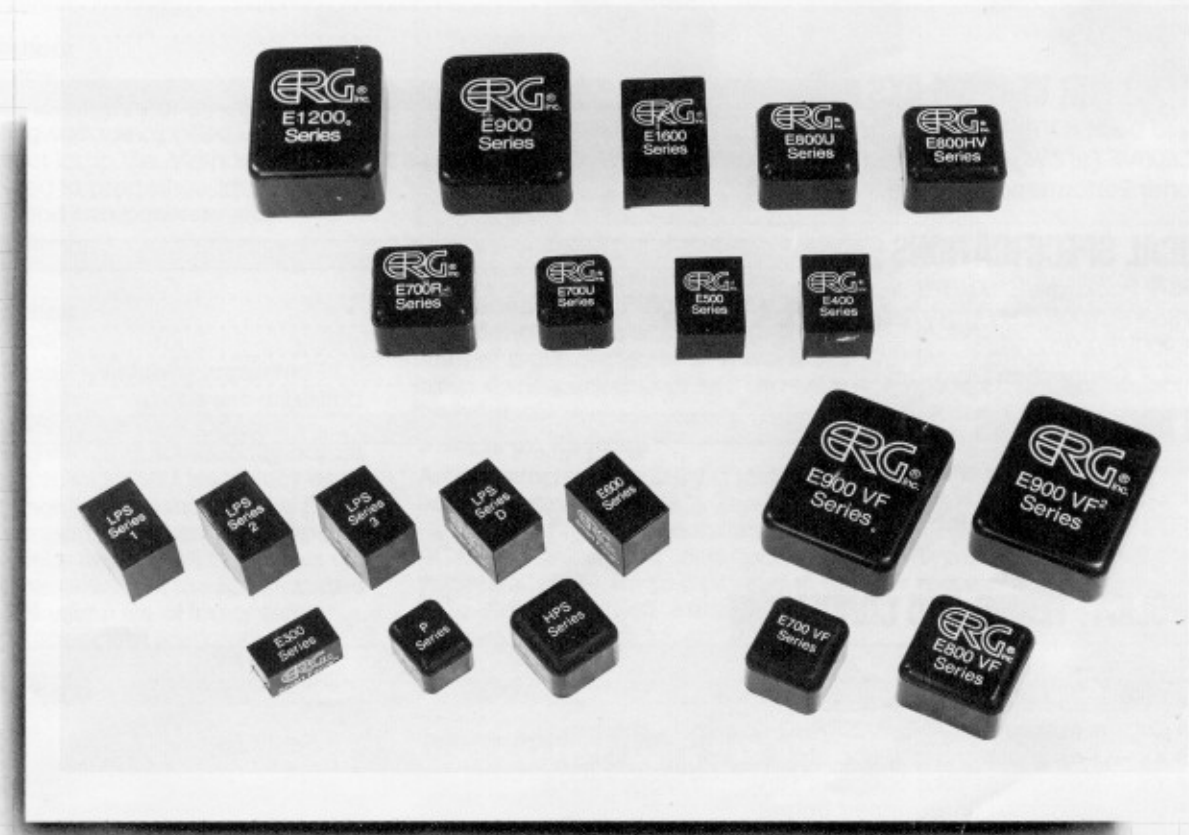
ERG™

Endicott Research Group, Inc.



DC-DC CONVERTERS TO 25W, POWER SUPPLIES FOR DISPLAYS & SMART FORCE™ INVERTERS FOR EL LAMPS

CONTENTS

SALES POLICY, TERMS AND CONDITIONS

Notes:

- Minimum billed order — $50.00
- Orders prepaid, COD or VISA/MC no min. (+ shipping)
- XX — Designates your option of 5, 9, 12 or 15 Vdc input
- YY — Designates your option of 18 Vdc or higher input
- U — Designates unregulated output
- R — Designates regulated output
- S — Designates single output
- D — Designates dual output
- CT — Designates center-tapped output
- HV — Designates high voltage output (1000 Vdc to 1500 Vdc)
- VF — Designates unit for vacuum fluorescent display

