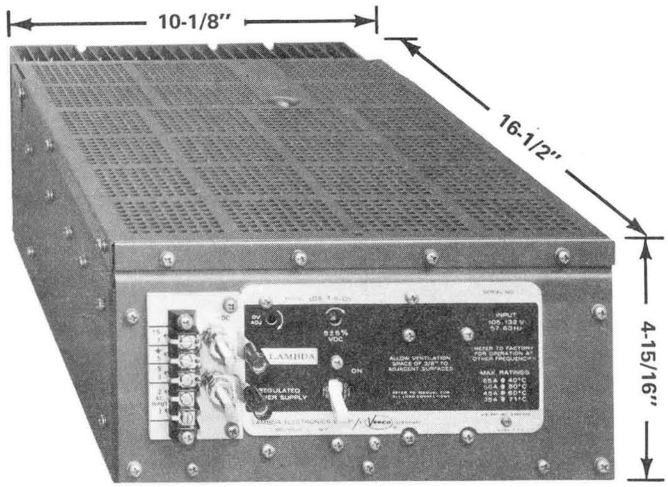


PACKAGE 5 3-3/16" x 4-15/16" x 15"

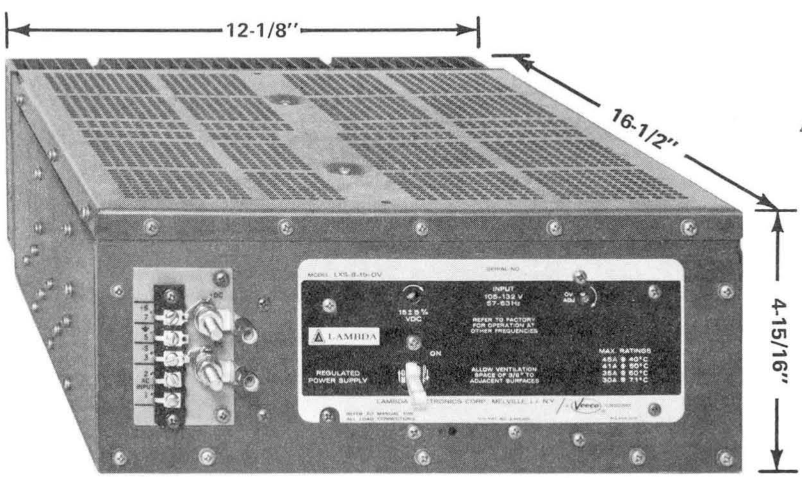


PACKAGE EE 4-15/16" x 7-1/2" x 16-1/2"

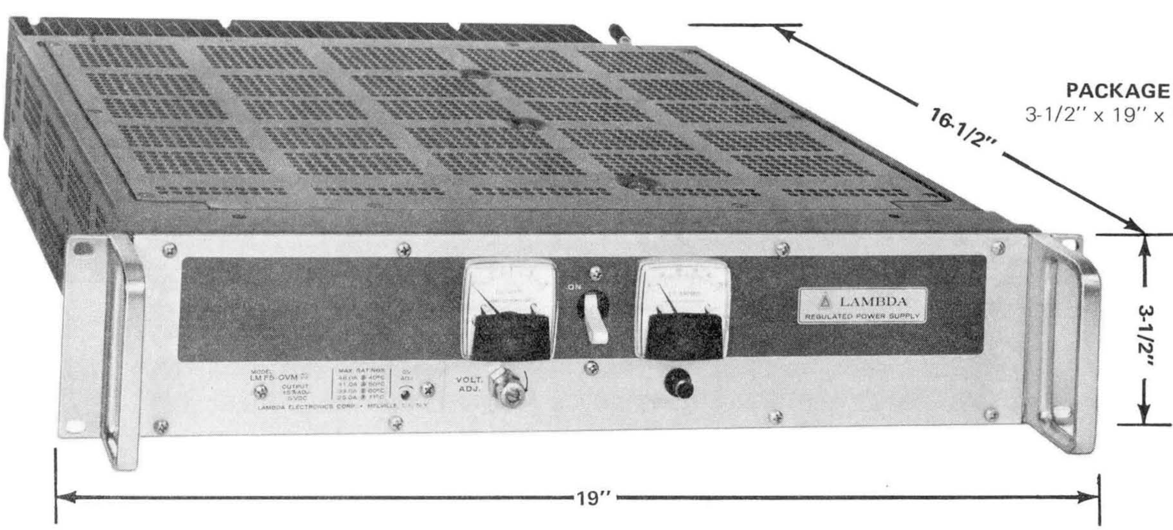
LAMBDA PACKAGE SIZES



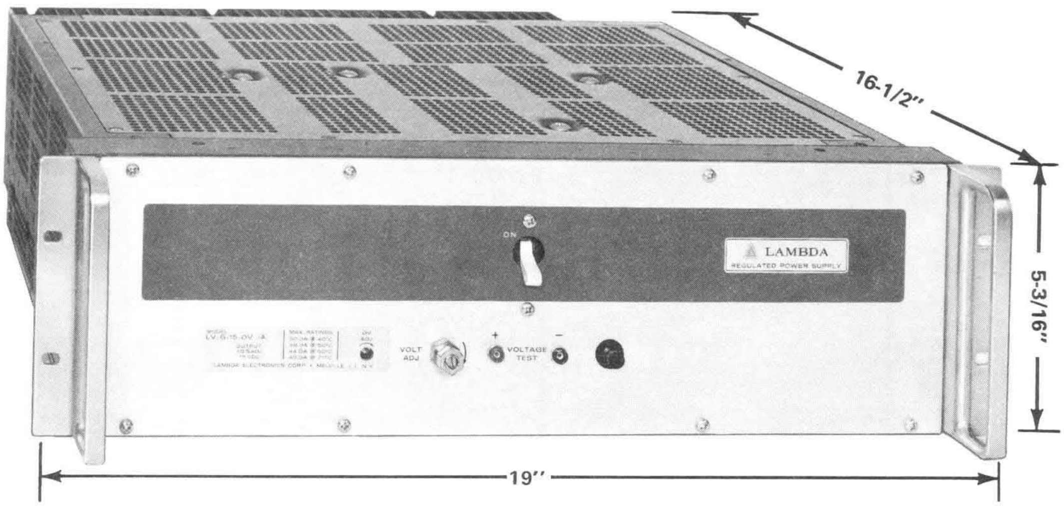
PACKAGE 7
4-15/16" x 10-1/8" x 16-1/2"



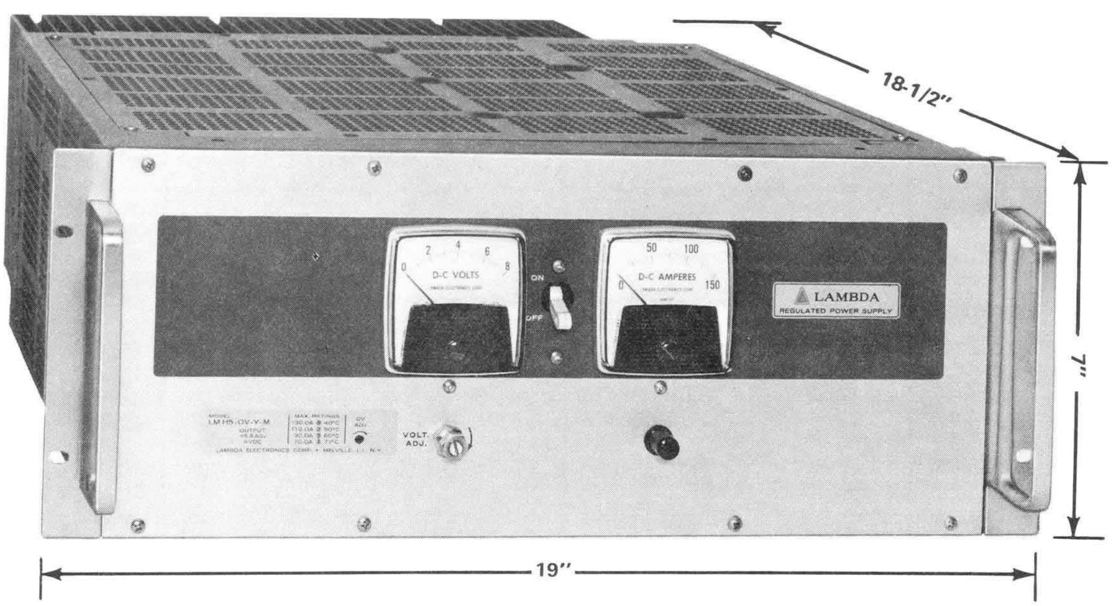
PACKAGE 8
4-15/16" x 12-1/8" x 16-1/2"



PACKAGE F
3-1/2" x 19" x 16-1/2"



PACKAGE G 5-3/16" x 19" x 16-1/2"



PACKAGE H 7" x 19" x 18-1/2"

PWR SUPPLIES, STD

MODULAR POWER SUPPLIES NON-STOCKED MODELS

Non-stocked Models	Nearest Equiv. In-stock Models
LCD-2-23	LCD-3-33
LCD-3-13	LCD-4-13
LCD-3-23	LCD-4-33
LCD-3-44	LCD-A-44
LCD-A-13	LCD-4-13
LCD-A-23	LCD-4-33
LCD-A-55	–
LCS-A-3	LCS-A-01
LCS-A-3P6	–
LCS-A-4	–
LCS-A-4P5	–
LCD-4-23	–
LCD-4-44	–
LCS-4-3	LCS-C-01
LCS-4-3P6	LCS-C-01
LCS-4-4	LCS-C-01
LCS-4-4P5	LCS-C-01
LCS-4-8	LCS-C-01
LCD-4-10	–
LCS-4-18	LMC-20
LCS-4-36	LCS-C-36
LCS-4-100	LCS-B-100
LCS-4-120	LCS-B-120
LCS-4-150	LCS-B-150
LM-201	LCS-A-01
LM-202	LCS-A-01
LM-203	LCS-A-02
LM-204	LCS-A-02
LM-206	LCS-A-03
LM-208	LCS-A-04
LM-226	LCS-C-02
LM-252	LCS-A-01
LM-258	LCS-A-02
LM-261	LCS-A-03
LM-262	LCS-B-03
LM-264	LCS-A-03
LM-266	LCS-A-04
LM-267	LCS-A-05
LM-268	–
LMB-0-60	–
LMB-3	LCS-B-01
LMB-3P6	LCS-B-01
LMB-4	LCS-B-01
LMB-4P5	LCS-B-01
LMB-8	LCS-B-01
LMB-10	LMC-0-14
LMB-18	LCS-B-20
LMB-36	LCS-B-36
LMB-48	LCS-B-48
LMB-100	LCS-B-100
LMB-120	LCS-B-120
LMB-150	LCS-B-150
LMC-0-60	–
LMC-3	LCS-C-01

Non-stocked Models	Nearest Equiv. In-stock Models
LMC-3P6	LCS-C-01
LMC-4	LCS-C-01
LMC-4P5	LCS-C-01
LMC-8	LCS-C-01
LMC-10	LMD-0-14
LMC-18	LMC-20
LMC-36	LCS-C-36
LMC-48	LCS-C-48
LMC-100	LCS-C-100
LMC-120	LCS-C-120
LMC-150	LCS-C-150
LMCC-3	LME-0-7
LMCC-3P6	LME-0-7
LMCC-4	LME-0-7
LMCC-4P5	LME-0-7
LMCC-8	LME-0-7
LMCC-10	LME-0-14
LMCC-18	LXS-CC-20-R
LMCC-36	LM-238
LMCC-100	LMD-100
LMCC-120	LMD-120
LMCC-150	LMD-150
LMD-0-60	–
LMD-3	LME-0-7
LMD-3P6	LME-0-7
LMD-4	LME-0-7
LMD-4P5	LME-0-7
LMD-8	LMEE-0-7
LMD-10	LMEE-0-14
LMD-18	LMEE-20
LMD-36	–
LME-0-60	–
LME-3	LMEE-0-7
LME-3P6	LMEE-0-7
LME-4	LMEE-0-7
LME-4P5	LMEE-0-7
LME-8	–
LME-10	–
LME-18	LME-20
LME-36	–
LME-100	–
LME-120	–
LME-150	–
LMEE-0-60	–
LMEE-3	LMF-0-7-OV-M-R
LMEE-3P6	LMF-0-7-OV-M-R
LMEE-4	LMF-0-7-OV-M-R
LMEE-4P5	LMF-0-7-OV-M-R
LMEE-8	LMF-0-7-OV-M-R
LMEE-10	LVEE-10-A-OV
LMEE-18	LMEE-20
LMEE-36	–
LMEE-48	–

Non-stocked Models	Nearest Equiv. In-stock Models
LMEE-100	–
LMEE-120	–
LMEE-150	–
LMF-3-R	LMG-0-7-OV-M-R
LMF-3P6-R	LMG-0-7-OV-M-R
LMF-4-R	LMG-0-7-OV-M-R
LMF-4P5-R	LMG-0-7-OV-M-R
LMF-8-R	–
LMF-10-R	LVEE-10-A-OV
LMF-18-R	LMG-20-R
LMF-36-R	LK-351-FM
LMF-48-R	–
LMF-100-M-R	–
LMF-120-M-R	–
LMF-150-M-R	–
LMG-3-R	–
LMG-3P6-R	–
LMG-4-R	–
LMG-4P5-R	–
LMG-6-R	LV-G-A-OV
LMG-8-R	–
LMG-10-R	–
LMG-18-R	LK-351-FM
LMG-36-R	LK-350-FM
LMG-48-R	
LMG-100-M-R	–
LMG-120-M-R	–
LMG-150-M-R	–
LMH-0-7-OV-Y-M	LK-360-FM
LMH-3P6-OV-Y-M	–
LMH-4-OV-Y-M	–
LMH-4P5-OV-Y-M	–
LMH-10-OV-Y-M	–
LMH-12-OV-Y-M	LXS-8-12-OV-R
LS-511A	LR-611-DM
LS-512A	LR-612-DM
LS-513A	LR-613-DM
LS-515A	LR-615-DM
LS-516A	LR-616-DM
LVE-3P3-A-OV	–
LVE-4-A-OV	–
LVE-4P5-A-OV	–
LVE-5-A-OV	LXS-E-5-OV-R
LVE-6-A-OV	LXS-E-6-R
LVEE-3-A-OV	–
LVEE-3P6-A-OV	–
LVEE-4-A-OV	–
LVEE-4P5-A-OV	–
LVG-3-A-OV	–
LVG-3P6-A-OV	–
LVG-4-A-OV	–
LVG-4P5-A-OV	–
LVG-10-A-OV	–

Non-stocked Models	Nearest Equiv. In-stock Models
LVG-12-A-OV	LXS-8-12-OV-R
LVG-15-A-OV	LXS-8-15-OV-R
LWEE-3-A	–
LWEE-3P6-A	–
LWEE-4-A	–
LWEE-4P5-A	–
LWEE-10-A	–
LWEE-18-A	–
LWEE-20-A	–
LWG-3-A	–
LWG-3P6-A	–
LWG-4-A	–
LWG-4P5-A	–
LWG-10-A	–
LWG-18-A	LK-360-FM
LWG-20-A	LK-360-FM
MIL-E-CD-2-11	–
MIL-E-CD-2-12	–
MIL-E-CD-2-13	–
MIL-E-CD-2-22	–
MIL-E-CD-2-23	–
MIL-E-CD-2-33	–
MIL-E-CD-2-44	–
MIL-E-CD-2-55	–
MIL-E-CS-1-01	–
MIL-E-CS-1-02	–
MIL-E-CS-1-03	–
MIL-E-CS-1-04	–
MIL-E-CS-1-05	–
MIL-E-CS-2-01	–
MIL-E-CS-2-02	–
MIL-E-CS-2-03	–
MIL-E-CS-2-04	–
MIL-E-CS-2-05	–
MIL-S-CD-2-11	–
MIL-S-CD-2-12	–
MIL-S-CS-2-13	–
MIL-S-CD-2-22	–
MIL-S-CD-2-23	–
MIL-S-CD-2-33	–
MIL-S-CD-2-44	–
MIL-S-CD-2-55	–
MIL-S-CS-1-01A	–
MIL-S-CS-1-02A	–
MIL-S-CS-1-03A	–
MIL-S-CS-1-04A	–
MIL-S-CS-1-05A	–
MIL-S-CS-2-01	–
MIL-S-CS-2-02	–
MIL-S-CS-2-03	–
MIL-S-CS-2-04	–
MIL-S-CS-2-05	–

Please consult factory for price and delivery. Models designated non-stocked may be available from stock at any given time of inquiry.

SPECIFICATIONS OF LC SERIES

DC output

Voltage range shown in tables

Regulated voltage

regulation, line	0.01% + 1 mV
regulation, load	0.01% + 1 mV
ripple and noise	250μV RMS, 1mV pk-pk
remote programming resistance	1000 ohms/volt, nominal
remote programming voltage	volt per volt
temperature coefficient	(0.01% + 300 μV)/°C with external programming resistor; (0.015% + 300μV/°C with internal programming resistor).

AC input

line	105-132 VAC; 47-440 Hz. Derate 10% for 50 Hz operation. For operation at other than 57-63 Hz and 187-242 VAC, see AC input option.
power	LCS-1 13 watts; LCS-2, LCD-2 20 watts; LCS-3, LCD-3 40 watts; LCS-A 80 watts; LCD-A 55 watts; LCS-4, LCD-4 125 watts; LCS-B 125 watts. LCS-C 215 watts; LCS-CC 300 watts; LCS-D 460 watts; LCS-E 600 watts; LCS-EE 850 watts; LCS-7 1300 watts.

Overshoot

no overshoot on turn-on, turn-off or power failure

Ambient operating temperature range

continuous duty from −20°C to +71°C with corresponding load current ratings for all modes of operation.

Storage temperature range

−55°C to +85°C

Overload protection

Thermal

thermostat; automatic reset when over-temperature condition is eliminated. (Not applicable to LCS-1, LCS-3, LCD-3, LCS-A, and LCD-A models.)

Electrical

external overload protection: automatic electronic current limiting circuit limits the output current to a preset value thereby providing protection for the load as well as the power supply.

Input and output connections

thru terminal block on chassis.

Integrated circuit regulation

integrated circuit provides regulation system, except for input and output capacitors, rectifiers and series regulation transistors.

Convection cooled

no external heat sinking or forced air required.

Number of package sizes

twelve (12). Package 1, 2, 3, A, B, 4, C, CC, D, E, EE, 7

Controls

DC output control

simple screwdriver voltage adjustment over entire voltage range.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation. A terminal (RP) is provided, for remote programming which eliminates interaction with internal voltage control, on LCS-CC, LCS-D, LCS-D, LCS-E, LCS-EE and LCS-7 models.

Current limit

140% of 40°C rating for LCS-1, LCS-2, LCD-2, LCS-3, LCD-3, LCS-A, LCD-A, 110% of 40°C rating for LCS-4, LCD-4, LCS-B, LCS-C, LCS-CC, LCS-D, LCS-E, LCS-EE, LCS-7.

Mounting

LCS-1 five mounting surfaces; LCS-2, LCD-2 four mounting surfaces; LCS-3, LCD-3, LCS-A, LCD-A, LCS-4, LCD-4, LCS-B, LCS-C, LCS-CC, and LCS-D three mounting surfaces, designed to mount in Lambda standard rack adapters. LCS-E LCS-EE and LCS-7 one mounting surface in horizontal plane.

Physical Data

Weight:

LCS-1 1 lb. net, 1 7/8 lbs. ship; LCS-2, LCD-2 2 1/4 lbs. net, 3 1/8 lbs. ship; LCS-3, LCD-3 3 1/2 lbs. net, 4 1/2 lbs. ship; LCS-A 6 lbs. net, 7 lbs. ship; LCD-A 5 lbs. net, 6 lbs. ship; LCS-4, LCD-4 8 lbs. net, 9 lbs. ship; LCS-B 7 lbs. net, 8 lbs. ship; LCS-C 10 lbs. net, 11 lbs. ship; LCS-CC 15.0 lbs. net, 17.0 lbs. ship; LCS-D 23.0 lbs. net, 26.0 lbs. ship; LCS-E 28 lbs. net, 31 lbs. ship; LCS-EE 37.0 lbs. net, 47.0 lbs. ship; LCS-7 48 lbs. net, 60 lbs. ship.

Size

LCS-1 3 5/32" x 3 9/32" x 1 21/32" single output models; LCS-2, LCD-2, 3 5/32" x 3 9/32" x 3 9/32" single and dual output models; LCS-3, LCD-3 3 3/16" x 3 5/16" x 5" single and dual output model; LCS-A, LCD-A 3 3/16" x 3 3/4" x 6 1/2" single and dual output models; LCS-4, LCD-4 4 29/32" x 4 29/32" x 5" single and dual output models; LCS-B 3 3/16" x 4 15/16" x 6 1/2" single output models; LCS-C 3 3/16" x 4 15/16" x 9 3/8" single output models; LCS-CC 4 15/16" x 4 15/16" x 9 3/8" single output models; LCS-D 4 15/16" x 7 1/2" x 9 3/8" single output models; LCS-E 4 15/16" x 7 1/2" x 11 3/4" single output models; LCS-EE 4 15/16 x 7 1/2" x 16 1/2" single output models; LCS-7 4 15/16" x 10 1/8" x 16 1/2" single output models.

Finish

gray, FED. STD. 595 No. 26081

Accessories

rack adapters, overvoltage protectors, chassis slides and blank panels. See pages 102-104

Option

A.C. input

add suffix -V to model number for operation at 187-242 VAC 47-440 Hz, and derate current 10% for 47-53 Hz operation. Add 12% or $15.00 to price, whichever is greater. For 360-440 Hz operation consult factory. "V" option not available on LCS 1 series. For operation of LCS 1 series at 47-53 Hz see tables for derating.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applied to operation at full published specifications at end of 5 years.

SPECIFICATIONS OF LX SERIES

DC Output

voltage ranges shown in tables

Regulated voltage

regulation, line	0.1%
regulation, load	0.1%
ripple and noise	1.5 mV RMS, 5 mV pk-pk with either positive or negative terminal grounded
temperature coefficient	0.03%/°C
remote programming resistance	1000 ohms/volt, nominal for package A, 4, 7, 8, CC, D, E and EE models 200 ohms/volt nominal for package B and C models
remote programming voltage	volt/volt (LXS units only)

AC input

line	105-132 VAC; 47-440 Hz. For 187-242 VAC, see A.C. input options. For operation of LXS-E LX-EE, LXS-7, and LXS-8 units at 50 Hz or at 400 Hz, consult factory. Ratings apply to 57-63 Hz. For all other models delete 40°C rating for 50 Hz operation.
power	LXD-3 35 watts; LXS-A 90 watts; LXD-A 90 watts; LXS-B 125 watts; LXD-B 115 watts; LXS-4 140 watts; LXS-C 215 watts; LXD-C 185 watts; LXS-CC 300 watts; LXS-D 460 watts; LXS-EE 700 watts; LXD-CC 300 watts; LXD-D 425 watts; LXT-D 500 watts; LXD-EE 850 watts. LXS-7 1300 watts LXS-8 1500 watts

Ambient operating temperature range

continuous duty from 0° to +71°C with corresponding load current ratings for all modes of operation.

Storage temperature range

–55°C to +85°C

Tracking accuracy (dual models)

2% absolute voltage difference; 0.2% change for all conditions of line, load and temperature.

Overload protection

Thermal

thermostat, automatic reset when over-temp. condition is removed. (Not applicable to LXD-3); circuit breaker must be reset on LX-8 models.

Electrical

external overload protection, automatic electronic current limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply.

Overshoot

no overshoot on turn-on, turn-off or power failure.

Input and output connections

through terminal block on chassis; output terminals on LX-7, LX-8 models are two heavy duty studs.

Power Hybrid Voltage Regulator or integrated circuit regulation

some models have Power Hybrid Voltage Regulator providing complete regulation system while others have an integrated circuit providing regulation system except for input and output capacitors, rectifiers and series regulation transistors

Convection Cooled

no external heat sinking or forced air required

Number of package sizes

eleven (11) packages 3, A, B, 4, C, CC, D, E, EE, 7 and 8

Controls

DC output Control

simple screwdriver voltage adjustment over entire voltage range.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Transformer

MIL-T-27C, Grade 6

Mounting

three mounting surfaces, designed to mount in Lambda standard rack adapters. LX-E, LX-EE, LX-7 and LX-8 models have only one mounting surface in horizontal plane.

Accessories

rack adapters, blank panels, chassis slides; overvoltage protectors are available for all models except 5V models which have built-in fixed overvoltage protection at 6.8 volts ±10%, and 6V LXS-EE models at 7.4 volts ±10%. All LXS-7, LXS-8 units have built-in continuously adjustable overvoltage protection.

Options

AC input

add suffix "V" to model number for operation at 187-242 VAC, 47-440 Hz, and add 12% or $30.00 to the price, whichever is greater.

Physical data

Weight

LXD-3 3.0 lbs. net, 4.0 lbs. ship; LXS A, LXD-A 6.0 lbs. net, 7.0 lbs. ship; LXS-B, LXD-B 7.0 lbs. net, 8.0 lbs. ship; LXS-4 8.5 lbs. net, 9.5 lbs. ship; LXS-C, LXD C 10.0 lbs. net 11.0 lbs. ship; LXS CC, LXD-CC 15.0 lbs. net, 17.0 lbs. ship; LXS-D, LXD-D, LXT-D 23.0 lbs. net 26.0 lbs. ship; 23.0 lbs. net, 26.0 lbs. ship; LXS-E 28.0 lbs. net, 31.0 lbs. ship; LXS-EE, LXD-EE 37.0 lbs. net, 47.0 lbs. ship; LXS-7 48.0 lbs. net, 60 lbs. ship; LXS-8 58.0 lbs. net, 70.0 lbs. ship.

Size

LXD-3, 3 3/16" x 3 5/16" x 5" dual output models; LXS-A, LXD-A, 3 3/16" x 3 3/4" x 6 1/2" single and dual output models; LXS-B, LXD-B, 3 3/16" x 4 15/16" x 6 1/2" single and dual output models; LXS-4, 4 29/32" x 4 29/32" x 5" single output models; LXS-C, LXD-C, 3 3/16" x 4 15/16" x 9 3/8" single and dual output models; LXS-CC, LXD-CC, 4 15/16" x 4 15/16" x 9 3/8",single and dual output models; LXS-D, LXD-D, LXT-D, 4 15/16" x 7 1/2" x 9 3/8" single, dual and triple output models; LXS-E, 4 15/16" x 7 1/2" x 11 3/4" single output models; LXS-EE, LXD-EE, 4 15/16" x 7 1/2" x 16 1/2" single and dual output models LXS-7, 4 15/16" x 10 1/8" x 16 1/2" single output models, LXS-8, 4 15/16" x 12 1/8" x 16 1/2" single output models.

Finish

gray, FED. STD. 595 No. 26081.

Fungus proofing

All fungi nutrient components are rendered fungi inert with MIL – V-173 varnish – Standard on all LX models and is included in price.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

SPECIFICATIONS OF LM SERIES

DC output

voltage range shown in tables

Regulated voltage

regulation, line	0.05% plus 4 mV for line variations from 105-132 Vac. 0.01% plus 1.0 mV for line variations from 105-132 VAC.("Y" option)
regulation, load	0.03% plus 3 mV for load variations from 0 to full load. 0.02% plus 2 mV for load variations from 0 to full load. ("Y" option)
remote programming resistance	200 ohms/volt, nominal
remote programming voltage	volt per volt
ripple and noise	1 mV RMS, 3 mV pk-pk with either pos. or neg. terminal grounded. 0.5 mV RMS, 1.5 mV pk-pk with 60 Hz input. ("Y" option)
temperature coefficient	0.03%/°C; 0.01%/°C ("Y" option)

AC input

line	105-132 VAC: 45-440 Hz. 40°C rating not applicable for 50 Hz operation. for 400 Hz operation consult factory. 187-242 VAC, see AC input option.		
power*	LM-B	Models,	80 watts;
	LM-C	Models,	140 watts;
	LM-CC	Models,	220 watts;
	LM-D	Models,	300 watts;
	LM-E	Models,	450 watts;
	LM-EE	Models,	750 watts;
	LM-F	Models,	900 watts;
	LM-G	Models,	1300 watts;
	LM-H	Models,	2200 watts.

*With output loaded to 40°C rating, input 132 VAC and 55-65 Hz.

Ambient operating temperature range

continuous duty from −20°C to +71°C ambient with corresponding load current ratings for all modes of operation and mounting positions.

Storage temperature range

−55°C to +85°C

Overload protection

Thermal

thermostat; automatic reset when over-temperature condition is eliminated. Circuit breaker must be reset on LM-H models.

Electrical

external overload protection: fixed, automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for load as well as power supply.

Overshoot

no overshoot on turn-on, turn-off, or power failure

Input and output connections

heavy duty terminal block on rear of chassis; output terminals on LM-F, LM-G, and LM-H are two heavy duty studs.

Controls

DC output control

simple screwdriver voltage adjustment over entire voltage range.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Meters

voltmeter and ammeter on metered models of LM-F, G, and H.

Mounting

three surfaces, each with tapped mounting holes, can be utilized for mounting LM-B, C, CC, and D Models. One mounting surface for E and EE Models, and only in the horizontal plane. Designed to mount in Lambda Standard Rack Adapters. LM-F, G and H Models are full rack supplies.

Physical data

Weight

LM-B Models, 6 lbs. net, 7 lbs. ship; LM-C Models, 9 lbs. net, 10 lbs. ship; LM-CC Models, 15 lbs. net 17 lbs. ship. LM-D Models, 20 lbs. net, 23 lbs. ship; LM-E Models, 28 lbs. net, 31 lbs. ship; LM-EE Models, 37 lbs. net, 47 lbs. ship; LM-F Models, 54 lbs. net, 64 lbs. ship; LM-G Models, 72 lbs. net, 84 lbs. ship; LM-H Models, 110 lbs. net, 145 lbs. ship.

Size

see tables.

Finish

LM-B, C, CC, D, E, EE, F, G, and H—grey, FED. STD. 595 No. 26081, LM-F, G, H front panels brushed aluminum clear anodized panels with grey inlay (standard).

Accessories

rack adapters, chassis slides, overvoltage protectors, metered and non-metered panels, blank panels. see pages 102-104.

Options

High performance

add suffix "-Y" — all models available with these specifications for $15.00 extra: line regulation .01% + 1 mV; Load regulation .02% + 2 mV; Ripple and noise — with 60 Hz input: 0.5 mV RMS; 1.5 mV pk-pk with either positive or negative terminal grounded; Temp. coeff. .01%/°C. These specifications are standard on all H Packages and are included in the price.

AC input

add suffix "-V" — for operation at 187-242 VAC. Add 12% or $15.00 to the price, whichever is greater.

Fungus proofing

add suffix "-R" — all models can be obtained with MIL-V-173 varnish for all fungi nutrient components. LM-B thru EE at $10.00 surcharge; LM-H at $15.00 surcharge. All LM-F, LM-G models have all fungi nutrient components rendered fungi inert with MIL-V-173 varnish - standard and included in price.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

SPECIFICATIONS OF LV-A SERIES

DC output

voltage range: refer to tables.

Regulated voltage

regulation, line	0.15% + 10 mV for line variations from 105-132 Vac.
regulation, load	0.15% + 10 mV, no load to full load or full load to no load.
ripple and noise	ripple reducer; 10 mV RMS, 100 mV max. p-p as measured with 25 MHz bandwidth oscilloscope.
remote programming resistance	200 ohms/volt nominal
remote programming voltage	volt per volt
temperature coefficient	(0.03% + 0.5 mV)/°C.

AC input

line	105-132 VAC, 57-63 Hz
power	LV-EE-A Models, 850 watts; LV-G-A Models, 1350 watts.

Turn-on time

2 sec. max.

Overshoot

no overshoot on turn-on, turn-off, or power failure

Efficiency

greater than 50%, with advanced SCR circuitry.

Ambient operating temperature range

0°C to + 71°C

Storage temperature range

−55°C to +85°C

Overload protection

Thermal

thermostat on LV-EE-A model, automatic reset when over-temperature condition is eliminated; circuit breaker must be reset on all LV-G-A models.

Electrical

external overload protection: fixed, automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for loads as well as power supply.

internal failure protection: provided by fuse.

Overvoltage protection

built-in, continuously adjustable overvoltage protection crowbars output when trip level is exceeded. Included on all models.

Input connections

heavy duty terminal block on rear of chassis.

Output connections

2 heavy duty studs on rear of chassis; 1/4" -28 on EE package, 5/16" -24 on G package.

Convection cooled

no external heat sinking or forced air required.

Number of package sizes

two (2) packages, EE, G.

Controls

DC output control

screwdriver voltage adjustment over entire voltage range.

Overvoltage protector control

screwdriver adjustment covers entire operating range.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Mounting

one surface with tapped mounting holes for mounting LV-EE-A models in horizontal plane only; designed to mount in standard Lambda rack adapters. LVG-A is rack mounted.

Physical data

Weight

LV-EE-A models, 60 lbs. net, 75 lbs. ship; LV-G-A models, 120 lbs. net, 140 lbs. ship.

Size

LV-EE-A, 4 15/16" H x 7 1/2" W x 16 1/2" D; LV-G-A, 5 1/4" H x 19"W x 16 1/2" D (full rack).

Finish

LV-EE-A, and G-A grey FED STD. 595 No. 26081. LV G-A Front panel — brushed aluminum clear anodized panels with grey inlay (standard).

Accessories

rack adapters, chassis slides, blank panels. See pages 102-104.

Options

AC input

add suffix "V" to LV-EE-A models only for operation at 187-242 VAC. 47-63 Hz and add 12% to the price; see voltage tables for current derating.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

SPECIFICATIONS OF LW-A SERIES

DC output

voltage range: refer to tables

Regulated voltage

regulation, line	2% for line variations from 105-132 VAC.
regulation, load	2%, 20% load to full load or full load to 20% load, or 2% full load to no load with a 20% preload throughout voltage adjust range.
ripple and noise	300 mV RMS, max., or 2% of output voltage, whichever is greater.
remote programming resistance	200 ohms/volt nominal
remote programming voltage	volt per volt
temperature coefficient	(0.03% + 0.5 mV)/°C

AC input

line	105-132 VAC, 57-63 Hz
power	LW-D-A Models, 450 watts; LW-EE-A Models, 850 watts; LW-G-A Models, 1350 watts.

Overshoot

no overshoot on turn-on, turn-off, or power failure.

Efficiency

greater than 50%, with advanced SCR circuitry.

Ambient operating temperature range

0°C to +71°C

Storage temperature range

−55°C to + 85°C

Overload protection

Thermal

thermostat on all LW-D-A and LW-EE-A models, automatic reset when over-temperature condition is eliminated; circuit breaker must be reset on LW-G-A models.

Electrical

external overload protection: fixed, automatic electronic current limiting circuit limits the output current upon external overloads, including short circuit, thereby providing protection for load as well as power supply.

internal failure protection: provided by input fuse.

Input connections

heavy duty terminal block on rear of chassis.

Output connections

2 heavy duty studs on rear of chassis, 1/4"-28 on all D and EE packages except LW-D-18-A thru 48-A; 5/16"-24 on all G packages.

Convection cooled

no external heat sinking or forced air required.

Number of package sizes

three (3) packages D, EE, G.

Controls

DC output control

screwdriver voltage adjustment over entire voltage range.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Mounting

one surface with tapped mounting holes for LW-EE-A models; three surfaces for LW-D-A; designed to mount in standard Lambda rack adapter. LW-G-A is rack mounted.

Physical data

Weight

LW-D-A models, 40 lbs. net, 50 lbs. ship; LW-EE-A models, 60 lbs. net, 75 lbs. ship; LW-G-A models, 120 lbs. net, 140 lbs. ship.

Size

LW-D-A, 4 15/16"H x 7 1/2"W x 9 3/8"D; LW-EE-A, 4 15/16"H x 7 1/2"W x 16 1/2D; LW-G-A, 5 3/16"H x 19" W x 16 1/2"D (full rack).

Finish

LW-D-A, EE-A, G-A grey, FED. STD. 505 No. 26081. LW-G-A Front Panel—brushed aluminum clear anodized panels with grey inlay (standard).

Options

AC input

add suffix "V" to LW-EE-A models only for operation at 187-242 VAC. 47-63 Hz and add 12% to the price; see voltage tables for current derating.

Accessories

rack adapters, chassis slides, blank panels. See pages 102-104.

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

SPECIFICATIONS OF LY SERIES

DC output

voltage range: refer to tables

regulation, line	0.1% for line variations from 105-132 VAC.
regulation, load	0.1% for load variations from 0 to full load
remote programming resistance	1000 ohms/volt (not applicable on dual tracking models)
remote programming voltage	volt/volt (not applicable on dual tracking outputs)
ripple and noise	10 mV RMS, 35 mV p-p for LYS-5-5, -6 and LYD-5-062 models; 15 mV RMS, 100 mV p-p for LYS-5-12, -15, -20, -24, -28 and LYD-5-152 models.
LYT & LYQ models	10 mV RMS, 50 mV p-p on 5 Vdc output; 3 mV RMS, 70 mV p-p on ±15 to ±12 Vdc output; 3 mV RMS, 70 mV p-p on 24-28 Vdc output.
temperature coefficient	0.03%/°C.
power failure	output will remain within regulation for 20 ms after power failure on LYS-5-5-OV, LYS-5-6, LYD-5-062, LYT-5-5152, and LYQ-5-5153 models.

AC input

line	105-132 VAC 47-440 Hz
power	LYS-5-5-OV 280 watts; LYS-5-6 280 watts; LYS-5-12 thru LYS-5-28 405 watts. LYD-5-062 280 watts; LYD-5-152 405 watts; LYT-5-5152 320 watts; LYQ-5-5153 320 watts.

DC input

145 VDC ± 10%

Overshoot

no overshoot on turn-on, turn-off, or power failure

Efficiency

greater than 50%, with advanced 20 KHz switching circuitry

Ambient operating temperature range

continuous duty from 0°C to + 71°C with load current ratings as shown in tables

Storage temperature range

-55°C to 85°C

Tracking accuracy (dual tracking outputs)

2% absolute voltage difference; 0.2% change for line, load and temperature.

Overload protection

Thermal

thermostat, automatic reset when over-temperature condition is removed.

Electrical

external overload protection: automatic factory preset electronic current limiting circuit limits the output current thereby providing protection for the load as well as the power supply.

internal failure protection: provided by fuse.

Input and output connections

heavy duty terminal block on rear of chassis.

Controls

DC output controls

one voltage adjustment control for single or dual tracking outputs.

two voltage adjustment controls for independent dual outputs.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Overvoltage protection

built in fixed overvoltage protection on all models with 5 VDC outputs. Non-adjusting trip point is 6.8 VDC ± 10%.

For all other voltages, optional overvoltage protection available.

Mounting

two surfaces with tapped mounting holes, designed to mount in Lambda standard rack adapters LRA-10 and LRA-11. For convection cooled operation mount with top or right side facing up and only in horizontal plane. See pages 103, 147.

Physical data

Weight:	Size:
11½ lbs. net 13 lbs. ship	3 3/16" x 4 15/16" x 15"

Finish:

gray, Fed. Std. 595 No. 26081.

Options

AC input

add suffix "V" to model number for operation at 187-242 VAC, 47-440 Hz and add 12% to the price. "V" option only available on single output models.

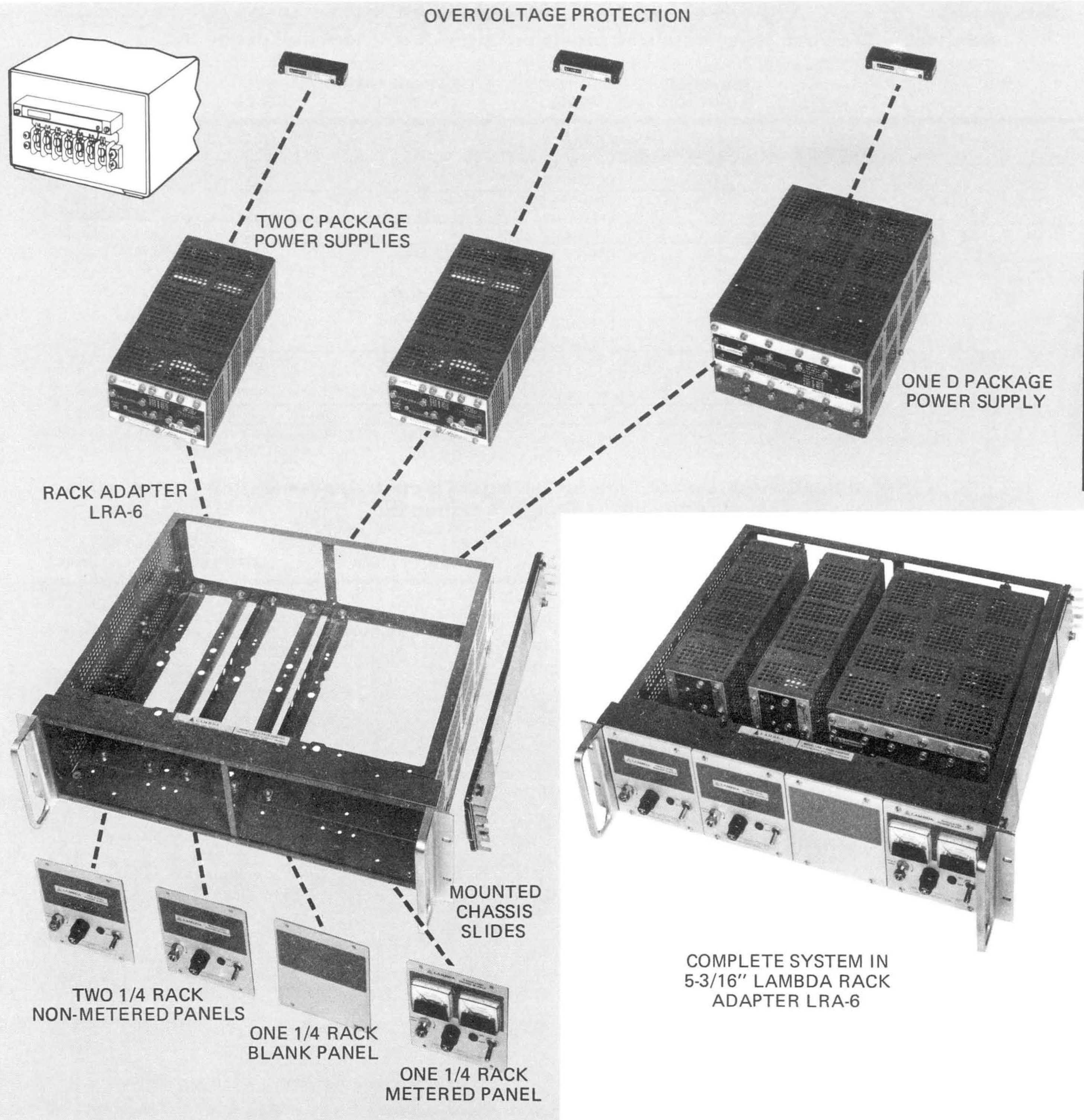
Accessories

rack adapters, overvoltage protectors (only one overvoltage protection unit required for dual tracking outputs). See pages 102-104.

