



DC-DC Converters

Mini Encapsulated - PC Board Mounting

REGULATED

single & dual tracking outputs

- Shipped Within 3 Days
- One Year Warranty

RoHS
COMPLIANT



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These versatile DC-DC Converters are ideally suited for powering a wide variety of analog and digital circuitry, such as op amps, logic and microprocessors. They may be mounted directly on a printed circuit board for OEM applications, or installed in a socket for developmental and small quantity requirements. For DC-DC Converters with screw terminals, see pages D3 and D4.

Efficiency is in the order of 65%, and is maintained down to low levels of output current. Input reflected ripple is reduced to less than 1% by means of a standard built-in pi filter, and electrostatic shielding on all six sides minimizes radiated energy. High input/output isolation permits separation of the output from the dc input bus to minimize circuit interaction due to ground loops, and the use of inputs in either polarity.

SPECIFICATIONS

Input Voltage: Nominal voltage $\pm 10\%$.

Input Reflected Ripple: 1% E_{in} (max.)

Output Regulation:

Line: $\pm 0.02\%$

Load: $\pm 0.05\%$

Output Ripple (@ 25 MHz bandwidth):

1 mV rms, 50 mV p-p (5-15V outputs).

1.5 mV rms, 75 mV p-p (18-28V outputs).

Output Voltage Setting: Outputs are factory preset to within $\pm 1\%$ of the nominal output voltage.

T/C terminal: For single output models, the T/C terminal can be used to trim the output more precisely to the nominal voltage rating by connecting an external resistor from the T/C terminal to either the + or - terminal. For dual output models, the T/C terminal is the output common.

Polarity: The output of single output models may be connected in either polarity. Dual output models have a positive/common/negative output terminal configuration.

Transient Response (NL-FL): 50 microseconds.

Overload/Short Circuit Protection: Electronic current limiting with automatic recovery. Models in case size ELC-10 also have thermal protection with automatic reset.

Input/Output Isolation:

Voltage: 500 Vdc

Resistance: 100 megohms

Capacitance: 100 pF

Switching Frequency: 20 kHz minimum.

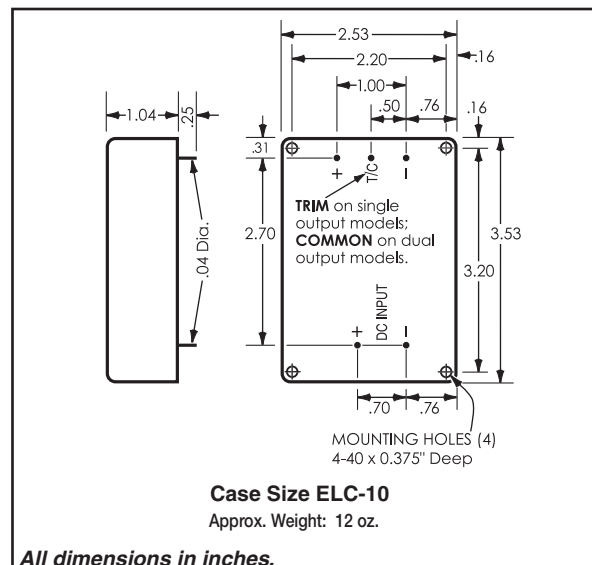
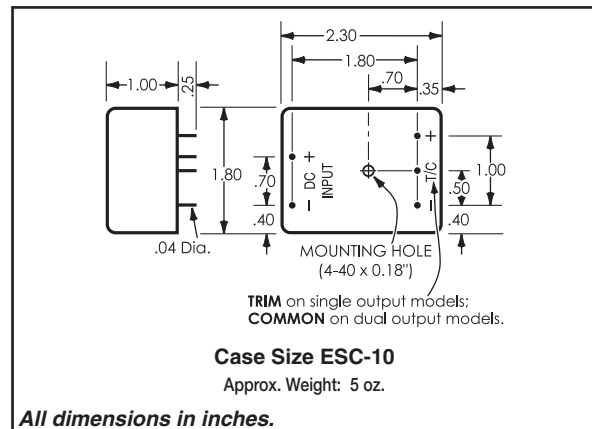
Temperature Coefficient: 0.02%/°C (Typical).