General:

- Standard terms are net 30/FOB Endicott to approved accounts
- VISA and MasterCard accepted for orders up to $250
- Published prices subject to change without notice
- Custom units subject to alternate pricing
- Contact factory for engineering and tooling fees

International:

- All charges for duties, tariffs, handling, currency exchange, etc., are the responsibility of the buyer.
- All pricing/charges/fees in U.S. dollars, payable in U.S. funds drawn on a U.S. Bank
- Minimum order may apply — consult factory

SMART FORCE™

DC-AC Inverters for Electroluminescent Lamps

Smart Force™ Power Helps Ensure Longer Useful EL Lamp Life

Problem:
Brightness Loss Over Time

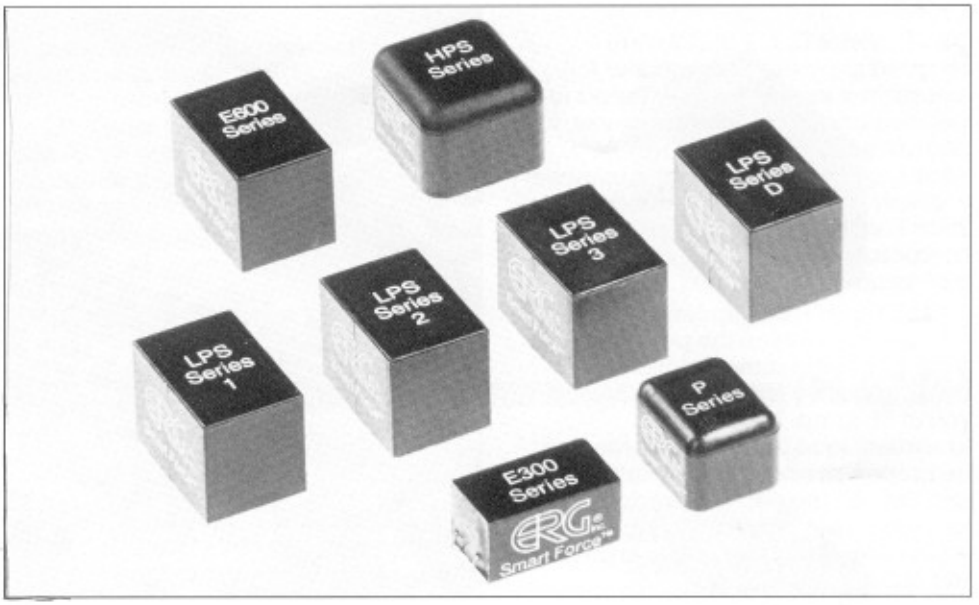
As electroluminescent lamps age, their brightness drops off considerably. For many years, this aging characteristic discouraged EL use by many engineers who sought the exciting design advantages afforded by EL technology.

Old Solution:
Brute Force

Maintain EL brightness by continually increasing voltage applied to lamp for duration of lamp life. Method often contributed to premature lamp failure—and componentry was expensive!

New Solution:
Smart Force™

"Smart Force"—achieve improved EL brightness longer using a self-adjusting dc-ac power inverter. A tuned, resonating circuit automatically adjusts operating voltage and frequency as the capacitance (impedance) of the EL lamp changes. This changing output can enhance the overall brightness vs. time characteristics of the EL lamp and extend the useful life of the system. *Energy efficiency at low cost!*



The output of the inverter is load dependent and changes as the lamp's impedance changes. Thus, when the inverter is connected to a "new" EL lamp, it will perform just as it did with the original.

What Is an EL lamp?

An EL Lamp is essentially a lossy, light-emitting capacitor (LEC). The two most widely used types of thick-film powder AC EL lamps are "foil" and "polymer thick-film" (PTF), terms that refer to the base electrode. "Foil" lamps use a thin aluminum foil base layer; "PTF" lamps use a conductive silver ink pad. Construction is similar: a laminate incorporating a front lead, bus bar, transparent front electrode, phosphorescent dielectric, rear electrode and rear lead.