Guaranteed for 5 years

5 year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

LAMBDA
MODULAR POWER SUPPLIES
ACCESSORIES



COMPLETE SYSTEM IN
5-3/16" LAMBDA RACK
ADAPTER LRA-6

ACCESSORIES FOR LAMBDA MODULAR POWER SUPPLIES

OVERVOLTAGE PROTECTOR ACCESSORIES

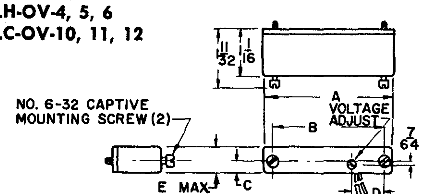
Adjustable Crowbar Type, Mounting provisions provided, 2 terminal connections

ADJ. VOLT. RANGE VDC	MODEL	FOR USE WITH PACKAGES	PRICE
3-24	**LC-OV-10**		$20
3-47	**LC-OV-11**	1, 2 & 3	20
3-70	**LC-OV-12**		25
3-24	**LH-OV-4**	Wide range models in	35
3-47	**LH-OV-5**	Packages A, B, 4, C, D, and E	35
3-70	**LH-OV-6**		35
3-8	**LM-OV-1**	Fixed voltage models in	30
6-20	**LM-OV-2**	Packages A, 4, B, C, CC, CA,	30
18-70	**LM-OV-3**	DB,DC,5,D,DA, E,and LXD-EE	30
3-8	**LM-OV-7**	All LM-EE, LCS-EE	75
6-20	**LM-OV-8**	LXS-EE	75
18-70	**LM-OV-9**		75
	Add Suffix "-OV" to Model No. OV is then built in	LM-F & LM-G	90
–	Built-in OV(2)	LM-H, LCS-7, LXS-7, LXS-8	–

Non-adjustable Crowbar Type for P-C board mounting or mounting directly onto DC output terminals

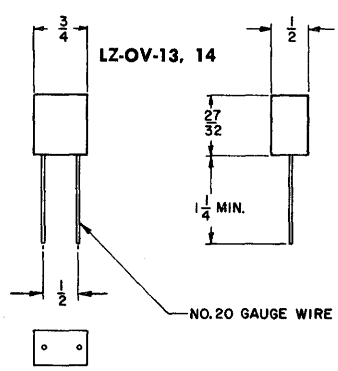
CROWBAR VOLTAGE VDC	MODEL	FOR USE WITH MODELS	PRICE	CROWBAR VOLTAGE VDC	MODEL	FOR USE WITH MODELS	PRICE
6.8±10%(4)	**LZ-OV-13**	**LCS-1-01A, LCS-2-01, LCS-3-01, LCS-A-01, LCD-2-11, LCD-3-11, LCD-H-11, LCD-A-11, LZS-10, LZS-30, LZD-21, LZD-31, LZT-36 (5V Output), LCS-1-02A, LCS-2-02**	$10	16.8±1.3V(4)	**LZ-OV-14**	**LCS-3-02, LCS-4-02, LCS-A-02, LCS-A-15, LCS-B-02, LCD-2-22, LZS-11, LZS-20, LCD-3-22, LCD-4-22, LZS-33, LZD-22, LZD-23, LZD-32, LZT-36 (±15V Output)**	$10

LM-OV-1, 2, 3
LH-OV-4, 5, 6
LC-OV-10, 11, 12

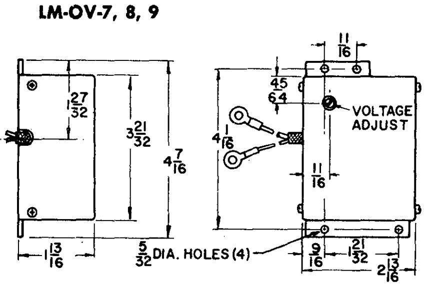


MODEL	A	B	C	D	E
LM,LHOV SERIES	3 13/32	3	5/16	3/8	5/8
LCOV SERIES	3 1/16	2 21/32	15/64	1 1/32	37/64

LZ-OV-13, 14



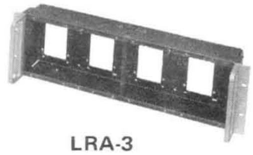
LM-OV-7, 8, 9



Notes:

1. Only one (1) overvoltage protector accessory is required for both outputs on LT and LX Series dual output power supplies.
2. LM-H, LCS-7, LXS-7, LXS-8 packages and all LV-A series models are only available with built-in overvoltage protection, price of which is included.
3. Overvoltage protection is not available on the LW-A Series.
4. Overvoltage shutdown may occur anywhere within the voltage trip-point range.
5. All dual LC series supplies require one overvoltage protector for each output.

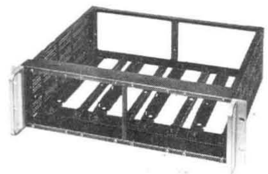
RACK ADAPTERS



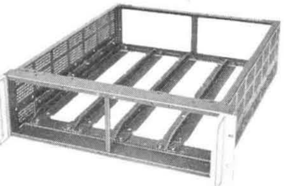
LRA-3

LRA-4

LRA-5



LRA-6



LRA-7

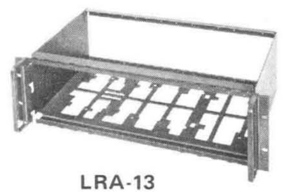
LRA-8

LRA-9

LRA-10

LRA-11

LRA-12



LRA-13

STANDARD RACK ADAPTERS (1)

MODEL	DIMENSIONS H x W x D	FOR USE WITH PACKAGES	PRICE
LRA-3 (2) (3)	5 3/16" x 19" x 2 9/16"	A,B,C,CC,D,E	**$35**
LRA-4	3 1/2" x 19" x 14"	A,B,C	**60**
LRA-5 (3)	3 1/2" x 19" x 2 9/16"	A,B,C	**35**
LRA-6	5 3/16" x 19" x 14"	A,B,C,CC,D,E,CA,DA	**60**
LRA-7	5 3/16" x 19" x 21"	A,B,C,CC,D,E,EE,CA,DA	**70**
LRA-8	3 1/2" x 19" x 14"	1,2,3,A,B,C	**$70**
LRA-9	1 3/4" x 19" x 14"	1	**60**
LRA-10	5 3/16" x 19" x 14"	1,2,3,A,4,B,C,CC,5,D,CA, DA	**70**
LRA-11	5 3/16" x 19" x 21"	1,2,3,A,4,B,C,CC,5,D E,EE,CA,DA,7,8	**70**
LRA-12	3 1/2" x 19" x 10"	A,B,C,1,2,3	**25**
LRA-13	5 3/16" x 19" x 10"	A,B,C,CC,D,E,1,2,3,4,5, CA,DA	**25**

NOTES:
(1) LRA-1 and -2 rack adapters are for use with Lambda power instruments, see page 141.
(2) Except the LXD-CC, LXS-D, LXD-D, LXT-D, LXSE, LCS-D, LCS-E, and LW-D-A.
(3) All models of LCS-A and LCD-A series and model LXD-A-152 require one spacer kit (KT-1 @ $2.00/Kit) for mounting each unit in LRA-3 and LRA-5.

See pages 145-148 for rack adapter dimensional drawings and quantity of each package size allowed.

CHASSIS SLIDES (4)

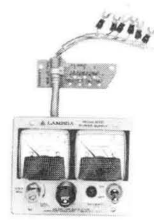
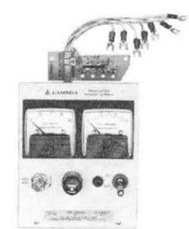
KHT-20-001 KHT-34-003 KHT-44-008 KHT-28-009 KHT-36-004

FOR USE WITH RACK ADAPTERS AND FULL RACK POWER SUPPLIES	LAMBDA PART NO.	ADD TO PRICE
LRA-4,LRA-6,LRA-8,LRA-10, LM-F, LM-G, LV-G-A, LW-G-A	**KHT-34-003**	**$ 60**
LMH	**KHT-36-004**	**110**
LRA-7,LRA-11	**KHT-44-008**	**60**
LRA-9	**KHT-28-009**	**60**
LRA-12,LRA-13	**KHT-20-011**	**30**

NOTE:
(4) To order rack adapters, or full rack power supplies with chassis slides, add suffix "-CS" to model number (Example: LRA-11-CS, LM-G-5-CS) and add price of chassis slides.

ACCESSORIES FOR LAMBDA MODULAR POWER SUPPLIES

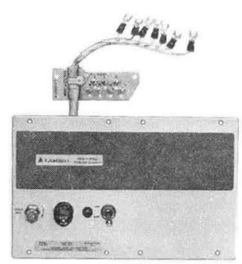
METERED PANELS

MODEL	WIDTH	FOR USE WITH LM PACKAGES	FOR USE WITH RACK ADAPTERS	HEIGHT	PRICE
MP-3	¼ rack	A, B, C	LRA-4, LRA-5	3 1/2"	$65
MP-5	¼ rack	A, B, C, CC, D, E	LRA-3, LRA-6	5 1/16"	65
MP-50	½ rack	EE	LRA-7	5 1/16"	75

Metered panels include voltmeter, ammeter, screwdriver voltage adjust, switch, pilot light, fuse, fanning strip and cabling for connecting to power supply, and an auxiliary terminal board for customer's external connections. Panel finish: brushed aluminum clear anodized panel with grey inlay (standard). To order, specify panel number **which must be followed by the model number of the power supply with which it will be used.** Example: MP-3 LM-B-3. For metered panels with fungus proofing, add suffix "R" to the model number and $10.00 to the price.

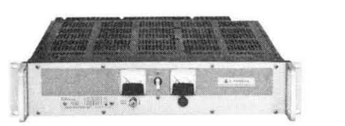
NON-METERED PANELS

MODEL	WIDTH	FOR USE WITH LM PACKAGES	FOR USE WITH RACK ADAPTERS	HEIGHT	PRICE
P-3	¼ rack	A, B, C	LRA-4, LRA-5	3 1/2"	$40
P-5	¼ rack	A, B, C, CC, D, E	LRA-3, LRA-6	5 3/16"	45
P-50	½ rack	EE	LRA-7	5 3/16"	50

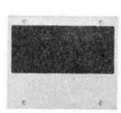
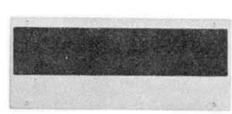
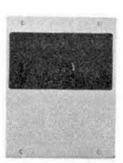
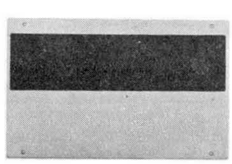
Non-metered panels include screwdriver voltage adjust, switch, pilot light, fuse, fanning strip and cabling for connecting to the power supply, and an auxiliary terminal board for customer's external connections. Panel finish: brushed aluminum clear anodized panel with grey inlay (standard). To order, specify panel number, **which must be followed by the model number of the power supply with which it will be used.** Example: P-3 LM-B-3. For non-metered panels with fungus proofing, add suffix "-R" to the model number and add $10.00 to the price of sub-rack models and $15.00 to the price of full-rack models.

METERS (VOLT AND AMP)



Full rack LM Series packages F and G are available metered or non-metered. For addition of meters, add suffix "-M" to the model number and add $30.00 to the price.

BLANK PANELS

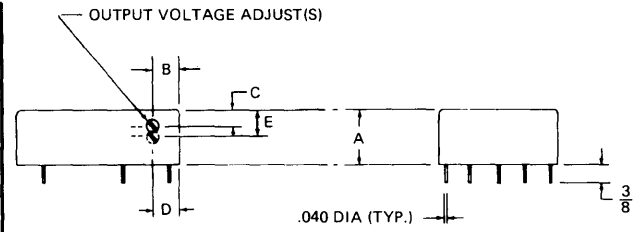
MODEL	SIZE	PRICE
	(For use with 3 1/2" Height Rack Adapters LRA-4, LRA-5)	
LBP-60	3 1/2" H, 1/4 rack width	$ 5.00
LBP-50	3 1/2" H, 1/2 rack width	10.00
LBP-30	3 1/2" H, full rack width	10.00
	(For use with 5 3/16 Height Rack Adapters LRA-3, LRA-6, LRA-7)	
LBP-10	5 3/16" H, 1/4 rack width	$ 5.00
LBP-20	5 3/16" H, 1/2 rack width	10.00
LBP-40	5 3/16" H, full rack width	10.00
	(For use with 1 3/4" Height Rack Adapter LRA-9)	
SB-1	1/16 Panel, 1 1/64" width	$ 2.50
SB-2	1/8 Panel, 2 1/32" width	5.00
SB-3	1/4 Panel, 4 1/16" width	10.00
SB-4	1/2 Panel, 8 9/16" width	10.00
SB-5	Full Panel, 16 23/32" width	10.00

MODEL	SIZE	PRICE
	(For use with 3 1/2" Height Rack Adapter LRA-8, LRA-12)	
SB-6	1/16 Panel, 1 1/64" width	$ 2.50
SB-7	1/8 Panel, 2 1/32" width	5.00
SB-8	1/4 Panel, 4 1/16" width	10.00
SB-9	1/2 Panel, 8 9/16" width	10.00
SB-10	Full Panel, 16 23/32" width	10.00
	(For use with 5 3/16" Height Rack Adapters LRA-10, LRA-11, LRA-13)	
SB-11	1/16 Panel, 1 1/64" width	$ 2.50
SB-12	1/8 Panel, 2 1/32" width	5.00
SB-13	1/4 Panel, 4 1/16" width	10.00
SB-14	1/2 Panel, 8 9/16" width	10.00
SB-15	Full Panel, 16 23/32" width	10.00

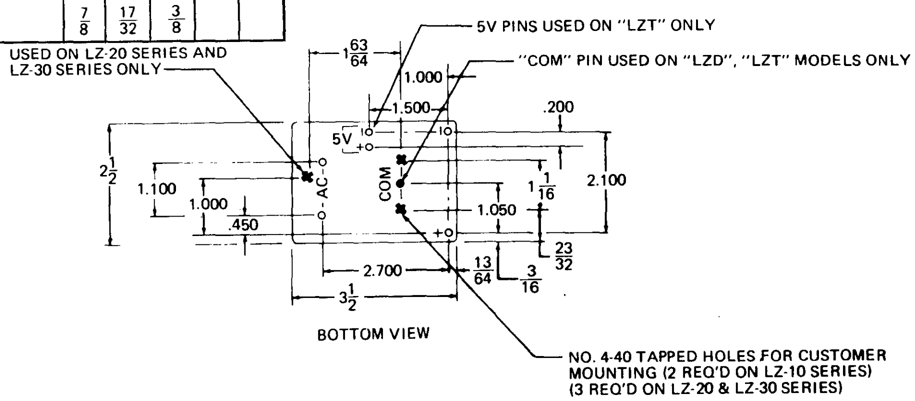
DIMENSIONAL DRAWINGS
LUS SUPPLY, LZ SERIES — COMMERCIAL TYPE POWER SUPPLIES
MODULAR SUPPLIES-PACKAGE SIZE 1

LZ SERIES
LUS SUPPLY

MODEL	A	B	C	D	E
LZS-10 SERIES	7/8	17/32	3/8	–	–
LZD-12	7/8	43/64	17/32	–	–
LZ-20 SERIES	1 1/4	17/32	3/8	–	–
LZS-30 LZD-31 SERIES	1 7/8	17/32	3/8	–	–
LZT-36	1 7/8	17/32	3/8	43/64	1 15/32
LUS	7/8	17/32	3/8		

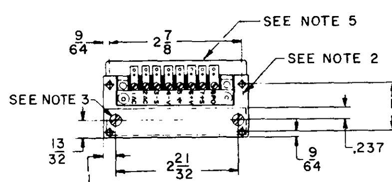


SIDE VIEW
END VIEW

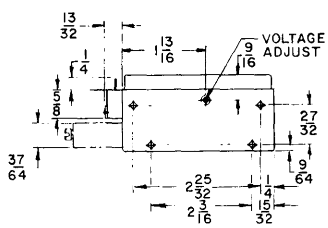


BOTTOM VIEW

LCS-1 SERIES



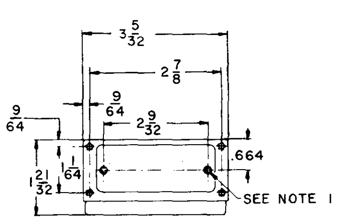
REAR VIEW
LCS-I SERIES



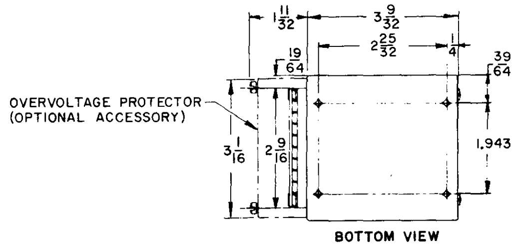
RIGHT SIDE

NOTES:

1. WHEN MOUNTING ON THIS SURFACE, CUSTOMER MUST PROVIDE CLEARANCE FOR NO. 4-40 COVER SCREWS.
2. WHEN MOUNTING ON THIS SURFACE, CUSTOMER MUST PROVIDE CLEARANCE FOR BARRIER STRIP.
3. TWO HOLES FOR MOUNTING O.V. PROTECTOR. WHEN PROTECTOR IS USED, THIS SURFACE CANNOT BE USED AS A MOUNTING SURFACE.
4. ALL MOUNTING HOLES ARE TAPPED FOR NO. 6-32 SCREWS.
5. THIS SURFACE CANNOT BE USED FOR MOUNTING.
6. CUSTOMERS MOUNTING SCREWS MUST NOT PROTRUDE INTO UNIT BY MORE THAN 3/8".



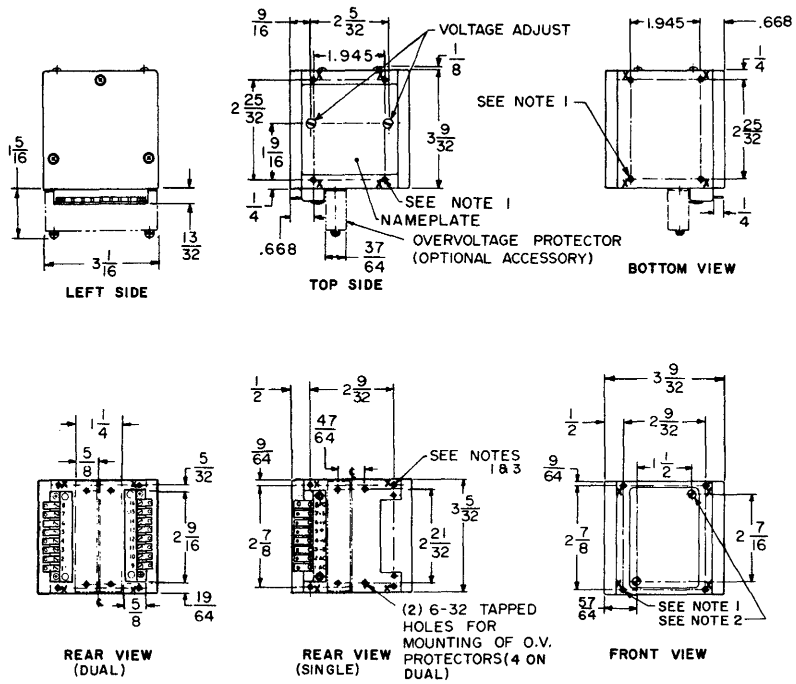
FRONT VIEW



BOTTOM VIEW

DIMENSIONAL DRAWINGS MODULAR SUPPLIES PACKAGE SIZES 2 AND 3

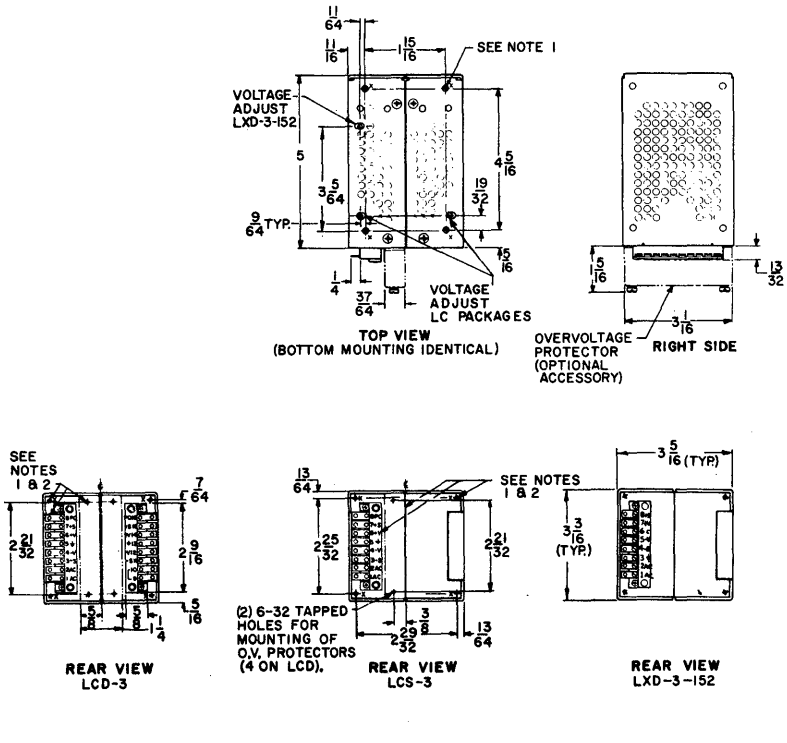
LCS-2, LCD-2 SERIES



NOTES:

1. HOLES MARKED "X" ARE 6-32 TAPPED HOLES FOR USE AS CUSTOMER MOUNTING HOLES. MTG HOLES ON BOTTOM SURFACE ARE IDENTICAL TO MTG HOLES ON TOP.
2. CUSTOMER MUST PROVIDE CLEARANCE FOR 4-40 PAN HD. SCREW (2 REQ.) FOR FLUSH MOUNTING ON THIS SURFACE.
3. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR COMPONENTS SHOWN FOR FLUSH MOUNTING ON THIS SURFACE.

LCS-3, LCD-3 SERIES
LXD-3 SERIES

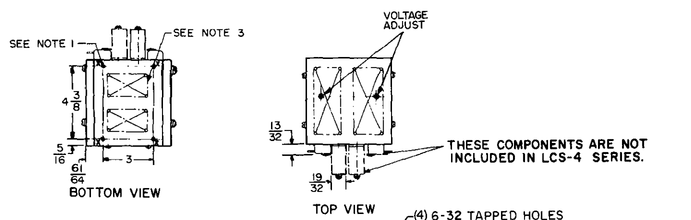


NOTES:

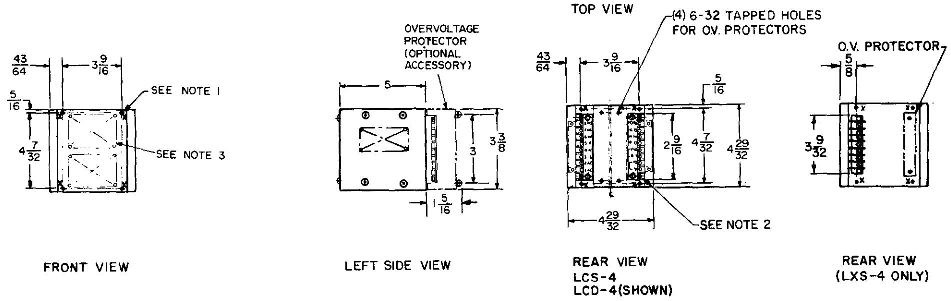
1. HOLES MARKED "X" ARE 6-32 TAPPED HOLES FOR USE AS CUSTOMER MOUNTING HOLES.
2. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR COMPONENTS SHOWN FOR FLUSH MOUNTING ON THIS SURFACE.
3. CUSTOMER MUST PROVIDE CUT-OUT IN HIS MOUNTING SURFACE TO CLEAR VENTILATION PATTERNS.

DIMENSIONAL DRAWINGS MODULAR SUPPLIES PACKAGE SIZES 4, A, B, C

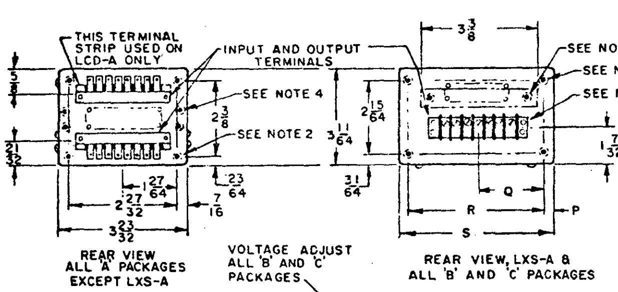
LCS-4, LCD-4 SERIES
LXS-4 SERIES

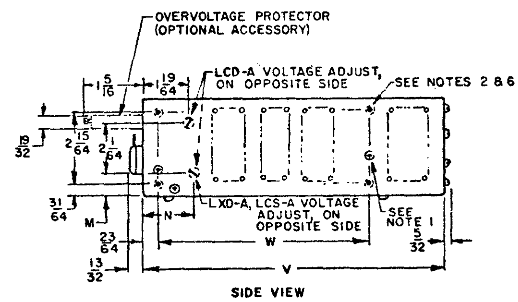


NOTES:
1. HOLES MARKED "X" ARE 8-32 TAPPED HOLES FOR USE AS CUSTOMER MOUNTING HOLES.
2. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR COMPONENTS SHOWN FOR FLUSH MOUNTING ON THIS SURFACE.
3. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR VENTILATION PATTERNS TO ALLOW CIRCULATION.
4. CUSTOMERS MOUNTING SCREW MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 3/8".

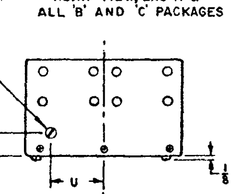


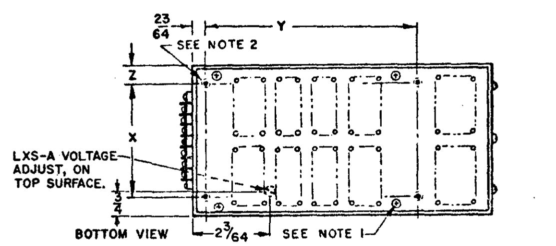
LCS-A, LCD-A SERIES
LCS-B, LXS-B, LXD-B, LM-B SERIES
LCS-C, LXS-C, LXD-C, LM-C SERIES
LXS-A, LXD-A SERIES





NOTES:
1. PROVIDE CLEARANCE HOLES, AS REQUIRED, FOR SCREW HEADS LOCATED ON BOTTOM OF "B" AND "C" PACKAGE SUPPLIES, AND ON SIDE OF "A" PACKAGE SUPPLIES.
2. NO. 8-32 TAPPED HOLES (4 ON EACH SURFACE) FOR CUSTOMER CHASSIS MOUNTING.
3. 8 POSITION TERMINAL STRIP USED ON MODELS LCS-B, LCS-C, LXD-B AND LXD-C.
4. TWO NO. 6-32 TAPPED HOLES FOR MOUNTING OVERVOLTAGE PROTECTOR (FOUR ON LCD-A).
5. CUSTOMERS MOUNTING SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 3/8". 1/4" FOR LCS-C, LXD-C & LXS-C SERIES.
6. THIS MOUNTING HOLE NOT USED ON LXS-A SERIES MODELS.





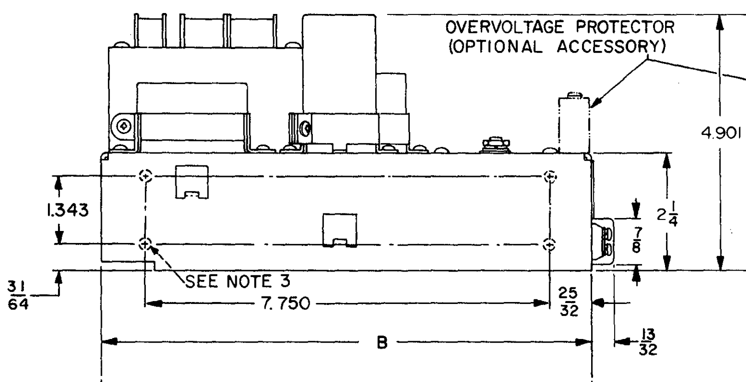
MODEL	M	N	P	Q	R	S	T	U	V	W	X	Y	Z
LXD-A SERIES	33/64	1 27/32	7/16	1 27/64	2 27/32	3 23/32	—	—	6 1/2	5 1/16	2 27/32	5 5/16	27/64
LXS-A SERIES	—	—	7/16	1 27/64	2 27/32	3 23/32	—	—	6 1/2	5 1/16	2 27/32	5 5/16	27/64
LCD-A, LCS-A SERIES	19/32	1 13/32	7/16	1 27/64	2 27/32	3 23/32	—	—	6 1/2	5 1/16	2 27/32	5 5/16	27/64
LCS-B, LXD-B, LXS-B SERIES	—	—	27/64	2 1/64	4 1/32	4 29/32	13/16	2 1/8	6 1/2	5 1/16	3 3/4	5 1/16	9/16
LCS-C, LXD-C, LXS-C SERIES	—	—	27/64	2 1/64	4 1/32	4 29/32	13/16	2	9 3/8	6 57/64	3 3/4	6 57/64	9/16
LM-B SERIES	—	—	27/64	2 1/64	4 1/32	4 29/32	2 15/64	31/32	6 1/2	5 1/16	3 3/4	5 1/16	9/16
LM-C SERIES	—	—	27/64	2 1/64	4 1/32	4 29/32	1 3/16	1 45/64	9 3/8	6 57/64	3 3/4	6 57/64	9/16

PWR SUPPLIES, STD

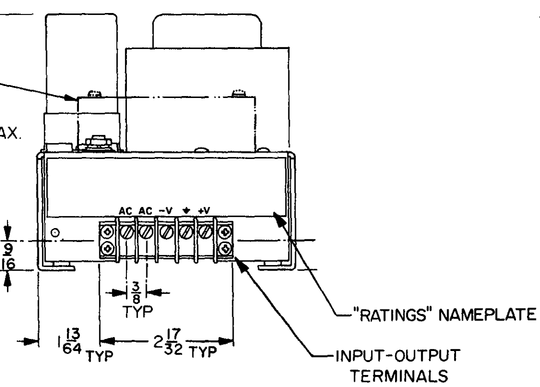
DIMENSIONAL DRAWINGS
MODULAR SUPPLIES
PACKAGE SIZE CA, DB, DC

LT- SERIES

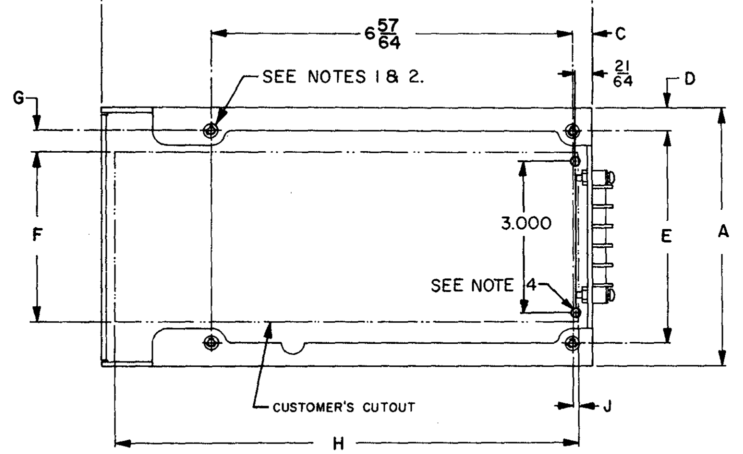
SIDE VIEW



FRONT VIEW



LTS-CA SERIES



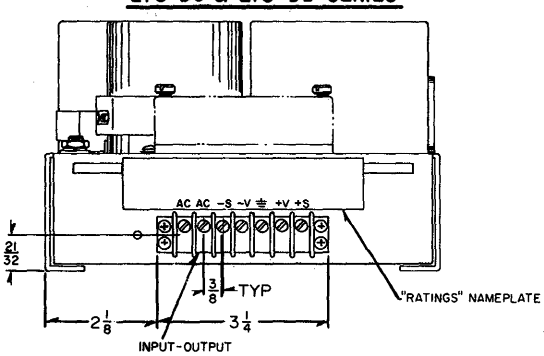
BOTTOM VIEW

NOTES:

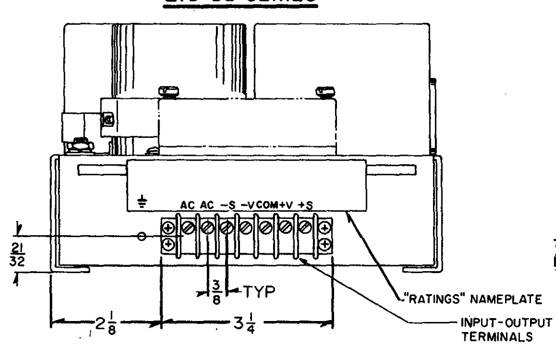
1. 8-32 TAPPED HOLES, 4 ON BOTTOM SURFACE, ARE FOR CUSTOMER CHASSIS MOUNTING.
2. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO UNIT BY MORE THAN 3/8".
3. $.213^{+.003}_{-.000}$ DIA. HOLES, FARSIDE, USED FOR CUSTOMER CHASSIS MOUNTING. (-CA SERIES ONLY)
4. TWO .156 DIA. HOLES FOR MOUNTING OVERVOLTAGE PROTECTOR.

MODEL	A	B	C	D	E	F	G	H	J
LTS-CA, LTD-CA SERIES	$4\frac{15}{16}$	$9\frac{5}{16}$	$\frac{23}{64}$	$\frac{7}{16}$	$4\frac{1}{16}$	$3\frac{1}{4}$	$\frac{13}{32}$	$8\frac{13}{16}$	$\frac{1}{8}$
LTS-DB, LTD-DB SERIES LTS-DC SERIES	$7\frac{1}{2}$	$10\frac{1}{2}$	$1\frac{17}{64}$	$\frac{31}{64}$	$6\frac{9}{16}$	$5\frac{13}{16}$	$\frac{3}{8}$	10	$\frac{15}{16}$

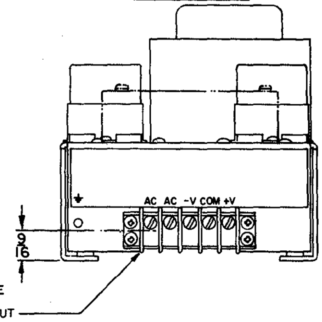
LTS-DC & LTS-DB SERIES



LTD-DB SERIES

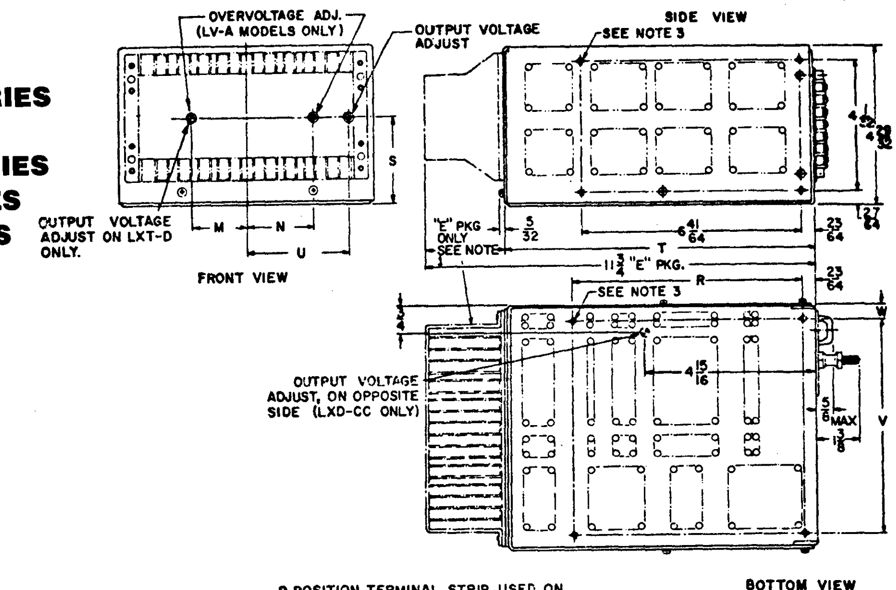


LTD-CA-SERIES



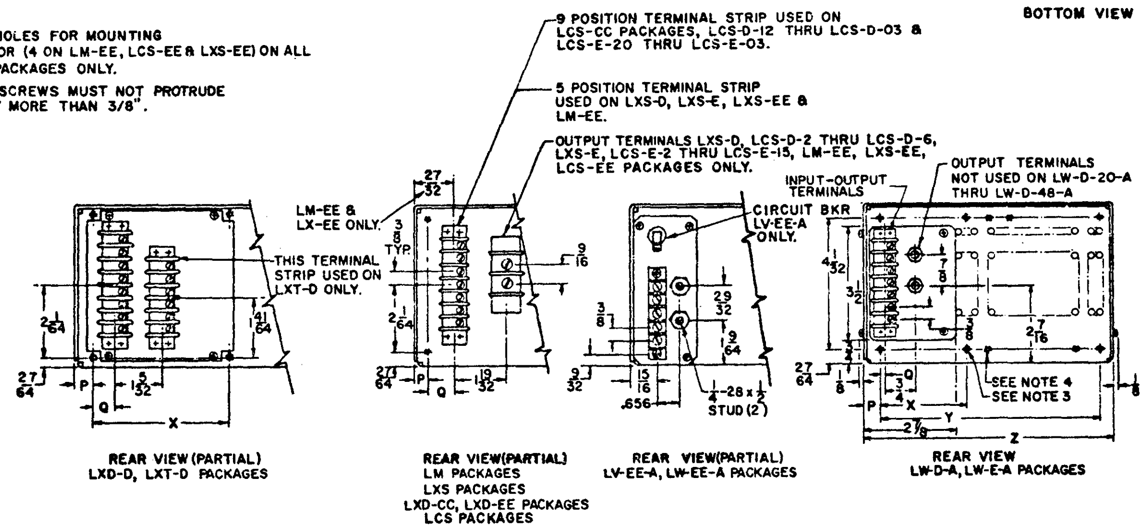
DIMENSIONAL DRAWINGS
MODULAR SUPPLIES
PACKAGE SIZES CC, D, E, EE

LM-CC, LCS-CC — SERIES
LXS-CC, LXD-CC — SERIES
LM-D, LCS-D, LXS-D, LWD-A — SERIES
LXD-D, LXT-D — SERIES
LM-E, LV-E-A, LXS-E, LCS-E — SERIES
LM-EE, LV-EE-A, LW-EE-A — SERIES
LXS-EE, LXD-EE, LCS-EE — SERIES



NOTES:

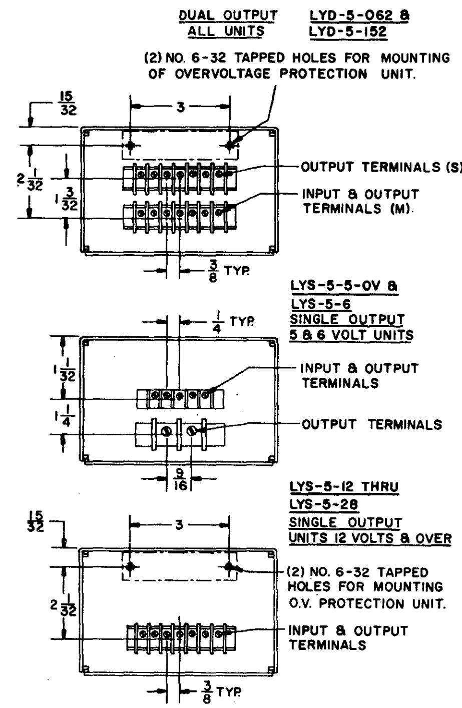
1. "E" PACKAGE MUST BE MOUNTED WITH RADIATOR FINS VERTICAL.
2. PROVIDE 5/16 DIA. CLEARANCE HOLES FOR SCREW HEADS ON SIDE OF ALL UNITS.
3. 8-32 TAPPED HOLES, 6 ON REAR SURFACE OF "D" AND "E" PACKAGES (4 ON LM-CC), 4 EACH ON BOTTOM AND SIDE SURFACES, FOR CUSTOMER CHASSIS MOUNTING (4 ON BOTTOM ONLY OF "EE" PACKAGES).
4. TWO NO. 6-32 TAPPED HOLES FOR MOUNTING OVERVOLTAGE PROTECTOR (4 ON LM-EE, LCS-EE & LXS-EE) ON ALL LC, LX & LM SERIES PACKAGES ONLY.
5. CUSTOMERS MOUNTING SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 3/8".



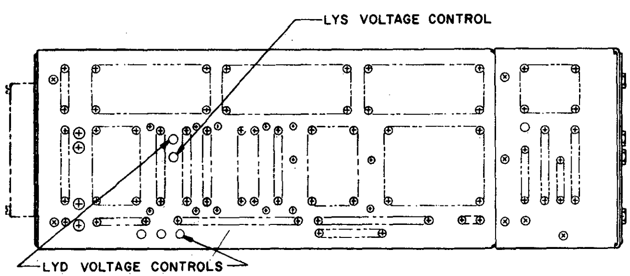
MODEL	M	N	P	Q	R	S	T	U	V	W	X	Y	Z
LM-CC, LXS-CC, LCS-CC SER.	—	—	31/64	47/64	6 57/64	2 11/16	9 3/8	1 23/32	4 1/16	7/16	—	3 61/64	4 15/16
LXS-D SERIES	—	—	31/64	11/32	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 1/4	6 33/64	7 1/2
LM-D SERIES	—	—	31/64	47/64	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 1/4	6 33/64	7 1/2
LM-E SERIES	—	—	31/64	47/64	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 1/4	6 33/64	7 1/2
LM-EE, LX-EE, LCS-EE SER.	—	—	—	—	12 3/8	2 9/32	16 1/2	2 15/16	6 9/16	31/64	—	—	7 1/2
LCS-D-12 THRU LCS-D-03, LCS-E-20 " LCS-E-03	—	—	31/64	1 3/32	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 61/64	6 33/64	7 1/2
LV-EE-A, LW-EE-A SERIES	1 3/4	—	—	—	12 3/8	1 3/8	16 1/2	1 7/16	6 9/16	31/64	—	—	7 1/2
LW-D-A SERIES	—	1 29/32	3/8	9/32	6 57/64	2 49/64	9 3/8	3 1/64	6 9/16	31/64	2 3/4	6 3/4	7 1/2
LXD-CC SERIES	—	—	31/64	19/32	6 57/64	—	9 3/8	—	4 1/16	7/16	—	3 61/64	4 15/16
LXD-D, LXT-D SERIES	2 59/64	—	31/64	19/32	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 61/64	6 33/64	7 1/2
LCS-D-2 THRU LCS-D-6, LCS-E-2 " LCS-E-15, LXS-E SERIES	—	—	31/64	11/32	6 57/64	2 11/16	9 3/8	3 1/64	6 9/16	31/64	3 61/64	6 33/64	7 1/2

DIMENSIONAL DRAWINGS MODULAR SUPPLIES PACKAGE SIZE 5

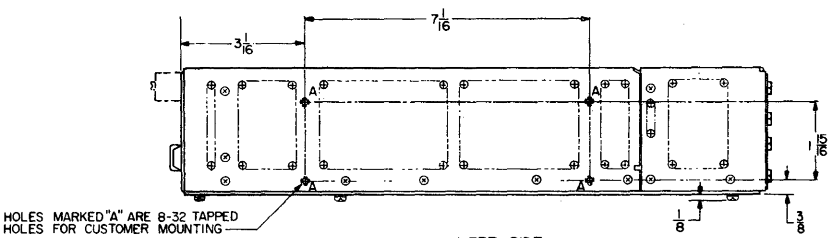
LYS-5 SERIES
LYD-5 SERIES



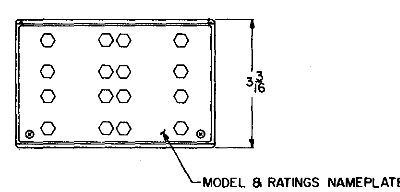
REAR VIEWS



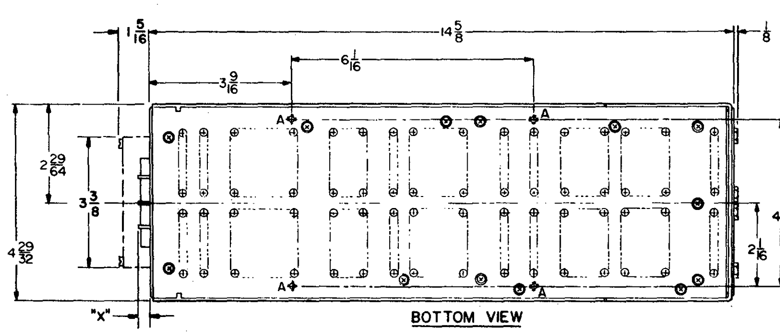
TOP VIEW



LEFT SIDE



FRONT VIEW

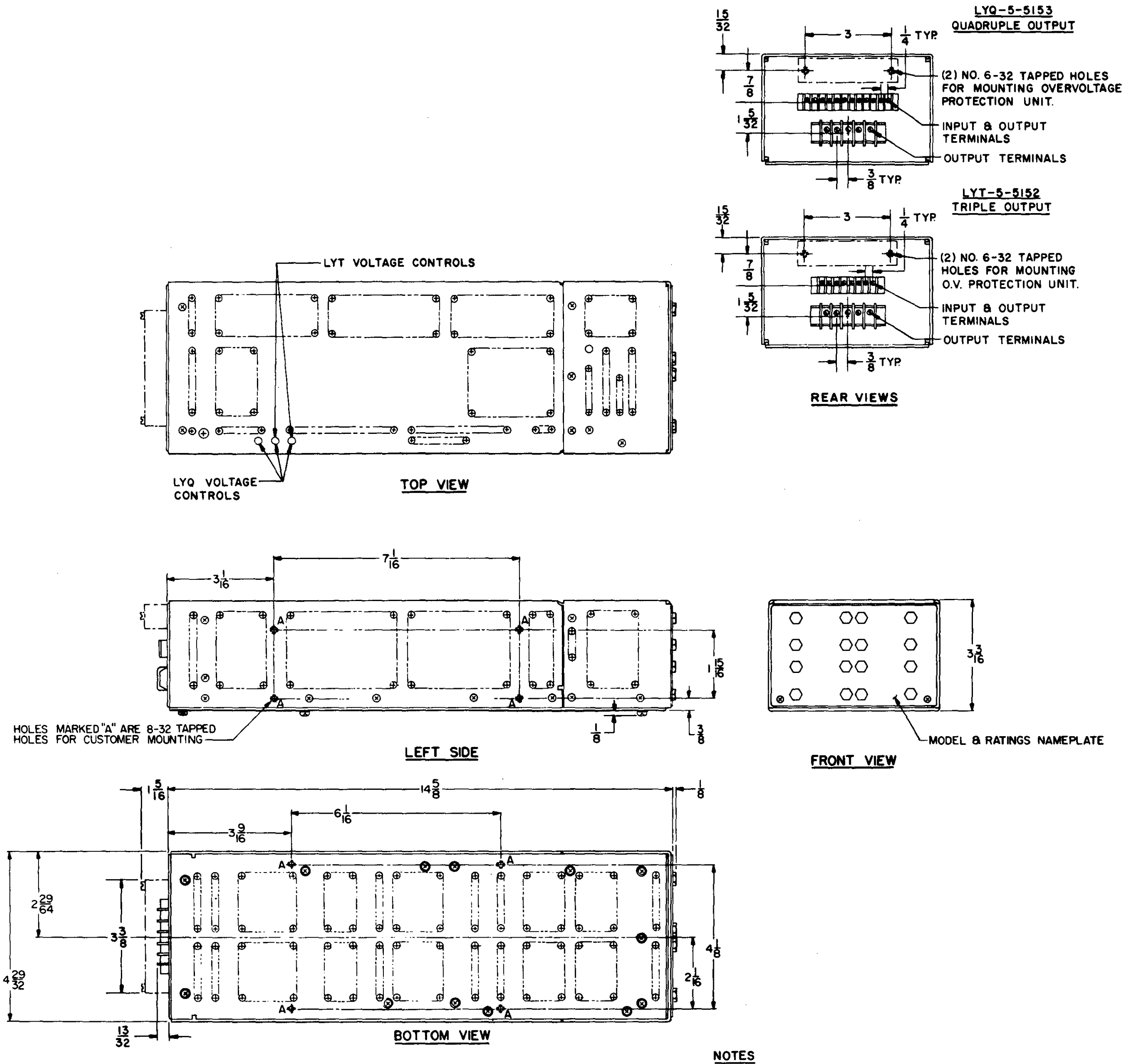

BOTTOM VIEW

OUTPUT	"X"
DUAL ALL	13/32
SINGLE 5 & 6 VOLTS	5/8
SINGLE 12 V. & OVER	13/32

NOTES
1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE TO CLEAR VENTILATION PATTERN.
2. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 3/8".