Ambient Operating Temperature: -20 to +71°C.

Storage Temperature: -40 to +85°C.

Humidity: 20% to 80% R.H. (non-condensing).

Mounting: May be mounted on printed circuit board or in socket (see page H4).



MINI ENCAPSULATED



SINGLE OUTPUT, FOR PC BOARD MOUNTING

DC-DC CONVERTERS

Nominal Input Voltage	Nominal Output Voltage	Output Current Amps. at			Model	Case Size
		40°C	55°C	71°C		
5	5	1.25	1.25	1.00	5E5E125	ESC-10
5	5	2.50	2.25	2.00	5E5E250	ELC-10
5	6	1.00	1.00	.80	5E6E100	ESC-10
5	6	2.00	1.80	1.60	5E6E200	ELC-10
5	8	.75	.75	.60	5E8E75	ESC-10
5	8	1.50	1.35	1.20	5E8E150	ELC-10
5	9	.70	.70	.55	5E9E70	ESC-10
5	9	1.40	1.25	1.10	5E9E140	ELC-10
5	10	.65	.65	.50	5E10E65	ESC-10
5	10	1.30	1.15	1.00	5E10E130	ELC-10
5	12	.60	.60	.50	5E12E60	ESC-10
5	12	1.20	1.10	1.00	5E12E120	ELC-10
5	13	.55	.55	.45	5E13E55	ESC-10
5	13	1.10	1.00	.90	5E13E110	ELC-10
5	15	.50	.50	.40	5E15E50	ESC-10
5	15	1.00	.90	.80	5E15E100	ELC-10
5	18	.40	.40	.30	5E18E40	ESC-10
5	18	.80	.70	.60	5E18E80	ELC-10
5	20	.35	.35	.28	5E20E35	ESC-10
5	20	.70	.60	.50	5E20E70	ELC-10
5	24	.25	.25	.20	5E24E25	ESC-10
5	24	.60	.55	.50	5E24E60	ELC-10
5	28	.25	.25	.20	5E28E25	ESC-10
5	28	.50	.45	.40	5E28E50	ELC-10
12	5	1.25	1.25	1.00	12E5E125	ESC-10
12	5	2.50	2.25	2.00	12E5E250	ELC-10
12	6	1.00	1.00	.80	12E6E100	ESC-10
12	6	2.00	1.80	1.60	12E6E200	ELC-10
12	8	.75	.75	.60	12E8E75	ESC-10
12	8	1.50	1.35	1.20	12E8E150	ELC-10
12	9	.70	.70	.55	12E9E70	ESC-10
12	9	1.40	1.25	1.10	12E9E140	ELC-10
12	10	.65	.65	.50	12E10E65	ESC-10
12	10	1.30	1.15	1.00	12E10E130	ELC-10
12	12	.60	.60	.50	12E12E60	ESC-10
12	12	1.20	1.10	1.00	12E12E120	ELC-10
12	13	.55	.55	.45	12E13E55	ESC-10
12	13	1.10	1.00	.90	12E13E110	ELC-10
12	15	.50	.50	.40	12E15E50	ESC-10
12	15	1.00	.90	.80	12E15E100	ELC-10
12	18	.40	.40	.30	12E18E40	ESC-10
12	18	.80	.70	.60	12E18E80	ELC-10
12	20	.35	.35	.28	12E20E35	ESC-10
12	20	.70	.60	.50	12E20E70	ELC-10
12	24	.25	.25	.20	12E24E25	ESC-10
12	24	.60	.55	.50	12E24E60	ELC-10
12	28	.25	.25	.20	12E28E25	ESC-10
12	28	.50	.45	.40	12E28E50	ELC-10
15	5	1.25	1.25	1.00	15E5E125	ESC-10
15	5	2.50	2.25	2.00	15E5E250	ELC-10
15	6	1.00	1.00	.80	15E6E100	ESC-10
15	6	2.00	1.80	1.60	15E6E200	ELC-10
15	8	.75	.75	.60	15E8E75	ESC-10
15	8	1.50	1.35	1.20	15E8E150	ELC-10
15	9	.70	.70	.55	15E9E70	ESC-10
15	9	1.40	1.25	1.10	15E9E140	ELC-10
15	10	.65	.65	.50	15E10E65	ESC-10
15	10	1.30	1.15	1.00	15E10E130	ELC-10
15	12	.60	.60	.50	15E12E60	ESC-10
15	12	1.20	1.10	1.00	15E12E120	ELC-10
15	13	.55	.55	.45	15E13E55	ESC-10
15	13	1.10	1.00	.90	15E13E110	ELC-10
15	15	.50	.50	.40	15E15E50	ESC-10
15	15	1.00	.90	.80	15E15E100	ELC-10
15	18	.40	.40	.30	15E18E40	ESC-10
15	18	.80	.70	.60	15E18E80	ELC-10