A third, rigid type of AC powder EL lamp is made using a metal substrate and a ceramic frit that sandwich the front electrode and phosphor.

Typical voltage and frequency requirements to achieve similar brightness levels may differ from one type of EL lamp to another.

E600 SERIES

Custom Applications

Use the original Smart Force™ E600 Series Inverter for PTF EL lamps, rigid EL lamps and some custom applications using popular foil-type lamps.

E600 Series Inverters, while originally designed to power EL lamps, also are used to power cold-cathode fluorescent lamps, such as JKL's "Micro-Lume", including models BF659, 6100 and 959. See Connection Diagram, Page 20. Contact factory for details.

Smart Force Inverters can be designed to operate from a variety of low voltage dc inputs, such as 3, 5, 6, 9, 12, 15, 18, 24 or 28 Vdc. (E600 Series Inverters should only be operated when loaded.)

If we have not made the input-output combination you require, we will be pleased to design and manufacture custom inverters at a standard unit price plus a nominal, non-recurring engineering fee.

"Spec Starter" Checklist

To help you determine the specifications on the dc-ac inverter you'll need for your EL application, we'll need to know the following:

- ☐ Lamp maker/type of phosphor
- ☐ Capacitance & Parallel Resistance (Phase Angle)
- ☐ Surface area to be excited
- ☐ Input Vdc/Type of Power Source
- ☐ Brightness Level Required
- ☐ Application
- ☐ Expected product & lamp life
- ☐ Temperature range
- ☐ Comments

LPS Matrix Defines 296 Standard Units for EL Applications!

The LPS Series D, 1, 2 and 3 were designed to power conventional foil-construction lamps of a given area to a specified brightness level (very low, low, medium or high, respectively). As a result, it is now possible for the engineer to specify and purchase a standard Smart Force Inverter for applications incorporating lamps from virtually all "foil" lamp manufacturers.

The LPS Series Part Numbering System is designed to define the performance of the inverter in direct relation to a fixed capacitive load that simulates a typical EL lamp. Thus, only an equivalent load is used in referencing the proper inverter for any particular application. The part numbering system allows the user to specify the inverter required, in a manner easily expressed and readily cataloged.

LPS Part Numbering System:

LPS XX — Y — Z

Package — Input Vdc — Series — Unit Load

General Information: E600 & LPS

Case:	Nylon (glass filled)
Size:	1.25" × .85" × .95" high 31.75 mm × 21.59 mm × 24.13 mm high
Mounting:	PC Board Mount Standard
Encapsulated:	Epoxy filled
Weight:	30 gms. (approx.)
Nominal Input Voltage DC:	Number can be expressed in nearest 0.1 Volt.
Series (LPS Only):	Defines general series of unit; series defines nominal output voltage (rms) and frequency combination.
Unit Number (LPS Only):	Refers to number of Unit Loads. Units will operate w/no load. Defines maximum input power directly. The higher the number, the greater the output.

This chart outlines the basic static parameters of the four LPS Series dc to ac inverters.

PARAMETER	SYMBOL	UNITS	SERIES D	SERIES 1	SERIES 2	SERIES 3
Input Power per Unit Load	P_{in}	Watts	* 0.200	0.300	* 0.400	* 0.500
Min. Input Voltage	V_{in}(min)	%	-40	-40	-40	-40
Max. Input Voltage	V_{in}(max)	%	+25	+25	+25	+25
Min. Operating Temperature	T(min)	Degrees C	-25	-25	-25	-25
Max. Operating Temperature	T(max)	Degrees C	+85	+85	+85	+85
Nominal Output Voltage	V_{out}	Vrms	60	80	100	120
Nominal Operating Frequency	F_{out}	Hz	400	400	400	400
Max. Number of Unit Loads	L_{max}	—	15	10	7	5
Unit Load Capacitance	C_{LU}	uf	0.02	0.02	0.02	0.02
Unit Load Resistance	R_{LU}	Ohms	100,000	100,000	100,000	100,000
Output Voltage Tolerance	— —	%	± 10	± 10	± 10	± 10
Operating Frequency Tolerance	— —	%	± 10	± 10	± 10	± 10
Output Current per Unit Load	I_{out}	marms	3.1	4.1	5.1	6.2

*Input power may increase by 10% on low input voltage single unit load inverters.