DIMENSIONAL DRAWINGS
MODULAR SUPPLIES
PACKAGE SIZE 5

LYT-5-5152
LYQ-5-5153

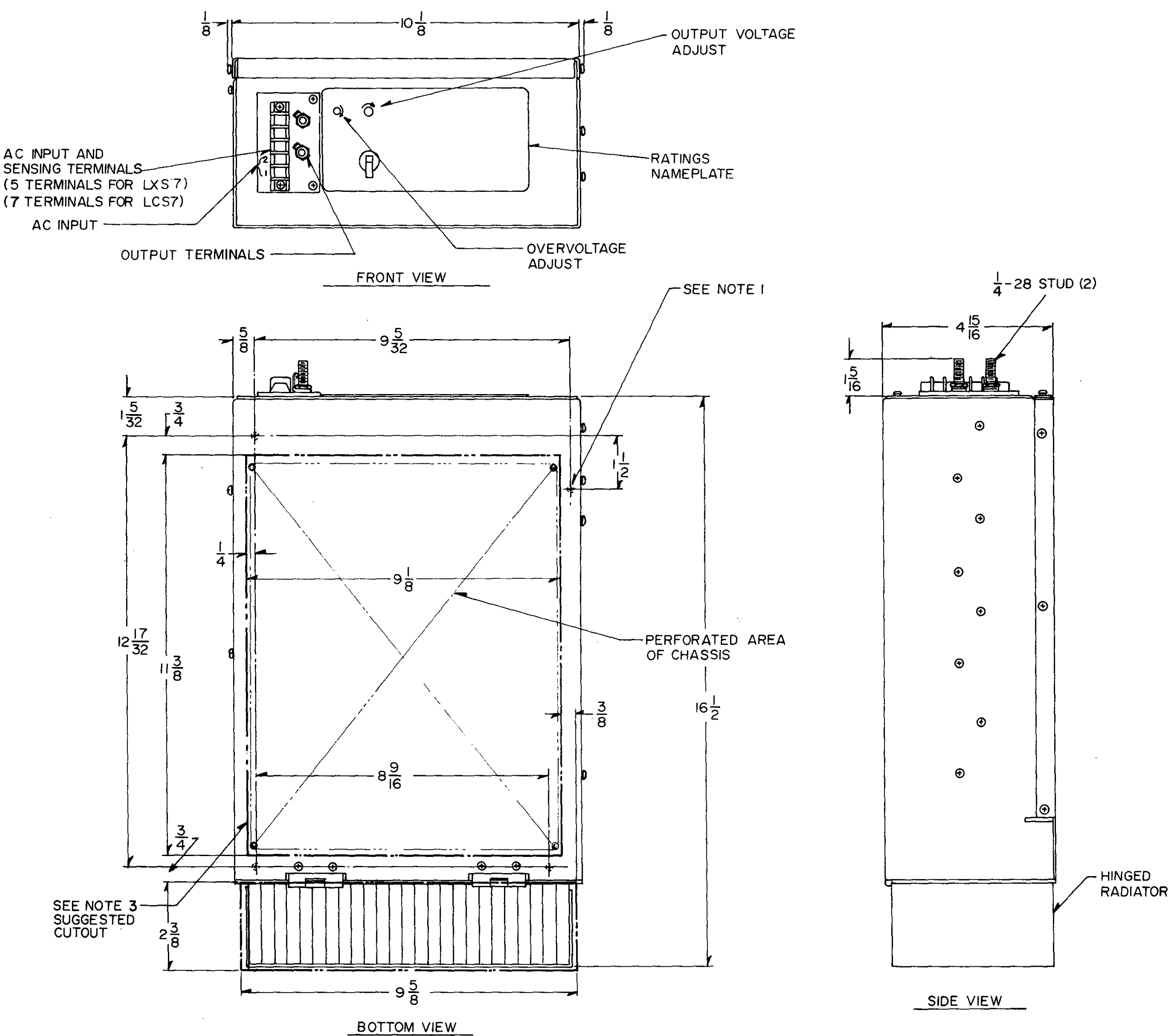


NOTES
1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE TO CLEAR VENTILATION PATTERN.
2. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 3/8".

PWR SUPPLIES, STD

DIMENSIONAL DRAWINGS MODULAR SUPPLIES PACKAGE SIZE 7

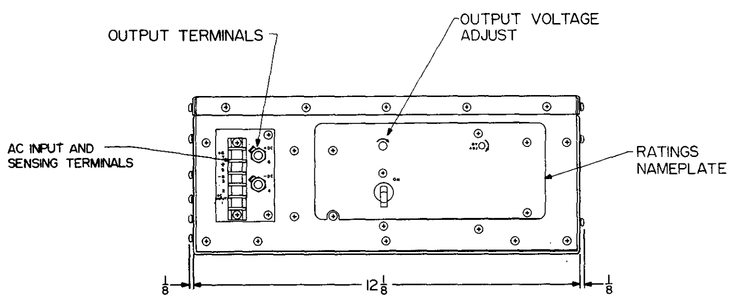
LXS-7 SERIES
LCS-7 SERIES



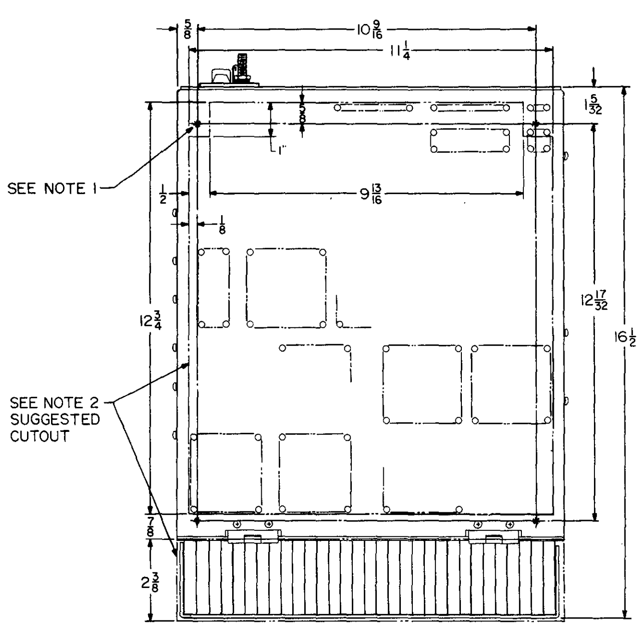
NOTES
1. 8-32 TAPPED HOLES (4) FOR CUSTOMER MOUNTING.
2. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO UNIT BY MORE THAN 3/8".
3. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR (PERFORATED) VENTILATION PATTERNS TO ALLOW AIR CIRCULATION.

DIMENSIONAL DRAWINGS
MODULAR SUPPLIES
PACKAGE SIZE 8

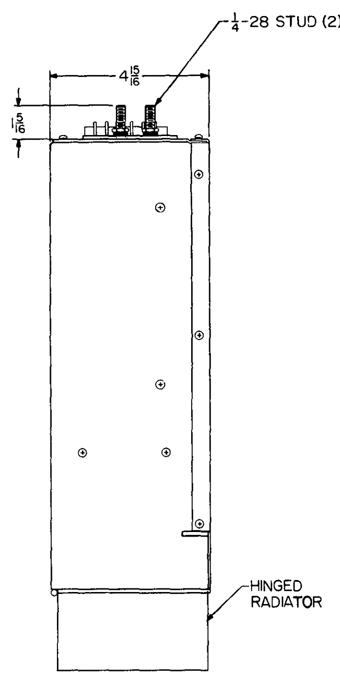
LXS-8 SERIES



FRONT VIEW



BOTTOM VIEW

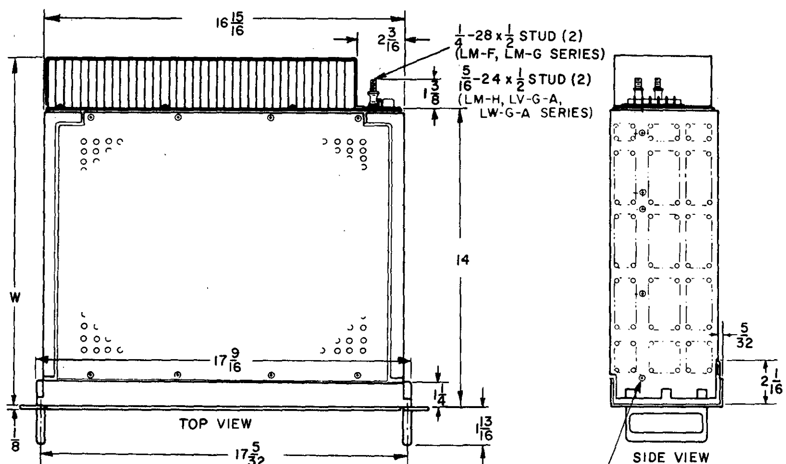


SIDE VIEW

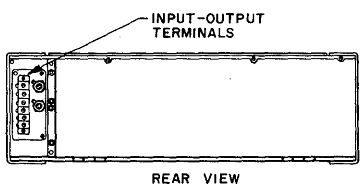
NOTES
1. 8-32 TAPPED HOLES (4) FOR CUSTOMER MOUNTING.
2. CUSTOMER MUST PROVIDE CLEARANCE CUTOUTS FOR (PERFORATED) VENTILATION PATTERNS TO ALLOW AIR CIRCULATION.
3. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO UNIT BY MORE THAN 3/8".

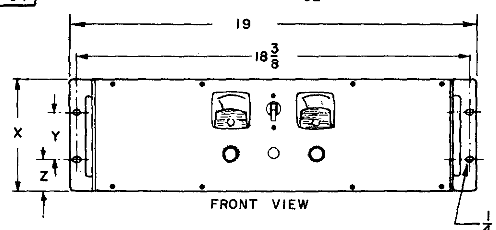
DIMENSIONAL DRAWINGS FULL-RACK POWER SUPPLIES — PACKAGE SIZES F, G, H MODULAR POWER SUPPLIES — PACKAGE SIZE DA

LM-F SERIES
LM-G, LV-G-A, LW-G-A SERIES
LM-H SERIES



MODEL	W	X	Y	Z
LM-F SERIES	16½	3 15/32	3	15/64
LM-G SERIES	16½	5 7/32	2¼	1 31/64
LM-H SERIES	18½	6 31/32	4	1 31/64
LV-G-A SERIES	16½	5 7/32	2¼	1 31/64
LW-G-A SERIES	16½	5 7/32	2¼	1 31/64

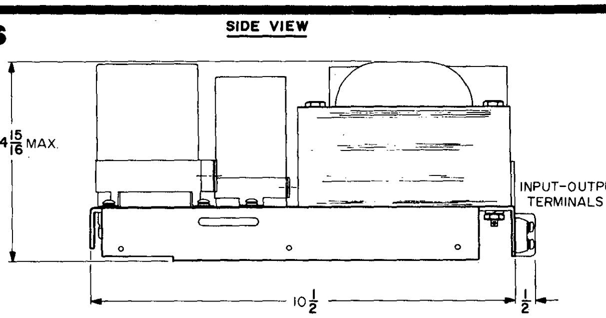


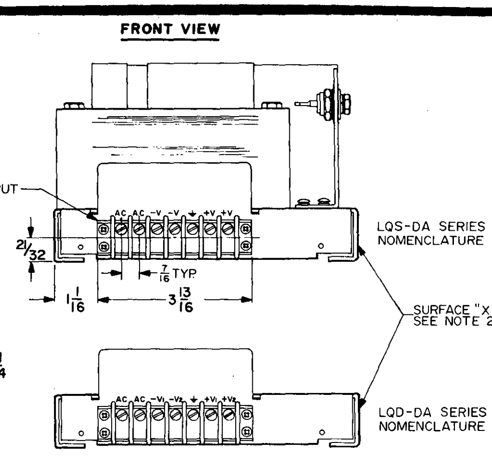


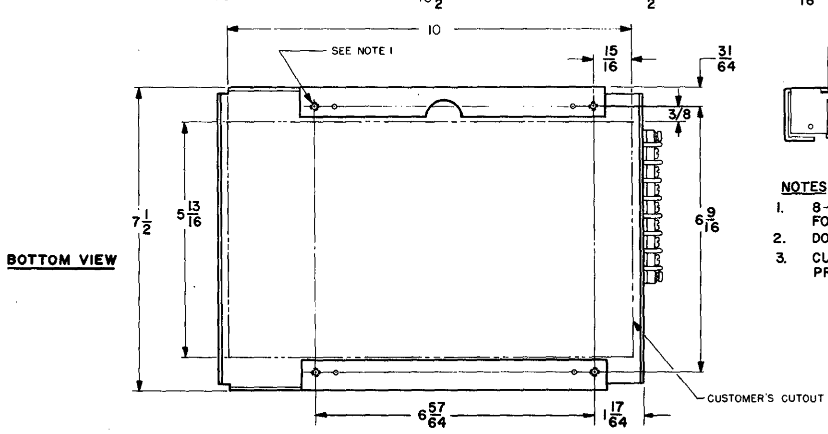
MOUNTING HOLES PROVIDED FOR CHASSIS SLIDES.
ALL "F" & "G" SERIES USES....
—LAMBDA SLIDES KHT-34-003.
—CHASSIS TRAK INC. NO. CTS-116, -114, -118.
—GRANT PULLEY 4435 SERIES.

LM-H SERIES USES....
—LAMBDA BALL BEARING TYPE SLIDES KHT-36-004.
—LAMBDA FRICTION TYPE SLIDES KHT-27-005 (ON SPECIAL ORDER ONLY).

LQ-DA SERIES







NOTES:
1. 8-32 TAPPED HOLES, 4 ON BOTTOM SURFACE, ARE FOR CUSTOMER CHASSIS MOUNTING.
2. DO NOT MOUNT WITH SURFACE "X" FACING UP.
3. CUSTOMER'S MOUNTING SCREWS MUST NOT PROTRUDE INTO UNIT BY MORE THAN 3/8".

HOW TO ORDER STANDARD POWER SUPPLIES

Lambda standard power supplies, described on pages 64-100, can be ordered directly from this catalog. Models, accessories, options and specifications are presented for each series.

Lambda power supplies may be ordered with various options and accessories, depending upon the series. Options and accessories are listed under "Specifications" for each series.

Specify options and accessories by adding one or more hyphenated letter(s) to the model number, or by ordering separately by accessory model number. Note that some models are available only with, or without, certain options and/or accessories.

Options and accessories available with Lambda power components

Options

	Suffix Designation or Model No.
1. High-performance (LM Series only)	("-Y")
2. AC input	("-V")
3. Fungus proofing	("-R")
4. Power supplies (for use with Systems Power Sequencer except wide range models)	("-S")
5. Power supplies (for use with Systems Power Protector — LM Series with built-in "OV" only)	("-SP")
6. Inclusion of meters (LM full-rack models only)	("-M")
7. Special paint	Specify
8. Inclusion of built-in "OV" (LM-F and LM-G only)	("-OV")
9. Overvoltage protectors (mandatory for units used with Systems Power Protector or Systems Power Sequencer)	("S")

Accessories

1. Overvoltage protectors	("-OV")
2. Rack adapter	("LRA-")
3. Chassis slides	("-CS")
4. Systems blank panels	("SB-")
5. Blank front panels	("LBP-")
6. Metered panels	("MP-")

Be certain to add the correct suffix for each option or accessory required, and adjust the overall price accordingly.

EXAMPLE

To order a metered model LM-F package with overvoltage protection and high-performance option, the model number would be written as follows:

LM-F-28-R-OV-M-Y.

Such a number would include:

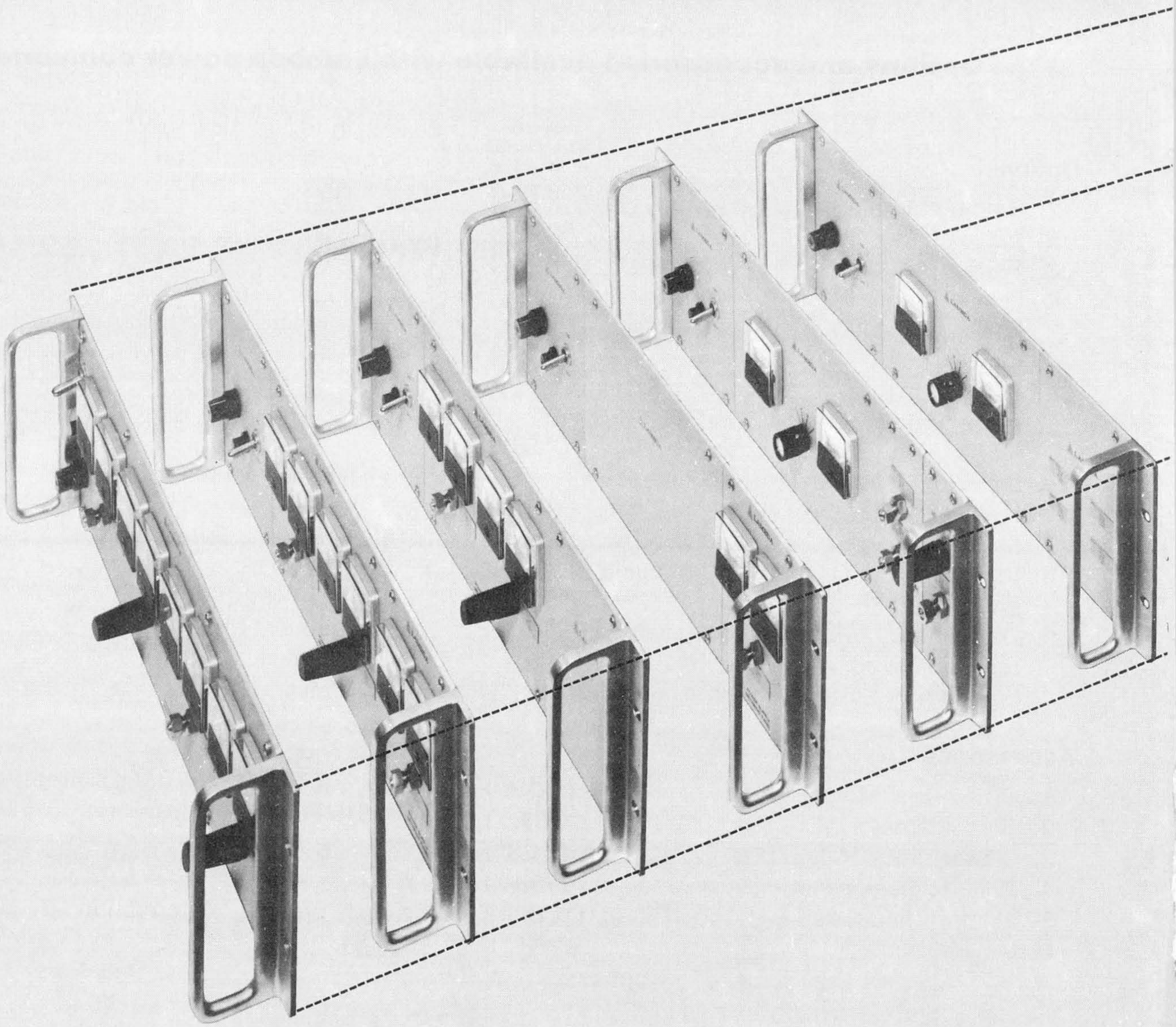
LM-F-28-R Power Supply with fungus proofing	**$495**
Overvoltage protection (built-in "-OV")	**90**
Metered model (-M)	**30**
High-performance option (-Y)	**15**
Total Price	**$630**

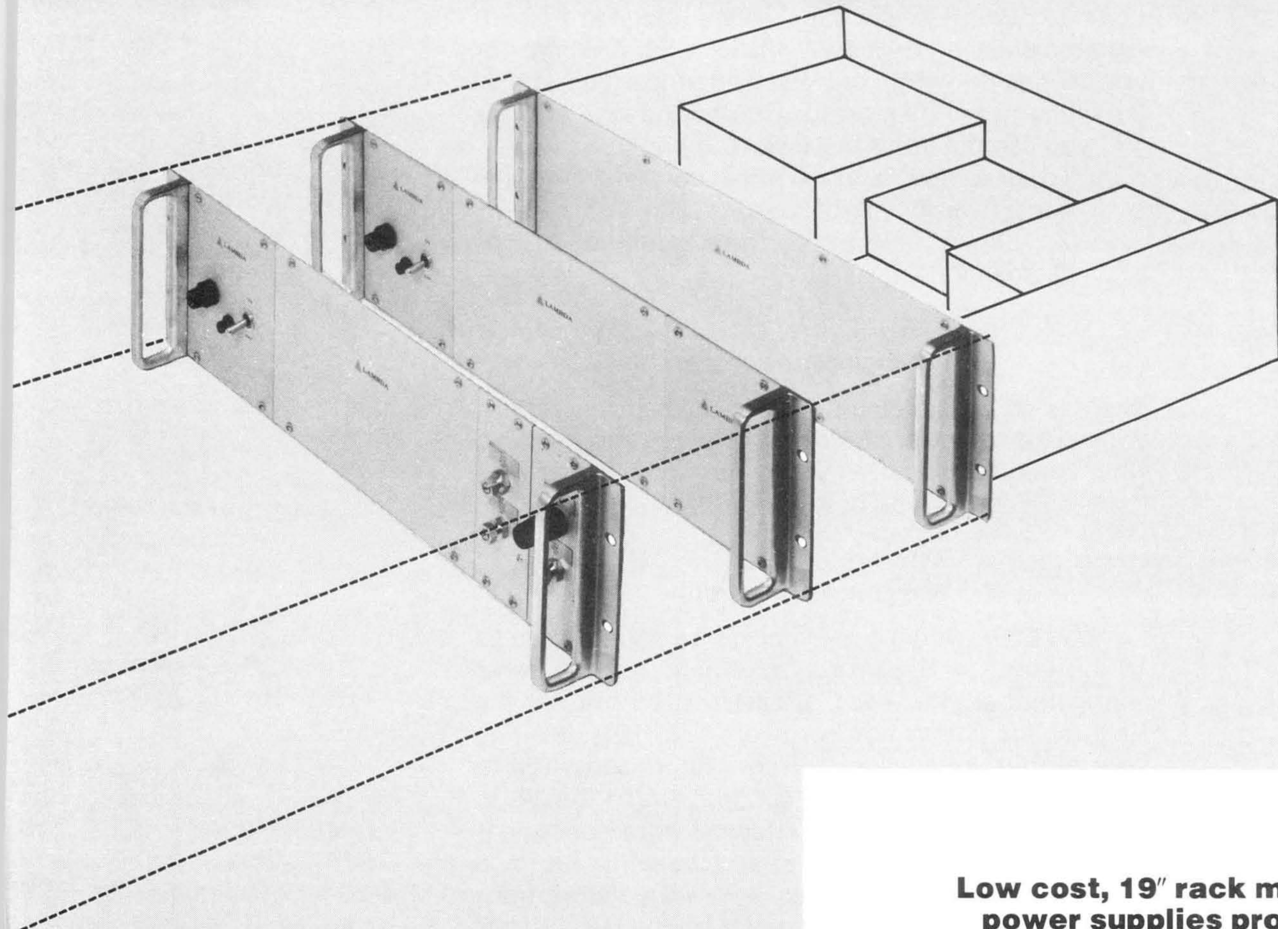
An order for a B Package LM-B-0-7 with high-performance, AC input, and fungus-proofing option (total price $159.00) would be written as follows:

LM-B-0-7-Y-V-R.

General ordering information is given on pages 183-184.

CUSTOM POWER SUPPLIES





PWR SUPPLIES, CUST

Low cost, 19″ rack mounting power supplies providing up to 16 outputs, 5 standard package sizes, 9 standard front panel configurations

Lambda will design to your requirements in 45 standard configurations, multi-output, multi-power level, 5 year guaranteed custom power supply, and deliver in 3 weeks.

LAMBDA MAKES IT EASY FOR YOU TO ORDER CUSTOM POWER SUPPLIES

Built to your requirements

Lambda custom power supplies are designed to your requirements, and we have made it very simple for you to specify within our 45 standard configurations. By filling in the Request for Quotation Form on page 191 you can tell us what we need to know:

1. To give you a firm price quotation on the number and type of custom units you require.
2. To design and build these supplies to the parameters you select.

No engineering charge

There is no engineering or set-up charge for designing your custom power supply. This is one more reason why Lambda can offer you a custom product at a lower cost than if you built it yourself.

Wide range of options

Lambda offers you a custom power supply with up to 16 outputs, in 5 package sizes and 9 front panel configurations for each package size. Fill in the Request for Quotation Form on page 191 detailing your output voltage and current requirements (up to 300 VDC and up to 182A*). Choose one of the group of 5 regulation, ripple and temperature coefficient specifications for each output and we will determine which package size you need. From the descriptions on the following pages, also enter on the Request for Quotation Form the front panel configuration which best meets your monitoring and control requirements.

*Maximum total output current.

Three week delivery

Your custom power supply, assembled, wired, and ready to operate will be shipped 3 weeks after receipt of your order.

5 year guarantee

Every custom power supply is covered by Lambda's comprehensive 5 year guarantee which includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

PACKAGE SIZE J

3½" x 19" x 14" • up to 16 outputs • up to 300 volts • up to 27 amperes for any single output

1

Blank panel. Economical when power supply will be remotely controlled. Maximum of 16 outputs may be obtained.

2

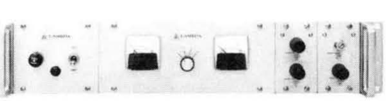
Panel with on/off switch for AC input, pilot light and fuse, Up to 16 outputs are available.

3

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls. 1 to 4 potentiometers provide individual output voltage adjustment. A maximum of 8 outputs may be controlled.

4

Panel with on/off switch for AC input, pilot light and fuse, plus metering panel. 3-range voltmeter, ammeter and rotary selector switch allow monitoring of 4 outputs. Switch selects one appropriate output on voltmeter and ammeter. (See notes.)



5

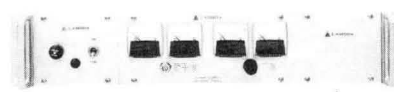
Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls and metering panel. Provides voltage adjustment of 8 outputs maximum, monitoring capability of 4 outputs. (See notes.)

6

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage control. Provides voltage adjustment and monitoring capability for 1 output.

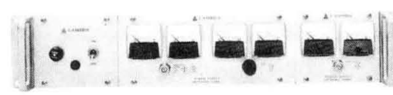
7

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 2 outputs.



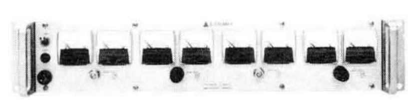
8

Panel with on/off switch for AC input, pilot light and fuse, plus metering panels with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 3 outputs.



9

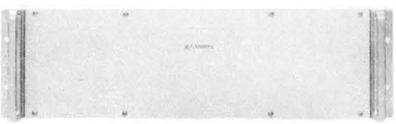
Panel with on/off switch for AC input, pilot light, fuse, optional voltage controls and metering. Provides voltage adjustment and simultaneous monitoring capability of 4 outputs.



NOTES: When metering panel is used, nameplates, to indicate meter scales and model number are also included. With Option No. 4, nameplates are mounted on right hand side of front panel. With Option No. 5, they are located on Voltage Control panel. Outputs rated above 50 amps cannot be monitored.

PACKAGE SIZE K

$5^3/_{16}$" x 19" x 14" • up to 16 outputs • up to 300 volts • up to 90 amperes for any single output



1

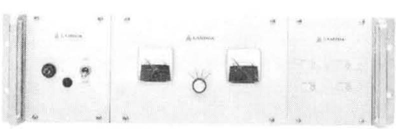
Blank panel. Economical when power supply will be remotely controlled. Maximum of 16 outputs may be obtained.

2

Panel with on/off switch for AC input, pilot light and fuse, Up to 16 outputs are available.

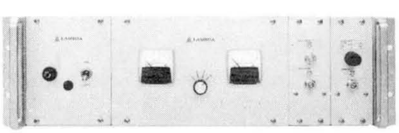
3

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls. 1 to 4 potentiometers provide individual output voltage adjustment. A maximum of 8 outputs may be controlled.



4

Panel with on/off switch for AC input, pilot light and fuse, plus metering panel. 3-range voltmeter, ammeter and rotary selector switch allow monitoring of 4 outputs. Switch selects one appropriate output on voltmeter and ammeter. (See notes.)

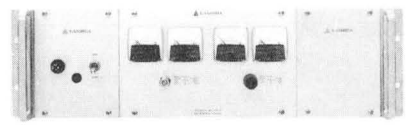


5

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls and metering panel. Provides voltage adjustment of 8 outputs maximum, monitoring capability of 4 outputs. (See notes.)

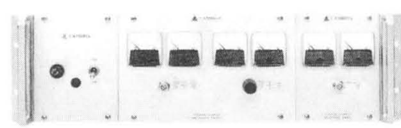
6

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage control. Provides voltage adjustment and monitoring capability for 1 output.



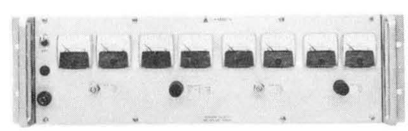
7

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 2 outputs.



8

Panel with on/off switch for AC input, pilot light and fuse, plus metering panels with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 3 outputs.



9

Panel with on/off switch for AC input, pilot light, fuse, optional voltage controls and metering. Provides voltage adjustment and simultaneous monitoring capability of 4 outputs.

NOTES: When metering panel is used, nameplates, to indicate meter scales and model number are also included. With Option No. 4, nameplates are mounted on right hand side of front panel. With Option No. 5, they are located on Voltage Control panel. Outputs rated above 50 amps cannot be monitored.

PACKAGE SIZE L

$5^3/_{16}''$ x 19″ x 21″ • up to 16 outputs • up to 300 volts • up to 182 amperes for any single output

1

Blank panel. Economical when power supply will be remotely controlled. Maximum of 16 outputs may be obtained.

2

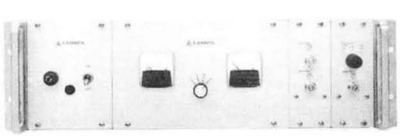
Panel with on/off switch for AC input, pilot light and fuse, Up to 16 outputs are available.

3

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls. 1 to 4 potentiometers provide individual output voltage adjustment. A maximum of 8 outputs may be controlled.

4

Panel with on/off switch for AC input, pilot light and fuse, plus metering panel. 3-range voltmeter, ammeter and rotary selector switch allow monitoring of 4 outputs. Switch selects one appropriate output on voltmeter and ammeter. (See notes.)

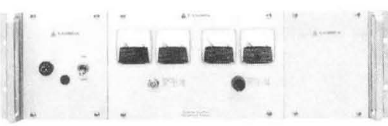


5

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls and metering panel. Provides voltage adjustment of 8 outputs maximum, monitoring capability of 4 outputs. (See notes.)

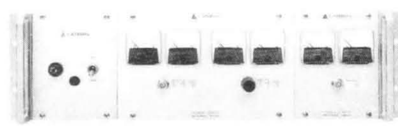
6

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage control. Provides voltage adjustment and monitoring capability for 1 output.



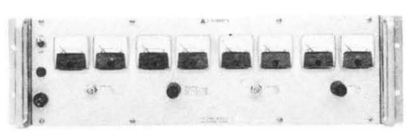
7

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 2 outputs.



8

Panel with on/off switch for AC input, pilot light and fuse, plus metering panels with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 3 outputs.



9

Panel with on/off switch for AC input, pilot light, fuse, optional voltage controls and metering. Provides voltage adjustment and simultaneous monitoring capability of 4 outputs.

NOTES: When metering panel is used, nameplates, to indicate meter scales and model number are also included. With Option No. 4, nameplates are mounted on right hand side of front panel. With Option No. 5, they are located on Voltage Control panel. Outputs rated above 50 amps cannot be monitored.

PACKAGE SIZE M

3½″ x 19″ x 10″ • up to 8 outputs • up to 300 volts • up to 17.4 amperes for any single output

1

Blank panel. Economical when power supply will be remotely controlled. Maximum of 8 outputs may be obtained.

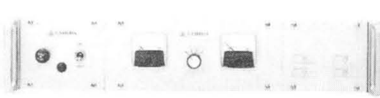
2

Panel with on/off switch for AC input, pilot light and fuse, Up to 8 outputs are available.

3

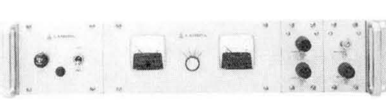
Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls. 1 to 4 potentiometers provide individual output voltage adjustment. A maximum of 8 outputs may be controlled.

4



Panel with on/off switch for AC input, pilot light and fuse, plus metering panel. 3-range voltmeter, ammeter and rotary selector switch allow monitoring of 4 outputs. Switch selects one appropriate output on voltmeter and ammeter. (See notes.)

5



Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls and metering panel. Provides voltage adjustment of 8 outputs maximum, monitoring capability of 4 outputs. (See notes.)

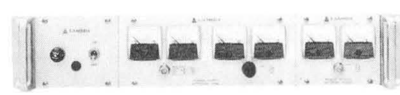
6

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage control. Provides voltage adjustment and monitoring capability for 1 output.

7

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 2 outputs.

8



Panel with on/off switch for AC input, pilot light and fuse, plus metering panels with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 3 outputs.

9

Panel with on/off switch for AC input, pilot light, fuse, optional voltage controls and metering. Provides voltage adjustment and simultaneous monitoring capability of 4 outputs.

NOTES: When metering panel is used, nameplates, to indicate meter scales and model number are also included. With Option No. 4, nameplates are mounted on right hand side of front panel. With Option No. 5, they are located on Voltage Control panel. Outputs rated above 50 amps cannot be monitored.

PACKAGE SIZE N

$5^{3}/_{16}$″ x 19″ x 10″ • up to 8 outputs • up to 300 volts • up to 60 amperes for any single output

1

Blank panel. Economical when power supply will be remotely controlled. Maximum of 8 outputs may be obtained.

2

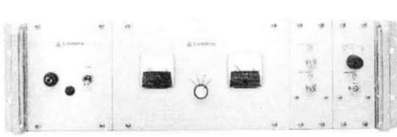
Panel with on/off switch for AC input, pilot light and fuse, Up to 8 outputs are available.

3

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls. 1 to 4 potentiometers provide individual output voltage adjustment. A maximum of 8 outputs may be controlled.

4

Panel with on/off switch for AC input, pilot light and fuse, plus metering panel. 3-range voltmeter, ammeter and rotary selector switch allow monitoring of 4 outputs. Switch selects one appropriate output on voltmeter and ammeter. (See notes.)

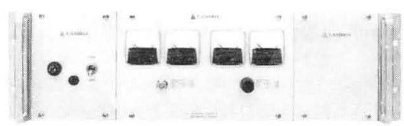


5

Panel with on/off switch for AC input, pilot light and fuse, plus voltage controls and metering panel. Provides voltage adjustment of 8 outputs maximum, monitoring capability of 4 outputs. (See notes.)

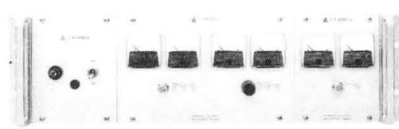
6

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage control. Provides voltage adjustment and monitoring capability for 1 output.



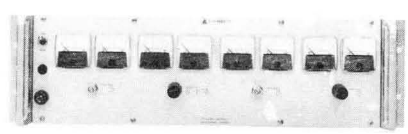
7

Panel with on/off switch for AC input, pilot light and fuse, plus a metering panel with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 2 outputs.



8

Panel with on/off switch for AC input, pilot light and fuse, plus metering panels with optional voltage controls. Provides voltage adjustment and simultaneous monitoring capability of 3 outputs.



9

Panel with on/off switch for AC input, pilot light, fuse, optional voltage controls and metering. Provides voltage adjustment and simultaneous monitoring capability of 4 outputs.

NOTES: When metering panel is used, nameplates, to indicate meter scales and model number are also included. With Option No. 4, nameplates are mounted on right hand side of front panel. With Option No. 5, they are located on Voltage Control panel. Outputs rated above 50 amps cannot be monitored.

SYSTEMS POWER SEQUENCER

for sequencing voltage ON and OFF, monitoring voltage status, protecting against AC input line voltage faults, undervoltage and overvoltage.

SYSTEMS POWER SEQUENCER [1]

	1¾" x 19" x 14"		**3⅛" x 3$^{13}/_{16}$" x 13¼"** (mountable in LRA-8, LRA-10 or LRA-11 rack adapters)		
MODEL[3]	POWER OUTPUTS ACCOMMODATED[2]	PRICE[5]	MODEL[3]	POWER OUTPUTS ACCOMMODATED[2]	PRICE[5]
SPS-92	2	$630	SPS-82	2	$580
SPS-94	4	720	SPS-84	4	670
SPS-96	6	810	SPS-86	6	760
SPS-98	8	900	SPS-88	8	850

See notes under Systems Power Protector.

FEATURES

Controls up to 8 power supplies
sequences ON up to 8 power supplies in predetermined sequence and sequences them OFF in mirror image. Time for ON sequence between power supplies is 300 msec; 8 power supplies approximately 2400 msec. Timing for OFF sequence identical to ON sequence.

Protects against incomplete turn ON sequence
incomplete sequence causes all output voltages to be crowbarred.

Protects against incomplete turn OFF sequence
protect system overrides and causes all voltages to be crowbarred.

Monitors
power supply overvoltage and undervoltage and ac input line voltage simultaneously.

Protects against ac input line voltage faults
power failure causes all output voltages to be crowbarred.

System ready signal
A system ready signal to permit sequencing is available one (1) second after application of AC power to the sequencer.

Protects against undervoltage
one fault can result in all output voltages crowbarring (with optional disable).

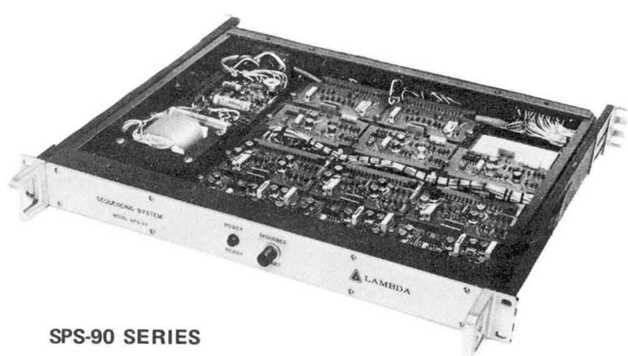
Protects against overvoltage
one fault causes all output voltages to be crowbarred.

Dry contact closure interlock
available for each power supply at the input/output connector. Loss of interlock causes all output voltages to be crowbarred.

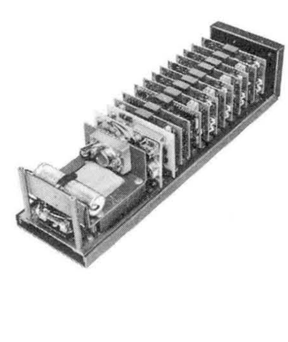
Logic-level signal alerts associated equipment
failure signal of +5V for 100 μsec is initiated when a crowbarred (faulty) power supply reaches the UV detect level; all other power supplies are crowbarred 1 μsec after initiation of failure signal. At all other times the signal line is at approximately 0.2V. Addition of external capacitor can increase the 1 μsec delay time up to 1 msec.

Fault signal indicates an output voltage fault (SPS-90 Series)
fault signal provided at initiation of any fault condition, is a 1 Hz square wave, from 0.2V to 14V that causes front panel fault lamp to flash on and off.

Fault signal indicates an output voltage fault (SPS-80 Series)
fault signal, available at initiation of any fault condition, is the collector of a transistor switch which produces a square wave of 1 Hz. User must supply collector load voltage: 60V @ 100 ma maximum.



SPS-90 SERIES



SPS-80 SERIES
(open view)

SYSTEMS POWER PROTECTOR

for protecting against AC input line voltage faults, undervoltage and overvoltage.

SYSTEMS POWER PROTECTOR (1)

1¾″ x 19″ x 14″

MODEL(3)	POWER OUTPUTS ACCOMMODATED(2)	PRICE(5)
SPP-92	2	$465
SPP-94	4	500
SPP-96	6	535
SPP-98	8	570

3⅛″ x 3 13/16″ x 13¼″

MODEL(3)	POWER OUTPUTS ACCOMMODATED(2)	PRICE(5)
SPP-82	2	415
SPP-84	4	450
SPP-86	6	485
SPP-88	8	520

(mountable in LRA-8, LRA-10 or LRA-11 rack adapters)

FEATURES

Controls up to 8 power supplies
accommodates up to 8 power supplies regardless of polarity.

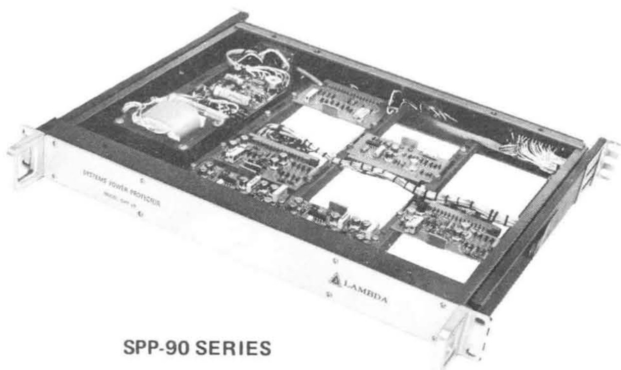
Monitors
power supply overvoltage and undervoltage and ac input line voltage simultaneously.

Protects against AC input line voltage faults
power failure causes all output voltages to be crowbarred.

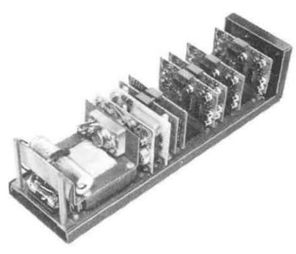
Protects against overvoltage
one fault can result in all output voltage crowbarring (with optional disable).

Protects against undervoltage
one fault causes all output voltages to be crowbarred.

Fault signal
fault signal output precedes system crowbar.



SPP-90 SERIES



SPP-80 SERIES
(open view)

NOTES:

(1) Overvoltage protectors must be used with each power supply to utilize the overvoltage and undervoltage functions of the Power Sequencer or Power Protector.