Nominal Input Voltage	Nominal Output Voltage	Output Current Amps. at			Model	Case Size
		40°C	55°C	71°C		
15	20	.35	.35	.28	15E20E35	ESC-10
15	20	.70	.60	.50	15E20E70	ELC-10
15	24	.25	.25	.20	15E24E25	ESC-10
15	24	.60	.55	.50	15E24E60	ELC-10
15	28	.25	.25	.20	15E28E25	ESC-10
15	28	.50	.45	.40	15E28E50	ELC-10
24	5	1.25	1.25	1.00	24E5E125	ESC-10
24	5	2.50	2.25	2.00	24E5E250	ELC-10
24	6	1.00	1.00	.80	24E6E100	ESC-10
24	6	2.00	1.80	1.60	24E6E200	ELC-10
24	8	.75	.75	.60	24E8E75	ESC-10
24	8	1.50	1.35	1.20	24E8E150	ELC-10
24	9	.70	.70	.55	24E9E70	ESC-10
24	9	1.40	1.25	1.10	24E9E140	ELC-10
24	10	.65	.65	.50	24E10E65	ESC-10
24	10	1.30	1.15	1.00	24E10E130	ELC-10
24	12	.60	.60	.50	24E12E60	ESC-10
24	12	1.20	1.10	1.00	24E12E120	ELC-10
24	13	.55	.55	.45	24E13E55	ESC-10
24	13	1.10	1.00	.90	24E13E110	ELC-10
24	15	.50	.50	.40	24E15E50	ESC-10
24	15	1.00	.90	.80	24E15E100	ELC-10
24	18	.40	.40	.30	24E18E40	ESC-10
24	18	.80	.70	.60	24E18E80	ELC-10
24	20	.35	.35	.28	24E20E35	ESC-10
24	20	.70	.60	.50	24E20E70	ELC-10
24	24	.25	.25	.20	24E24E25	ESC-10
24	24	.60	.55	.50	24E24E60	ELC-10
24	28	.25	.25	.20	24E28E25	ESC-10
24	28	.50	.45	.40	24E28E50	ELC-10
28	5	1.25	1.25	1.00	28E5E125	ESC-10
28	5	2.50	2.25	2.00	28E5E250	ELC-10
28	6	1.00	1.00	.80	28E6E100	ESC-10
28	6	2.00	1.80	1.60	28E6E200	ELC-10
28	8	.75	.75	.60	28E8E75	ESC-10
28	8	1.50	1.35	1.20	28E8E150	ELC-10
28	9	.70	.70	.55	28E9E70	ESC-10
28	9	1.40	1.25	1.10	28E9E140	ELC-10
28	10	.65	.65	.50	28E10E65	ESC-10
28	10	1.30	1.15	1.00	28E10E130	ELC-10
28	12	.60	.60	.50	28E12E60	ESC-10
28	12	1.20	1.10	1.00	28E12E120	ELC-10
28	13	.55	.55	.45	28E13E55	ESC-10
28	13	1.10	1.00	.90	28E13E110	ELC-10
28	15	.50	.50	.40	28E15E50	ESC-10
28	15	1.00	.90	.80	28E15E100	ELC-10
28	18	.40	.40	.30	28E18E40	ESC-10
28	18	.80	.70	.60	28E18E80	ELC-10
28	20	.35	.35	.28	28E20E35	ESC-10
28	20	.70	.60	.50	28E20E70	ELC-10
28	24	.25	.25	.20	28E24E25	ESC-10
28	24	.60	.55	.50	28E24E60	ELC-10
28	28	.25	.25	.20	28E28E25	ESC-10
28	28	.50	.45	.40	28E28E50	ELC-10
48	5	1.25	1.25	1.00	48E5E125	ESC-10
48	6	1.00	1.00	.80	48E6E100	ESC-10
48	8	.75	.75	.60	48E8E75	ESC-10
48	9	.70	.70	.55	48E9E70	ESC-10
48	10	.65	.65	.50	48E10E65	ESC-10
48	12	.60	.60	.50	48E12E60	ESC-10
48	13	.55	.55	.45	48E13E55	ESC-10
48	15	.50	.50	.40	48E15E50	ESC-10
48	18	.40	.40	.30	48E18E40	ESC-10
48	20	.35	.35	.28	48E20E35	ESC-10
48	24	.25	.25	.20	48E24E25	ESC-10
48	28	.25	.25	.20	48E28E25	ESC-10