LPS Inverters for Electroluminescent Lamps

LPS SERIES D

The **LPS Series D** consumes the least amount of power of any LPS Inverter Series. It is designed to produce 60 Vrms @ 400 Hz into a specified load. The brightness level is approximately 4-6 foot-lamberts in a conventional foil-type EL lamp, which is 40% less than its big brother—the LPS Series One. The low brightness level helps extend the useful life of the EL lamp, and thus of the system in which it is used.

The LPS Series D is capable of powering up to 60 in.^{2} of conventional foil-type EL material. Its low power consumption makes it ideal for battery operated EL backlighting applications.

Note: The maximum input power may be as much as 10% higher on low-input voltage, single-unit load inverters.

LPS SERIES 1

The **LPS Series 1** is the most well defined Smart Force Inverter Series. Specifications and performance characteristics cited refer to the LPS Series unless otherwise noted. Nominal output is 80 Vrms @ 400 hertz into a specified load. This output voltage and frequency combination will produce approximately 8 to 10 foot-lamberts when powering a conventional green foil-type EL lamp, a brightness level ideal for most LCD and membrane switch backlighting applications.

LPS SERIES 2

Using the same basic criteria as the Series 1, **LPS Series 2** Inverters are designed to produce 100 Vrms @ 400 hertz into a specified load. This 20 volt increase in output voltage produces an approximate 50% increase in brightness over the Series 1. This increased brightness level is helpful in applications where a lit EL lamp enhances the performance of the product under normal office or factory lighting conditions.

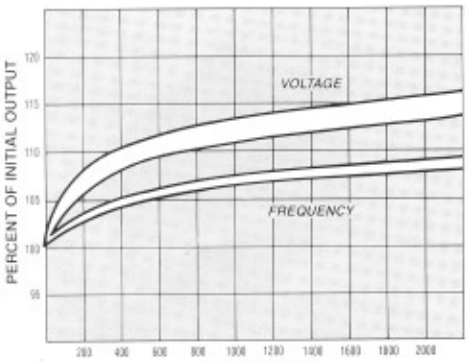
Note: The maximum input power may be as much as 10% higher on low-input voltage, single-unit load inverters.

LPS SERIES 3

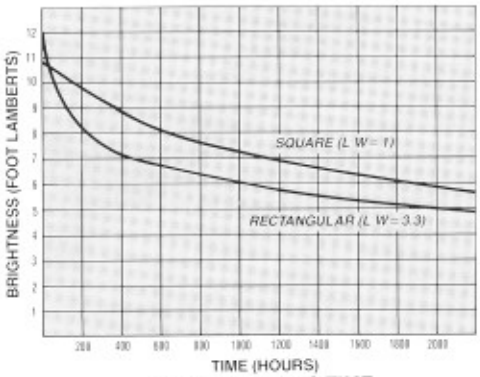
The **LPS Series 3** is designed to produce 120 Vrms at 400 hertz into a specified load. This voltage-frequency combination will produce approximately 20 foot-lamberts in a new, green, conventional EL foil lamp. Series 3 units typically are used to power reverse-mode transmissive LCD backlights, in emergency lighting and in novelty applications that require higher brightness.

Note: The maximum input power may be as much as 10% higher on low-input voltage, single-unit load inverters.