(2) All power supplies used with the Systems Power Sequencer, except zero-voltage units, must be specified with the "-S" suffix. Also, all overvoltage protectors must be specified with the "-S" suffix. Simply add the suffix "-S" to the applicable power supply model number or overvoltage protector if it is to be used with the Systems Power Sequencer and to all overvoltage protectors used with the Systems Power Protector. All LM-F, LM-G, and LM-H power supplies to be used with the Systems Power Protector must be specified with an "-SP" suffix after the OV option designation, for example LM-F-3-OV-SP. This difference in nomenclature is required because the power supply internal voltage program resistor must be shorted out to use the power supply with the SPS but cannot be shorted when the power supply is used with the SPP.

(3) The Systems Power Protector and the Systems Power Sequencer can be used with Lambda power supplies furnishing up to 70 VDC. For applications above 70 VDC, consult factory.

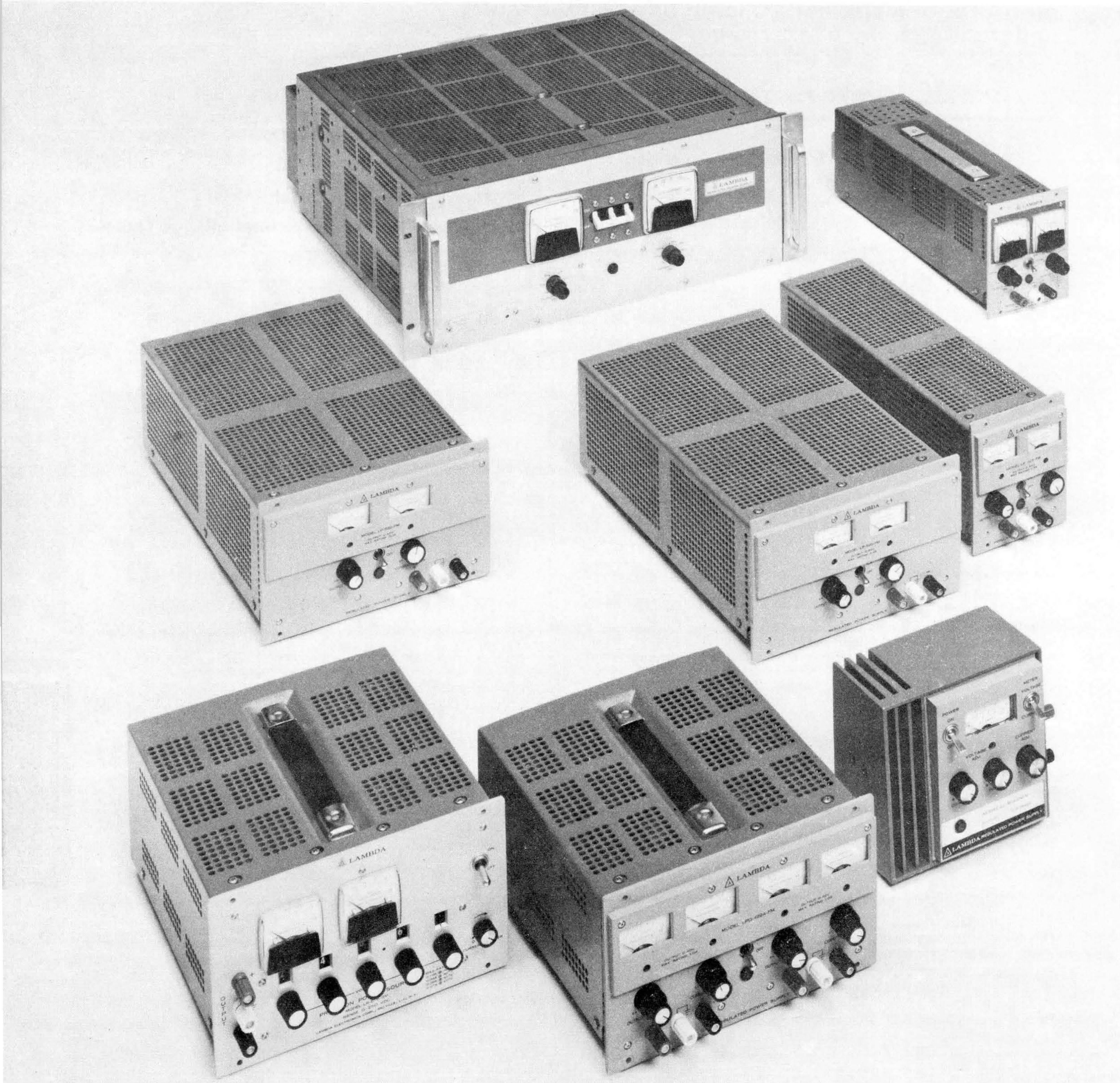
(4) Chassis slides are available as an accessory for use with the systems power protector or sequencer. For example, specify SPP-92-CS and add $50.00 to the price.

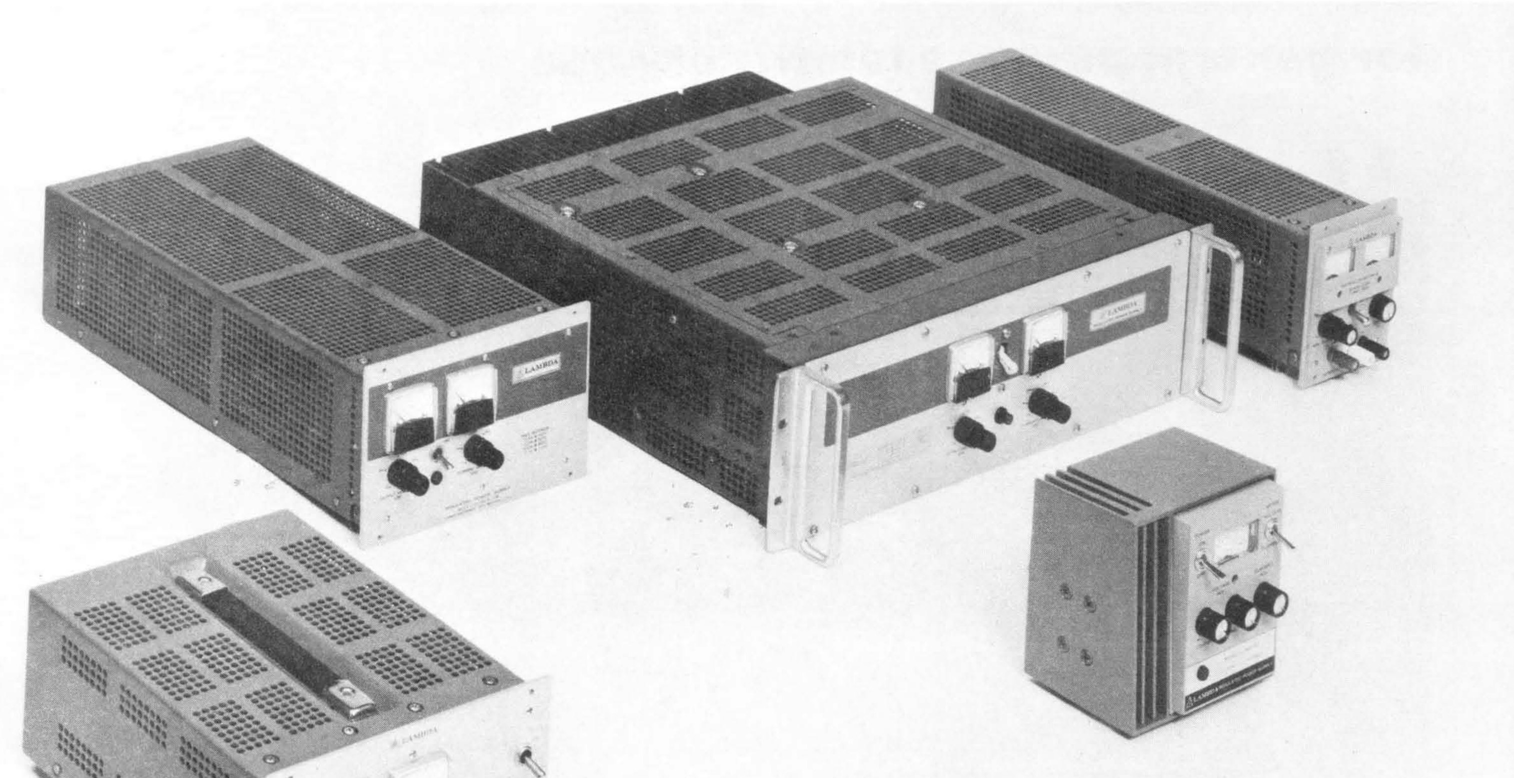
(5) All specifications and prices subject to change without notice. See pages 183-184 for ordering information.

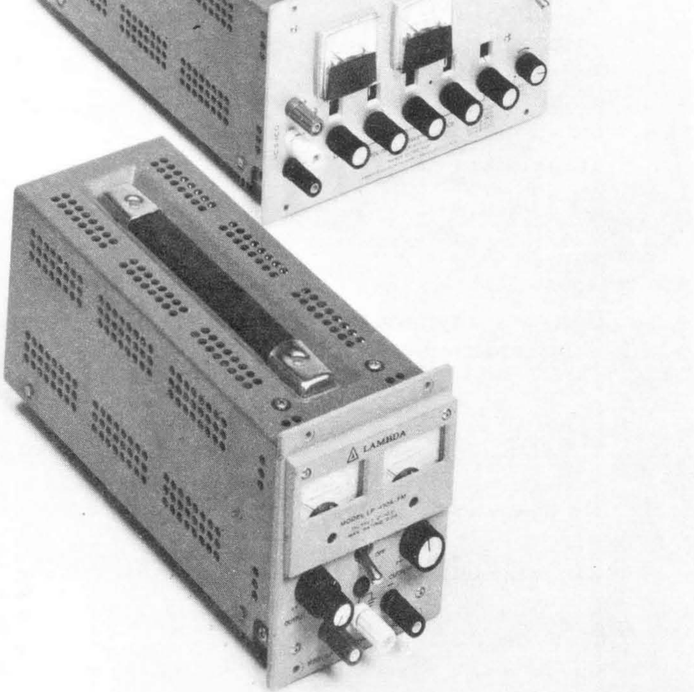
(6) Systems interwiring cables for use with systems power sequences or systems power protectors are supplied by the customer.

PWR SUPPLIES, CUST

LAMBDA POWER INSTRUMENTS



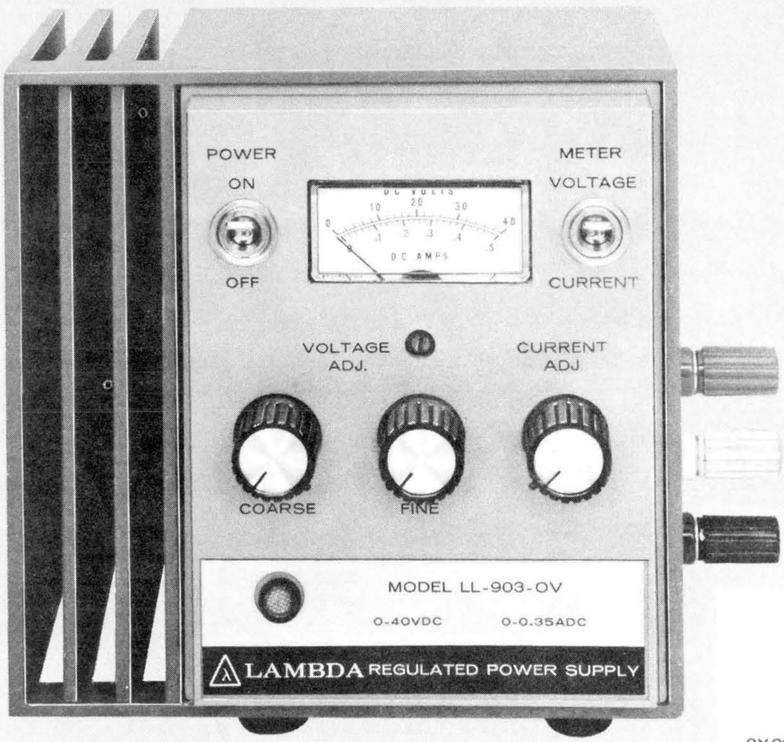




bench and rack mounted power supplies for laboratory, test instrumentation and general purpose use

LL SERIES
I-C REGULATED
BENCH POWER SUPPLIES

for general purpose laboratory use



L L Series I-C Regulated Power Supply

Multi-position lies flat or stands erect

LL SERIES BENCH TYPE SUPPLY
5⅝" x 5½" x 3⅞"

MODEL	ADJ. VOLT. RANGE VDC	CURRENT RANGE (1)	PRICE(2)
3 models with built-in tracking overvoltage protection (1)			
LL-901-OV	0-10	0-1 amp	**$99**
LL-902-OV	0-20	0-0.65 amp	**99**
LL-903-OV	0-40	0-0.35 amp	**99**
LL-905	0-120	0-65 ma	**99**

REGULATION: Line: 0.01% + 1 mV Load: 4 mV

RIPPLE: 250 uV RMS

NOTES:
(1) Consult factory for operation at 400 HZ or temperatures above 50°C. Ratings apply 0-50°C.
(2) All prices and specifications subject to change without notice.

Outstanding Features

All-silicon DC power supply using integrated circuit to provide regulation system
except for input and output capacitors, rectifiers, and series regulation transistors

Regulation
line: 0.01% + 1 mV
load: 4mV

Ripple
250 uV RMS, 1 mV pk-pk

Convection cooled

Multi-position operation
lies flat or stands erect

Die-cast aluminum construction

Weight
less than 6 lbs.

No overshoot
on turn-on, turn-off or power failure

Adjustable current limiting
0 to 110 % of rating

Controls
course voltage adjust, fine voltage adjust, current adjust, ON/OFF switch, meter function switch

Built-in tracking overvoltage protection models available

SPECIFICATIONS OF LL SERIES

DC output
voltage ranges: 0-10V, 0-20V, 0-40V, 0-120V.

Regulated voltage

regulation, line	0.01% + 1mV
regulation, load	4 mV
ripple and noise	250 uV RMS 1 mV pk-pk
temperature coefficient	(0.015% + 300 uV) /°C

AC input

line	105-132 VAC 47-440 Hz (current ratings based on 57-63 Hz) derate current 10% for 50 Hz operation. 182-242 VAC 45-440 Hz, see "AC Input Option"
power	LL-901-OV, 30 watts; LL-902-OV, 32 watts; LL-903-OV, 32 watts; LL-905, 15 watts

Ambient operating temperature range
continuous duty from 0° to + 50°C

Storage temperature range
-40°C to +85°C

Overload Protection
Electrical
external overload protection: automatic electronic current limiting circuit limits the output current to a preset value, thereby providing protection for load as well as the power supply. Automatic current limiting is adjustable from 0-110% of rating.

Overvoltage protection
built-in tracking overvoltage protection on LL-901-OV, LL-902-OV and LL-903-OV.

Input connections
heavy-duty, 3-wire line cord provided.

Output connections
5-way binding posts on side panel.

Meter
dual function meter measures voltage or current output as selected by meter function switch on front panel.

Controls
DC output controls
course voltage adjust, fine voltage adjust and current adjust on front panel. On models LL-901-OV, LL-902-OV and LL-903-OV adjustment of voltage control allows overvoltage protector to track voltage output automatically.
Power
on-off switch on front panel.
Meter
function switch to measure output voltage or current.

Multiposition operation
lies flat or stands erect

Physical data
Size
5 5/8"W x 5 1/2"H x 3 7/8"D
Weight
6 lbs. net, 7 lbs. ship

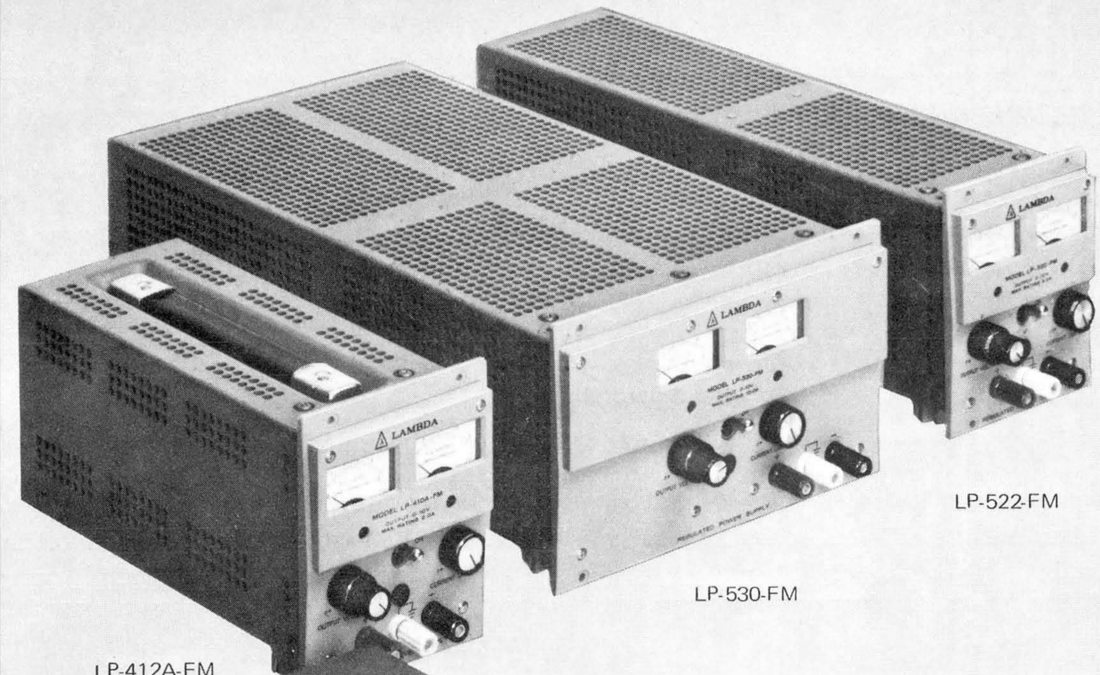
Accessories
pot covers. See page 141.

Options
AC input
187-242 VAC 45-440 Hz. Add suffix "-V" to model number and $20.00 to the price. Derate current 10% for 50 Hz operation.

Guaranteed for 5 years
5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

LP SERIES SINGLE-OUTPUT POWER SUPPLIES
LPD SERIES DUAL-OUTPUT POWER SUPPLY

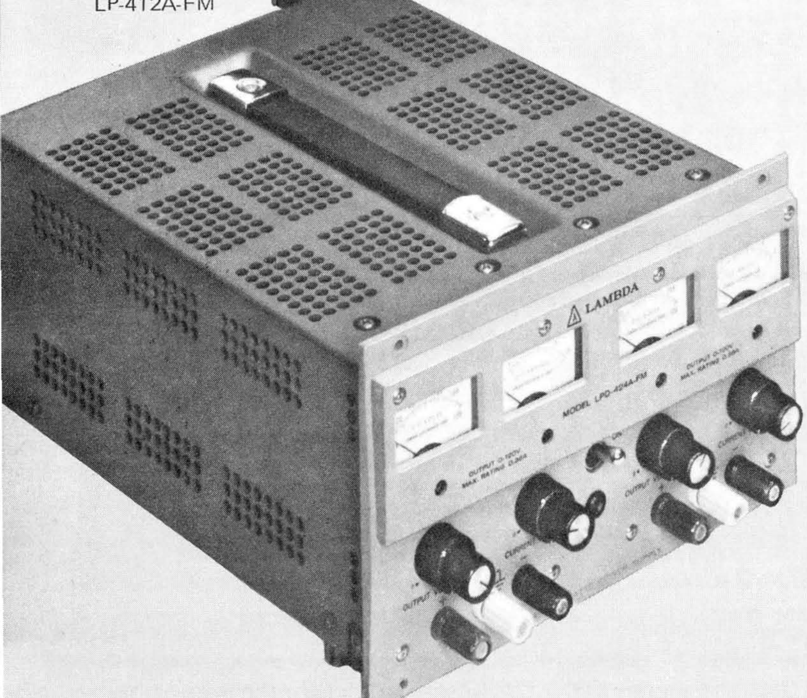
for general purpose laboratory and test equipment use.



LP-522-FM

LP-530-FM

LP-412A-FM



LPD-421A-FM

Widest selection of laboratory supplies with big-system features and capabilities for bench or rack use.

Outstanding Features

Designed for both bench and rack use.
Convection cooled

no blowers, no external heat sinks

Series/parallel operation
Continuously variable
Remotely programmable
Remote sensing
Constant voltage/constant current
Designed to meet RFI

per MIL STD 826A

Completely protected

Short circuit proof; continuously adjustable automatic current limiting

No overshoot

on turn-on, turn-off or power failure

Features of dual output models

5 models with two independent DC outputs offer widest choice

up to ±250 VDC, up to 1.7 amps. Either output may be plus or minus, or both outputs may be plus or minus.

Series/parallel operation

of both outputs yields two times the voltage or two times the current — up to 500 volts or up to 3.4 amps.

Auto series/auto parallel (master-slave)

permits tracking to a common reference

4 meters

provide simultaneous monitoring of both voltage and current.

LPD SERIES DUAL OUTPUT MODELS

MODEL	REGULATION	RIPPLE (RMS)	VOLTAGE RANGE Per Output/ Outputs in Series VDC	MAX CURRENT, AMPS AT AMBIENT OF: (1) Per Output/ Outputs in Parallel 30°C	40°C	50°C	60°C	DIMENSIONS	Price(2)(3)
*LPD-421A-FM	0.01% + 1 mV	500 uV	0- ±20/0-40	1.7/3.4	1.5/3.0	1.3/2.6	0.9/1.8	5 3/16" x 8 3/8" x 10 3/32"	$300
*LPD-422A-FM	0.01% + 1 mV	500 uV	0- ±40/0-80	1.0/2.0	0.85/1.7	0.7/1.4	0.55/1.1	5 3/16" x 8 3/8" x 10 3/32"	300
*LPD-423A-FM	0.01% + 1 mV	500 uV	0- ±60/0-120	0.7/1.4	0.6/1.2	0.5/1.0	0.4/0.8	5/3/16" x 8 3/8" x 10 3/32"	340
LPD-424A-FM	0.01% + 1 mV	500 uV	0- ±120/0-240	0.38/0.76	0.32/0.64	0.26/0.52	0.20/0.40	5 3/16" x 8 3/8" x 10 3/32"	340
LPD-425A-FM	0.01% + 1 mV	1 mV	0- ±250/0-500	0.13/0.26	0.12/0.24	0.11/0.22	0.10/0.20	5 3/16" x 8 3/8" x 10 3/32"	365

LP SERIES SINGLE OUTPUT MODELS

0-10 VOLTS

MODEL	REGULATION	RIPPLE (RMS)	MAX CURRENT AMPS AT AMBIENT OF: (1) 30°C	40°C	50°C	60°C	DIMENSIONS	Price(2)(3)
*LP-410A-FM	0.01% + 1 mV	500 uV	2.0	1.8	1.6	1.4	5 3/16" x 4 3/16" x 10"	$180
*LP-520-FM	0.01% + 1 mV	500 uV	5.0	4.7	4.3	3.7	5 3/16" x 4 3/16" x 15 1/2"	220
*LP-530-FM	0.01% + 1 mV	500 uV	10.0	9.0	8.0	7.0	5 3/16" x 8 3/8" x 15 5/8"	335

0-20 VOLTS

*LP-411A-FM	0.01% + 1 mV	500 uV	1.2	1.1	1.0	0.8	5 3/16" x 4 3/16" x 10"	$165
*LP-521-FM	0.01% + 1 mV	500 uV	3.3	3.0	2.6	2.3	5 3/16" x 4 3/16" x 15 1/2"	220
*LP-531-FM	0.01% + 1 mV	500 uV	5.7	5.3	4.7	4.0	5 3/16" x 8 3/8" x 15 5/8"	315

0-40 VOLTS

*LP-412A-FM	0.01% + 1 mV	500 uV	1.0	0.90	0.80	0.60	5 3/16" x 4 3/16" x 10"	$165
*LP-522-FM	0.01% + 1 mV	500 uV	1.8	1.6	1.4	1.2	5 3/16" x 4 3/16" x 15 1/2"	220
*LP-532-FM	0.01% + 1 mV	500 uV	3.0	2.9	2.7	2.3	5 3/16" x 8 3/8" x 15 5/8"	315

0-60 VOLTS

*LP-413A-FM	0.01% + 1 mV	500 uV	0.45	0.41	0.37	0.33	5 3/16" x 4 3/16" x 10"	$165
*LP-523-FM	0.01% + 1 mV	500 uV	0.9	0.8	0.7	0.6	5 3/16" x 4 3/16" x 15 1/2"	225
*LP-533-FM	0.01% + 1 mV	500 uV	2.4	2.2	2.1	1.8	5 3/16" x 8 3/8" x 15 5/8"	360

0-120 VOLTS

LP-414A-FM	0.01% + 1 mV	500 uV	0.20	0.18	0.16	0.12	5 3/16" x 4 3/16" x 10"	$200
LP-524-FM	0.01% + 1 mV	500 uV	0.5	0.45	0.4	0.35	5 3/16" x 4 3/16" x 15 1/2"	285
LP-534-FM	0.01% + 1 mV	500 uV	1.2	1.0	0.9	0.8	5 3/16" x 8 3/8" x 15 5/8"	365

0-250 VOLTS

LP-415A-FM	0.01% + 1 mV	500 uV	80 mA	72 mA	65 mA	60 mA	5 3/16" x 4 3/16" x 10"	$220

NOTES:

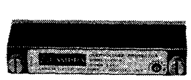
* Overvoltage protection available as an accessory. Each output requires separate OV accessory – add $35.00 for each output.

(1) Current rating applies over entire voltage range. Ratings based on 57-63 Hz operation.

(2) Prices are for metered models. LP and LPD series models are not available without meters.

(3) All prices subject to change without notice.

OVERVOLTAGE PROTECTOR ACCESSORIES	Adj. Voltage Range VDC	Model	For Use With	Price
each model requires separate OV accessory	3–24	LH-OV-4	LP-410A-FM, LP-411A-FM LP-520-FM, LP-530-FM LP-521-FM, LP-531-FM, LPD-421A-FM	$35
	3–47	LH-OV-5	LP-412A-FM, LP-522-FM LP-532-FM, LPD-422A-FM	35
	3–70	LH-OV-6	LP-413A-FM, LP-523-FM, LP-533-FM, LPD-423A-FM	35



NOTE: Price is for a single overvoltage accessory. LPD series models require one LH-OV for each output.

PWR INSTRUMENTS

SPECIFICATIONS OF LP AND LPD SERIES

DC output

voltage ranges shown in tables.

Regulated voltage

regulation (line or load)	0.01% + 1mv for line variations from 105-132 VAC or for load changes from no load to full load.
current range	as shown in table
remote programming resistance	200 ohms/volt nominal
remote programming voltage	volt per volt
ripple and noise	500 uV RMS, 1.5 mV pk-pk (either plus or minus terminal grounded.) LPD-425-A-FM model only – 1 mV RMS, 3 mV, pk-pk.
Temperature coefficient	(0.015% + 0.3mV)/°C-LP models (0.015% + 0.5mV/°C-LPD models

Constant current

(current regulated line and load)

Automatic crossover

voltage range	as shown in tables
current range	min: 45 mA or 1% whichever is greater (LP-530-FM – LP 534-FM models only) all other LP models and LPD models 6 mA or 1% whichever is greater. max: as shown in tables.
regulation (line or load)	less than 0.2% or 5 mA whichever is greater.

AC input

105-132 VAC; 47-440 Hz. Ratings based on 57-63 Hz.
187-242 VAC. See "AC Input Option."

Ambient operating temperature range

continuous duty from 0° to +60°C

Storage temperature range

-55°C to +85°C

Overload protection

Thermal

Thermostat, automatic reset.

Electrical

external overload protection	adjustable, automatic electronic current limiting, settable to 105% of rated current.
internal failure protection	provided by fuse

Input and output connections

covered terminal block on rear of chassis; five-way binding posts on front panel. On LPD Models one set of five-way posts is provided for each output.

Meters

voltmeter and ammeter. For LPD Models, each output has a separate voltmeter and ammeter.

Controls

DC output controls

coarse and fine voltage and coarse and fine current adjust provided on front panel of all LPD models for each output. On all other LP models coarse and fine voltage adjust and single current adjust controls are provided.

Power

on-off switch, front panel.

Remote sensing

provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Physical data

Size

LP-410A Series: 5 3/16"H x 4 3/16"W x 10"D; LP 520 Series 5 3/16"H x 4 3/16"W x 15 1/2"D; LPD Series: 5 3/16"H x 8 3/8"W x 10 3/32"D; LP-530 Series: 5 3/16"H x 8 3/8"W x 15 5/8"D; LP, LPD Series: Retractable Bench Rest included.

Weight

LP-410A Series: 7 lbs. net., 10 lbs. ship.; LP-520 Series: 14 lbs. net. 18 lbs. ship., LPD Series: 13 lbs. net, 16 lbs. ship., LP-530 Series: 25 lbs. net, 30 lbs. ship.

Panel finish

tan glass-filled, flame-retardant nylon panels.

Accessories

rack adapters, overvoltage protectors, pot covers, blank panels. See page 141.

Options

Ac input

add suffix "-V" to model for operation at 187-242 VAC and add 12% or $30.00 to the price (whichever is greater).
For 50 Hz operation derate current 10% on all models.

Fungus proofing

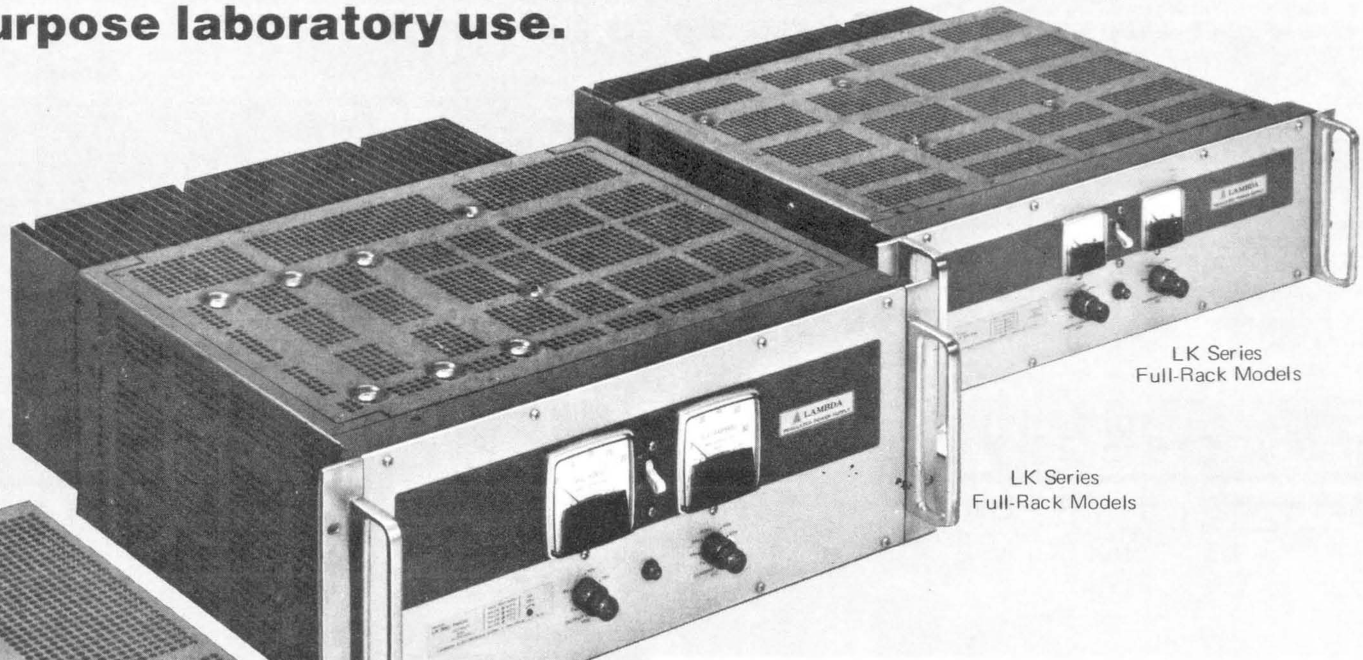
add suffix "-R" to model number and add 10% or $25.00 to the price (whichever is greater).

Guaranteed for 5 years

5-year guarantee includes labor as well as parts. Guarantee applies, to operation at full published specifications at end of 5 years.

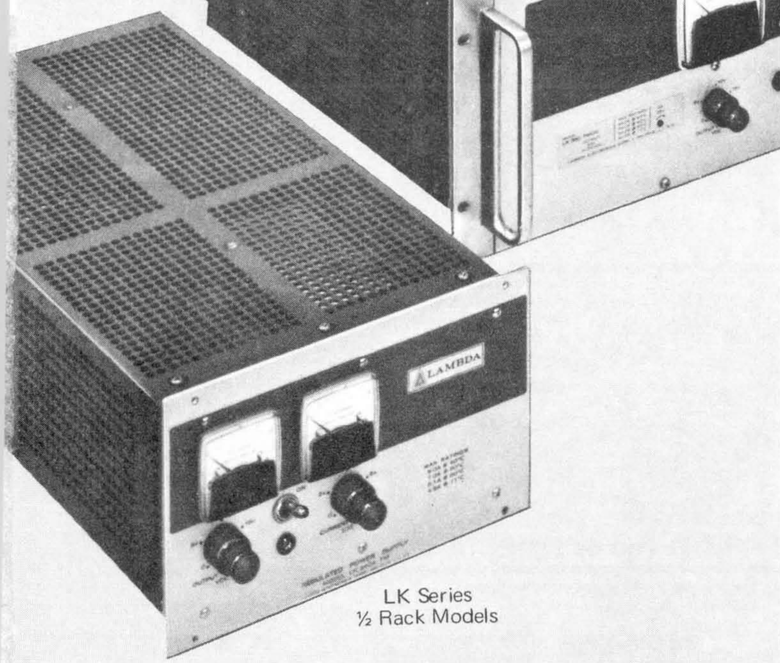
LK SERIES HIGH CURRENT POWER SUPPLIES

for automatic test equipment, systems, and general purpose laboratory use.



LK Series
Full-Rack Models

LK Series
Full-Rack Models



LK Series
½ Rack Models

All silicon convection-cooled power supplies
for bench or rack use

Outstanding Features

Convection-cooled
no blower, no external heat sinking

Regulation
0.015% or 1 mV — line or load

Ripple
500 uV RMS max.

No voltage spikes or overshoot
on turn-on, turn-off or power failure

Series/Parallel operation

Constant voltage/constant current

Remotely programmable
all models, by voltage or resistance

Remote sensing
eliminates effect of power output lead resistance on DC regulation

Meet mil, environment specs.
vibration: MIL-T-4807A
shock: MIL-E-4970A Proc. 1 &2
humidity: MIL-STD-819 Meth. 507
temp. shock: MIL-E-5272C (ASG) Proc. 1
Altitude: MIL-E-4970A (ASG) Proc. 1
marking: MIL-STD-130
quality: MIL-Q-9858

PWR INSTRUMENTS

LK SERIES

Three high current, all convection-cooled power packages
0-20, 0-36, 0-60 VDC and up to 66 amps.

0-20 VOLTS

MODEL	REGULATION	RIPPLE (RMS)	MAX. CURRENT, AMPS AT AMBIENT OF:(1) 40°C	50°C	60°C	71°C	DIMENSIONS	PRICE (5)
LK-340-A-FM	0.015% + 1 mV	500 uV	8.0	7.0	6.1	4.9	5 3/16" x 8 3/8" x 16"	$ 375
LK-341-A-FM	0.015% + 1 mV	500 uV	13.5	11.0	10.0	7.7	5 3/16" x 8 3/8" x 16"	550
LK-350-FM	0.015% + 1 mV	500 uV	35.0	31.0	26.0	20.0	5 3/16" x 19" x 16 1/2"	740
LK-360-FM*	0.015% + 1 mV	500 uV	66.0	59.0	50.0	40.0	7" x 19" x 18 1/2"	1,150

0-36 VOLTS

LK-342-A-FM	0.015% + 1 mV	500 uV	5.2	5.0	4.5	3.7	5 3/16" x 8 3/8" x 16"	$ 380
LK-343-A-FM	0.015% + 1 mV	500 uV	9.0	8.5	7.6	6.1	5 3/16" x 8 3/8" x 16"	550
LK-351-FM	0.015% + 1 mV	500 uV	25.0	23.0	20.0	15.0	5 3/16" x 19" x 16 1/2"	700
LK-361-FM*	0.015% + 1 mV	500 uV	48.0	43.0	36.0	30.0	7" x 19" x 18 1/2"	1,050

0-60 VOLTS

LK-344-A-FM	0.015% + 1 mV	500 uV	4.0	3.5	3.0	2.5	5 3/16" x 8 3/8" x 16"	$ 420
LK-345-A-FM	0.015% + 1 mV	500 uV	6.0	5.2	4.5	4.0	5 3/16" x 8 3/8" x 16"	550
LK-352-FM	0.015% + 1 mV	500 uV	15.0	14.0	12.5	10.0	5 3/16" x 19" x 16 1/2"	710
LK-362-FM*	0.015% + 1 mV	500 uV	25.0	24.0	22.0	19.0	7" x 19" x 18 1/2"	1,150

*AC INPUT 188-238 VAC STANDARD

OVERVOLTAGE PROTECTOR ACCESSORIES

ADJ. VOLT. RANGE VDC	MODEL	FOR USE WITH	PRICE
3-24	LH-OV-4	LK-340-A-FM, 341-A-FM	$35
3-47	LH-OV-5	LK-342-A-FM, 343-A-FM	35
3-70	LH-OV-6	LK-344-A-FM, 345-A-FM	35
3-70	Add "-OV" to	LK-350-FM to 352-FM	90
3-70	Model No.	LK-360-FM to 362-FM	120

NOTES:

(1) Current rating applies over entire voltage range.
(2) Prices are for metered models. Non metered models available at same price. Models LK-360-FM, LK-361-FM, and LK-362-FM, which are metered models, not available without meters.
(3) Overvoltage protection up to 70 VDC as a built-in option for full-rack models. To order, add suffix "-OV" and add $90.00 to price of models LK-350-FM, 351-FM, 352-FM. For models LK-360-FM, 361-FM, 362-FM, add $120.00 and order by adding -OV to model number.
(4) Chassis slides for full rack models: add suffix "-CS" to model number and add $60.00 to the price, except for models LK-360-FM, LK-361-FM and LK-362-FM, for which add $110.00.
(5) All specifications and prices subject to change without notice.

SPECIFICATIONS OF LK SERIES

DC output
voltage ranges shown in tables.

Regulated voltage

regulation line or load	0.015% or 1 mV whichever is greater for line variations from 105-132 VAC. (or 188-238 VAC LK-360-FM series).
remote programming resistance	200 ohms/volt
remote programming voltage	volt per volt
ripple and noise	500 uV RMS; with either pos. or neg. terminal grounded.
temperature coefficient	0.015%/°C

Constant current
(current regulated line and load)

Automatic crossover

voltage range	as shown in tables.
current range	minimum – 5% of 40° rating. maximum – as shown in tables.
regulation, line	less than 10 mA or 0.1% whichever is greater for Input Variations of 105-132 VAC (188-238 VAC LK-360-FM series).
regulation, load	less than 10 mA or 0.1% whichever is greater – for Input Variations of 105-132 VAC (188-238 VAC LK-360-FM series) from 0 to rated VDC load voltage change.

AC input
105-132 VAC, 47-63 Hz. (188-238 Vac, 47-63 Hz LK-360-FM Series only). For operation at 50 Hz derate output current by 10%. 187-242 VAC, see AC option.

Ambient operating temperature range
continuous duty from 0° to +71°C with load current ratings shown in tables.

Storage temperature range
-55°C to +85°C

Overload protection
Thermal

thermostat; automatic reset when over-temp. condition is removed.

Electrical

external overload protection: adjustable, automatic electronic current limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply. Current limiting settability to 105% of rated current. internal failure protection: provided by fuse.

Input and output connections
terminal block on rear of chassis

Meters
voltmeter and ammeter on all models.

Controls
DC output controls

coarse and fine voltage adjust and coarse and fine current adjust on front panel.

Power

on-off switch, front panel, – ½ rack models; circuit breakers, front panel – full-rack models.

Remote Sensing
provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Physical data
Size

LK-340A-FM Series: 5 3/16"H x 8 3/8"W x 16"D; LK-350-FM Series: 5 3/16"H x 19"W, 16 1/2"D; LK-360-FM Series: 7"H x 19"W x 18 1/2"D.

Weight

LK-340A-FM thru LK-345A-FM – 36 lbs. net, 41 lbs. ship.
LK-350-FM thru LK-352-FM – 95 lbs. net, 125 lbs. ship.
LK-360-FM thru LK-362-FM – 135 lbs. net, 170 lbs. ship.

Panel finish

brushed aluminum clear anodized panels with grey inlay (standard).

Accessories
rack adapters LRA-1, LRA-2 (LK-340 series only) chassis slides, over-voltage protectors, pot covers, blank panels. See page 141

Options
AC input

for operation of all models at 187-242 VAC, add suffix "-V" to model numbers and add 12% to the price. For operation of LK-360 series at 205-262 VAC, 47-63 Hz add suffix "-V" to model number and add 12% to price. For 50 Hz operation derate current 10% for all models.

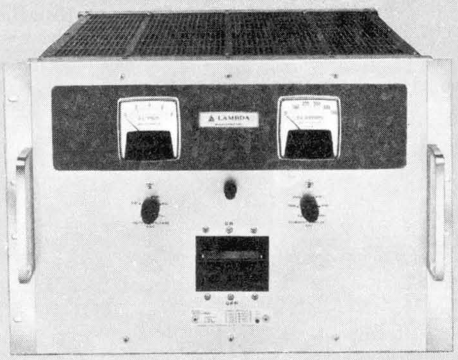
Fungus proofing

add suffix "R" to model number and add 10% to price.

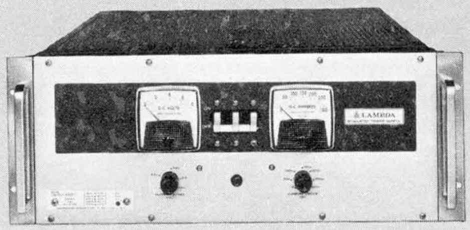
Guaranteed for 5 years
5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

LB SERIES
HIGH CURRENT, HIGH-EFFICIENCY POWER SUPPLIES

for use in main frame computers, component life tests aging racks and test equipment



LB-720 Series High-Efficiency Power Supplies



LB-700 Series High-Efficiency Power Supplies

Convection cooled – no internal fans

0-7.5 VOLTS

MODEL	MAX AMPS AT AMBIENT OF: (1) 40°C	50°C	60°C	71°C	DIMENSIONS	PRICE (4)
LB-701-FM-OV	300	270	235	200	7" x 19" x 20 1/16"	$1,600
LB-721-FM-OV	500	450	400	350	12 3/16" x 19" x 22 1/16"	2,500

0-15 VOLTS

MODEL	40°C	50°C	60°C	71°C	DIMENSIONS	PRICE
LB-702-FM-OV	180	170	160	150	7" x 19" x 20 1/16"	$1,600
LB-722-FM-OV	300	265	225	180	12 3/16" x 19" x 22 1/16"	2,500

0-36 VOLTS

MODEL	40°C	50°C	60°C	71°C	DIMENSIONS	PRICE
LB-703-FM-OV	80	75	70	65	7" x 19" x 20 1/16"	$1,500
LB-723-FM-OV	135	130	125	120	12 3/16" x 19" x 22 1/16"	2,400

0-60 VOLTS

MODEL	40°C	50°C	60°C	71°C	DIMENSIONS	PRICE
LB-704-FM-OV	50	47	44	40	7" x 19" x 20 1/16"	$1,500
LB-724-FM-OV	80	75	70	65	12 3/16" x 19" x 22 1/16"	2,400

0-120 VOLTS

MODEL	40°C	50°C	60°C	71°C	DIMENSIONS	PRICE
LB-705-FM	25	22	19	16	7" x 19" x 20 1/16"	$1,500
LB-725-FM	40	36	32	28	12 3/16" x 19" x 22 1/16"	2,400

0-300 VOLTS

MODEL	40°C	50°C	60°C	71°C	DIMENSIONS	PRICE
LB-706-FM	10	9.5	9.0	8.0	7" x 19" x 22 1/16"	$1,500
LB-726-FM	16	15	14	13	12 3/16" x 19" x 22 1/16"	2,400

NOTES:

(1) Current rating applies over entire voltage range.
(2) Prices include meters. LB Series models are not available without meters. Prices for all models up to and including 60 VDC include built-in over-voltage protection.
(3) Chassis slides are available with LB-701 thru LB-706-FM models only. Add suffix "CS" to the model number and add $110.00 to the price.
(4) Prices are U.S.A. list prices only. F.O.B. Melville, N.Y. All prices and specifications are subject to change without notice.