120 to 180

See pages C1-C2.

DUAL TRACKING OUTPUTS

Nominal Input Voltage	Nominal Output Voltages	Amps. per Output at			Model	Case Size
		40°C	55°C	71°C		
5	±10	.30	.30	.25	5E10D30	ESC-10
5	±10	.60	.55	.50	5E10D60	ELC-10
5	±12	.30	.30	.25	5E12D30	ESC-10
5	±12	.60	.55	.50	5E12D60	ELC-10
5	±15	.25	.25	.25	5E15D25	ESC-10
5	±15	.50	.45	.40	5E15D50	ELC-10
5	±18	.20	.20	.20	5E18D20	ESC-10
5	±18	.40	.35	.30	5E18D40	ELC-10
12	±10	.30	.30	.25	12E10D30	ESC-10
12	±10	.60	.55	.50	12E10D60	ELC-10
12	±12	.30	.30	.25	12E12D30	ESC-10
12	±12	.60	.55	.50	12E12D60	ELC-10
12	±15	.25	.25	.25	12E15D25	ESC-10
12	±15	.50	.45	.40	12E15D50	ELC-10
12	±18	.20	.20	.20	12E18D20	ESC-10
12	±18	.40	.35	.30	12E18D40	ELC-10
15	±10	.30	.30	.25	15E10D30	ESC-10
15	±10	.60	.55	.50	15E10D60	ELC-10
15	±12	.30	.30	.25	15E12D30	ESC-10
15	±12	.60	.55	.50	15E12D60	ELC-10
15	±15	.25	.25	.25	15E15D25	ESC-10
15	±15	.50	.45	.40	15E15D50	ELC-10