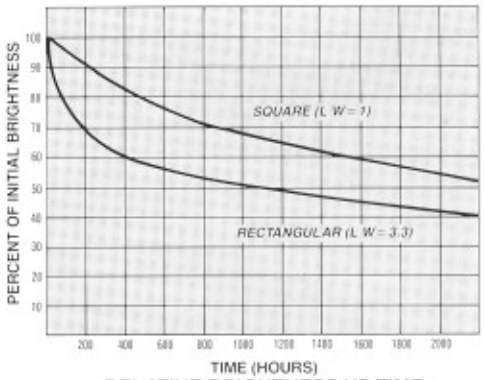
LPS Inverter Performance Curves



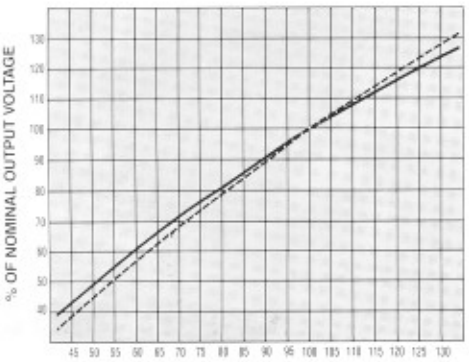
OUTPUT VS TIME



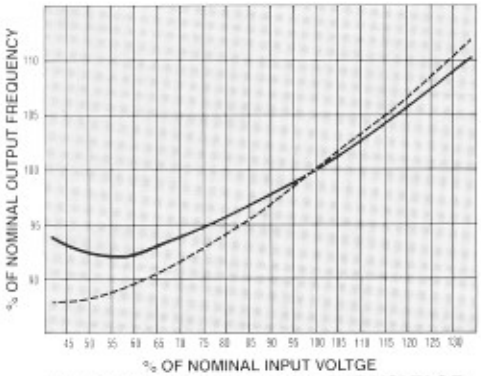
BRIGHTNESS VS TIME



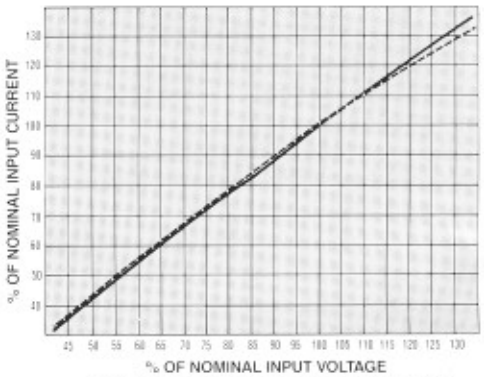
RELATIVE BRIGHTNESS VS TIME



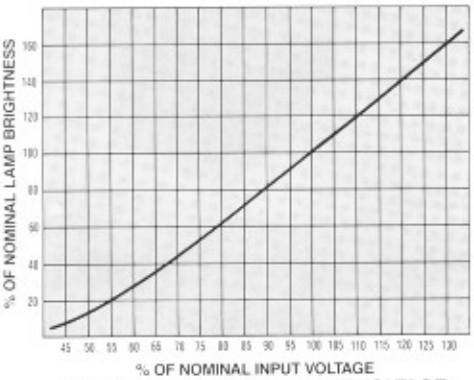
OUTPUT VOLTAGE VS INPUT VOLTAGE



OUTPUT FREQUENCY VS INPUT VOLTAGE



INPUT CURRENT VS INPUT VOLTAGE



LAMP BRIGHTNESS VS INPUT VOLTAGE

SOLID LINE: EL LAMP [LSI 0313 1232 (4.3 SQ. IN.)]
DASHED LINE: EQUIVALENT LOAD (.020 uf // 100 KOHMS)

To calculate approximate load values for Foil EL Lamps:

LU = Unit Load = Approx. 4 sq. in. foil-type EL
Z = Number of Unit Loads = Lamp Area divided by 4

C_{LU} = .02 uF multiplied by the number of unit loads

C_{LU} = .02 uF * Z

R_{LU} = 100,000 ohms divided by the number of unit loads

R_{LU} = 100,000 ohms ÷ Z

LPSXX-1-Z: Partial Table of Specifications

LPS Part No.	Nominal VDC In	Minimum VDC In	Maximum VDC In	Maximum Input Current (mA)* Z = 1	Z = 2	Z = 3	Z = 4	Z = 5
LPS05-1-Z	5.0	3.0	6.3	60	120	180	240	300
LPS06-1-Z	6.0	3.6	7.5	50	100	150	200	250
LPS09-1-Z	9.0	5.4	11.3	34	68	102	136	170
LPS12-1-Z	12.0	7.2	15.0	25	50	75	100	125
LPS15-1-Z	15.0	9.0	18.3	20	40	60	80	100
LPS18-1-Z	18.0	10.8	22.5	16	32	48	64	80
LPS24-1-Z	24.0	14.4	30.0	12.5	25	37.5	50	62.5
LPS28-1-Z	28.0	16.8	35.0	11	22	33	44	55

*At Nominal Input Voltage.