Outstanding Features

Up to 87% efficiency

Regulation

line 0.05% + 6 mV
load 0.1% + 10 mV

Ripple

10 mV RMS max. by use of electronic ripple reducer

Convection cooled

no blowers or internal fans, no external heat sinking

Overvoltage protection

standard on all models up to 60 VDC rating

No overshoot

on turn-on, turn-off or power failure

Remotely programmable

Remotely sensing

Magnetics

designed to MIL-T-27C, grade 6

Completely protected

short circuit proof – continuously adjustable automatic current limiting

Constant I./Constant V.

by automatic crossover

Series operation

Multi-current-rated

for 40°C, 50°C, 60°C, 71°C

SPECIFICATIONS OF LB SERIES

DC output
voltage ranges as shown in tables

Constant voltage

regulation, line	0.05% + 6 mV for line variations from 187-229 VAC or from 229-187 VAC
regulation, load	0.1% + 10 mV for load variations from 0 to full load
remote programming, resistance	200 ohms/volt nominal
remote programming, voltage	volt per volt
ripple and noise	10 mV RMS max; 100 mV RMS max for LB-706-FM; 150 mV RMS max for LB-726-FM. With "Z" option: 15 mV RMS for LB-701 thru LB-705; 150 mV RMS for LB-706
temperature coefficient	(0.03% + 0.5 mV/)°C

Constant current
(current regulated line and load)

Automatic crossover

current range	zero to max. current as shown in tables
regulation (line and load combines)	less than 1% + 10 mA (1% + 50 mA for LB-706-FM, 726-FM) for input variations from 187-229 VAC or from 229-187 VAC and from 0 to 95% output voltage change
ripple and noise	for LB-701-LB-705-FM and LB-721-FM-OV-LB-725-FM less-than (1/Vout*)% RMS of load current either positive or negative terminal grounded for LB-706-FM, less than (10/Vout*)% of load current for LB-726-FM, less than (15/Vout*)% of load current. With "Z" option (1.5/Vout*)% of 1 DC for LB-701-705; (15/Vout)% of 1dc for LB-706

*Vout equals Iout R_L measured at output terminals of power supplies.

AC input
208 ± 10% VAC; 57-63 Hz, 3 phase ± 10% max. phase unbalance, 4 wire. For operation at other than 57-63 Hz, see AC input option.

Efficiency
up to 87% efficiency.

Response time
for a 20% load change between 20% and 100% load, the voltage will recover to within 0.5 volt in 150 milliseconds.

Ambient operating temperature range
continuous duty from 0° to 71°C with load current rating shown in tables.

Storage temperature
-55° to +85°C.

Overload protection
Thermal
thermostat required resetting of circuit breaker to re-energize.

Overvoltage protection
built-in overvoltage protection on all model up to 60 VDC ratings.

Electrical
external overload protection: adjustable, automatic electronic current limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply. Current limiting settability to 110% of rated current.

internal failure protection: provided by primary circuit breaker.

Input connections
terminal block on rear of chassis.

Output connections
LB-700 series: 2 heavy duty studs 1/2"-20 on LB-701-FM-OV and LB-702-FM-OV models; all other models: 5/16"-24 studs on rear of chassis. LB-720 series: 4 heavy duty studs 5/16"-24 on LB-721-FM-OV and LB-722-FM-OV models; all other models: 2 studs, 5/16"-24.

Meters
independent voltmeter and ammeter with ±2% accuracy.

Controls
DC output and control
coarse and fine voltage adjust and coarse and fine current adjust on front panel.

Power
circuit breaker to protect against internal failure and to provide an on-off control on front panel. Pilot lamp on front panel energizes when circuit breaker is "on."

Remote sensing
provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation up to 5 volts in each leg.

Physical data
Weight
LB-700 Series: 215 lbs. net, 240 lbs. ship.
LB-720 series: 360 lbs. net, 410 lbs. ship

Size
LB-700 series: 7"H x 19"W x 20 1/16"D
LB-720 series: 12 3/16"H x 19"W x 22 1/16"D

Panel finish
brushed aluminum clear anodized panels with grey inlay.

Chassis finish
grey, FED. STD. 595 No. 26081

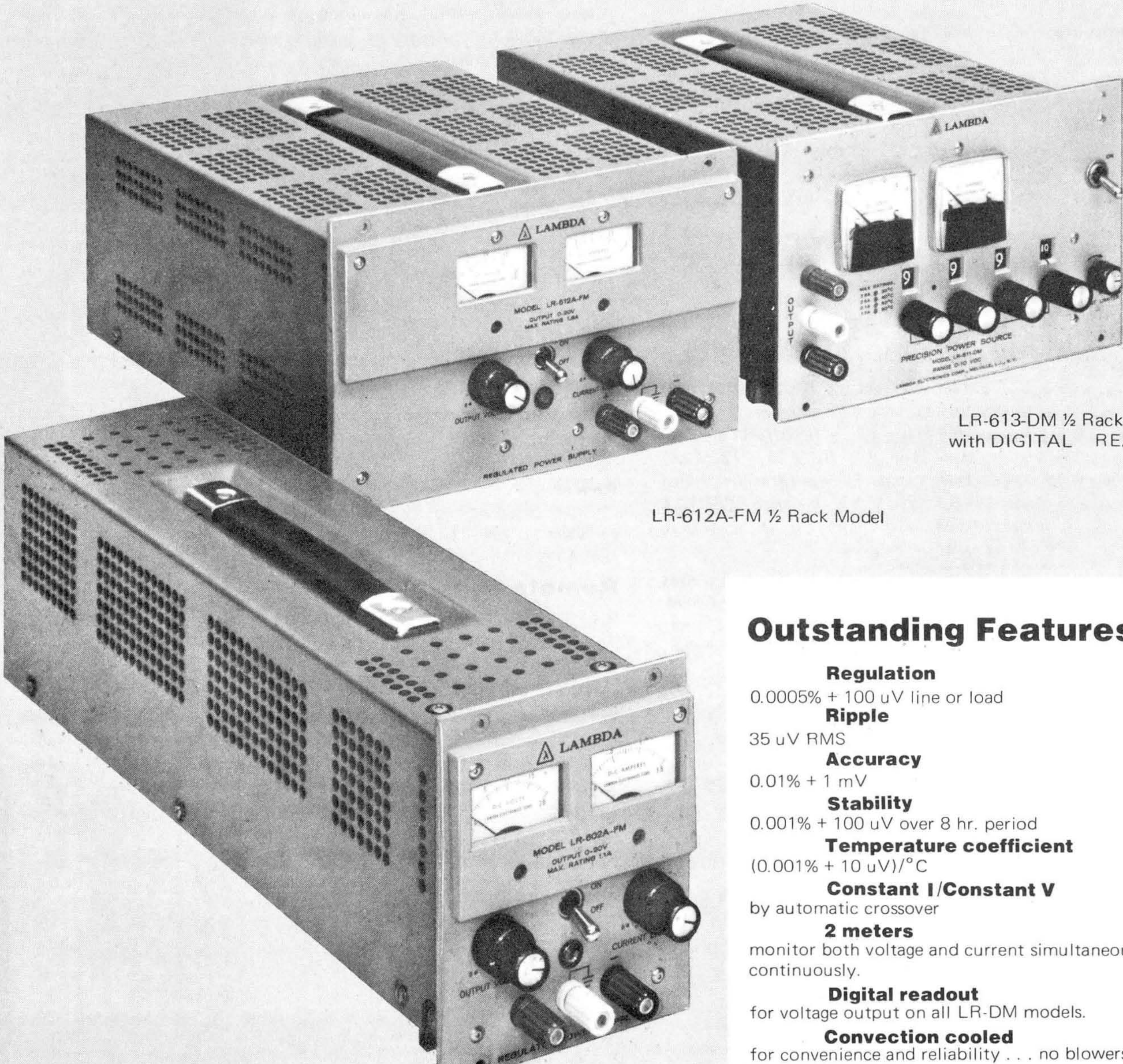
Options
AC input
the LB-700 and 720 Series are available for operation at 230 ±10% VAC 57-63 Hz 3 phase. Add suffix "V" to the model number and add 12% to the price. LB-700 Series only is available for operation at 208 ±10% VAC 47-53 Hz 3 phase. Add suffix "Z" to the model number and add 12% to the price. For "Z" option derate current 10.%

Accessories
chassis slides (LB-701-FM-OV thru LB-706-FM models only) and pot covers. See page 141

Guaranteed for 5 years
5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

LR SERIES
HIGH PERFORMANCE
POWER SUPPLIES

for automatic test equipment in systems where high accuracy is required.



LR-613-DM ½ Rack Model
with DIGITAL READOUT

LR-612A-FM ½ Rack Model

LR-602A-FM ¼ Rack Model

Outstanding Features

Regulation
0.0005% + 100 uV line or load

Ripple
35 uV RMS

Accuracy
0.01% + 1 mV

Stability
0.001% + 100 uV over 8 hr. period

Temperature coefficient
(0.001% + 10 uV)/°C

Constant I/Constant V
by automatic crossover

2 meters
monitor both voltage and current simultaneously and continuously.

Digital readout
for voltage output on all LR-DM models.

Convection cooled
for convenience and reliability . . . no blowers or external heat sinks

Remote sensing

Remote programming
by external voltage or resistance for convenience in systems, test equipment and automatic equipment applications.

Auto series/auto parallel
with Master-Slave tracking

Completely protected
short-circuit proof; continuously adjustable automatic current limiting.

Overvoltage protection
available as low cost add-on accessory.

High performance, high regulation power supplies from 100 mA to 2.8 amperes for rack or bench use.

0-10 VOLTS

MODELS	REGULATION	RIPPLE	MAX. CURRENT AMPS AT AMBIENT OF: (1) 30°C	40°C	50°C	60°C	DIMENSIONS	PRICE (2)
LR-611-DM*	0.0005% + 100 uV	35 uV	2.8	2.5	2.1	1.7	5 3/16" x 8 3/8" x 10 3/32"	$445

0-20 VOLTS

LR-602A-FM	0.0005% + 100 uV	35 uV	1.1	0.95	0.80	0.64	5 3/16" x 4 3/16" x 15 1/4"	$265
LR-612A-FM	0.0005% + 100 uV	35 uV	1.8	1.6	1.3	1.1	5 3/16" x 8 3/8" x 10 3/32"	305
LR-612-DM*	0.0005% + 100 uV	35 uV	1.8	1.6	1.3	1.1	5 3/16" x 8 3/8" x 10 3/32"	445

0-40 VOLTS

LR-603A-FM	0.0005% + 100 uV	35 uV	0.60	0.50	0.42	0.33	5 3/16" x 4 3/16" x 15 1/4"	$265
LR-613A-FM	0.0005% + 100 uV	35 uV	1.0	0.9	0.75	0.6	5 3/16" x 8 3/8" x 10 3/32"	305
LR-613-DM*	0.0005% + 100 uV	35 uV	1.0	0.9	0.75	0.6	5 3/16" x 8 3/8" x 10 3/32"	445

0-120 VOLTS

LR-615A-FM	0.0005% + 100 uV	35 uV	0.33	0.29	0.25	0.21	5 3/16" x 8 3/8" x 10 3/32"	$320
LR-615-DM*	0.0005% + 100 uV	35 uV	0.33	0.29	0.25	0.21	5 3/16" x 8 3/8" x 10 3/32"	445

0-250 VOLTS

LR-616A-FM	0.0005% + 100 uV	35 uV	100 mA	90 mA	80 mA	70 mA	5 3/16" x 8 3/8" x 10 3/32"	$340
LR-616-DM*	0.0005% + 100 uV	35 uV	100 mA	90 mA	80 mA	70 mA	5 3/16" x 8 3/8" x 10 3/32"	445

*Provided with digital readout.

PWR INSTRUMENTS

OVERVOLTAGE PROTECTORS ACCESSORIES

ADJ. VOLT. RANGE VDC	MODEL	FOR USE WITH	PRICE
3-24	LH-OV-4	LR-602A-FM, LR-612A-FM	$35
3-47	LH-OV-5	LR-603A-FM, LR-613A-FM	35

NOTES:

(1) Current rating applies over entire voltage range. Ratings based on 55-65 Hz operation. Derate current 10% for 50 Hz input.
(2) Prices are for metered models. LR series models are not available without meters.
All specifications and prices subject to change without notice.

SPECIFICATIONS OF LR SERIES

DC output
voltage ranges shown in tables.

Regulated Voltage

regulation, line	0.0005% plus 100 uV for line variations from 105-132 VAC.
regulation, load	0.0005% plus 100 uV for load variations from 0 to full load.
remote programming resistance	1000 ohms/volt. nominal
remote programming voltage	volt per volt
ripple and noise	35 uV RMS, 100 uV pk-pk with either positive or negative terminal grounded, with 60 Hz input.
temperature coefficient	(0.001% plus 10 uV)/°C

Constant current
(current regulated line or load)

Automatic crossover

voltage range	as shown in tables.
current range	continuously adjustable from 1% to 100% of 30°C rating.
regulation (line or load)	less than 2.0 mA for input variations of 105-132 VAC and from 0 to rated VDC load voltage change.
ripple and noise	less than 500 uA with either pos. or neg. terminal grounded.

AC input
105-132 VAC, 47-440 Hz (derate dc output current 10% at 50 Hz). 187-242 VAC, 47-440 Hz, see AC input option.

Accuracy *
0.01% plus 1 mV at 25°C.

Stability *
0.001% plus 100 uV over any 8-hour period after 30 minute warmup.

*Remote programming mode only on FM models.

Ambient operating temperature range
continuous duty from 0° to +60°C with load current ratings shown in table

Storage temperature range
55°C to +85°C.

Overload protection
Thermal

thermostat; automatic reset when overtemperature condition is removed.

Electrical

limiting circuit limits the output current to the preset value, thereby providing protection for load as well as power supply. Current limiting settability to 105% of rated current.

internal failure protection: provided by fuse.

Input and output connections
covered DC output and AC input terminal blocks on rear of chassis.

Controls
DC output controls

coarse and fine voltage adjust on FM models; 5 digits voltage readout system including a continuous vernier on DM models.

Current limiter

coarse and fine front panel concentric controls on FM models; single front panel control on DM models.

Power

on-off switch, front panel.

Remote sensing
provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation, rear panel.

Physical data
Size

LR-602A-FM—603A-FM, 5 3/16"H x 4 3/16"W x 15 1/4"D.
LR-612A-FM—616A-FM, 5 3/16"H x 8 3/8"W x 10 3/32"D.
LR-611-DM—616-DM, 5 3/16"H x 8 3/8"W x 10 3/32"D.
Retractable Bench Rest included for LR-FM Series.

Weight

LR-603A-FM — LR-603A-FM, 11 lbs. net, 14 lbs ship.
LR-612A-FM — LR-616A-FM, 14 lbs. net, 17 lbs. ship.
LR-611-DM — LR-616-DM, 14 lbs. net, 17 lbs. ship.

Finish

DM Models only	Brushed aluminum clear anodized panels with grey inlay (standard).
FM Models only	Tan glass-filled, flame-retardant nylon panels.

Accessories
rack adapters LRA-1, LRA-2, overvoltage protectors, pot covers, blank panels. See page 141.

Options
AC input

for operation at 187-242 VAC, add suffix "-V" to model number and add 12% to the price. Derate output current 10% at 50 Hz.

Fungus proofing

add suffix "R" to model number and add 10% to price except LR-DM models, for which fungus proofing option doesn't apply.

Guaranteed for 5 years
5-year guarantee includes labor as well as parts. Guarantee applies to operation at full published specifications at end of 5 years.

ACCESSORIES FOR USE WITH LAMBDA POWER INSTRUMENTS

Overvoltage Protectors Accessories

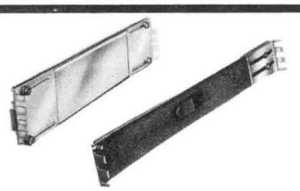
Adjustable Crowbar type (Mounting provisions provided - 2 terminal connections.)	Adj. Volt. Range VDC	Model	For Use With	Price
	3-24	LH-OV-4	LP-530-FM, LP-531-FM, LK-340A-FM, LK-341A-FM, LP-410A-FM, LP-411A-FM, LPD-421A-FM, LR-602A-FM, LR-612A-FM	$ 35
	3-47	LH-OV-5	LP-532-FM, LK-342A-FM, LK-343A-FM, LP-412A-FM, LPD-422A-FM, LR-603A-FM, LR-613A-FM	35
	3-70	LH-OV-6	LP-533-FM, LK-344A-FM, LK-345A-FM, LP-413A-FM, LPD-423A-FM, LP-523-FM, LP-413A-FM	35
		Add "-OV" to power supply model number	LK-350-FM, LK-351-FM, LK-352-FM,	90
			LK-360-FM, LK-361-FM, LK-362-FM	120

RACK ADAPTERS

LRA-1 Rack Adapter
5 3/16"H x 19"W x 16 1/2"D
For use with LP, LPD, LK, LR, series $60

LRA-2 Rack Adapter
5 3/16" Heights
For use with LP, LPD, LK, LR series $35

CHASSIS SLIDES

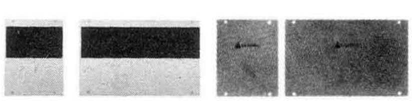


For use with Rack Adapter or Full Rack Power Instrument	Lambda Part No.	Add to Price
5 3/16" full-rack power instruments, LRA-1	KHT-34-003	$ 60
7" full-rack power instruments (LK series)	KHT-36-004	110
*7" full-rack power instruments (LB-700 series)	KHT-42-010	110

*The LB series, models LB-721 thru LB-726 power supplies are not available with chassis slides.

To order rack adapters or full rack power supplies with chassis slides, add suffix "-CS" to the model number. For example: LRA-1-CS, LB-705-FM-CS.

BLANK FRONT PANELS



*LBP-10, **LBP-11 Blank Front Panel
1/4 rack size, 5 3/16" height
. . . .$5.00

*LBP-20, **LBP-21 Blank Front Panel
1/2 rack size, 5 3/16" height
. . . .$10.00

Panel finish:	*Brushed aluminum clear anodized panels with grey inlay (standard)
	**Tan in color to match tan plastic front panels now used in certain 1/4 and 1/2 rack supplies.

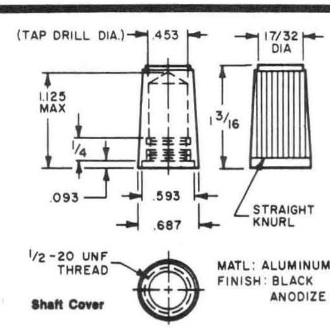
POT COVER

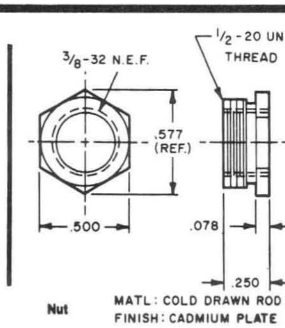
Tamper-proof potentiometer spindle cover designed for use with Lambda power supplies, but may be used with most instruments.

Front panel control knob with the Lambda PC-1 control knob cover, which fits standard potentiometer shaft threads. Useful in those applications which require permanent or semi-permanent laboratory or systems settings with no possibility of disturbing those critical settings.

The Pot Cover may be used with any pot using a 3/8" mounting shaft. There are two parts to the Pot Cover – a lock nut and a black anodized knurled knob. The device screws onto the threads of the potentiometer shaft and is tightened. (Note that the opening in the front panel must be of large enough diameter to accommodate the 3/8" diameter thread nut.) See dimensional drawing.

PC-1 Pot Cover $2.00

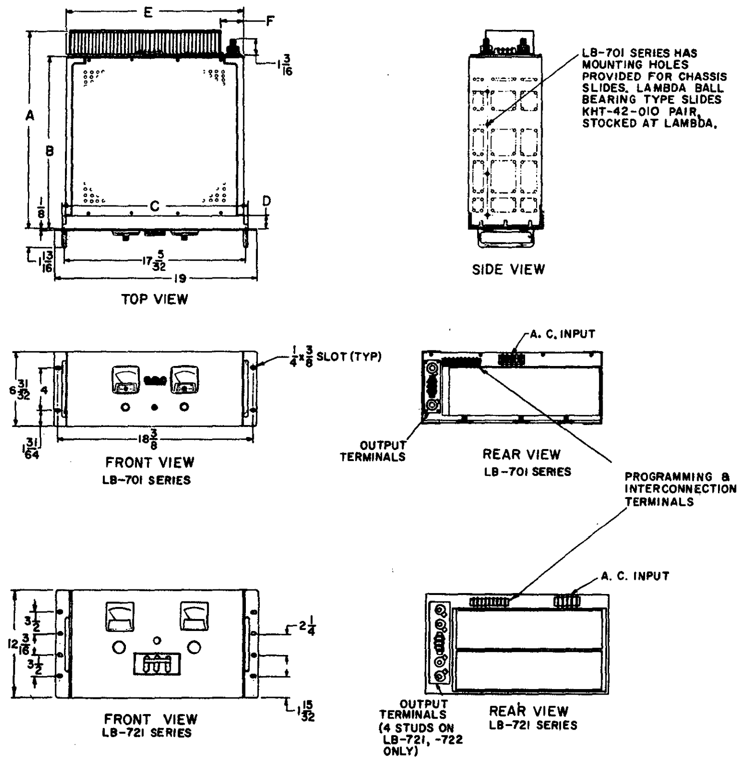




PWR INSTRUMENTS

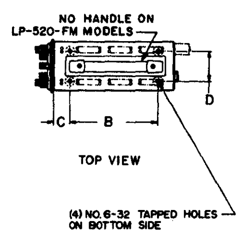
DIMENSIONAL DRAWINGS
LB SERIES, 1/4 RACK MODELS OF LP, AND LR SERIES

LB SERIES

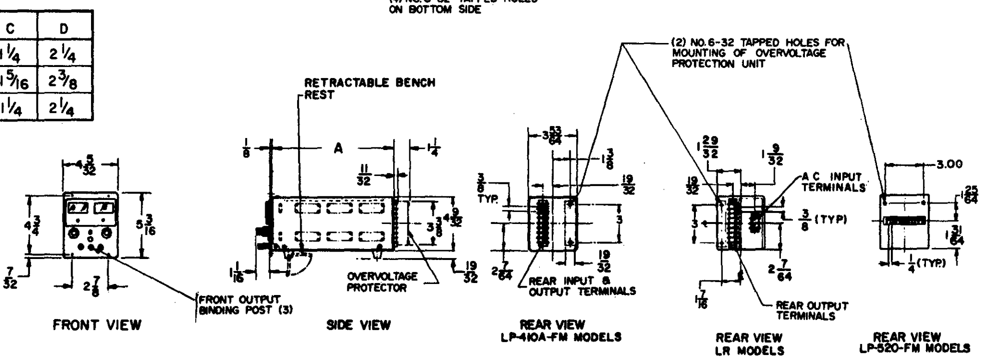


MODEL	A	B	C	D	E	F
LB 701 SERIES	20 1/16	17 33/64	17 9/16	1 1/4	17	2 3/16
LB 721 SERIES	22 1/16	19 1/2	17 5/8	1 1/2	17 5/8	2 1/2

LP-520-FM SERIES — 1/4-RACK MODELS
LP-410A-FM SERIES — 1/4-RACK MODELS
LR-602A-FM SERIES — 1/4-RACK MODELS

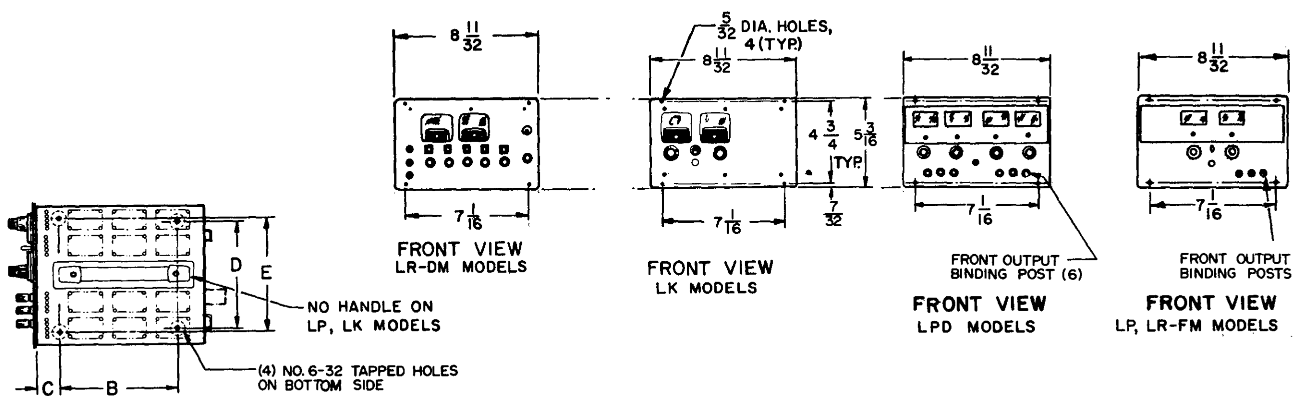


MODEL	A	B	C	D
LP-520-FM SERIES	15 7/32	12 13/16	1 1/4	2 1/4
LP-410A-FM SERIES	9 15/32	6 31/32	1 5/16	2 3/8
LR 1/4 RACK SERIES	15 7/32	12 13/16	1 1/4	2 1/4



DIMENSIONAL DRAWINGS
½ RACK MODELS OF LP, LPD, LK, AND LR SERIES

LP SERIES — ½-RACK MODELS
LPD SERIES — ½-RACK MODELS
LK SERIES — ½-RACK MODELS
LR SERIES — ½-RACK MODELS



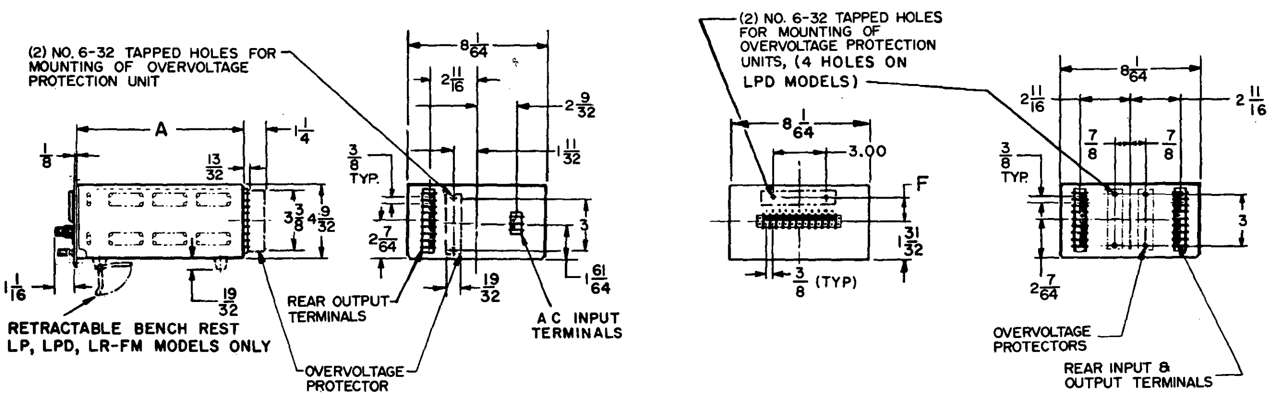
TOP VIEW

FRONT VIEW LR-DM MODELS

FRONT VIEW LK MODELS

FRONT VIEW LPD MODELS

FRONT VIEW LP, LR-FM MODELS



SIDE VIEW

REAR VIEW LR MODELS

REAR VIEW LP, LK MODELS

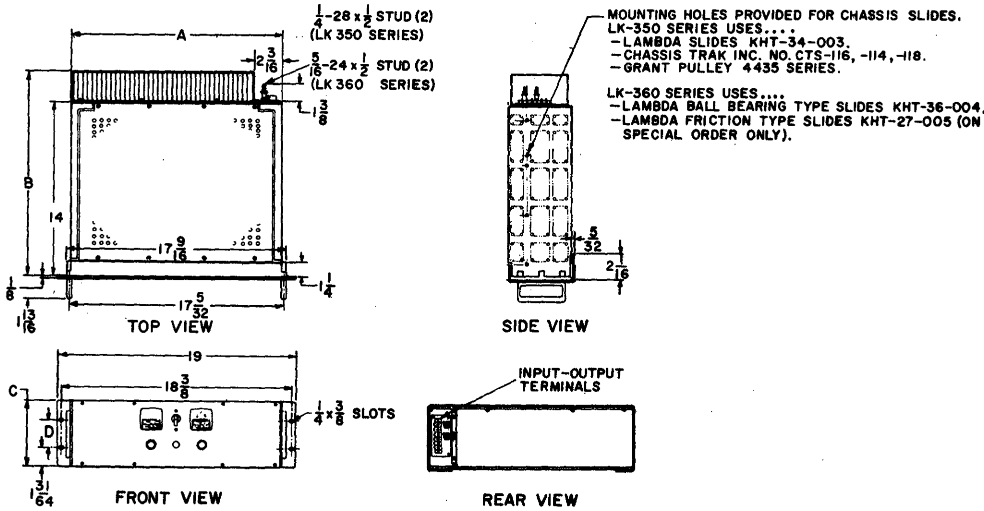
REAR VIEW LPD MODELS

MODEL	A	B	C	D	E	F
LP ½ RACK SERIES	15 7/32	12 13/16	1 1/4	6 7/16	6 7/16	1 25/64
LK ½ RACK SERIES	16	12 13/16	1 1/4	6 7/16	6 7/16	1 27/64
LPD ½ RACK SERIES	10 3/32	6 23/32	1 5/16	6 1/16	6 9/16	—
LR ½ RACK SERIES	10 3/32	6 23/32	1 5/16	6 1/16	6 9/16	—

PWR INSTRUMENTS

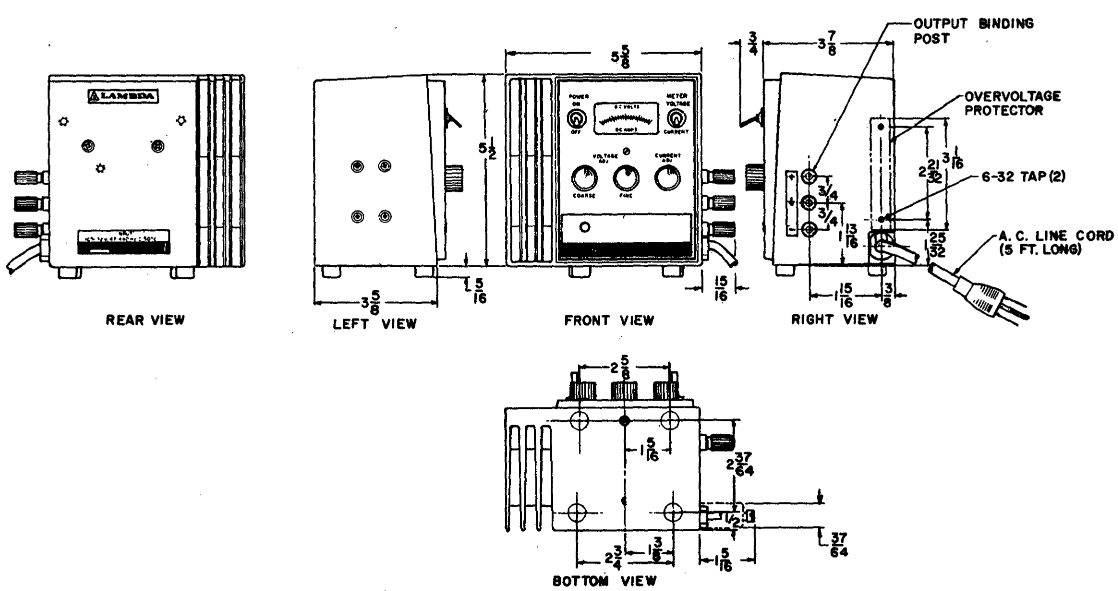
DIMENSIONAL DRAWINGS
LK SERIES FULL-RACK MODELS, LL SERIES

LK SERIES — FULL-RACK MODELS



MODEL	A	B	C	D
LK 350 SERIES	16 15/16	16 1/2	5 7/32	2 1/4
LK 360 SERIES	17	18 1/2	6 31/32	4

LL SERIES



DIMENSIONAL DRAWINGS
RACK ADAPTERS

LRA-1 RACK ADAPTER
LRA-2 RACK ADAPTER

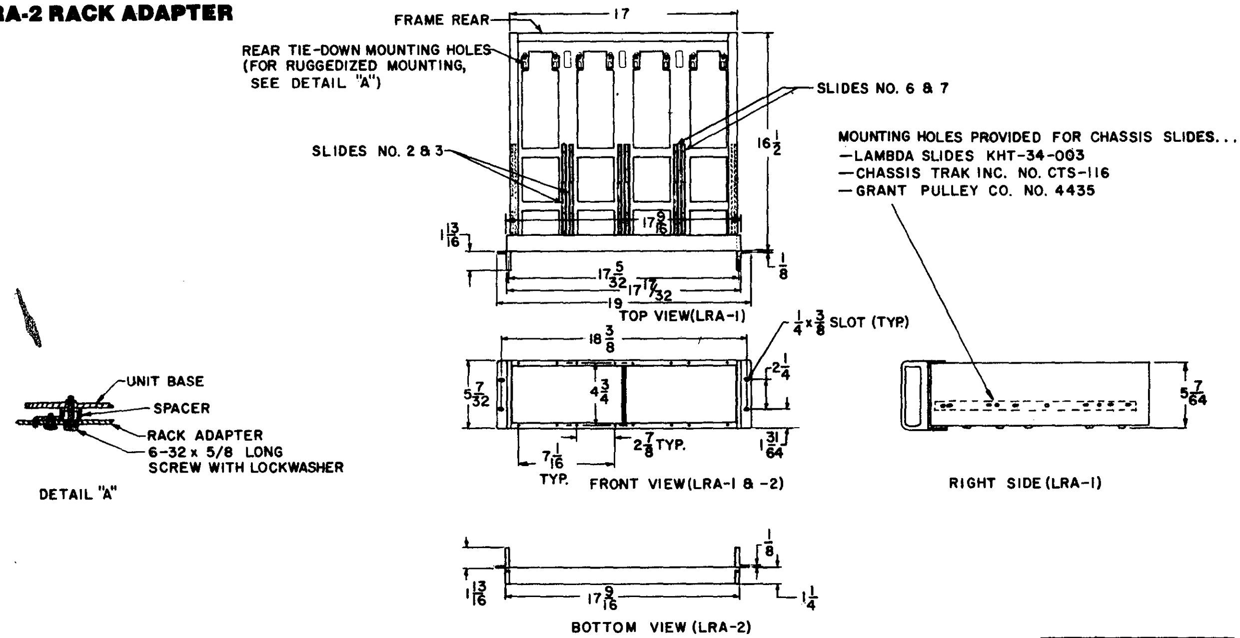
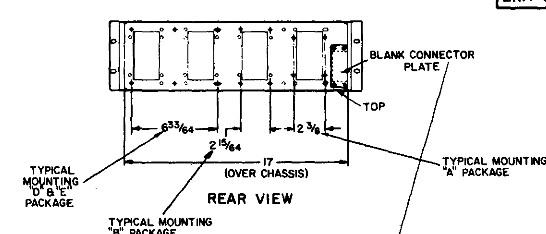


TABLE OF WEIGHTS		
MODEL	NET (LBS)	SHIPPING (LBS)
LRA-1	12	18
LRA-2	3	4
LRA-3	5	6

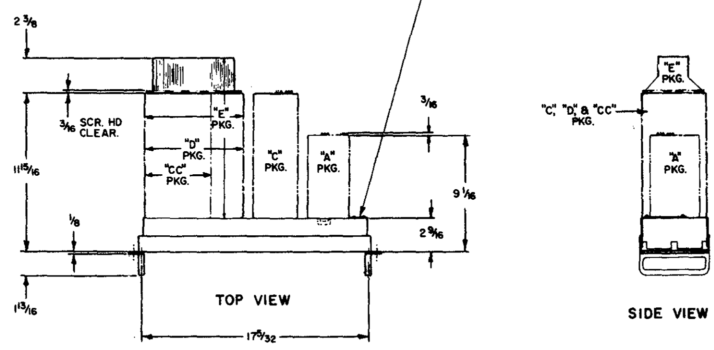
LRA-3 RACK ADAPTER

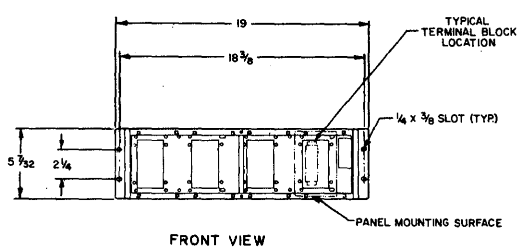


THIS RACK ADAPTER HAS PROVISIONS FOR MOUNTING:
(2) "D" PACKAGES OR "E" PACKAGES OR
(2) "CC" PACKAGES OR (4) "A", "B", OR "C" PACKAGES OR
(1) "D" WITH (1) "E" PACKAGE OR
(1) "CC" OR "D" OR "E" WITH (2) "A", "B", OR "C" PACKAGES OR
(1) "CC" WITH (1) "D" OR "E" PACKAGES.

NOTE:

THE FOLLOWING MODELS WILL NOT FIT IN A LRA-3: LXD-CC, LXS-D, LXD-D, LXT-D, LXS-E, LCS-CC, LCS-D, LCS-E & LW-D-A.

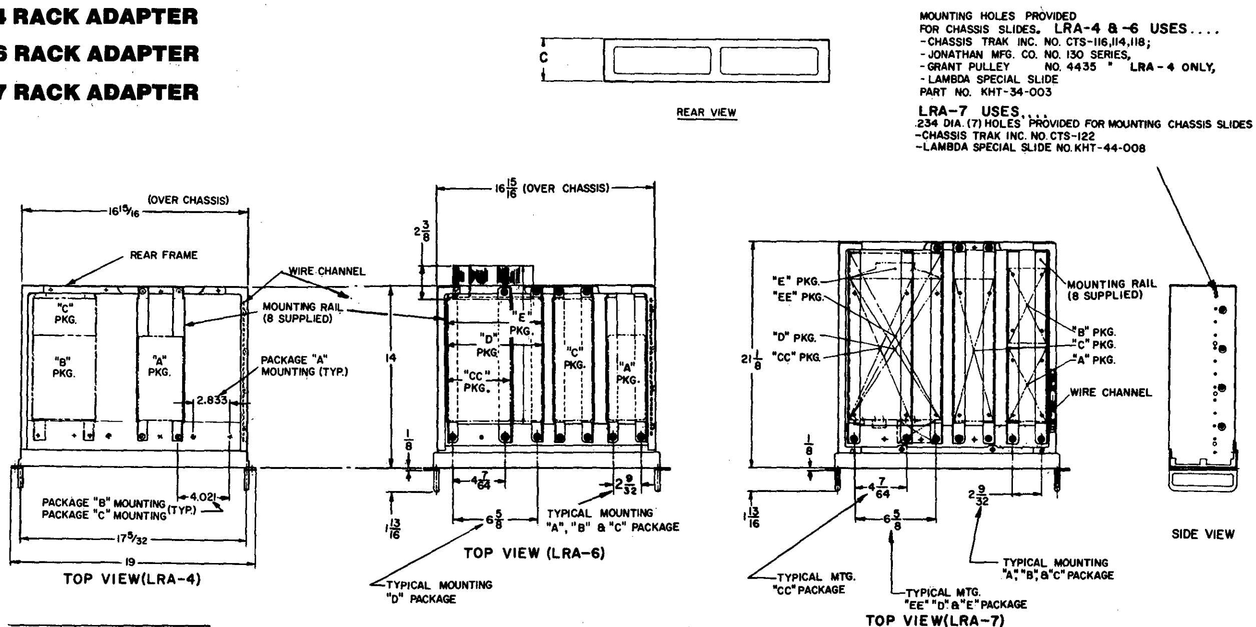




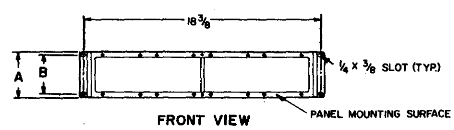
PWR INSTRUMENTS

DIMENSIONAL DRAWINGS RACK ADAPTERS

LRA-4 RACK ADAPTER
LRA-6 RACK ADAPTER
LRA-7 RACK ADAPTER



MODEL	A	B	C
LRA-4	$3\frac{15}{32}$	3	$3\frac{5}{16}$
LRA-6	$5\frac{7}{32}$	$2\frac{1}{4}$	$5\frac{1}{16}$
LRA-7	$5\frac{7}{32}$	$2\frac{1}{4}$	$5\frac{1}{16}$



FRONT VIEW

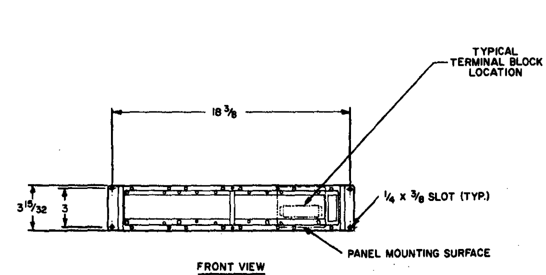
LRA-4....
THIS RACK ADAPTER HAS PROVISIONS FOR MOUNTING:
(4) "A" PACKAGES OR
(3) "B" PACKAGES OR
(3) "C" PACKAGES OR
(2) "B" OR "C" PKGS. & (1) "A" PKG. OR
(1) "B" OR "C" PKG. & (2) "A" PKGS.

LRA-6....
THIS RACK HAS PROVISIONS FOR MOUNTING:
(2) "D" PACKAGES OR "E" PACKAGES OR
(3) "CC" PACKAGES OR (4) "A", "B", OR "C" PACKAGES OR
(1) "D" WITH (1) "E" PACKAGE OR
(1) "CC" OR "D" OR "E" WITH (2) "A", "B", OR "C" PACKAGES OR
(1) "CC" WITH (1) "D" OR "E" PACKAGES

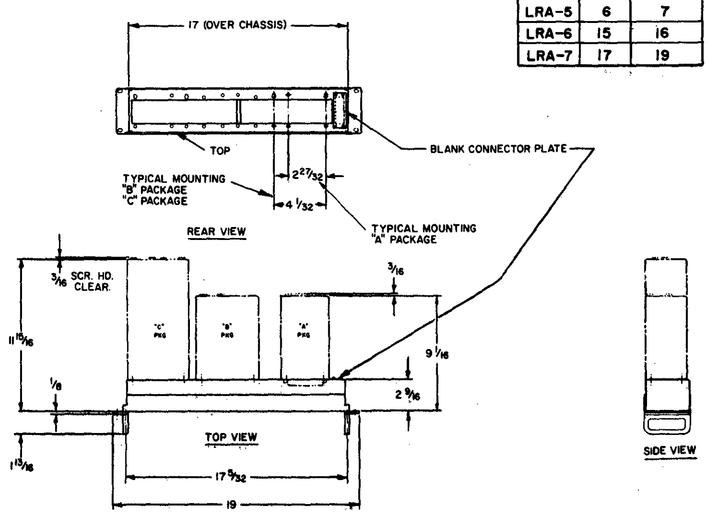
LRA-7....
THIS RACK ADAPTER HAS PROVISIONS FOR MOUNTING
(2) "EE" PKG. OR
(2) "D" PKG. OR
(2) "E" PKG. OR
(3) "CC" PKG. OR
(8) "A" OR "B" PKG. OR
(4) "C" PKG. OR
(1) "EE" WITH (1) "E" OR (1) "D" OR (2) "C" OR (4) "B" OR (4) "A" OR
(1) "CC" OR "D" OR "E" WITH (4) "A" OR (4) "B" OR (2) "C" OR
(1) "CC" WITH (1) "EE" OR "E" OR "D" PACKAGE.