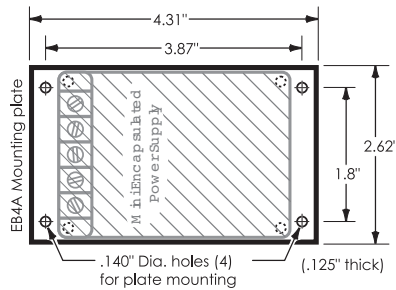
Nominal Input Voltage	Nominal Output Voltages	Amps. per Output at			Model	Case Size
		40°C	55°C	71°C		
15	±18	.20	.20	.20	15E18D20	ESC-10
15	±18	.40	.35	.30	15E18D40	ELC-10
24	±10	.30	.30	.25	24E10D30	ESC-10
24	±10	.60	.55	.50	24E10D60	ELC-10
24	±12	.30	.30	.25	24E12D30	ESC-10
24	±12	.60	.55	.50	24E12D60	ELC-10
24	±15	.25	.25	.25	24E15D25	ESC-10
24	±15	.50	.45	.40	24E15D50	ELC-10
24	±18	.20	.20	.20	24E18D20	ESC-10
24	±18	.40	.35	.30	24E18D40	ELC-10
28	±10	.30	.30	.25	28E10D30	ESC-10
28	±10	.60	.55	.50	28E10D60	ELC-10
28	±12	.30	.30	.25	28E12D30	ESC-10
28	±12	.60	.55	.50	28E12D60	ELC-10
28	±15	.25	.25	.25	28E15D25	ESC-10
28	±15	.50	.45	.40	28E15D50	ELC-10
28	±18	.20	.20	.20	28E18D20	ESC-10
28	±18	.40	.35	.30	28E18D40	ELC-10
48	±10	.30	.30	.25	48E10D30	ESC-10
48	±12	.30	.30	.25	48E12D30	ESC-10
48	±15	.25	.25	.25	48E15D25	ESC-10
48	±18	.20	.20	.20	48E18D20	ESC-10
48	±18	.40	.35	.30	48E18D40	ELC-10

Mounting Kits for 'Mini Encapsulated - with screw terminals' power supplies:

WALL MOUNTING

Model EB4A

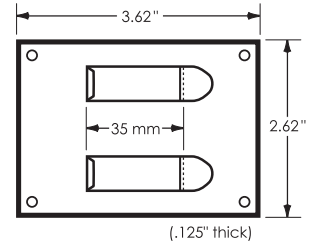
Use Mounting Kit EB4A to mount from the power supply side of the mounting surface, necessary when the other side of the mounting surface is inaccessible. This kit consists of an aluminum plate and four screws for attaching it to the power supply, effectively adding mounting flanges to any Mini Encapsulated power supply with screw terminals or any Mini DC-DC Converter with screw terminals.



DIN RAIL MOUNTING

Model EB35DIN

Mounting Kit EB35DIN consists of an aluminum plate, with two DIN clips attached to it, and four screws for attaching the plate to the bottom of any Mini Encapsulated power supply with screw terminals or any Mini DC-DC Converter with screw terminals. The power supply can then be snapped onto a 35mm 'top hat' type of DIN rail.

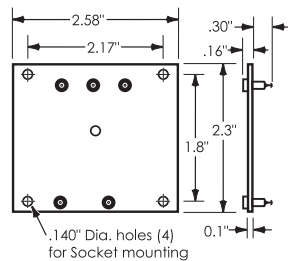


Sockets for 'Mini Encapsulated - PC Board mounting' power supplies:

For use with PC board mounting Mini Linears and PC board mounting DC-DC Converters. Each of these sockets has a sturdy phenolic base with gold plated teflon-insulated contacts.

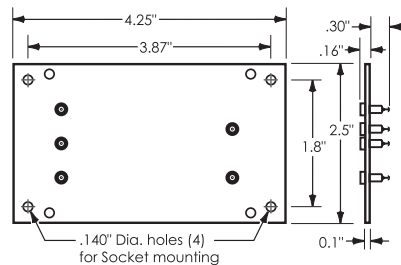
Model ES-1

For case sizes ES-10 and ESC-10



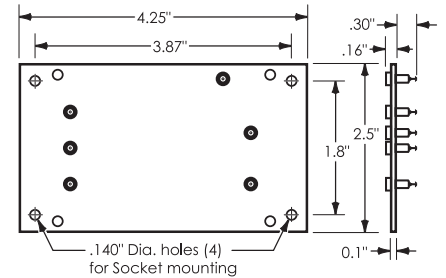
Model EL-1

For case sizes EL-10, EL-13, EL-20 and ELC-10



Model ELW-1

For case sizes ELW-13 and ELW-20

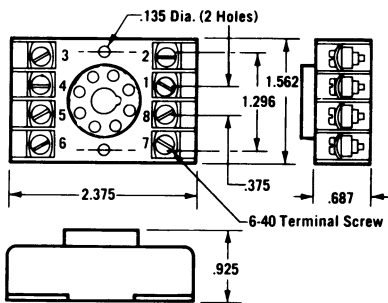


Sockets for 'Plug-In' power supplies:

RETMA-numbered screw-type terminals simplify wiring and permit the use of wire terminals or bare wire, 12 to 20 gauge. Rated at 300 volts RMS, 10 amp.