LRA-5 RACK ADAPTER

TABLE OF WEIGHTS		
MODEL	NET (LBS)	SHIPPING (LBS)
LRA-4	14	15
LRA-5	6	7
LRA-6	15	16
LRA-7	17	19



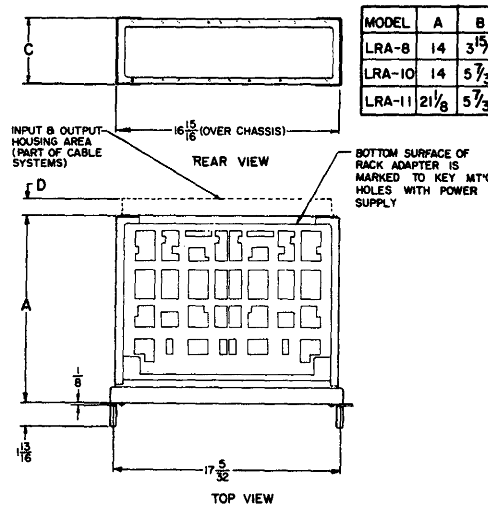
THIS RACK ADAPTER HAS PROVISIONS FOR MOUNTING:
(4) "A" PACKAGES OR
(3) "B" PACKAGES OR
(3) "C" PACKAGES OR
(2) "B" OR "C" PKGS. & (1) "A" PKG. OR
(1) "B" OR "C" PKG. & (2) "A" PKGS.

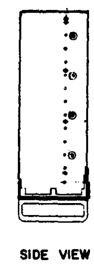


DIMENSIONAL DRAWINGS
RACK ADAPTERS

LRA-8 RACK ADAPTER
LRA-10 RACK ADAPTER
LRA-11 RACK ADAPTER

MODEL	A	B	C	D	E	F	G
LRA-8	14	3 15/32	3 5/16	2 23/32	3	15/64	3
LRA-10	14	5 7/32	5 1/16	2 23/32	2 1/4	1 31/64	4 3/4
LRA-11	21 1/8	5 7/32	5 1/16	1 1/8	2 1/4	1 31/64	4 3/4



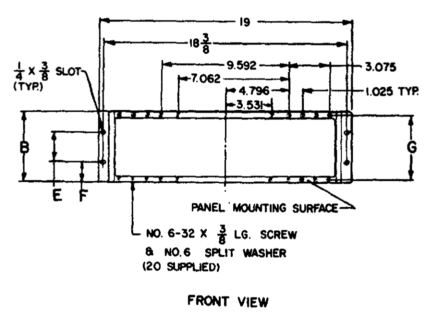


LRA-8
MOUNTING HOLES PROVIDED FOR CHASSIS SLIDES:
- CHASSIS TRAK INC. NO. CTS-116,114,118
- JONATHAN MFG. CO. NO. 130 SERIES
- GRANT PULLEY NO. 4435 SERIES
- LAMBDA SPECIAL SLIDE NO. KHT-34-003

THIS RACK HAS PROVISIONS FOR MOUNTING: (4) "A" OR DUAL "A" PACKAGES OR (3) "B" OR "C" PACKAGES OR (8) NO. "1" OR NO. "2" PACKAGES OR COMBINATIONS OF THESE UNITS

LRA-10
MOUNTING HOLES PROVIDED FOR CHASSIS SLIDES:
- CHASSIS TRAK INC. NO. CTS-116,114,118
- JONATHAN MFG. CO. NO. 130 SERIES
- GRANT PULLEY NO. 4435 SERIES
- LAMBDA SPECIAL SLIDE NO. KHT-34-003

THIS RACK HAS PROVISIONS FOR MOUNTING: (8) NO. "1" OR NO. "2" PACKAGES OR (4) DUAL "A" PACKAGES OR (3) NO. "4" PACKAGES OR (4) "A", "B", OR "C" PACKAGES OR (3) "CA", "CC" PACKAGES OR (2) "DA", "D" PACKAGES OR (3) NO. "5" PACKAGES OR COMBINATIONS OF THESE UNITS.



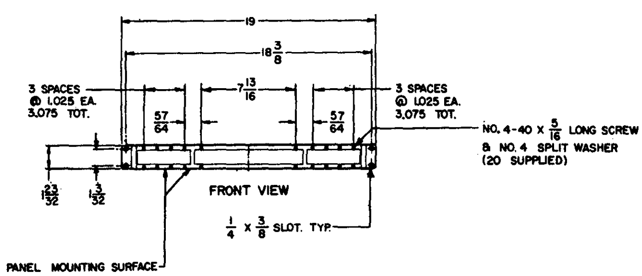
LRA-11
MOUNTING HOLES PROVIDED FOR CHASSIS SLIDES:
- CHASSIS TRAK INC. NO. CTS-122
- LAMBDA SPECIAL SLIDE NO. KHT-44-008

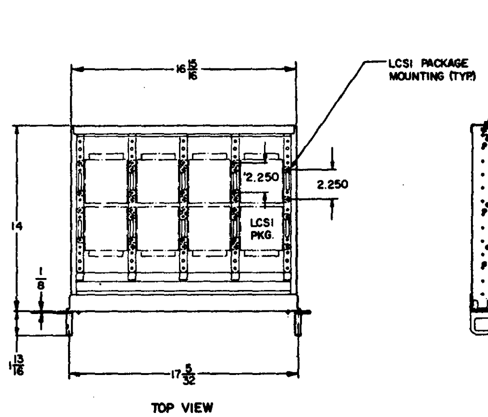
THIS RACK ADAPTER HAS PROVISIONS FOR: (8) "A" OR "B" OR DUAL "A" PACKAGES OR (4) "C" PKGS. OR (3) "CA" PKGS. OR (3) "CC" PACKAGES OR (2) "D" OR "DA" OR "E" OR "EE" PACKAGES OR (12) NO. "1" OR NO. "2" PACKAGES OR (6) NO. "4" PACKAGES OR (4) NO. 5 PACKAGES

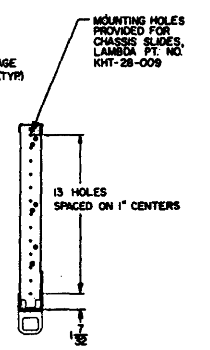
TABLE OF WEIGHTS		
MODEL	NET (LBS)	SHIPPING (LBS)
LRA-8	9	10
LRA-9	4 3/4	5 3/4
LRA-10	10	11
LRA-11	13 1/4	14 1/4

LRA-9 RACK ADAPTER

THIS RACK ADAPTER HAS PROVISIONS FOR MOUNTING (8) LCSI POWER SUPPLIES.







PWR INSTRUMENTS

DIMENSIONAL DRAWINGS
RACK ADAPTERS

LRA-12 RACK ADAPTER

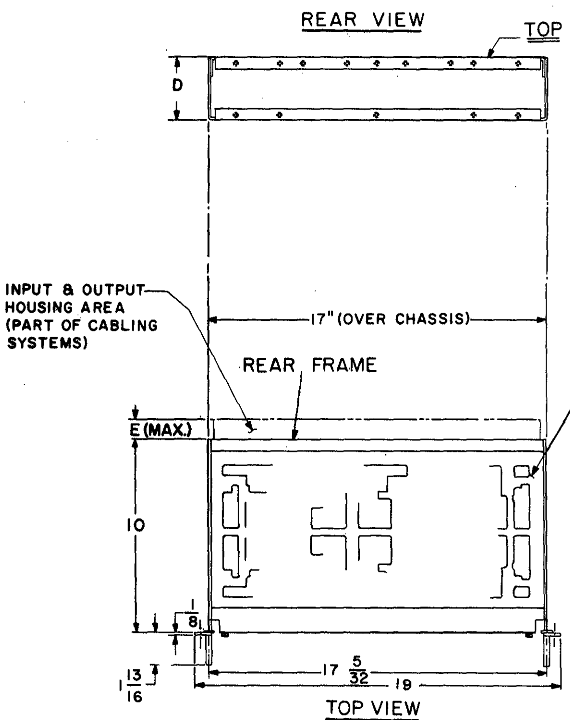
LRA-13 RACK ADAPTER

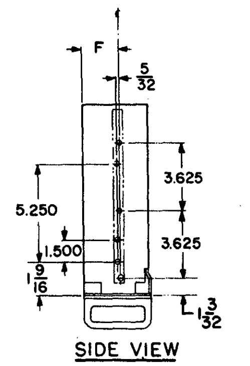
THESE RACK ADAPTERS HAVE PROVISIONS FOR MOUNTING:

LRA-12, LRA-13:
(1) SYSTEMS POWER CONTROL PANEL
(1) 4 OUTPUT, 3 OUTPUT, 2 OUTPUT OR SINGLE OUTPUT SIMULTANEOUS METERING PANEL
(1) 4 OUTPUT MAX. SELECTIVE METERING PANEL

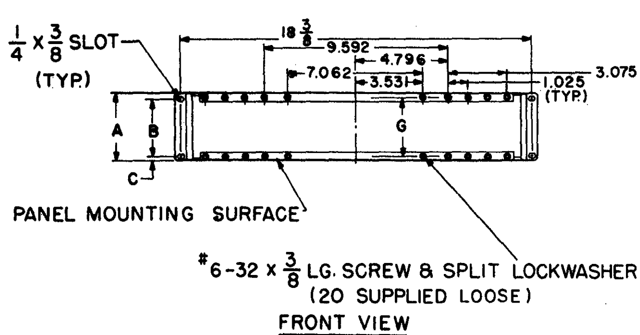
LRA-12:
(4) NO. "1","2",OR "3" PACKAGES OR (3) "A" OR "B" PACKAGES OR (1) "C" PACKAGE OR COMBINATIONS OF THESE UNITS.

LRA-13:
(4) NO. "1", "2", "3", "A", OR "B" PACKAGES OR (3) NO. "4" PACKAGES OR (2) NO. "5" OR "C" PACKAGES OR (1) "CA", "DA", "CC", "D", OR "E" PACKAGE OR COMBINATIONS OF THESE PACKAGES





MOUNTING HOLES PROVIDED FOR CHASSIS SLIDES.
-CHASSIS TRAK INC. NO. C-300-S-10 (USE .218 DIA., LOWER (℄), MTG. HOLES).
-LAMBDA SPECIAL SLIDE NO. KHT-20-011 (USE .218 DIA., UPPER, MTG. HOLES).



MODEL	A	B	C	D	E	F	G
LRA-12	3 15/32	3	15/64	3 21/64	1	1 47/64	3.000
LRA-13	5 7/32	2 1/4	13/64	5 5/64	1 3/8	2 49/64	4.750

HOW TO ORDER POWER INSTRUMENTS

Lambda power instruments, described on pages 126-144, can be ordered directly from this catalog. Models, accessories, options and specifications are presented for each series.

Lambda power instruments can be ordered with various options and accessories, depending upon the series. Options and accessories are listed under "Specifications" for each series.

Specify options and accessories by adding one or more hyphenated letter(s) to the model number, or by ordering separately by accessory model number. Note that some models are available only with, or without, certain options and/or accessories.

OPTIONS AND ACCESSORIES AVAILABLE WITH LAMBDA POWER INSTRUMENTS

Options	Suffix Designation or Model No.
1. AC input	**("-V")**
	("-Z")
2. Fungus proofingd	**("-R")**
3. Inclusion of meters (LK models)	**("-FM")**
4. Special paint	**Specify**

Accessories	
1. Overvoltage protectors	**("-OV")**
2. Rack adapter	**("LRA-")**
3. Chassis slides	**("-CS")**
4. Blank front panels	**("LBP")**
5. Pot cover	**("PC-1")**

Be certain to add the correct suffix for each option or accessory required, and adjust the overall price accordingly.

EXAMPLE

A metered model LK-344A-FM Power Instrument, with overvoltage protection and fungus proofing, supplied with an LRA-1 rack adapter, chassis slides and 1/2 rack blank panel, would be written as LK-344A-FM-R, and the price would be:

LK-344A-FM	**$420**
Fungus Proofing Option (-R)	**42**
Total Price	**$462**

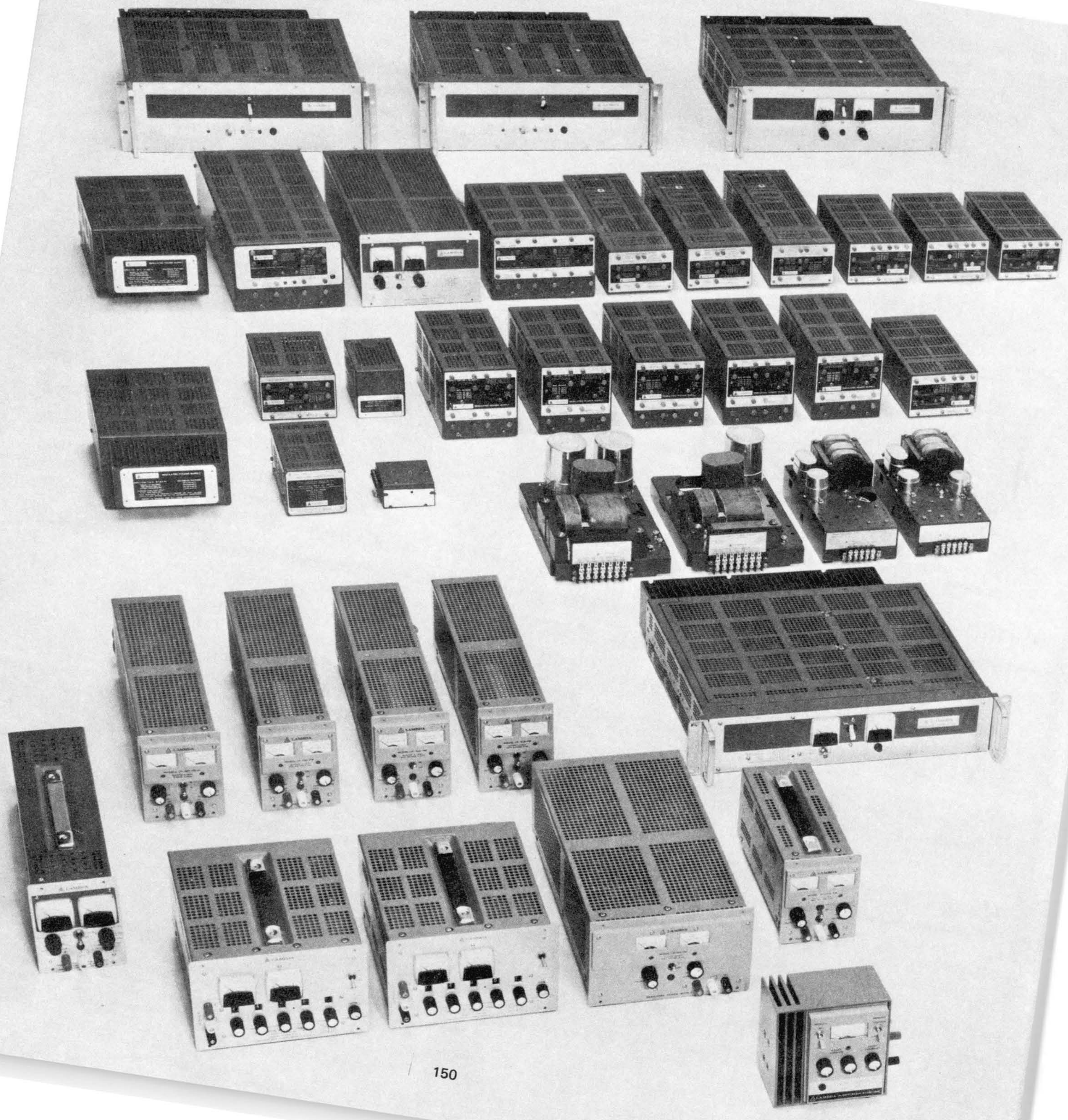
The rack adapter with chassis slides, overvoltage protector and blank panel would be ordered separately by model number:

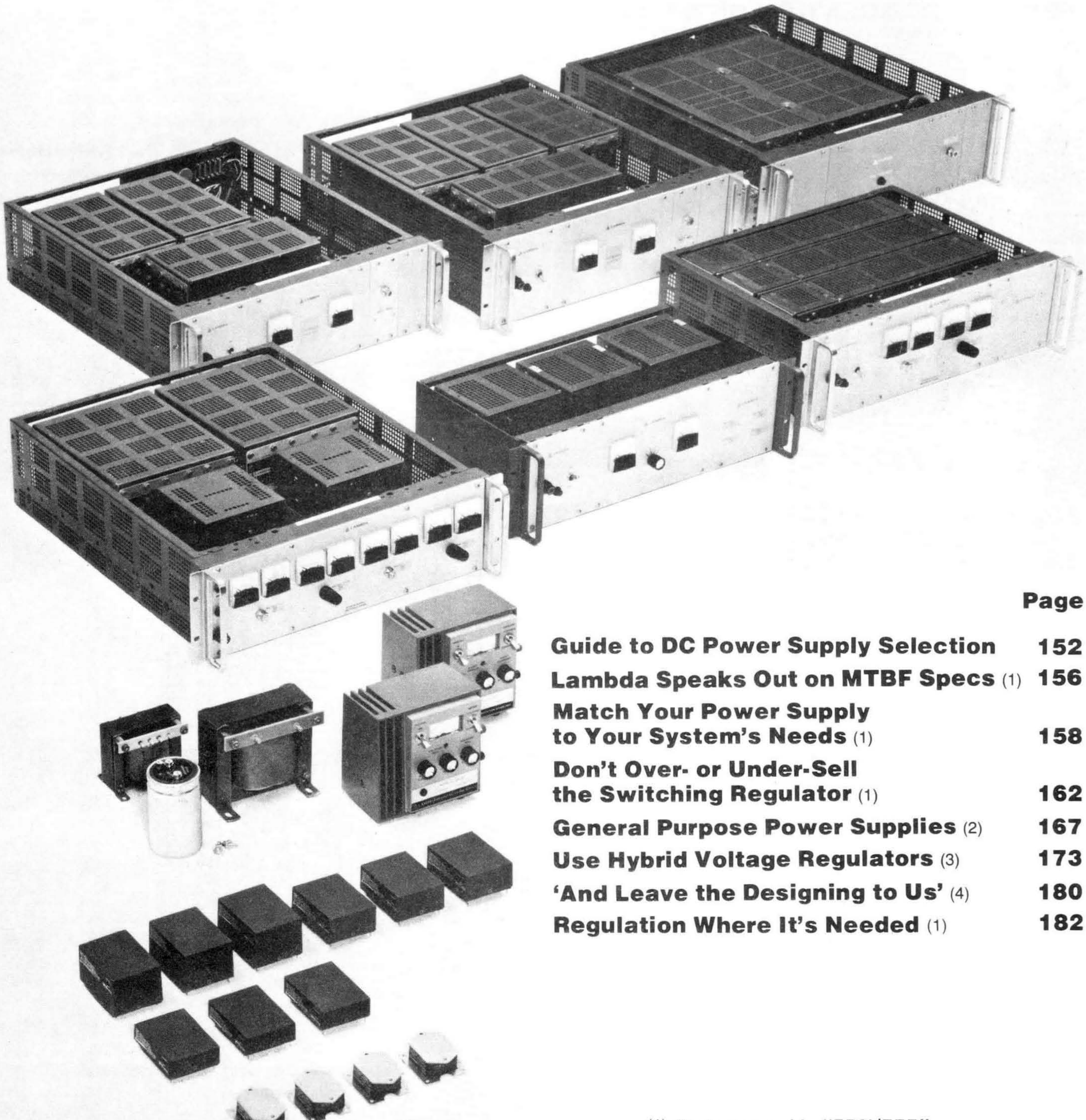
LRA-1-CS	**$120**
LH-OV-6	**35**
LBP-20	**10**

The total price for the power supply and all accessories would be **$627.**

General ordering information is given on pages 183-184.

LAMBDA POWER SUPPLY APPLICATIONS

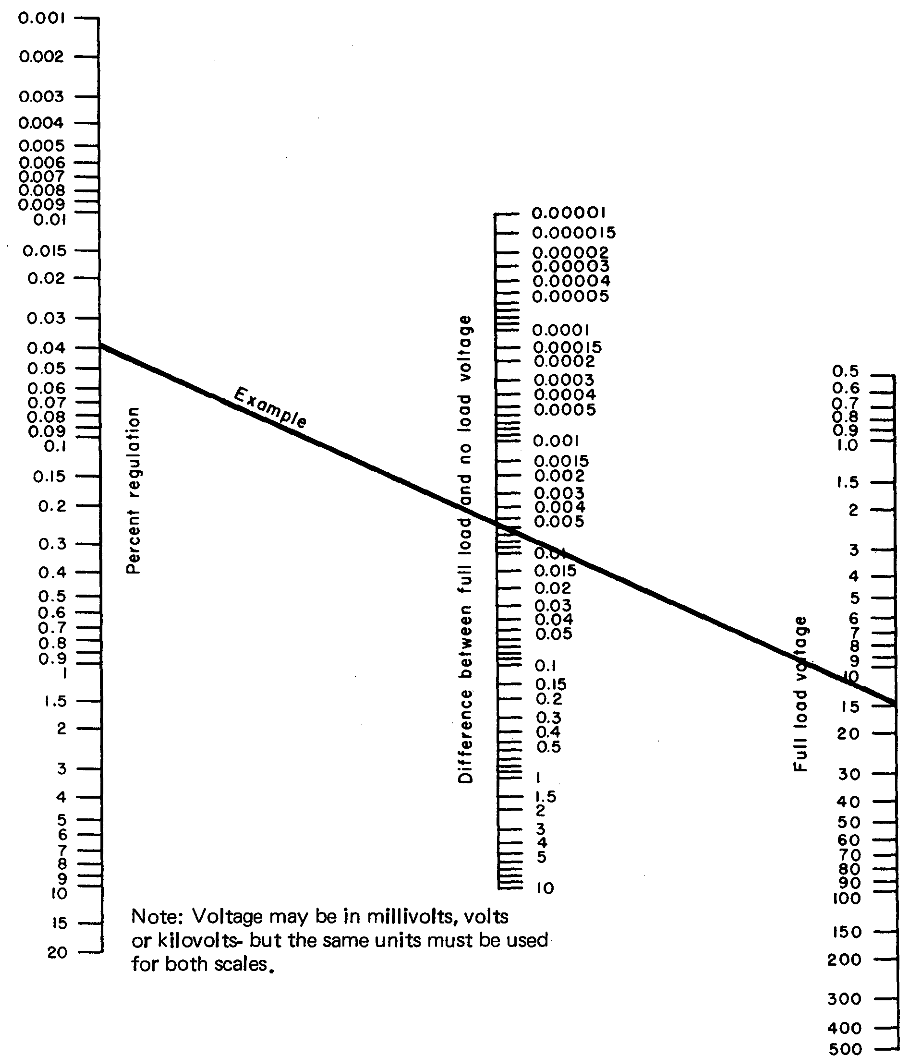




(1) First appeared in "EDN/EEE"
(2) First appeared in "Electronic World"
(3) First appeared in "Electronic Design"
(4) First appeared in "Electronics"

GUIDE TO DC POWER SUPPLY SELECTION

PERCENT REGULATION OF A POWER SUPPLY



The % regulation of a power supply is given by the formula:

$$\%\ \text{regulation} = \frac{\text{No Load Voltage} - \text{Full Load Voltage}}{\text{Full Load Volatage}} \times 100$$

The user should be aware that a DC offset voltage is often included as part of the regulation specification. Usually, this offset is significant at low output levels only and is indicated as a constant voltage added to the % regulation. Typically, regulation is between 0.01% and 0.1% of output voltage plus a fixed offset of from 1 to 5 mV.

Example: For 0.04% regulation what is maximum allowable change in output voltage if required Full Load voltage is 15V.
Answer: 0.006V.

TERMS AND DEFINITIONS

Constant Current—Operation of the power supply where output current remains fixed within specifications at a preset value while the load resistance varies, resulting in variation of the output voltage within the voltage range of the power supply.

Constant Voltage—Operation of the power supply where the output voltage remains fixed within specifications at a preset value while the output current varies within the range of the power supply.

Convection Cooled Power Supply—A power supply whose construction is such that it contains no blowers or fans and whose cooling results from the natural upward motion of air flowing through the surfaces of the heat dissipating elements.

Current Limiting—A method used to limit the maximum steady state output current to a preset value.

Efficiency—The efficiency of a power supply is the ratio of the output power to the input power expressed as a percentage.

Line Regulation (Voltage)—The maximum amount of change in the output voltage as the result of a change in the input voltage.

Load Regulation (Voltage)—The maximum amount of output voltage change due to a change in the load from a condition of over a specified load change.

Output Impedance—The complex ratio of the sinusoidal voltage and an incremental sinusoidal output current, the one being caused by the other. The magnitude of output impedance is a function of frequency.

Parallel Operation—Two or more power supplies so connected that their output currents are additive and feed a common load.

PARD (Ripple and Noise)—The periodic and random deviation of a dc output parameter from its average value, over a specified bandwidth with all external operating and environmental parameters maintained constant. PARD is sometimes referred to as "Ripple and Noise" and is expressed in terms of its rms or peak-to-peak value.

Range—The maximum and minimum limits of output voltage and output current of a power supply.

Remote Programming—The remote controlling of the DC output (voltage or current) by means of an external variable resistance, conductance or voltage.

Remote Sensing—A means by which the DC output voltage is sensed at the load rather than at the terminals of the power supply, thus compensating for the voltage drops in the wires connecting the power supply to the load.

Series Operation—Two or more power supplies so connected that their output voltages are additive and the total voltage across the load is equal to the sum of the output voltages.

Stability—The change in output voltage or current as a function of time, after power supply has reached thermal equilibrium, at conditions of constant line voltage, constant load and constant ambient temperature.

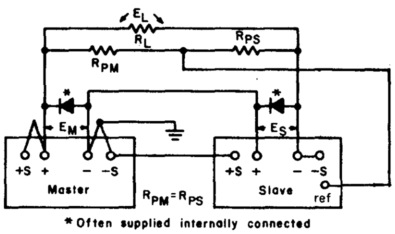
Temperature Coefficient—The percent change in the output (voltage or current) averaged over the operating ambient temperature range expressed in percent per °C. This assumes constant AC input voltage and constant load.

Temperature Range—The range of environmental temperatures, without supplementary cooling or heating, over which the power supply can be operated. The lowest operating temperature is the lowest temperature of the environment before power supply is turned on.

GUIDE TO DC POWER SUPPLY SELECTION

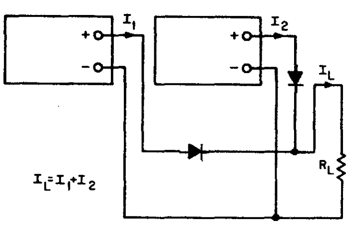
Power supply hookups

MULTI-UNIT OPERATION, SERIES OPERATION (Tracking)



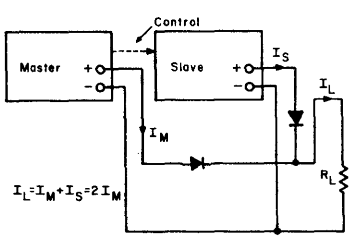
Tracking series operation often used in operational amplifier systems to provide equal and opposite voltage. Tracking performance is superior to individual units because the "master" unit provides a reference voltage for the "slave" unit.

MULTI-UNIT OPERATION, DIRECT PARALLELING



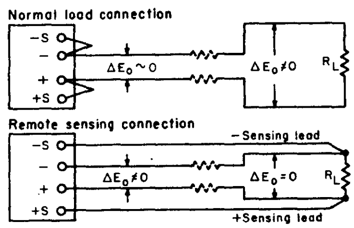
Paralleling of power supplies is used when meeting load current requirements that exceed the current capacity of a single supply. Direct paralleling uses constant-voltage/constant-current supplies. The current crossover point of each is chosen so that the sum is greater than the required load current. The output voltages of the units then are matched as closely as possible. Voltage regulation is maintained over a load current range equal to the output current of the unit operating in constant current. Check manual of individual power supplies for correct parallel output configuration hook-up.

MULTI-UNIT OPERATION, MASTER-SLAVE PARALLELING



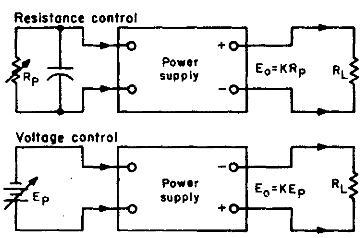
In master-slave paralleling, the master unit supplies a control signal to the control elements of the slave unit. The master regulates the output voltage of all units, thus no deterioration of regulation occurs. Unlike direct paralleling, the load current is shared equally between units and has a max. value that is the product of the number of parallel units.

REMOTE SENSING



Found on most power supplies, remote sensing uses two extra wires between supply and load allowing compensation for the IR drop in the current carrying leads. This achieves optimum regulation at load rather than at the power supply output terminals. Since the sensing leads carry a very small current, the voltage drop through them is negligible. However, shielded, twisted cable should be used for sensing leads with shield grounded to the power supply to reduce EMI.

REMOTE PROGRAMMING



A useful feature, remote programming permits control of the regulated output or voltage by means of a remotely varied resistance of voltage. The value of the programming resistor is determined by using the power supply Ω/V sensitivity (or Ω/A for current control). When choosing the resistor, select one with a low temp. coefficient, and a wattage rating at least 10 times the dissipated power. Lead requirements are the same as for remote sensing. A capacitor should be connected across the remote programming terminals of the power supply to minimize pickup. When using voltage programming, the output resistance of the voltage source must be small relative to the programming current for which it must act as a sink.

APPLICATIONS

LAMBDA SPEAKS OUT ON MTBF SPECS

Everybody wants reliability. It's one of those good things like flag and motherhood; we all love it. And since we're engineers we like to quantify things. So there's great appeal in a document that helps us stick numbers on our failure rates.

Numbers can look very "scientific," even when they're meaningless. So it's easy for us to kid ourselves.

Mil-Handbook 217A, gives us a way to calculate stress factors on operating components so we can predict failure rates in terms of Mean Time Between Failures. The failure rates assume the use of components on the Qualified Parts List.

In many applications, like low-voltage and low-power circuits, the calculation methods in 217A can really be relevant. Even here, however, we must add another ingredient to complete the overall quality picture, and this is the manufacturer's ability to produce a quality product. True, this is an intangible, but it's one we must not overlook in equipment selection. An MTBF calculation has little relevance if it's not backed up by sound engineering, sturdy packaging and a regard for quality controls in manufacturing.

But MTBF is applied indiscriminately by manufacturer and end user alike. The power-supply industry in particular has been plagued by MTBF misuse and misunderstanding. Since the end use of this product is normally industrial rather than military, QPL parts are not normally used. Understaffed operations from coast to coast advertise 100,000-hour MTBF ratings while manufacturing inferior products for uninformed users. Let's see how power supplies stress components in ways that MIL-Handbook 217A doesn't even recognize.

In the series-pass (or linear) power supply, the power transistor is subjected to major stress. MIL-Handbook 217A calculates stress by comparing the worst-case **operating** junction temperature to the device's maximum **rated** junction temperature. But nowhere does it mention second-breakdown characteristics, a primary cause of power-transistor failure.

Second-break failures can and usually do occur well within the safe-operating-power rating of the device. These failures are almost instantaneous and non-reversible and can be prevented only by knowing the limitation of the device and recognizing all its operating conditions including transient overloads and load short circuits.

In this respect the power-supply manufacturer has the same problem as the power-supply customer. He must know which semiconductor manufacturer understands the second-break phenomenon and specifies it correctly. Even though a confidence level does exist, new devices must be thoroughly checked out by the user since a mistake in specifications can be disastrous.

A more subtle cause of failure in power transistors can be created by unequal thermal expansions at the interface of the power chip and the heat spreader that's mounted on the header. This is most prevalent in the 2N3771 type of power transistor, which uses a 30-amp chip in a TO-3 case. Because the chip is so large, thermal problems of this type are greater than in devices rated at 15 amps or less. Thermal stresses can be relieved by using a moly pad between the power chip and heat spreader. The 2N3771 can be bought from some manufacturers with or without the moly pad since its use adds a hefty price premium to the device. But to disregard its need is a compromise in quality which must lead to increased failures.

Therefore, the power-supply manufacturer must be concerned with the internal construction of all power semiconductors. That's a requirement not easily accomplished by marginal operations where engineering coverage is limited.

If you've ever believed that all devices with the same JEDEC number are manufactured to the same criteria, try a simple test. Select any TO-3 type power transistor from several manufacturers. Remove the cap to expose the chip on the header and with the naked eye examine the construction for cleanliness of lead attachment at the chip, wire gage used in lead attachment, thoroughness of lead attachment to the output terminals and overall uniformity. You don't even need a magnifying glass to see specific differences in manufacture. It's a real eye-opener.

MIL-Handbook 217A treats diodes and SCRs like transistors, taking into account maximum operating junction temperatures only. When the device works into a capacitor filter, its i^2t rating is usually the most critical rating. The in-rush current to an uncharged filter section can be greater than 30 times the normal steady-state operating current and it occurs within a half cycle of the charging voltage. Here again, the discussion of transistor vendors and construction techniques are all applicable.

Capacitor stresses are calculated by comparing the maximum allowable WVDC rating of the component to actual circuit requirements, with ambient temperature as a variable. But in a capacitive-input filter, the more severe requirement would be capacitor ripple current. Ripple current through an electrolytic capacitor causes heating of the electrolyte. If the electrolyte vaporizes, the capacitor is destroyed. Operation at temperatures below the vaporizing temperature determines capacitor life, where capacitor life is defined in terms of equivalent series resistance.

ESR introduces an additional variable since ESR degradation for a given temperature varies from one capacitor type to another, even within a given manufacturer's line. For instance, a TV-grade capacitor is much inferior to a computer-grade capacitor. And a 65°C computer-grade capacitor is much inferior to an 85°C computer-grade capacitor.

Again, the question of construction techniques can be brought into the picture. One finds that all 85°C computer-grade electrolytics are not similar. End seals, packaging density, ESR, CV product, ripple-current capability and general construction techniques are all variables. Again the deciding factor for quality must be determined by vendor selection.

Let's consider the stress on one of our simplest and most common components—the resistor.

We can calculate the stress on a fixed or variable resistor by comparing the rated wattage to the operating wattage of the device with the ambient temperature as a variable. Variable resistors have very critical requirements in power supplies since any change or instability in the voltage-adjustment potentiometer is reflected directly to the output. Therefore, pot resolution, stability and torque all have significant effects on product performance. In a supply that's variable down to zero volt, the output-adjust pot can be turned from maximum output to minimum output in a fraction of a second.

When there's no load, this programming of the output from maximum voltage causes the output capacitor to discharge through the voltage-adjust pot through some low-impedance path in the amplifier. If the end terminations of the pot cannot take this current surge, the pot burns out, though steady-state power ratings were never exceeded. For a power supply, then, a pot must have high torque and high resolution to reduce instability and must have strengthened terminations to withstand surges during programming. All of these factors have nothing to do with MTBF or 217A. But if we ignore them we get a low-quality product with a high failure rate.

Similar situations exist for all components involved in the MTBF calculation. We've tried to explain in terms of critical components of a familiar product – the power supply. But the same considerations apply to many other products.

Equal MTFB numbers don't guarantee equal reliability.

Product reliability is a function of product engineering, manufacturing expertise and loving care. These are not measured in 217A. The product user, therefore, must know the capabilities and reliability of his suppliers. After he selects acceptable sources he can use MTBF numbers as procurement criteria.

To quote the handbook itself: "Intelligent evaluation for applicability must be made for the particular situation. This handbook is not a substitute for well-planned testing or judicious physical analysis of specific failures."

One additional word of caution: Many suppliers of any given type of equipment or component may have various levels of reliability (for example, plastic transistors and hermetic-sealed transistors, or TV capacitors and computer-grade capacitors). It's wise to understand fully the differences between products for the same function, even if they're from the same manufacturer.

It's wise, also, when you're buying equipment of any kind to open the box. Look around and judge the workmanship. You may not be able to stick an MTBF number on it, yet it can show up in what we really want – product reliability.□

MATCH YOUR POWER SUPPLY TO YOUR SYSTEM'S NEEDS

Virtually all electronic equipment requires some device to transform available ac line voltage into dc output voltages which are isolated from the ac line. This device is known as a power supply. There are several performance criteria which may be used to evaluate a power supply. These generally indicate how close a power supply approximates a zero-output impedance dc voltage source that is completely independent of the input line, output load and ambient temperature. This is the case for an ideal power supply. (In the case of the less-frequently used constant-current power supply, the ideal unit has infinite output impedance.)

As is the case with most things, the closer you approach the ideal power supply, the more money you need to spend. Therefore it is important that you evaluate your needs carefully. Overspecifying a power supply can lead to increased system costs without necessarily achieving improved system performance.

For example, if all you're interested in as far as your system is concerned is a power supply that has roughly 0.1% regulation and supply efficiency is mildly important, specifying a supply that uses SCR control elements gives 0.15% line and load regulation and 45% efficiency, yet can save you 35% in cost over ones using DC-to-DC converters. The latter types may provide 0.1% regulation and are slightly more efficient (50%), but they also cost quite a bit more **(Table 1).** Of course they can provide other advantages such as faster transient response and less weight, but these parameters may not be justified in a system given the additional cost.

Power supply methods

There are essentially four methods of providing regulated DC voltage from an AC source **(Fig. 1).** The simplest and least expensive method consists of a ferroresonant transformer, rectifiers and a DC filter capacitor. As can be seen from **Table 1,** this method provides relatively coarse regulation with high output ripple. There is also no way to adjust the output voltage without changing transformer windings. And the output voltage is very dependent upon the line frequency (2.4% per hertz of line change for a 60 Hz transformer).

The second method is the linear or series regulator which consists of a linear transformer, rectifiers and filter capacitors followed by a dissipative pass element. This type of supply provides fine regulation but relatively low efficiency. It is also relatively costly.

The third and fourth methods differ from the linear or series regulator in that the regulation is not provided by a linear dissipative element but from some type of duty-cycle control. These two methods employ what is generically known as switching regulators. Here, the regulator is generally a high-efficiency switch followed by some type of integrating network, usually a low-pass IC filter which allows only the average or dc component of the switched waveform to reach the output.

The first of these last two techniques utilizes line-frequency phase control, usually with SCRs as the power control elements. Supplies using this method provide a tradeoff between cost and some performance parameters.

The second switching-regulator method takes the ac line voltage and rectifies it to high-voltage dc which is then used to power an ultrasonic square-wave oscillator. The oscillator output is rectified and regulated, usually with a magnetic amplifier as the controlling device. The high-frequency operation of this dc-to-dc converter allows a great reduction in the size and weight of the magnetics and filter components but is usually the most expensive in cost.

How they compare

In applications where the input frequency is very narrow, the ferro-resonant supply will be satisfactory. If, however, wide input frequency variations are anticipated, this type of supply is not usable.

Of the three remaining approaches, what are the performance areas which require critical examination? If extremely fine regulation, low ripple and noise, and fast transient response to step load changes are required, the series regulator represents the only solution. When considering regulation requirements, the system user must recognize that even with remote sensing, the power supply can only regulate to one point. If the load is distributed in a large system, the precision load regulation will not be attained for all load points. This can only be accomplished by using multiple point-of-load regulators which are fed from a coarse dc source.

Table 1. Power supply types

	LINEAR	SCR WITH DYNAMIC FILTER	ULTRASONIC	FERRORESONANT
Rating ($/W) @ 5V	$1.75	$1.25	$2.00	$0.80
Line regulation	0.01% to 0.1%	0.15%	0.1%	2%
Load regulation	0.01% to 0.1%	0.15%	0.1%	5%
Ripple (pk-pk)	5 mV	100 mV	35 mV	
Ripple (rms)	1.5 mV	10 mV	10 mV	1%
Temperature coefficient	0.03%/°C	0.03%/°C	0.03%/°C	0.05%/°C
AC input (VAC)	105-132V	105-132V	105-132V	105-132V
AC input (frequency)	47-440 Hz	57-63 Hz	47-440 Hz or 145Vdc ±10%	59-61 Hz
Temperature range	–20 to +71°C	–20 to +71°C	–20 to +71°C	–20 to +55°C
Protection (overload)	Yes	Yes	Yes	Yes
Protection (over-voltage)	Maybe optional	Maybe optional	Maybe optional	Inherent characteristics
Protection (thermal)	Yes	Yes	Yes	Yes
Efficiency (@ 5V output)	25%	45%	50%	75%
Storage time after line failure	5 msec	1 msec	20 msec	1 msec
Weight (lbs./A) @ 5V	0.9	0.8	0.4	0.6
Transient response	100 μsec	100 msec	2 msec	25 msec
W/in³	0.4	0.6	1.0	1.0

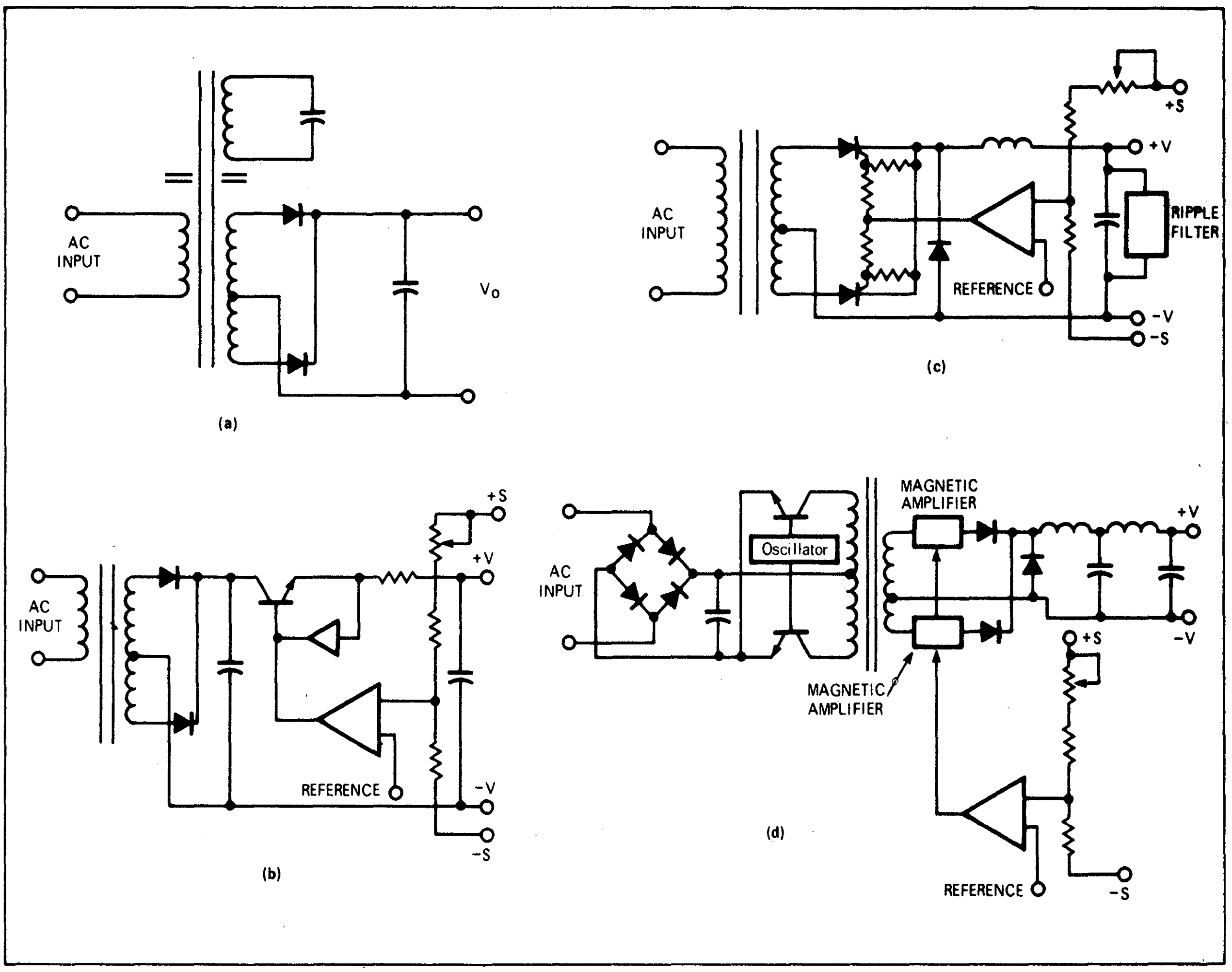


Fig. 1. The four common methods of getting regulated DC voltage from an AC voltage source. The least-expensive is the ferroresonant supply (a) which also provides relatively course regulation and high output ripple. The second method (b) uses a linear or series regulator which is more expensive but provides fine regulation. It is also low in efficiency. The third and fourth methods make use of switching regulators, either with SCRs (c) or ultrosonic square-wave oscillators (d) respectively. The use of SCRs allows for a tradeoff between cost and performance. Supplies with ultrasonic oscillators are small in size but cost the most.

In most logic applications, there are many logic boards, each with its own decoupling networks. Even though the individual gates may be changing states very rapidly, the total load current seen by the power supply is fairly constant. Thus in an application of this type, the full-load transient response of the power supply is a meaningless parameter. Most applications of this type find either the SCR phase-control or the ultrasonic supply adequate.

At present the SCR supply represents a less-expensive source of power than either the linear or the ultrasonic types. The ultrasonic one does have some advantages which are unique. It offers a relatively long storage time, something useful in many computer applications. It is, of course, smaller and lighter than any other method, which is important in any application when space is at a premium. In addition, it can run from battery power, which is useful in many situations.