Model SL608

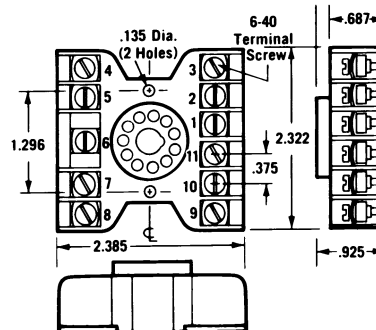
For 8-pin plugs.



All dimensions in inches.

Model SL611

For 11-pin plugs.



All dimensions in inches.

ACOPIAN SELLS FACTORY DIRECT WORLDWIDE: We do not use representatives or distributors. Contact Acopian for technical information or a quote.

WARRANTY: Acopian power supplies are warranted to be free from defects in material and workmanship for a period of five years (encapsulated devices, for one year) from date of original shipment. Acopian's obligation under this warranty is limited to repairing any power supply returned to the factory Service Department in Easton, PA or Melbourne, FL, and replacing any defective parts. Mini Encapsulated power supplies are not repairable. Authorization must be obtained from Acopian before a power supply may be returned for repair. Units must be well packed when shipping to Acopian; the repair of any damage incurred during shipment will be charged. Transportation charges are to be paid by the purchaser. A reinspection and handling charge will be applied to returned units found to have no defects. If a failure has been caused by misuse, operation in excess of specifications, or modification by the customer, repairs will be billed at cost; in such cases, a cost estimate will be submitted before work is started.

Acopian reserves the right to make changes or improvements in its products without incurring any obligation to install the same on products previously manufactured.

This warranty is in lieu of all other warranties, obligations, and liabilities, expressed or implied, and is the purchaser's exclusive remedy. Acopian makes no warranty, either express or implied, of merchantability, fitness for a particular purpose or otherwise. In no event shall Acopian be liable whether in contract, tort, or negligence, for special, indirect, incidental or consequential damages of any kind, including loss of business or profits, or any other losses incurred by the purchaser or any third party, the Customer's remedies being limited, at Acopian's option, to replacement, repair or credit at the price on the date of claim.

The validity, performance and construction of all terms and conditions and any sale made by Acopian shall be determined by the law of Pennsylvania, without regard to its conflict of law principles, and all parties to the transaction expressly consent to the jurisdiction of such courts and consent to the venue of the Court of Common Pleas for Northampton County, Pennsylvania.

PRICES: The prices shown are F.O.B. our factory; Easton, PA or Melbourne, FL. ('EXW Factory' if outside the 50 United States.) All prices and specifications are subject to change without notice.

TERMS: Net 30 days, subject to credit approval. Visa, MasterCard and American Express also accepted.

SHIPPING: Location permitting, small shipments are made by United Parcel Service, FedEx, DHL (international orders) or by Parcel Post; larger shipments, by insured motor freight collect. Shipments can be made by air upon request. Risk of loss shall be F.O.B. Our Factory, even in cases where freight may be prepaid or allowed to destination by Acopian. If equipment is received in damaged condition, it is the customer's responsibility to contact the carrier and file a claim for damages.

TIME FOR DELIVERY: The time for delivery quoted by Acopian is the time required to ship from our plants. We will not be liable for delays in delivery caused by any reason beyond our control, including but not limited to acts of God, casualty, civil disturbance, labor disputes, transportation or supply difficulties, or any interruption of our facilities, and the quoted time for delivery shall be extended during the continuance of such conditions and for a reasonable time thereafter. In no event will Acopian be liable for any premium transportation, procurement, or similar costs incurred by the Customer as a result of conditions beyond Acopian's control resulting in Acopian's inability to deliver product in accordance with customer's requested delivery schedules.