Commonly used power supply terms

Ambient temperature

The temperature of the air surrounding the power supply, generally taken to be the room temperature. Care must be exercised here in interpreting this term, as some supplies may produce very high-temperature ambients of their own when not properly cooled.

Constant-current supply

A supply that provides a fixed output current regardless of changes in its output voltage, line voltage and ambient temperature.

Constant-voltage supply

A supply that maintains a fixed output voltage regardless of changes in output current, line voltage and ambient temperature.

Constant-current/constant-voltage supply

A supply that behaves as a constant-voltage source for relatively large values of load resistance and as a constant-current source for relatively small values of load resistance. The crossover point between these two modes of operation occurs when the value of the critical load resistance (Rc) equals the value of the supply voltage setting (Es) divided by the supply current setting.

Efficiency

The relative percentage of the output power delivered at the supply's output terminals divided by the power delivered to the supply needed to produce this output power. The ideal supply would be 100% efficient.

Load regulation

For a constant-current supply, it is the change in the steady-state value of the output DC current due to a change in load resistance from a short-circuit current (zero resistance) to a value which results in the maximum rated output voltage.

For a constant-voltage supply, it is the change in the steady-state value of the output DC voltage due to a change in load resistance from an open-circuit condition (infinite resistance) to a value which results in the maximum rated output current.

Line regulation

The change in the steady-state value of the output DC current (for a constant-current supply) or the output DC voltage (for a constant-voltage supply) caused by a change in the AC input line voltage from maximum to minimum or minimum to maximum specified levels.

Ripple and noise

The superimposed residual AC component on the output DC voltage of a supply. Ripple and noise are generally specified in terms of rms or pk-pk values. Switching-regulator type power supplies can however have very-large-amplitude spikes in the output that may not show up in any rms or pk-pk noise specifications. A wideband instrument should be used to measure noise to indicate the presence of these large-amplitude and high-frequency spikes.

Temperature coefficient (TC)

The maximum change in a supply's output voltage (for a constant-current supply) or output current (for a constant-voltage supply) per degree of change in ambient temperature, given a constant ac input voltage and a constant load value. The TC is sometimes calculated by taking two temperature extremes and plotting their voltages to give a TC slope. This method can be misleading as it does not indicate what happens during the temperature change or between the two extreme temperature points.

Transient response or recovery

The time it takes a supply's output voltage to recover to within a few millivolts (usually specified) of the nominal output dc voltage, following a sudden change in load current (usually the supply's maximum rated current).□

DON'T OVER-OR UNDER-SELL THE SWITCHING REGULATOR

Switching regulators differ from the more conventional series regulators in that they do not employ linear or dissipative elements as power handling tools. Regulation is accomplished in a non-dissipative mode. In the world of ideal components the switching regulator would have an efficiency of 100%, whereas even utilizing these non-existent devices, the series regulator's efficiency would be only somewhat above 70%.

The basic concepts employed in switching regulators are not at all new. In applications where size and efficiency are at a premium, particularly for military usage, the non-dissipative regulator has been on the scene for many years. However, there are still many people who still don't either fully understand or appreciate the design considerations and characteristics of these regulators. This article is aimed at clarifying these points by describing the design of an efficient, state-of-the-art switching regulator.

For the purpose of this discussion, switching regulators shall not include line-frequency phase control circuits but will be limited to those circuits that employ high-frequency techniques. The use of these techniques provides a reduction in the size of the magnetic components, which is not possible with line-frequency phase control systems.

In evaluating a power-supply design, the relative merits of the various regulation systems must be considered. Of the four basic techniques employed today (ferroresonant, series or dissipative, line-frequency phase control and ultrasonic switching), the high-frequency switching supply provides high efficiency along with the highest watts/cubic inch and watts/pound. Only the ferroresonant regulator provides higher efficiency.

Table 1 shows a comparison of the characteristics of a switching regulator to a series regulator. The power densities, cost and efficiencies are based on 5V supplies having maximum output power ratings of approximately 150W.

A review of the table provides some insight into the black-box characteristics of a switching supply. However, in

Table 1. Switching vs. series regulators

	SERIES REGULATOR	SWITCHING REGULATOR
Regulator	0.01%	0.1%
Ripple P-P	5mV	35mV
RMS	1.5mV	10mV
T.C.	0.03%/°C	0.03%/°C
AC input: VAC	105-132	105-132
frequency	47-440 Hz	47-440 Hz
Temperature range	−20°C to 71°C	0°C to +71°C
Storage time after line failure	5 msec	20 msec
Weight (lb/A) @ 5V	0.9	0.4
W/in³	0.4	1.0
$/W	$1.75	$2.00

order to fully recognize the advantages as well as the limitations of this device, one must look into the black-box and study each of the components.

A block diagram of a switching supply is shown in **Fig. 1.** The input power is applied through an emi suppression circuit. This input ac voltage is then rectified by a full-wave bridge circuit and capacitor filtered.

The high voltage DC of the filter circuit is applied to a free-running inverter circuit which provides transformer isolation between the input and output. The nominal operating frequency of the inverter if 20 kHz. In this circuit the isolation transformer (T_2) is designed to operate in the linear region. Oscillator drive is provided by saturating transformer T_1.

The output of T_2 is rectified using fast-recovery rectifiers and then regulated with a magnetic-amplifier circuit. The output of the magnetic amplifier is filtered by a 2-stage L-C filter.

Alternate configurations of the switching supply obtain regulation by controlling the duty cycle of the inverter transistors. In theory, such a circuit must be capable of adjusting the duty cycle from maximum to zero. In practice there are enough internal losses so that control is not required to zero, but only down to about 5%. For a unit operating at 20 kHz, this means that each transistor is to be on for only 1.25 μsec. The storage time of today's power transistors is in the 3 to 4 μsec region, which makes this control impossible. The only solution is to vary the frequency. Using transistors with 4 μsec storage time, the operating frequency would have to drop to 10 kHz. The circuitry required for this frequency shifting is complicated and leads to reduced system reliability, as well as considerable audible noise.

Once the decision is made to regulate on the secondary, there are two basic approaches which must be considered:

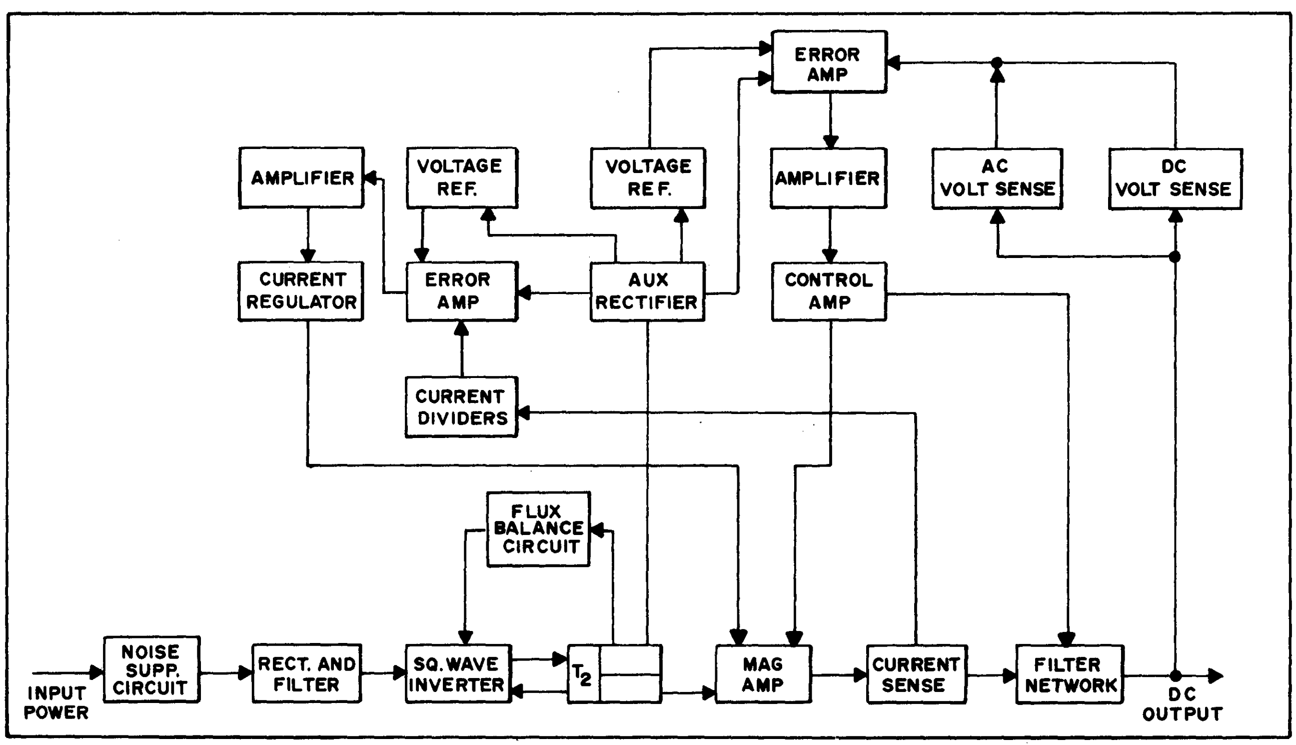


Fig. 1. Switching Power Supply uses magnetic amplifiers as the switching regulator elements.

APPLICATIONS

1. Semiconductor switching: This may be either with SCRs or transistors. SCR turn-off times are too long to provide efficient control. Transistors, which do not have adequate reverse blocking capabilities, require series diodes, thus reducing overall efficiency.

2. Magnetic amplifier switching: Magnetic amplifiers are chosen for this design for several reasons. They have very low power loss; the inherent frequency characteristics of the material is used in stabilizing the closed-loop system; and from a reliability standpoint they provide increased margin over transistor control, particularly at high currents.

The filtering beyond the magnetic amplifier is a classical L-C filter. A 2-stage device is employed to provide the 12 dB/octave rolloff required for loop stability and ripple rejection.

The rectifier-filter stage is shown in **Fig. 2.** The series resistance is required to protect the rectifiers by limiting the amplitude of the turn-on current surges. In addition, the series resistance reduces the RMS current in the filter capacitor, which lowers the heating in both the capacitor and the input rectifiers. In a low-source-impedance circuit of this nature the capacitor current may run as high as twice the dc load current on the filter. As the series resistance is increased, the rectification efficiency of the filter circuit decreases. This leads

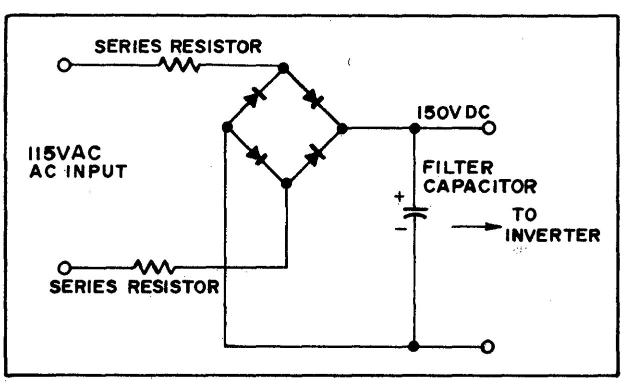


Fig. 2. The rectifier-filter section includes series resistors to protect the rectifiers and capacitors.

to additional stress on other parts in the supply. If a very low impedance line is not available, it may be possible to insure proper circuit operation by not operating the supply at the lower limits of the input voltage range.

The next block in the system is the inverter section, shown in schematic form in **Fig. 3.** The proper design of this section is essential to the reliable operation of the power supply. The basic mode of operation is well known. Transistors Q_1 and Q_2 are biased to be either saturated or cutoff; thus, the full input voltage is impressed alternately on one side of the primary of T_2 and then the other.

Transistor biasing is provided by a regenerative circuit, consisting of saturating transformer T_1, limiting resistors R_6 and R_3, and CR_1 and C_7. (Do not consider L_1 or winding 3 of T_1 at this time.) When Q_1 is ON, the voltage at the collector of Q_2 is high, providing base drive for Q_1 through T_1, which simultaneously back-biases Q_2 During this time, C_7 charges to the voltage drop provided by CR_1 and R_3. At some time after the beginning of the cycle, T_1 will saturate; the primary and secondary voltages of T_1 then go to zero. The voltage on C_7 is such that it turns Q_1 off. Regenerative action of the closed loop of T_1, T_2, Q_1 and Q_2 then cause the circuit to switch states, and Q_2 is turned ON.

The frequency of operation is selected by adjusting the parameters of the drive circuit. The operating frequency is a compromise. As the frequency is increased from line frequency, magnetic sizes go down and semi-conductor switching losses go up. At higher operating frequencies, the wiring inductance becomes very critical and wiring techniques must change from those used in 60 Hz power supplies. Switching supplies are therefore usually operated above 16-17 kHz to eliminate the problem of audible noise and below 25 kHz to keep switching losses at acceptable levels.

The operating load line of an inverter transistor is shown in **Fig. 4.** Due to the transformer action, the transistor which is OFF is subject to a voltage equal to twice Vcc. During turn-on the collector voltage falls before the current rises, which minimizes switching loss. In conduction, the collector current

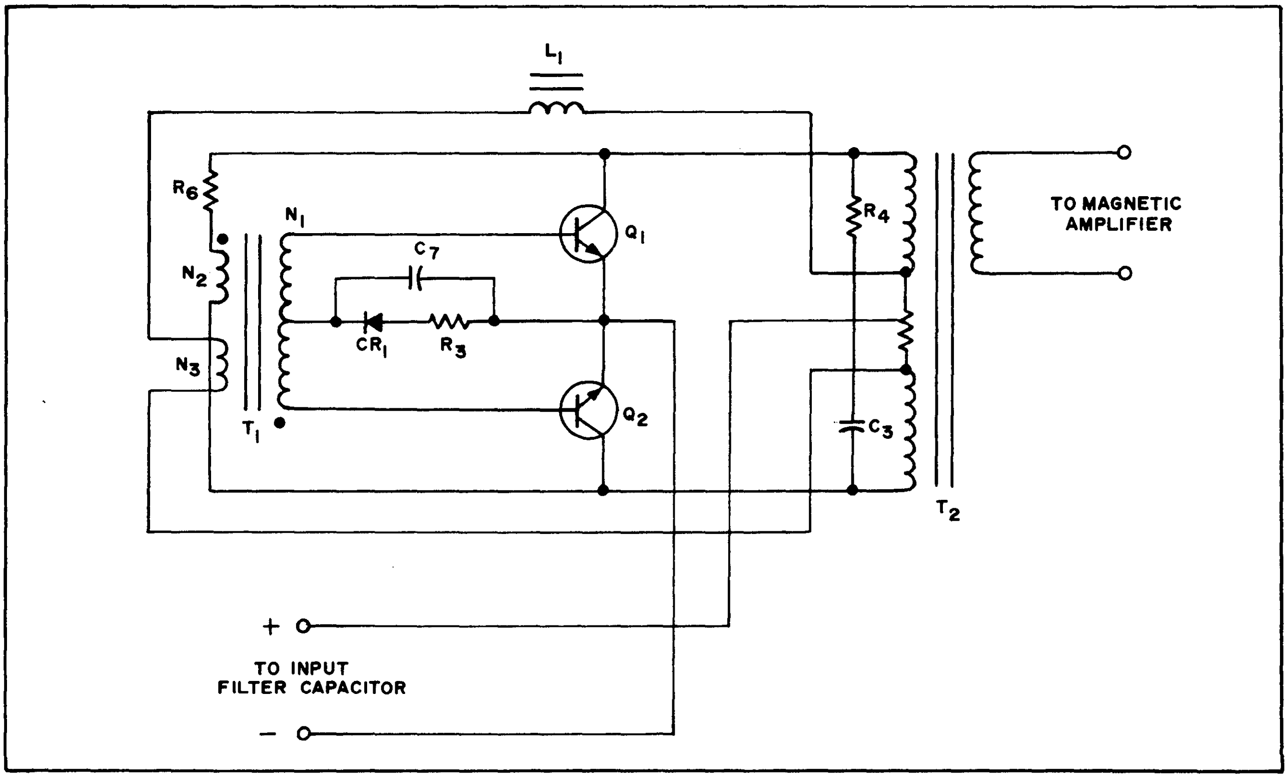


Fig. 3. The inverter section provides the switching action for the supply by means of alternately-conducting transistors Q_1 and Q_2 and magnetic components T_1 and T_2.

is high but the collector-emitter voltage is very low, usually one to two volts, and the power is, therefore, low. During turn-off the collector current is falling while the collector-emitter voltage is rising. If the fall time of the transistor is kept short enough, the power loss in this time can be minimized;

P Transistor = P Rise Time + P Conduction + P + Fall Time + P Off Time

$$= \frac{Pr\ tr}{T} + \frac{Ic\ Vces}{2} + \frac{Pf\ tf}{T} + Vcc\ Icev$$

where Ic = collector current during conduction Pf = instantaneous power during turn-off, Pr = instantaneous power during turn-on, T = total period of oscillation, tf = transistor fall time, tr = transistor rise time and Vces = collector-emitter saturation voltage.

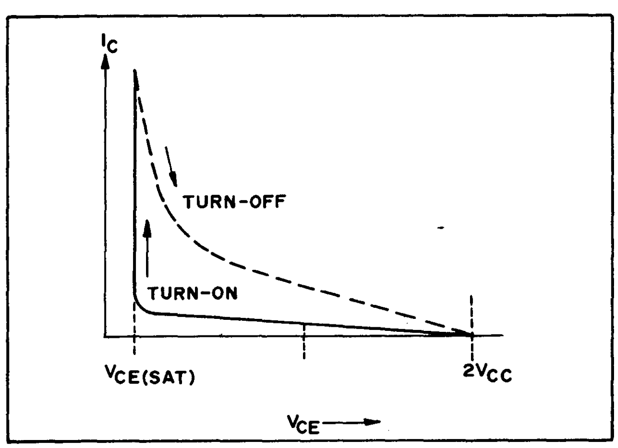


Fig. 4. Inverter transistor load line shows the turn-on and turn-off characteristics required for low power losses during switching.

APPLICATIONS

Looking at the load line of **Fig. 4**, one can see that deviation will result in very high dissipation or in secondary breakdown failures. The transistors must be kept in saturation during the conduction time. A transistor operating from a 200V source with a collector current of 5A will have a conduction loss of about 5W (5A x 2V x 1/2) if saturated properly. If however, the transistor comes out of saturation, the instantaneous power could go to 1000W (5A x 200V), which would surely destroy the device.

A second failure mode is the simultaneous turn-on of both devices. In this case there is flux cancellation in the transformer primary, and the collector currents are limited only by the circuit resistance. The "snubber" circuit (C_3 and R_4) prevents T_2 from switching instantaneously, which allows enough time for the transistor to completely turn off before the circuit changes status.

A third cause for failure is saturation of T_2. When T_2 saturates, the switching transistor's currents will again be limited only by circuit resistance. Normally, T_2 will be designed to withstand the operating ac flux levels. Any imbalance in the switching transistors will lead to a dc bias of the core of T_2. Although the core may be designed to withstand a certain dc flux level, if this is exceeded, the transformer will saturate. Once source of DC imbalance is storage-time mismatch.

When T_1 saturates, C_7 back-biases both transistors. A reverse base current will then flow in the conducting transistor. During this time there will be no change in the collector current. This phenomenon, known as storage time, results from the excess of charge in the base region. It is not until this charge is swept out of the base that the transistor current begins to fall.

Storage time varies from transistor to transistor even within the same family. The results of using two transistors with unequal storage time is an unsymmetrical square-wave which has a DC component.

DC biasing of the core may also be the result of mismatch of other parameters, usually $V_{BE(SAT)}$ or $V_{CE(SAT)}$. One design approach is to select matched transistors. This is not valid, since there is little assurance that the transistors will remain matched; thus, the long term reliability of such a system would be suspect. The proper approach requires some type of closed-loop balancing circuit. That is the purpose of L_1 and winding 3 of T_1. If there is any net DC across R_5, the driver core (T_1) will be biased in a direction to correct the imbalance. The use of a circuit of this type allows the use of transistors with very wide parameter variations.

On the secondary winding of T_2, one finds the rectifiers, regulation elements and filters required to obtain useful DC from a 20 kHz square wave. Efficient regulation is provided by a magnetic amplifier, which acts as a phase-control device. The output of the magnetic amplifier is filtered by a 2-stage L-C filter. The magnetic amplifier provides static regulation and line-frequency ripple attenuation. Attenuation of switching frequency ripple is provided by the L-C filter. In designing the system, one must shape the gain characteristics properly to provide the required input line transient attenuation.

The control for the magnetic amplifier is accomplished using an integrated circuit regulator, which contains a reference and an error amplifier section. The design criteria for the amplifier is straightforward. The system must provide adequate gain for regulation. In addition, it must be such that there is no loss of control during either turn-on or turn-off. As with the conventional series regulator, the gain frequency characteristic must be properly shaped to ensure stable operation.

From this discussion it should be obvious that there are many possible pitfalls in the design and building of a switching regulator. Certain fundamentals must be observed in order to have a reliable product. In addition, some precautions must be taken to have a useful product. The switching regulator may be an emi generator as well as a DC power supply. The emi can be controlled by proper shielding and wiring techniques. Radiated emi makes this type of supply virtually useless in an open-frame construction.

As the switching regulator becomes more widely accepted in the industrial marketplace, we can expect to see many further strides in the component and manufacturing technologies. The inverter transistors will become more readily available at lower cost and higher voltage and current levels than they are presently. In addition, we are sure to see labor saving methods developed for the manufacture of the required magnetics. At certain power levels, the switching regulator will approach a selling price of $1/watt, making it less expensive than a series regulator of equivalent ratings.□

GENERAL PURPOSE POWER SUPPLIES

Power supplies and power regulators are represented by a wide assortment of devices ranging from batteries and generators to dynamic electronic units using feedback circuits.

The specific function of the AC-to-DC power supply is to provide DC voltage and current from a primary AC source. The electrical characteristics of the power supply and the physical form it takes must be a function of the circuitry being powered and the physical requirements of the system in which the circuitry is used.

Circuits and characteristics

Power conversion generally starts with rectification, i.e., converting AC input voltage to a DC voltage. Because the output of a rectifier contains a relatively large AC ripple component in addition to its DC value, a filter must be used to attenuate the ripple component before this dc voltage is applied to a dc load. **Figs. 1A** and **1B** show two types of unregulated power supplies while **Fig. 1C** shows the output ripple.

The amount of ripple present after filtering the rectified output is a function of the circuit components and the load current. In actual practice, at full-rated load, the capacitor-input filter supply is limited to approximately 5% rms ripple voltage while the **LC** input filter supply attains 1% rms ripple voltage. Of course, better filtering can be had by using components larger than those dictated by economics or package volume when compared to the size of the transformer. However, such filtering can better be accomplished using other means.

With the unregulated power supply, no matter how efficiently ripple is reduced, the rectified-filtered DC output can change substantially with load current and/or power-line variations. Typical regulation characteristics include: For capacitor-input filter supply: line regulation of 1.2% per % line change at full load, and load regulation of 20% from 1/2 load to full load. For **LC**-input filter supply: line regulation is 1% per % line change at full load, and load regulation is 10% from 1/2 load to full load.

Because of these relatively poor performance specifications, unregulated supplies find limited application and are generally only used to power lamps and electromechanical devices where poor regulation is acceptable. They find greater use as front-ends for regulated power supplies or as DC power distribution sources in systems where DC-to-DC point-of-load regulators are employed.

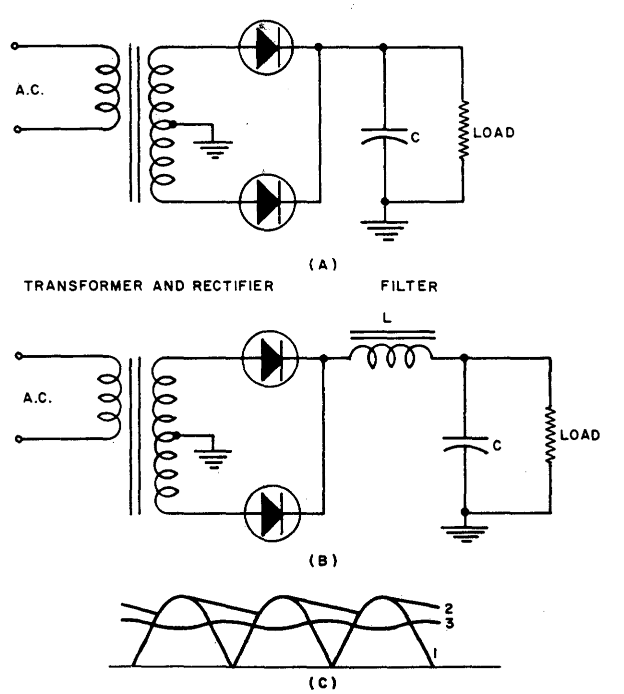


Fig. 1. Rectifier and filter configurations showing (A) capacitor and (B) LC filter. (C) (C) DC output voltage waveforms for single-phase, full-wave rectifier with (1) no filter, (2) capacitive filter, and (3) an LC filter.

APPLICATIONS

It is only recently that the unregulated supply has been readily available as an off-the-shelf item. **Lambda** has made available, as stock items, a line of power kits containing components selected for a predesigned power supply circuit so that a purchaser could build his own DC power supply. The kit components vary depending on circuits selected as well as the DC voltage and DC current required. Major components supplied are transformers, filter chokes, computer-grade electrolytics, silicon rectifiers, and a Power Hybrid Voltage Regulator when a regulated output is required.

The ferroresonant transformer

The ferroresonant transformer is an effective means of compensating for poor line regulation. The capacitor-input filter supply can be transformed into an improved regulated supply by replacing the linear input transformer with a ferroresonant transformer which provides regulated AC to the rectifier-filter section and improves ripple attenuation by squaring the sine wave. Line regulation and ripple waveform change are caused by the resonance set up between a transformer winding and an external AC capacitor. See **Fig. 2.**

The ferroresonant transformer, inherently a current-limiting device, provides automatic protection against overload. Because its major drawback is sensitivity to line frequency changes, it is used only where line-frequency stability is assured. A typical ferroresonant power-supply specification includes: line regulation of 2% for line changes from 105 to 132 VAC or 132 VAC to 105 VAC for any load between 25% and 100% of full load; load regulation of 5% from 1/2 load to full load; frequency regulation of 2.4% for each cycle change in line frequency; and ripple of 1% rms.

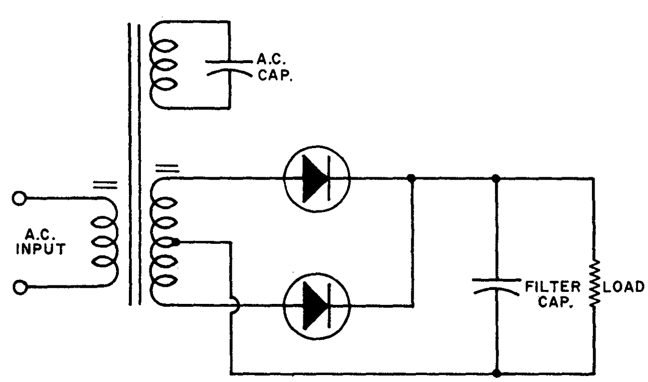


Fig. 2. Ferroresonant transformer power supply.

The simple ferroresonant power supply is the most reliable regulated power supply in use today. Prerequisites for its use are: fixed input frequency, small load variations, and a tolerance for slow response to transients. A ferroresonant supply requires many cycles of input frequency to recover from any line transient.

Feedback-controlled regulation

The demand for better regulation imposed by today's sophisticated circuits and complex electronics systems is best met by the feedback-controlled power supply. This type of regulated power supply is capable of maintaining a substantially constant output voltage at a selected value, even though changes occur in the AC input voltage (within specified limits) and/or in the rated DC load current. In addition, these power sources can be made short-circuit-proof, preventing damage to the supply caused by load fault and can be made load-protecting by using overvoltage protectors to prevent load damage caused by internal supply failure. **Fig. 3** is a general block diagram of the feedback-controlled regulated power supply.

There are many circuits which can be used to meet the requirements of the feedback-controlled power supply. The approach selected is determined by economics, performance requirements, power output needs, efficiency, and specified input/output voltage levels.

The circuit with the widest application is the linear or series-regulated power supply, which is used most often where output voltages are below 100 volts and power output is below 500 watts. Refer to **Fig. 4.**

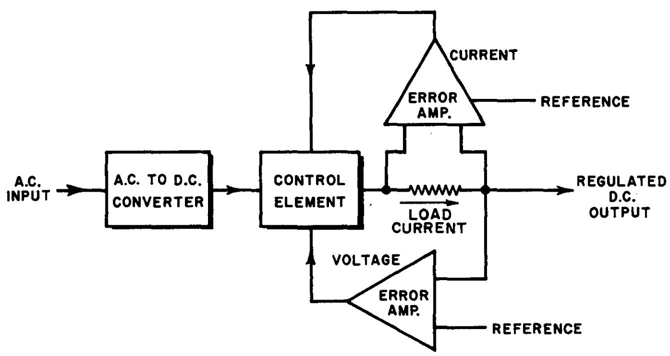


Fig. 3. Regulated power supply using feedback control.

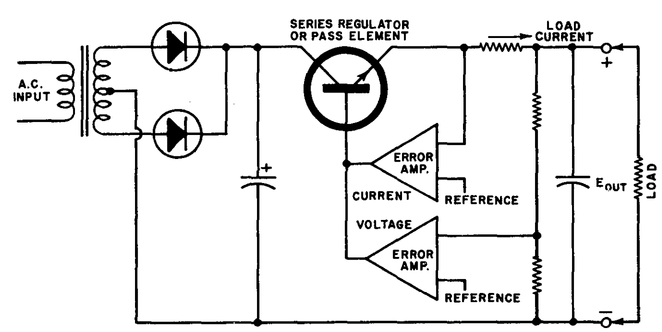


Fig. 4. Simplified schematic of the series-regulated power supply.

In this example, AC-to-DC conversion is accomplished by using a full-wave rectifier and a capacitor-input filter circuit. The control element is one power transistor or many transistors in parallel, as required, which absorbs the difference between the desired output voltage and the unregulated dc input. Because the series-pass element must handle the full-load current while maintaining relatively high voltage between input and output, it is basically a low-efficiency circuit. But since it is a linear circuit it has the potential for the best general specifications. No other practical circuit has as fast a response, possesses the regulation specifications, as low a ripple, or is as versatile in application as the series-regulated power circuit.

Circuits with higher efficiency are usually obtained by switching techniques (see page 162), a circuit that produces pulses of current when the control element is in a saturated state or when the control element is at cut-off and absorbing maximum voltage and no current flows. The pulse width or repetition rate determines the output voltage and a filter section is required to transform the pulses of energy to DC. control element in this type of circuit is usually an SCR (for low-frequency switching, high-power applications) or transistor (medium-power, high-efficiency package with poorer regulation, ripple, and transient response than a series regulator but more watts per unit volume and lower cost per watt).

As seen from the preceding categories, the selection of a power supply is a study in economics and specification trade-offs with no single approach having an advantage for all applications. By studying some typical application requirements, a better understanding of power-supply technology and selection can be obtained.

power-supply applications

Laboratory Supplies: Use of supplies for a laboratory can be broken down into two categories, 1) standards and calibration, and 2) experimentation and breadboarding.

When a DC power supply is used as a voltage standard or a transfer standard for calibration purposes, its specs must be an order of magnitude better than average laboratory measuring equipment and include a means of setting up output conditions accurately. Almost all lab supplies are series-regulator types because of their superior performance characteristics. By using aged reference elements and high-quality resistors, voltages with accuracies of better than 0.01% can be obtained. By housing temperature-sensitive circuitry in a proportional-control oven within the supply, temperature coefficients better than 0.001%/°C are obtained which virtually eliminate output changes caused by changes in ambient temperature. Circuit design and shielding techniques allow ripple to be below 100 μV peak-to-peak thereby approaching an almost perfect DC signal. The aged components and the oven insure a stability and order of magnitude better than the accuracy. Decade switches can be used to set up output conditions so that resolution down to the microvolt range is obtained. If the calibrator is to be part of an automatic test rack, its output voltage must be capable of being programmed from an external source, such as a resistor network or a digitally coded signal. In the latter case, an accurate digital-to-analog converter is required to transform the digital command into either a programming resistor or analog voltage, depending on the accuracy required. In most applications, this type of supply is programmed by either a resistor or a programming voltage. In all cases, of course, the dynamic voltage standard must not be affected by load conditions or overloads, hence current limiting is a necessity and a line/load regulation specification of 0.0005% is required.

As a general lab tool, the power supply must be versatile, reliable, and rugged. Most lab supplies are capable of constant-voltage operation, constant-current operation, of being remotely programmed by either resistance or voltage, or series or parallel operation with similar supplies for expanded capabilities, and are completely protected against load fault. Voltage regulation for line or load is usually around 0.01% with ripple and noise approximately 1 mV peak-to-peak.

Meters are a "must" on lab supplies so that conditions of experiments can be monitored. Because these supplies are constantly handled, heat sinks should be inaccessible or, if exposed, electrically isolated and thermally cool to the touch. Power supplies, dissipative by nature, must have reliable cooling. For this reason fans should be eliminated in favor of convection cooling because fans and their associated filters represent a weak-link maintenance problem.

System Supplies: The power-supply user, faced with the problem of putting together a complicated electronic system, has a difficult job selecting not only the regulation technique to be used but also the method of power distribution. An electronic system normally needs a number of voltages to power a variety of circuits. Irrespective of the types of power supplies used, power can be distributed using various methods, e.g., 1) individual power modules for each voltage required, 2) a multi-output power supply where all power required for a system is derived from a single package, 3) unregulated DC voltage or coarsely regulated voltage distributed to point-of-load regulators where power is regulated at the point of final usage, and 4) a combination of all or some of the above.

Selecting the individual module is an attractive approach because almost any rating is available as a standard product from the power-supply manufacturer. This insures reliability because standard products from a reliable vendor usually have a performance record that can be verified and can be counted on for mechanical stability and production reproducibility. Moreover, the individual module requires simpler maintenance and fewer spare parts provisioning. Most power-supply manufacturers will assemble standard individual modules into a complete system power supply.

Multiple-output power supplies, usually less expensive than individual modules when volume production quantities are involved, normally lead to custom design, which has drawbacks. In addition to the initial circuit design phase, power-supply design also includes mechanical packaging design, thermal performance evaluation, and printed-circuit board layout design. Consequently custom design, where quick delivery is required, usually yields poor mechanical and thermal design, with resultant poor reliability. If, however, series regulators are used, power hybrid regulators, with known electrical and thermal properties, can be used to reduce design time. By using a number of hybrid regulators in a standard mechanical package with known thermal properties, packaging design is greatly simplified, the printed-circuit board is eliminated, and more time can be spent on testing to assure greater reliability of the multi-output power supply. Although this approach does not guarantee instant availability, it eliminates many of the disadvantages inherent in the custom-design approach.

When system noise and power-line degeneration results in power distribution problems, the point-of-load regulator is used. In this application a highly efficient power source such as an unregulated supply, a ferroresonant regulator, or a coarsely regulated SCR supply delivers DC power to remote sites within the system. Regulation and fine filtering is accomplished at various circuit locations, eliminating cross-talk and noise injection between different sections of the system. The DC-to-DC type point-of-load regulators can be hybrid, monolithic, or discrete circuits mounted on printed-circuit boards or some other local assemblies where the regulated power is required. Here, again, the hybrid approach has the advantage because it provides the greatest amount of power (up to 5 amps) with a minimum of design time. Present monolithic regulators are not practicable above 200 mA. In most very large electronic systems, it is not uncommon to find combinations of approaches used to satisfy the power distribution needs of the system.

It becomes evident, then, without even raising the question of regulation techniques, that the formidable problems confronting the system designer in the areas of power distribution are staggering. Factors involving economics, availability, maintenance, reliability, and signal conditioning must all be considered and a decision made.

Another factor not previously mentioned is: 3-phase vs. single-phase power input to reduce copper requirements and power-supply skin temperature and their effects on associated circuitry. Because system power supplies are not accessible from exterior positions, they are normally designed with surface temperatures exceeding 100°C. Judgment must be used in power-supply placement to ensure proper cooling and prevent system circuitry temperature rise.

Data-Processing Equipment: All foregoing problems related to system power supplies are equally applicable to data-processing equipment. Because this type of equipment is commonplace in non-industrial environments, it is increasingly coming under the jurisdiction of **Underwriters' Laboratories.** Thus, it can be assumed that any power supply used in data processing must have or be capable of obtaining **UL** approval.

Modern data-processing equipment, because of its increased use of LSI (Large-Scale Integration), requires large concentrations of power in relation to equipment size. Because digital circuits do not require very finely regulated power sources, high-efficiency regulation techniques can be used. Generally, power supplies in these applications should have a combined performance bandwidth (line, load, ripple, and temperature) of better than 1 or 2%. In some applications, however, ferroresonant power supplies are acceptable, where combined performance bandwidths of better than 10% are compatible with requirements.

Memory Systems: Memory systems are a particular problem because the preservation of data is of prime importance and a specific requirement. In order to ensure that no data is lost, power supplies must be sequenced "on" and "off" in a prescribed order. In the event of AC input power-line failure, DC power must be kept available for anywhere from 1 to 20 ms so that the system can permanently store the data before DC power is lost. Some means of detecting the loss of prime power must be provided. The same requirement also results in the need for undervoltage and overvoltage sensing circuits so that power-supply malfunction can be detected and the data stored before the power supplies fault to an out-of-limit condition.

In core-memory systems, the power-supply voltage must be varied with ambient temperature to assure proper functioning of the magnetic memory material. This is accomplished by programming the power supply with a thermistor network located at the core memory site.

Analog Circuits: The most widely used analog circuit is the operational amplifier. Its power requirements are normally a plus and a minus voltage of equal magnitude (±12 to 15 volts being the most popular range). In analog circuits the accuracy of the signal being processed is of the utmost importance. In order to keep power supply fluctuations from affecting signal processing, the plus and minus supplies are made to track each other so that changes caused by one supply are offset by changes caused by the other. Feedback-controlled regulators can easily track each other within 0.2% for all conditions of line, load, and temperature variations. This is satisfactory for most applications.

Since signal-processing accuracy is of primary importance, most analog circuits use power supplies with line and load regulation of no worse than 0.1% and ripple specifications of no more than 5 mA peak-to-peak. To prevent power-supply errors due to distribution wire drops, remote sensing is used. This allows regulations of the DC power at some point other than the output terminals of the supply.

Battery Chargers and back-up power: To prevent shutdown of electronic equipment when AC prime power is lost, batteries are used as back-up power for AC-to-DC power supplies. When AC power is available, the power supplies charge the batteries and supply load current. When AC power is lost, the batteries supply full load current. The power supplies must be electonically current-limited to ensure that proper charging rates are used. With no AC power, the supply must be capable of withstanding a voltage at its output terminals without causing internal circuit damage.

If loss of ac power is not a prime consideration, a redundant power supply can be used to permit continuing equipment operation in the event of power-supply failure. Power supplies can be made to share the load, each operating at approximately half-load, or if desired, one supply can handle the full load while the other is set to a slightly lower voltage idling at no load. Redundant operation is normally handled by isolating each power supply from the load through a diode. When redundant operation is required, it is best to consult the applications department of the power-supply manufacturer to assure proper power-supply connections.

Protection of power supply and load

Protection devices are used for two main reasons, 1) to protect the power supply from load faults, and 2) to protect the load from power-supply malfunctions. A discussion of commonly used fault protectors follows.

Current Limiting: Power-supply overload beyond current rating limits must always be considered. Overloads caused by either operator error or load failure can result in catastrophic damage to the power supply. Unregulated power supplies can be protected by a fuse or circuit breaker in series with the output. Circuit breakers can be reliably selected to trip at selected current levels. Fuses, on the other hand, must be selected to blow at levels well above the maximum operating current to prevent random fuse failure due to electrical or mechanical fatigue of the element. A 50% to 100% safety factor is normally required of fuses. Conversely, a fuse may last indefinitely at its maximum rating so that a protection level cannot be accurately set or relied upon using this method.

As mentioned previously, the ferroresonant power supply is inherently current-limiting. Irrespective of load conditions, the output will never develop more than 200% of maximum current rating (maximum fault current will occur at short-circuit).

The feedback-controlled regulated power supply is designed with electronic current limiting which holds the output current to a preset value, thereby providing protection for the load as well as the power supply. Removal of load fault should result in normal power-supply operation without having to manually reset the supply.

Thermal Protection: Many power supplies are provided with a thermostat which automatically cuts off power when an overtemperature condition is sensed. This type of protection is primarily intended to prevent operation of the supply at load currents or ambient temperatures which exceed the manufacturer's ratings. Thermostats normally take several minutes to reset themselves once the cause of overtemperature is removed.

Overvoltage Protection: Excessive power-supply voltage output can be caused by power-supply malfunction or operator error. In either event, with today's delicate integrated circuits, excessive voltage can cause catastrophic failure. Because the cost of protection is minimal when compared to the cost of the circuitry being powered, overvoltage protection has been adopted as a standard requirement by most power-supply users. The overvoltage-protection circuit should be an independent system, not having to depend on the power supply for anything other than as a source to be monitored. In the event of an overvoltage condition, the protection circuit will "crowbar" (short) the output by means of an SCR before the circuit limit is exceeded. Refer to **Fig. 5** for diagram of a simple overvoltage protector.

Undervoltage Detection: As explained previously, an undervoltage condition can cause loss of information in memory systems. Circuits are available which give an alarm should a power supply voltage output drop below the prescribed limit.

A check list

Before selecting a power supply, a careful check list should be made, which should include the following points:

1. Performance based on minimum circuit requirements
2. Power supply cost vs. performance
3. Power supply cost vs. application
4. Requirements for system circuit protection
5. Requirements for power-supply protection

Such an evaluation can only be made if all the interrelated characteristics associated with the product are completely understood by the potential user. □

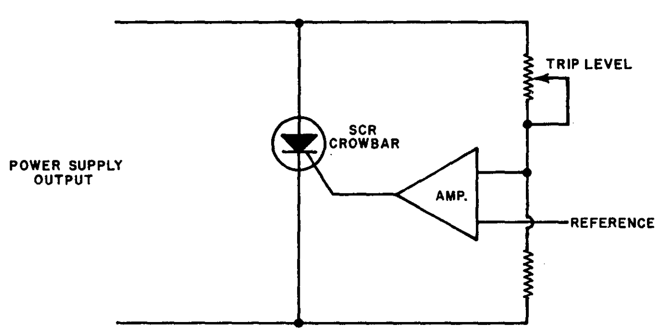


Fig. 5. Functional diagram of an overvoltage protection system.

USE HYBRID VOLTAGE REGULATORS

There's another choice now in power-supply design. You're no longer restricted to a supply designed by others, nor to one you have to design from scratch. You can buy the heart of the supply – the voltage regulator – in a hybrid form that offers much more power output than monolithic regulators. Then you can design the rest of the supply and the heat sink, if necessary, using a straightforward procedure.

Hybrid regulators are now available in many models with outputs to 28 VDC and to 5A. Dissipation at 25°C can reach 85W – a far cry from the watt or so available in monolithic regulators.

Though there are differences in circuitry, specifications and packaging among regulators available from various companies, the approaches to designing with them are basically similar.

A typical unit designed for unregulated-DC input, **Fig. 1,** has a power and a control section. The power section contains the series-regulator power transistor, a current-sensing resistor and a temperature-sensing element that shuts the regulator down when the safe operating temperature limit is exceeded.

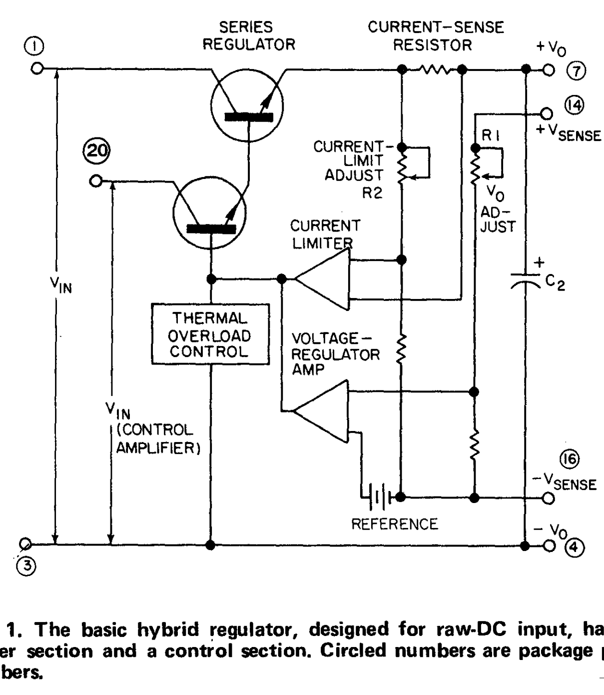


Fig. 1. The basic hybrid regulator, designed for raw-DC input, has a power section and a control section. Circled numbers are package pin numbers.

The control section contains a monolithic voltage regulator, thick-film resistors, chip capacitors and, in some models, a tantalum output capacitor.

The perfect regulator

A perfect regulator would deliver a constant output voltage—but none is perfect. The output changes within specified limits as a result of dynamic factors—line voltage or load current—and temperature. Dynamic regulation, which some specs call line and load effects, can be held to acceptable levels in most cases without exotic circuitry. But it's important to remember that dynamic regulation is often given for constant junction temperature. It's then the system designer's responsibility to consider over-all regulation and to calculate the effects of thermal changes.

However, the regulator designer can reduce thermal effects by selecting components with offsetting temperature coefficients and by reducing the temperature variation experienced by temperature-sensitive control components on a common substrate, thermally isolated from the power section. Then he can offer a regulation figure that includes dynamic and thermal factors.

That simplifies the selection and design procedures for the system designer. Any design requires, first, a statement of the performance requirements: output voltage and current, regulation, ambient-temperature range, input-voltage range and permissible output ripple. Once these requirements are defined, an engineer can select the model to be used, determine the proper heatsink needs and select any external components that may be necessary.

Example 1: Fixed DC input

Let's assume we need a power supply for use in a vehicle with a 12V battery. The principal specifications are:

Input voltage	10 to 14 VDC
Output voltage	5V ±2% (not adjustable)
Output current	0 to 5A
Ambient temperature	0 to 55°C
Load regulation	0.2%
Line regulation	0.1%

We start by reviewing specifications like those in **Tables 1** and **2** to see that our requirements can be met by available regulators. The input range, 10 to 14V, falls within the allowable range of 9.6 to 40V. The input-to-output differential, 5 to 9V (10-5 to 14-5), is within the limits of 4.6 to 37.5V. The output voltage, 5V ±2%, falls between 2.5 and 28V. And the output current of 5A does not exceed the maximum rating of the line. So we can start.

To get 5V at 5A without external transistors, we can choose Model 1 or 3. Since there's no requirement for output-voltage adjustment or remote sensing, and because our 2% tolerance requirement can be accommodated by the 1% tolerance of the 4-pin packages, we can choose Model 1.

The power dissipated in the regulator is the product of the maximum load current and the voltage differential between maximum input and minimum output. Thus,

$$P_{max} = 5(14\text{-}5) = 45\text{W}.$$

A heat sink must be selected to allow the device to dissipate 45W safely in an ambient of 55°C. The graph of **Fig. 2** shows that the maximum allowable case temperature for 45W dissipation is 105°C. So the required thermal resistance of the heat sink is

$$\theta_{HS} = (105\text{-}55)/45 = 1.1^\circ\text{C/W}.$$

That figure calls for a rather substantial heat sink if only free-air convection and radiation are used. The size can be reduced if we use forced-air cooling.

This selection of a heat sink is based on regulator operation at maximum rating in a non-fault mode. As a safety measure, we should check the dissipation during a short circuit at the output. The manufacturer's literature shows that the regula-

Table 1. Output ratings of representative hybrid regulators

	MODEL	V_o (V)	I_o (A) (at 40°C)
Fixed (±1%) output	**1**	5.0	5.0
4-pin package	**2**	6.0	5.0
Adjustable (±5%) output	**3**	5.0	5.0
4-pin package	**4**	6.0	5.0
Wide-range input, adjustable output	**5**	5.0	3.0
14-pin package	**6**	6.0	3.2

Table 2. Key specifications for a series of hybrid regulators

PARAMETER	SYMBOL	MIN.	MAX.	UNITS
Input voltage	V_{in}	9.6	40.0	V
Output voltage[1]	V_o	2.5	28.0	V
Input-output differential[2,3]	$V_{in} - V_o$	4.6	37.5	V
Input-output differential[3,4]	$V_{in} - V_o$	2.5	37.5	V
Output current[1]	I_o	0	5.0	A
Standby current	I_s		10	mA
Power dissipation[5]	P_d		85	W
Power dissipation[6]	P_d		9.0	W
Thermal resistance junction — Case 1	θ_{cl}		2.0	°C/W
Thermal resistance junction — free air	θ_{fa}		15.0	°C/W
Storage temperature[7]	T_s	−55	+125	°C
Line regulation[8]			0.01	% V_{in}
Load regulation[9]			0.2	%
Programming resistance[10]		1000		Ω/V
Programming voltage		1/1		V/V
Temperature coefficient	TC	0.007		%/°C
Ripple attenuation[11]		60		dB

NOTES:

[1] Varies with model.
[2] Single DC-input voltage.
[3] Minimum input-output differential based on T = 25°C.
[4] For separate DC-input voltages for power circuit (Pin 1) and control circuit (Pin 20), $V_{in\,min}$ = 9.5V at Pin 20.
[5] Heat sink at 25°C.
[6] Free air at 25°C.
[7] Maximum storage temperature limited by tantalum capacitor.
[8] I_o constant from $V_{in\,min}$ to $V_{in\,max}$.
[9] V_{in} constant from no load to full load.
[10] Nominal.
[11] Ripple attenuation (at $V_{in\,min}$, $I_{o\,max}$) is 54 dB minimum for 20V, 24V and 28V models, 60 dB for others.

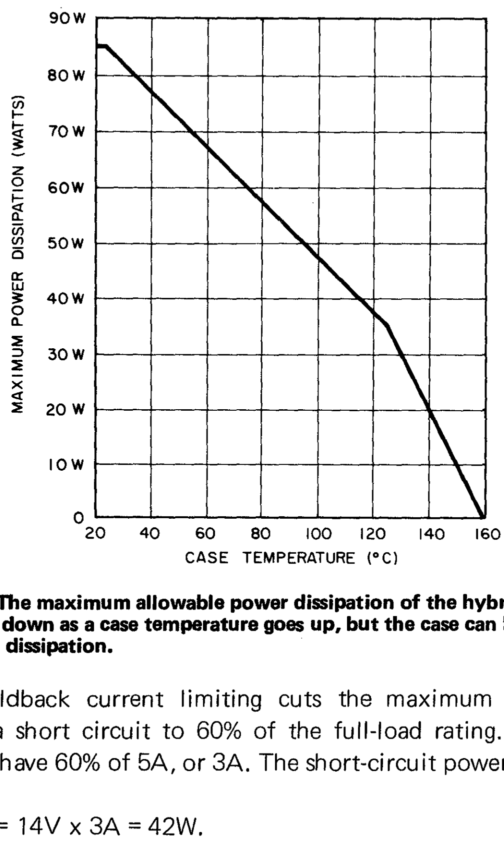


Fig. 2. The maximum allowable power dissipation of the hybrid regulator goes down as a case temperature goes up, but the case can be cooled to boost dissipation.

tor's foldback current limiting cuts the maximum current during a short circuit to 60% of the full-load rating. In this case we have 60% of 5A, or 3A. The short-circuit power is

$$P_{SC} = 14V \times 3A = 42W.$$

This is less than the maximum power under normal operating conditions, so the regulator will withstand a short-circuit.

If the short-circuit power were less than 40W, the thermal-shutdown circuit could protect the regulator by turning it off before any damage is done. In this case, there is a delay from the time the short is removed to the time the output voltage returns to within the regulation band. This is because the power section must cool down before the thermal-shutdown circuit allows the regulator to return to operation.

The next step involves checking the regulation. In this example, the requirement for load regulation is 0.2% – which is that specified for the entire line, and the requirement for line regulation is 0.1%. **Table 2** shows that the line regulation is 0.01% per volt of line change. The maximum line change the regulator experiences is 4V, so the maximum line regulation is 0.04% – which is well within the 0.1% requirement.

Thus, the regulator selected for this application requires no external components and the design is complete.

Example 2: Wide-range AC input

In this example, the input is variable and we must specify the proper transformer secondary voltages, hybrid regulator and heat sink. The key requirements are:

Input voltage	To be specified based on line variation of 105-132VAC at 60 Hz
Output voltage	6 VDC ±5% (adustable)
Output current	0 to 2.8A
Ambient temperature	0 to 40°C
Load regulation	0.2%
Line regulation	0.2%
Output ripple	5 mV pk-pk max.

The transformer specifications depend, in part, on the specific circuit we use external to the regulator. Let's first consider the design in **Fig. 3.**

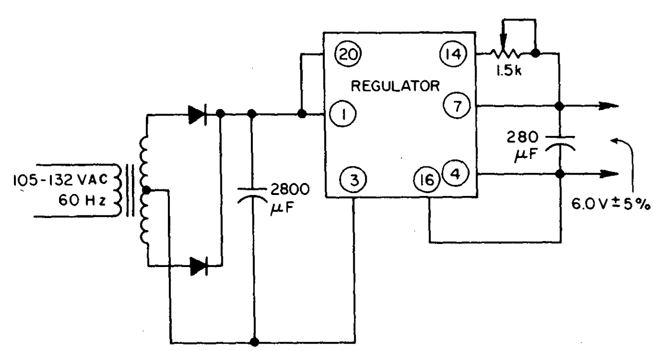


Fig. 3. A simple approach to a design for wide-range AC input may not be as effective as the approach in Fig. 5.

According to the manufacturer's specifications, the minimum input voltage required at Pin 20, the bias input to the voltage-control amplifier, is 9.6V. However, the spec also requires a minimum input-out differential of 4.6V. Thus,

$$V_{in} = (1.05 \times 6V) + 4.6V$$

or 10.9V. This is the minimum instantaneous voltage on the input filter capacitor — at low line and full load. It's not just the minimum dc value.

To determine the minimum filter capacitance, one must consider the output-ripple requirement of 5 mV pk-pk. Since the ripple attenuation of the regulator is 60 dB (or 1000), according to **Table 2,** the maximum ripple that can appear on the capacitor is 5V pk-pk. At 60 Hz, this requires a filter capacitor of about 1000 μF/A (a good rule-of-thumb approximation) or, in this case, 2800 μF.

The exact ripple is a function of the transformer source impedance, the capacitor, and the load current. If the transformer-capacitor combination is designed to yield a maximum of 5V pk-pk ripple at high line, the ripple at low line will be somewhat less, usually about 4.5V. The average voltage on the capacitor at low line is the sum of the V_{in} (min) requirement and half the peak-to-peak ripple.

$$V_{in}(\text{average}) = 10.9 + 2.25 = 13.15 \text{ VDC}$$

The maximum power dissipated depends on the input voltage at high line, which is

$$V_{in}(\text{average}) = 132/105 \times 1.1 \times 13.5 = 18.2 \text{ VDC}$$

where the 1.1 factor accounts for the change in rectification efficiency that occurs during the transition from low (105V) to high line (132V). This is an approximate figure that must be calculated during the transformer design.

The dissipation of the regulator is

$$P = (18.2 - 5.7V) \times 2.8A = 35.5W.$$

The 5.7V value is the output when it's adjusted to 5% below the nominal 6.0V level. This low-output value is required for calculating the maximum dissipation.

If we go back to **Fig. 2,** we find that the maximum allowable case temperature with a dissipation of 35.5W is 125°C. The thermal resistance of the heat sink is

$$\theta_{HS} = (125 - 40)/35.5 = 2.4°C/W.$$

According to **Fig. 4,** a 5 x 5 x 3/32-inch horizontal heat sink would dissipate about 28W. Mounting the heat sink vertically and painting it should increase dissipation to about 35W.

We can now select the regulator. Since we want external programming, we need a 14-pin model, so we're limited to Model 4 or 6. Both have output-current ratings that exceed those required in this design.

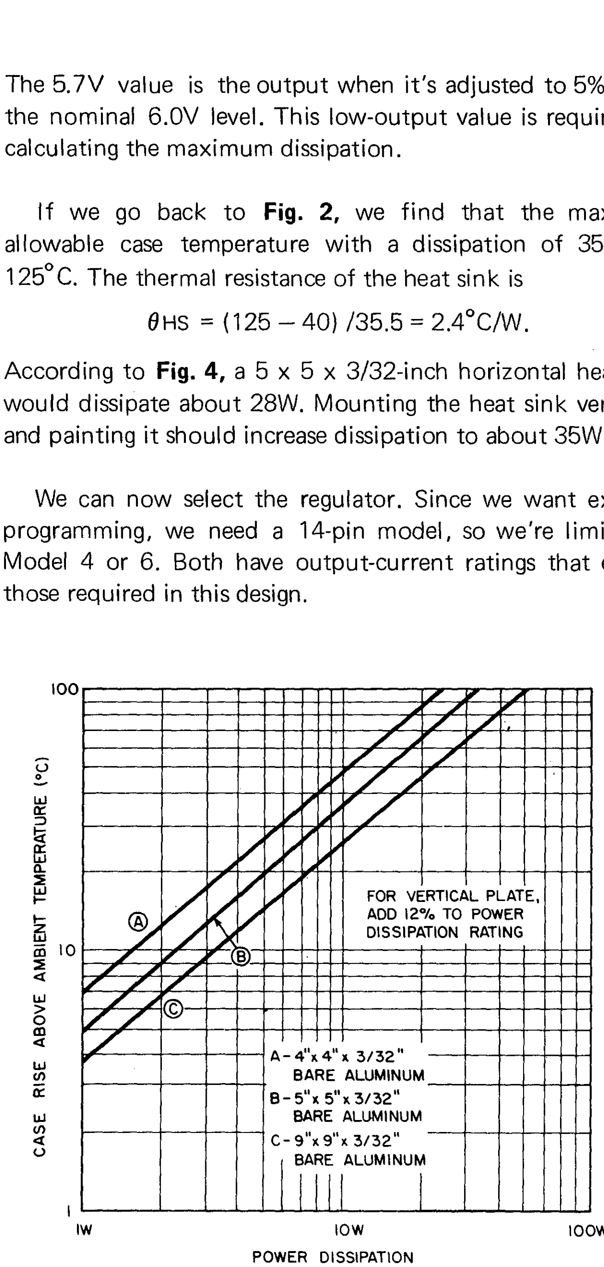


Fig. 4. Typical heat-sink data for a horizontal plate. Another 12% can be added to the power-dissipation rating for a vertical plate and an additional 10% can be added if surfaces are painted.

APPLICATIONS

It might appear that Model 4, designed for 5A, would give a greater safety margin than Model 6, which is rated at only 3.2A. But a calculation of dissipation during a short circuit shows that Model 6 is the better choice. Recalling that the short-circuit current is 60% of nominal, we find, for Model 4,

$$P_{SC} = 18.2 \times (0.6 \times 5) = 54.6W.$$

For Model 6, the short-circuit power is

$$P_{SC} = 18.2 \times (0.6 \times 3.2) = 35W.$$

Which is equal to its normal dissipation.

Now we must check the regulation. The required load regulation is 0.2%, which is that specified for all the models. A line regulation of 0.2% is required. The change in voltage across the filter capacitor when the input line is varied from 105 to 132V is

$$\Delta V = 18.2 - 13.15 = 5.05V$$

The line regulation for the regulator series is specified as 0.1%/V of line change so

$$\Delta V_o = 0.01\%/V \times 5.05V = 0.05\%,$$

which is well within the regulation requirement. In this case the transformer must provide 51W (18.2V at 2.8A) at high line.

We must now determine the values needed for the voltage control and for the output capacitor. The voltage adjustment requires a 1.5-kΩ pot (specified by the hybrid manufacturer), which should be selected for high stability and low temperature coefficient because any variation results in an output-voltage change.

The output capacitor should be at least 100 μF/A, according to the hybrid manufacturer, or 280 μF. The part should be a high-grade aluminum or tantalum electrolytic with low equivalent series resistance. The voltage rating of the capacitor should be such that if an external sense lead opens and the output loses regulation, the capacitor rating will not be exceeded by the unregulated output voltage.

Example 3: Wide-range AC input

Let's consider an alternate design, **Fig. 5,** that requires more components, but results in a smaller transformer and heat sink. In this design the control input (Pin 20) and the power input (Pin 1) are separated. The power circuit, according to Table 2, requires that the voltage differential between the input (Pin 1) and the output (Pin 7) be at least 2.5V. Therefore,

$$V_{in} \ (1.05 \times 6.0V) + 2.5V = 8.8V \text{ at Pin 1.}$$

If the same capacitor used in the first AC design is still employed, the average input voltage at low line is

$$V_{in} = 8.8 + 2.25 = 11.05V \text{ at 105V line.}$$

Similarly,

$$V_{in} = 1.38 \times 11.05 = 15.2V \text{ at 132V line.}$$

The maximum power dissipation is then

$$P = (15.2\text{-}5.7) \times 2.8A = 26.6W,$$

a reduction of 25%. The transformer output is reduced to 42.5W (15.2V at 2.8A), a saving of 17%.

Now consider the control circuit. The minimum differential between Pin 20 and Pin 7 (which has 6V ±5%) is 4.6V. Thus, Pin 20 must never see less than 10.9V. In **Fig. 5,** the maximum

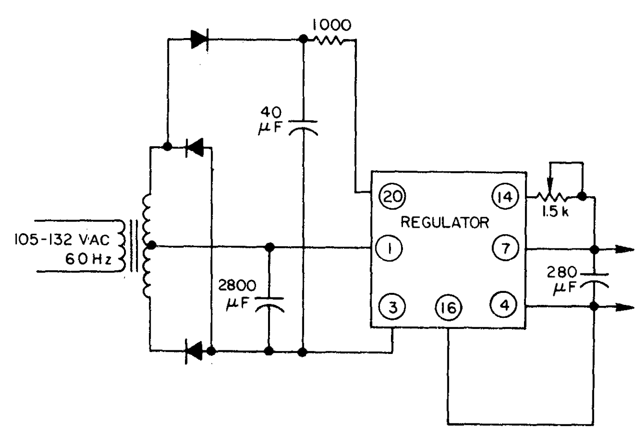


Fig. 5. A more complex design for wide-range AC input calls for a smaller transformer and heat sink.

voltage of the peak-detector capacitor is twice the highest voltage on the main filter capacitor. Thus, at low line, full load, when the peak voltage on the main capacitor is 13.3V, the voltage on the peak-detector capacitor is approximately 26.6V. This is more than adequate biasing for the control input. A resistor is required between the peak-detector capacitor and the control-circuit input. Let's now consider requirements for this resistor and the peak-detector capacitor.

The ripple attenuation of the regulator is defined as the ratio of the ripple at the control-circuit input to that at the output. Thus, to maintain no more than 5 mV at the output, the maximum ripple on the peak-detector capacitor must be 5V pk-pk. The peak-detector capacitor is shown in a half-wave configuration to minimize the number of components. In a half-wave, 60 Hz system, the conduction time of the peak-detector rectifier is approximately 3 ms. The discharge time of the capacitor is therefore 13.6 ms – the line period, 16.6 ms, minus 3 ms. The maximum input standby current to Pin 20 is specified as 10 mA. Therefore, the minimum value of the capacitor is the product of the standby current and the discharge time divided by the maximum ripple voltage.

$$C_{min} = 10 \text{ mA} \times (13.6 \text{ ms}/5\text{V}) = 27.2\ \mu\text{F}.$$

To allow for capacitor tolerances and to provide some margin above the specified requirements, we should use approximately 40 μF.

Though the voltage-doubler configuration provides a high-voltage source for the input-control regulator biasing, the amplitude of the voltage change for line variations seen by the amplifier is also greater. In this case the voltage at high line, full load is approximately 2 x (15.2 + 2.5V) = 35.4V. This is close to the maximum input of 40V and limits this circuit to applications where the output voltage is less than 7 or 8V, depending on the range of the input line swing. Maximum voltage appears when input is maximum and the load is removed.

The change sensed by the control input in this case is 8.8V = (35.4 – 26.6), which results in a line regulation of 0.09%. That's still within the requirements.

The other component that must be considered is the resistor that limits the current into the control during turn-off. During this time, the regulator tries to provide load current from the peak-detector circuit. The control circuit cannot carry much current for even a very short time. It will be destroyed if the current is not limited to 150 mA.

When the power supply is turned off, both the peak-detector and main capacitors start to discharge. When the main capacitor discharges below the voltage required at Pin 1 to maintain the output, the load current is drawn from the peak-detector circuit.

1. Assume that the power supply is operating at high line, full load and is turned off.

2. Calculate the time required for the main capacitor to discharge to the minimum voltage required at Pin 1.

3. Calculate the value to which the voltage on the peak-detector capacitor has decayed in the time found in Step 2.

4. The peak current in the control circuit is controlled by the external limiting resistor. The voltage that appears across the resistor is the voltage on the peak-detector capacitor at the end of the time calculated in Step 2.

In this case, it is assumed that the following voltages are present at turnoff:

Peak-Detector Cap: 36V   Main Cap: 17.7V

When the input capacitor discharges to 8.5V = (6.0 + 2.5), the peak detector starts to supply the current. The time required for this to happen is

$t = CV/1$

$t = 2800\ \mu\text{F}\ (17.7 - 8.5\text{V})/28\text{A} - 9.2 \text{ ms}.$

During this time the voltage change on the peak-detector capacitor is

$V = It/C$

$= 10 \text{ mA} \times 9.2 \text{ ms}/40\ \mu\text{F} = 2.3\text{V}.$

The voltage remaining on the peak-detector capacitor is 35.7V = (38.0-2.3). The voltage that can appear across the limiting resistor is 35.7V. To limit the current to 150 mA, the resistor must be at least 240 ohms.

This sets the minimum value for this resistor. There is also a constraint on the maximum value. In normal operation, the bias requirement for the control section is 10 mA, which results in a voltage drop across the current-limiting resistor. The resistor must be selected so that under conditions of low line, maximum rated output voltage, and full load, there is enough voltage at Pin 20 for proper operation. In this case the requirement at Pin 20 is 10.9V.

Minimum instantaneous voltage on the peak-detector capacitor is the low-line peak of 26.6V minus the peak-to-peak ripple of the capacitor. With 40 μF, the peak-to-peak ripple is roughly 3.5V. Therefore, the minimum instantaneous voltage is (26.6 − 3.5) or 23.1V. Hence, the maximum value of the limiting resistance is

$$R_{max} = (23.1 - 10.9)/10 \text{ mA} = 1.2 \text{ k}\Omega.$$

The value selected for this resistor would then be somewhere between 240 and 1200 ohms; 1000 ohms is a reasonable choice.

The criteria for selection of this voltage adjustment control and the output capacitor are the same as in the first solution to this problem.

This configuration then provides a means for reducing the transformer size by about 15 to 20% and the heat sink by 25% for the price of three extra components. ☐

"And Leave the Designing to Us"

Custom design

is a get-what-you-pay-for proposition at most electronics companies: to obtain special features they have to incur special design costs. Lambda, however, will throw in custom design and engineering free, when the user buys Lambda-furnished parts to assemble themselves.

This new approach is geared toward supplying the custom power-supply business. With sales of over $15 million, it figures Lambda is the largest maker of off-the-shelf supplies.

The custom business is larger than the test equipment, laboratory and breadboard markets combined. Altogether, power supplies built in-house and by custom suppliers for makers of all types of electronic original equipment are worth anywhere from $300 to $500 million yearly. This size is the reason why Lambda is expanding its assemble-it-yourself standard supply kit program introduced about a year ago to include custom units.

Requirements

The parts charge alone will cover such special design requirements as multiple output voltages and currents, regulation, ripple and form factor. Lambda will design circuits, make thermal design calculations, and develop a components layout to assure operation at a safe temperature.

Lambda is betting that it can handle its custom orders routinely and swiftly, relying on 25 years experience in designing standard units. Noteworthy is that power supply design requires cooperation among circuit, mechanical, and thermal engineers.

Many companies can't afford to keep one full-time supply designer on staff, let alone three. That's why they turn to outside help. Lambda didn't want to sell custom supplies in the usual way. Just to be cheaper would make it hard to beat the manufacturers already in the business.

At present, output limits in Lambda's kits are set at about 150 volts dc and currents of 25 amperes DC for regulated lines, and 50A for coarsely regulated lines. Input may be any of the 50 and 400 Hz and 110 and 220VAC power systems usually available.

The upper limits on the outputs coincide with the operating ceilings of the components Lambda has been using in its standard supplies, particularly of the integrated circuit hybrid regulators Lambda has been offering since early 1972. This single device replaces as many as 60 discrete components; without it, it would be impossible to custom-design a system with so many parts at no charge.

Savings

As for customers' advantages, equipment manufacturers will save money because they won't have to pay for the value added plus profit to an outside supplier. What's more, the manufacturer will have better control over his production – he won't have to worry about a supplier meeting delivery dates. And with a short lead time, the customer will be able to respond quickly to fluctuations in sales volume, so that he won't be stuck with a shipment of assembled supplies arriving after a decision to curtail production.

Also, a point is that Lambda will be providing parts it orders "in tremendously large quantities" for its standard line of supplies. Consequently, it will be possible to pass on to custom-parts customers the cost savings incurred by ordering parts in large volume.

Some firms specializing in building power supplies may feel they can do the job for considerably less than companies whose forte is assembling other systems.

This attitude can be understood, especially for production runs in the thousands of units which could be where outside suppliers will continue to have the advantage. Some custom supply customers would generally realize a greater return on their labor dollars if they devoted them to manufacturing their particular line of equipment, rather than power supplies.

But Lambda maintains that cost savings may still be great enough to warrant in-house assembly. Another factor some manufacturers consider, is that the OEM's dollars may be unnecessarily tied up in parts during the time it takes to receive them, put them into stock, and move them out to the assembly floor. Ordering completed supplies, they feel, delivered when needed, could prevent this.

Quotes

Yet, Lambda has been quietly developing this "build your own" idea since mid 1972, and has quoted on at least a hundred different systems. Customers include manufacturers of communications, medical electronics, peripherals, and cable television gear.

One buyer's, assistant general manager, claims he will save more than $400 on each supply his company assembles. The firm, a 23-man operation with a five-man assembly s, manufactures keno ticket-issuing machines for casinos. The company ordered 100 custom kits and expects a production run of 400-500 machines.

Cost of parts for each supply, which includes two transformers providing five regulated and three unregulated outputs, is $280; projected assembly cost is $50. An additional $12 per supply is for power transistors the firm is buying itself. Separate off-the-shelf units supplying the outputs would have cost close to $1,100. And the quotes received from custom houses "invariably" were in the $700 to $800 range.

Work-maker

Assembly of the power supplies is an "ideal time filler for slack periods." A test supervisor of a large corporation states this as a reason for building its own power supplies. The company is considering putting Lambda custom do-it-yourself kits in some of its atomic absorption gear.

Still another reason is cited by another engineer. He needed about two dozen power supplies for prototype ground receivers and went to Lambda because he wanted to "use their expertise in picking components. We're in the microwave business, not in the power supply business," he points out, adding that his requirements were very similar to what Lambda was already offering in a kit form.

A similar sentiment is held by a supervisory engineer at another leading firm. He's "considering" purchasing Lambda-supplied parts to fit a custom design for his company's series of commercial ground-based digital computers. Like the other firm's men, he says he's in the computer design business and would rather not devote manpower to designing supplies, or even to selecting the proper components.

Confidence

He trusts Lambda's experience in handling these chores and describes its approach as offering him something halfway between an off-the-shelf supply and a fully customized design. And he adds: "We'll get a custom design without having to pay for the design labor and the extra cost of designing something from scratch." When it comes to building the power supplies, he will schedule the work in with the assembly of the rest of the computer.

Lambda calculates that production runs as low as 25 pieces could justify the engineering the company is ready to provide with the power supply kits. Just where the economical upper limit lies, though, can vary from case to case. □

REGULATION WHERE IT'S NEEDED

Many systems contain both digital and analog circuits that use the same power supply voltage. In more complex systems, this circuitry is distributed over many p-c boards, and each board is connected to the power supply bus. Any change in current drawn by a particular circuit not only produces a voltage fluctuation on the distribution line, but because of the complex impedance of the power-supply bus, produces transient voltages as well. In systems that experience rapid changes in load current, the transients produced are much more significant than the simple ohmic drop. Although usually inadequate, designers hoped that decoupling capacitors placed on each p-c card would minimize this problem.

An alternate approach now being considered uses a source of coarsely regulated or unregulated power that is distributed to various points in the system. The designer simply places point-of-load regulators at each local load point in his system. This method provides better isolation between circuits and more effective decoupling than could be achieved with passive components.

Point-of-load regulators provide adequate DC regulation at all points in the system, whereas the single regulated power supply does that at only one point. Often, to minimize voltage drops and supply line impedance, much more money is spent on copper than is dictated by the current handling capacity of the wire.

A point-of-load regulator provides independent current limiting for each load. Although single power supplies have current limiting, the limit is usually set much higher than needed for local requirements. This proves ineffective in protecting circuit boards and local wiring during localized faults.

The point-of-load type of power supply system consists of a bulk power source and multiple regulators **(Fig.1).** Bulk sources range from a linear transformer-full wave rectifier with a capacitor filter to a complete high-current series with a regulator power supply. The latter is expensive and supplies an unneeded amount of regulation. What's needed is simply a preregulator that maintains an output voltage within 5% to 10% of the preset voltage.

POWER OUTPUT VDC in Volts	I in Amps	LQ SERIES Model	Cost	POWER-HYBRID VOLTAGE REGULATORS Model	Qty Used	Total Cost	System Cost	Conventional Power Supply Cost
5	25	LQS-DA-6105	$135	LAS-2105	5	$ 90	$225	$235
5	40	LQS-DA-6305	$160	LAS-2105	8	$144	$304	$425
28	5	LQS-DA-6128	$110	LAS-2128	3	$ 54	$164	$190
28	10	LQS-DA-6328	$135	LAS-2128	5	$ 90	$225	$235
±15	5	LQD-DA-6115	$120	LAS-2615 LAS-2115	1 1	$ 20 $ 18	$158	$260
±15	10	LQD-DA-6315	$135	LAS-2615 LAS-2115	2 2	$ 40 $ 36	$215	$435

Total cost of point-of-load vs conventional voltage regulation.

Lambda's LQ 6000 Series has been designed with point-of-load application in mind. This low-cost line of power supplies uses a ferroresonant transformer and a rectifier filter combination to supply pre-regulated voltage to Lambda's Power Hybrid Voltage Regulators (PHVR). These power supplies **(Fig. 2)** provide up to 40 amp at 28 v.

The output voltage of the LQ 6000 Series changes about 2% as the AC line changes from 105 to 132 VAC for any load between 25% and 100% of full load. When used with a Lambda Power Hybrid Voltage Regulator, DC line regulation is within 0.02% for line changes from 105 to 132 VAC; load regulation is within 0.02% for zero to full load for the same line changes.

The table shows a cost comparison between a single regulated power supply and a point-of-load system that uses an LQ 6000 and the PHVR. The comparison assumes 100-quantity pricing for point-of-load and that they operate at maximum current capability (25 amp at 5 v uses five 5-amp regulators).

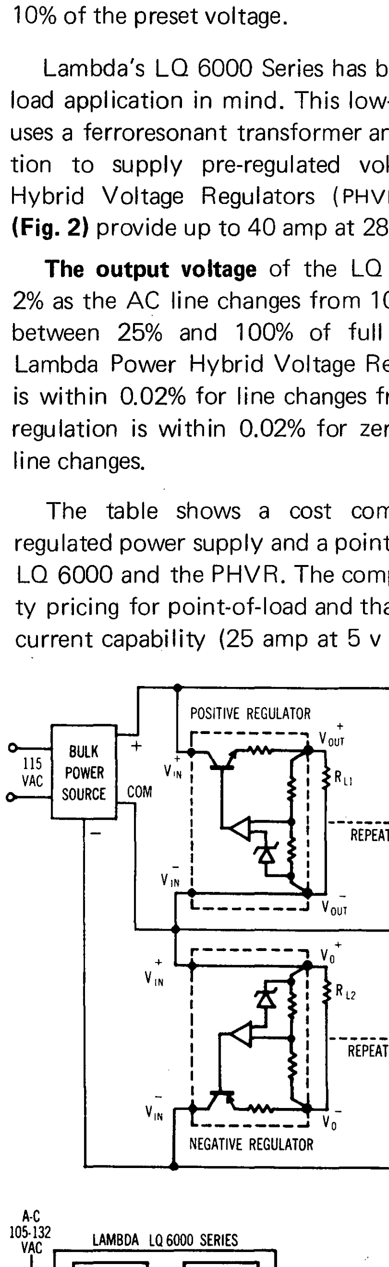


Fig. 1. Point-of-load regulation isolates local loads better than the passive decoupling method.

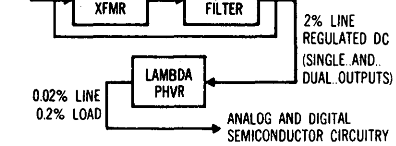


Fig. 2. Lambda's LQ 6000 provides a preregulated DC to point-of-load regulator.

GENERAL ORDERING INFORMATION

PRICES

U.S. and Canada — All prices F.O.B. Melville, N.Y.; No. Hollywood, Calif.; or Montreal, Canada for Power Supplies, Custom Power Supplies, Power Hybrid Voltage Regulators, and Accessories. For Power Kits and Transformer prices are F.O.B. Gouldsboro. Penn.; or No. Hollywood, Calif. All prices are effective May 1, 1974 and are in U.S. funds.

TERMS

Net 30 days.

TAXES

All applicable taxes, federal, state and local, are extra.

DISCOUNTS

Available to quantity buyers. For details consult with the Lambda Sales Department or Field Sales Engineer.

QUOTATIONS

All written quotations will be honored for 30 days from the date on which they are made.

SOURCE INSPECTION

2% EXTRA ($25.00 minimum) per shipment for standard in-plant inspection procedures. For shipments requiring DD 250 forms, add $10.00 for each destination.

DISTRIBUTION POINTS

Lambda power supplies, Power Hybrid Voltage Regulators, power kits and accessories are shipped from four distribution points for minimum shipping costs.

AREAS SERVED

1. Melville, New York
2. Gouldsboro, Pennsylvania
3. North Hollywood, California
4. Montreal, Canada

HANDLING CHARGES

The following charges are applicable for shipment from other than Melville, N.Y. and Montreal, Canada. There is no handling charge on units shipped from Montreal to Canadian customers.

Value of Order*	Handling Charge
up to $50.00	$1.00
$51.00 to $180.00	$3.00
$181.00 to $300.00	$5.00
$301.00 to $500.00	$8.00

*For orders with values in excess of $500.00 add handling charges for the value(s) in the "Value of Order" list needed to cover the total value of the order being placed; for example with an order value of $1274.00, double the $8.00 handling charge for $500.00 order value and add to it the $5.00 handling charge, for the $181.00-$300.00 order value for a total handling charge of $21.00.

SHIPMENTS TO FACTORY

To keep your "downtime" to a minimum, contact the factory or the nearest service group before returning equipment. Shipments must be prepaid, contain reason for return, and instructions for return shipment, and be packed in a manner to preclude shipping damage. Any shipping damage will be the responsibility of the customer.

A NOTE ABOUT ADDING SUFFIXES

Suffixes can be added to the basic model number. Just be certain you add the correct suffix for each option you require, separated by a dash, and adjust the price accordingly.

For example, a typical LM-"F" package model could be written as follows: LM-F-5-R-OV-M. Such a number would include:

	PRICE
LM-F-5-R Power Supply with fungus proofing	**$495**
Built-in Overvoltage Protection (-OV)	**90**
Metered Model (-M)	**30**
Total Price	**$615**

An order for a B Package LM-B-0-7 with high performance, AC input and fungus proofing options (total price $159.00) would be written as follows: LM-B-0-7-Y-V-R.

A metered LK-344-A-FM, with fungus-proofing and overvoltage protection, supplied with an LRA-1 rack adapter, chassis slides, and ½ rack blank panel would be written as LK-344-A-FM-R, and the price would be as follows:

LK-344-A-FM	**$420**
Fungus Proofing Option (-R)	**42**
Total Price	**$462**

The rack adapter with chassis slides, blank panel, and overvoltage protector would be ordered separately by model number:

LRA-1-CS . . . .**$120** LH-OV-6 . . .**$35** LBP-20 . . . . .**$10**

OPTIONS AVAILABLE WITH LAMBDA POWER SUPPLIES

Options	Suffix Designation or Model No.
1. High-performance (LM series only)	**("-Y")**
2. AC input	**("-V") or ("-Z")**
3. Fungus proofing	**("-R")**
4. Power Supplies (for use with Systems Power Sequencer except wide range models)	**("-S")**
5. Power Supplies (for use with Systems Power Protector — LM Series with built-in "OV" only)	**("-SP")**
6. Overvoltage Protector (mandatory for use with Systems Power Sequencer and Systems Power Protector)	**("-OV")**
7. Inclusion of meters	
LM full-rack models	**("-M")**
LK	**("-FM")**
8. Special paint	**Specify**

GENERAL ORDERING INFORMATION
(continued)

ACCESSORIES AVAILABLE WITH LAMBDA POWER SUPPLIES

Accessories	Suffix Designation or Model No.
1. Overvoltage protector	("-OV")
2. Rack adapter	("LRA-")
3. Chassis slides	("-CS")
4. Blank front panels	("LBP-")
5. Metered panels	("MP-")
6. Non-metered panels	("P-")
7. Blank panels	("SB-")
8. Systems Power Sequencer	("SPS-")
9. Systems Power Protector	("SPP-")
10. Pot cover	("PC-1")

See specific product series description for options and accessories available with each product series. Options and accessories available with each series are described in the "Specifications, pages 95-100." Accessories are also described on pages 101-104, 141.

SHIPMENT

Express shipment in our experience has provided the fastest and safest delivery of power supplies. Unless you specifically request otherwise, your order will be forwarded in this manner. Urgent needs can be accommodated by air express or air freight in accordance with your instructions. If equipment is received damaged, it is the customer's responsibility to contact the carrier and file a claim for damages.

DELIVERY

Under normal conditions, we ship from stock. Over 90% of all power supply models can be shipped within 24 hours. If circumstances do not permit immediate delivery on a particular model, you will be notified at once and a firm shipping date will be given you. Urgent requirements often can be handled on an expedited basis. Your mail, telephone or telegraph order or inquiry will bring you a same-day reply. Contact your nearest Lambda sales office, see inside back cover.

OVERSEAS MODELS

Most units are wired for 115 VAC. Models are equipped for factory conversion from 115 VAC to 187-242/205-265 VAC ("-V" option) or 188-229 VAC ("-Z" option) input, where such provision is specified in this catalog. You may request the factory to do the changeover wiring for you at a nominal cost. Most models will accommodate a range of input frequencies from 47 to 63 Hz and some models (as specified on their catalog page) will accept source frequencies to 440 Hz.

EXPORT PACKING

We will crate in a separate wooden box for export shipment. Consult factory for prices.

TESTING

Each Lambda power supply is electrically tested to insure conformance, with published specifications. There is a large safety margin between published maximum specifications and factory test limits. This tolerance is incorporated in the specifications to allow for normal industrial component deviations.

RATINGS

All components used are of the highest quality and are operated well within manufacturers' ratings. Ample safety factors are provided in the design to insure the long life, and the dependable, trouble-free operation so desirable in military, industrial and laboratory applications.

WARRANTY

(5 YEARS). Most Lambda products listed in this catalog are backed by a firm five-year warranty covering the cost of parts and labor. The warranty is honored at our Service Departments in Melville, New York, North Hollywood, California, Montreal, Canada, Bucks, England and Orsay, France. Advise Lambda of equipment to be returned and request shipping instructions.

Equipment beyond the 5-year guarantee will be repaired only after customer has authorized quoted repair charges.

REPAIR PARTS

Repair parts are always in stock for immediate shipment for repair purposes. When ordering a repair part, please give the Lambda part number on the component. Also state the model number, serial number and date of original purchase of power supply. Customers may repair and calibrate equipment without voiding the guarantee, provided work is performed in a workmanlike manner. Lambda will supply parts free of charge to those customers who elect to repair equipment that is under the warranty.

RETURNED GOODS ORDERED IN ERROR

Contact factory for authorization prior to returning equipment for credit. All returned equipment must be new, unused, in the original carton, and in the customer's possession no longer than 30 days. Under these circumstances, restocking charges will be 25% or $25, whichever is greater, for all models except LM-F, LM-G, LV-G-A, LW-G-A and LM-H Series full-rack power supplies. Restocking charges for the LM-F, G and H Series and LV-G-A and LW-G-A Series is 50%. Assemblies, accessories, power supplies or Power Hybrid Voltage Regulators with built-in options, obsolete or non-standard units, and material modified or built to customer specification cannot be accepted for credit.

PRODUCT/PRICE INDEX

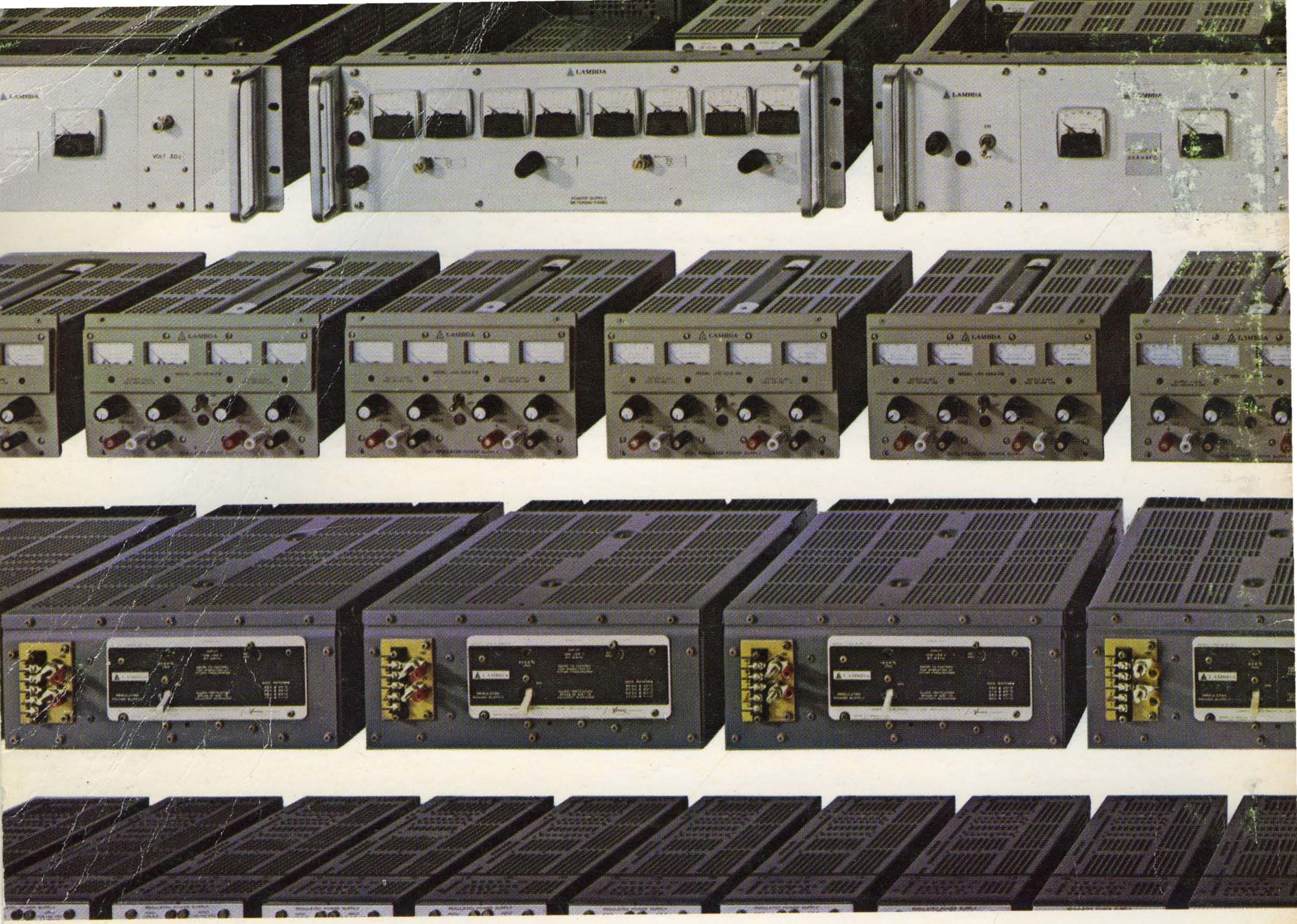
PRODUCT/PRICE INDEX

PRODUCT/PRICE INDEX

PRODUCT/PRICE INDEX

ACCESSORIES

LAMBDA POWER KITS



LAMBDA ELECTRONICS CORP.
515 BROAD HOLLOW ROAD, MELVILLE, L. I., NEW YORK 11746.

ADDRESS CORRECTION REQUESTED — DO NOT RETURN CATALOG

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