QUANTITY DISCOUNTS: Discounts are available to quantity buyers and are dependent upon the order quantity and the manufacturing scheduling anticipated by the order, and apply only to the quantity and delivery ordered. Partial shipments are considered as separate orders for discounting purposes.

EXPORT ORDERS: A minimum export documentation charge of \$60.00 applies. (A minimum charge of \$25.00 applies on orders to certain U.S. territories requiring customs forms.)

MOISTURE/FUNGUS PROOFING: Power supplies can be furnished with a moisture and fungus resistant varnish applied to interior surfaces. To order, add the suffix letter F to the model number. This option requires two additional days and is not available on High Voltage, Mini Encapsulated, Rack Mounting, and Gold Box Switching models.

TAGGING: Add \$10.00 to price.

TEST DATA: Cost, \$35.00 or 2% of order, whichever is greater.

SPECIAL MODELS/MODIFICATIONS: Cataloged models can be altered at the factory to meet special requirements. Contact the Applications Engineering Department to discuss your needs.

PARTS: The designs used in Acopian power supplies utilize standard components to the greatest practical extent. When replacements are required, the types originally used, or their equivalents, can usually be obtained most quickly from a local electronic components distributor.

Special components, such as transformers, are stocked at the factory warehouses. Contact the Applications Engineering Department for information on the parts required, referencing the model number of the power supply, the circuit designation of the component, and a description.

PURCHASE ORDER ACCEPTANCE: Orders are accepted subject to Acopian's Terms and Conditions. Any Terms and Conditions of any Purchaser's order, agreement, or understanding which are in addition to or inconsistent with Acopian's shall not be binding upon Acopian unless made in writing and accepted over the signature of an authorized officer of Acopian. Orders shall not be considered accepted until entered into production at our plant. Acopian reserves the right to refuse any order. All typographical and clerical errors are subject to correction by Acopian.

RETURNED GOODS: Acopian products are built on a per-order basis, and ordinarily no credit can be extended for their return. No goods will be accepted for return unless authorized in writing by Acopian.

CHANGES: The customer may, by a written notice, request changes within the general scope of the order, in the drawings, designs or specifications; method of shipment; and place of delivery. If any such change causes an increase or decrease in the cost, or the time required for the processing of any part of the order, an equitable adjustment shall be made in the price or delivery schedule, or both, and the order shall be modified in writing accordingly.

CANCELLATION: Suspension or cancellation of orders may be made only upon our written approval and on terms that will indemnify us against all loss.

OVERTIME: It is anticipated that any order will be processed during regular working hours on regular working days. If for any reason the Purchaser requests Acopian to process the order, or any portion of it, outside of such regular working hours, any overtime or other additional expense occasioned thereby shall be billed to and paid by the Purchaser as an extra cost. Acopian reserves the right to decline to process the order outside regular working hours.

CUSTOMER DELAY OF WORK: If the performance of all or any part of the work is delayed or interrupted by Customer's failure to act within the time specified (or within a reasonable time if no time is specified) and such act is not expressed or implied by the order, an adjustment shall be made in the cost of performance of the order caused by such delay or interruption and the order modified in writing accordingly. Adjustment will also be made in the delivery or performance dates and any other contractual provisions affected by such delay or interruption.

GOVERNMENT SPECIFICATIONS: Pricing is based upon industrial-grade construction, marking, packing, and packaging. Exception is taken to any MIL specifications, and to any requirements for the use of special forms, documentation other than quoted, and Government Source Inspection. Acopian must decline to quote on any other basis.

APPLICATIONS ASSISTANCE: *Questions regarding the specifications, features, and use of any Acopian product should be directed to the Applications Engineering Department. A staff of power supply specialists will be pleased to assist you.*

ACOPIAN IS AN ISO 9001 CERTIFIED COMPANY