"P" Package Inverter for LPS & E600 Series

Miniaturized Inverter Package Opens Door on New EL Applications!

Endicott Research Group's "P Package" Smart Force inverters are designed to provide the output power of most E600 and LPS Series inverters—in a uniquely small package, encapsulated for superior environmental protection!

Perfect for applications where space is at a premium. Use to backlight LCDs and membrane switches in portable hand-held instruments and field equipment, point of purchase displays, commercial signs, novelty items and more!

The P Package Inverter is available in all standard E600 and LPS dc input voltage versions, i.e., 5, 6, 9, 12, 15, 18, 24 and 28 Vdc. Use to power 4, 8, 12, 16,20 or more square inches of electroluminescent material, depending upon the type of EL lamp, dc input voltage available and required brightness level.

LPS "P" Package inverters conform to the same General Operating Specifications listed elsewhere in this data sheet for LPS Series inverters.

To specify the proper P Package inverter for your application, simply add the suffix "P" to the LPS or E600 part number you're already using. For example:

Old Part Number	New Part Number
E613-E0003	E613-E0003P
LPS 12-1-1	LPS12-1-1P

A nominal nonrecurring engineering fee may apply to parts not already designed. Please contact your local representative or the factory for lead times, volume pricing, further product information and applications assistance.

GENERAL SPECIFICATIONS

Input:	5, 6, 9, 12, 15, 18, 24, 28 Vdc standard
Temp. Range, Operating:	−25°C to + 85°C standard (other ranges available)
Size:	1.01" × .82" × .70" high 25.3 mm × 20.5 mm × 17.5 mm high
Mounting:	PC mounting standard
Case:	Plastic case standard
Encapsulated:	All standard units fully encapsulated with epoxy resin

E300 SERIES

GENERAL SPECIFICATIONS

Input:		5, 6, 9, 12, 15, 28 Vdc standard
Temp Range, Operating:		0°C to + 70°C standard (other ranges available)
Weight:		Approx. 20 gms
Mounting:		PC Board Standard
Case:		No Case. Molded.
Size:		.60"×.60" × 1.15" long 15.0 mm × 15.0 mm × 28.8 mm long
Loading:		Never operate without load
E312-E0001	Nominal Input:	12 Vdc
Notes:	Nominal Load:	343 KOhm/.016uf
	Nominal Input Current:	100 madc
	Nominal Output:	125 Vrms @ 600 Hz

Units can be designed for Foil, Polymer Thick Film, and other kinds of EL lamps, depending upon input voltage, brightness, lamp area and input current. Device is pc board mountable and can be wave soldered. Contact factory for details.

HPS SERIES

The HPS was specifically designed to power large areas of electro-luminescent material for backlighting large area LCDs, such as those used in flat panel computers; however, it can be used anywhere that a combination of small size and relatively high power output are required. The HPS inverter package is 1.10" × 1.20" × .90" high. Please consult the factory for further information.

GENERAL SPECIFICATIONS

Input:	12, 15, 28 Vdc standard
Temp Range, Operating:	0°C to + 70°C standard (other ranges available)
Weight:	Approx. 30 gms
Size:	1.10" × 1.20" × .90" high 27.9 mm × 30.5 mm × 22.1 mm high
Mounting:	PC mounting standard
Case:	Plastic case standard
Encapsulated:	All standard units fully encapsulated with epoxy resin

E400 SERIES

Step-Up & Step-Down DC-DC Regulators

Units Offer up to 2.5 W Total Output Power with High Efficiency Under Light Load Conditions...

ERG's E400 Series provides a small, highly efficient, low-cost solution for providing regulated logic-type voltages from unregulated power sources—without a heat sink or external components.

Componentry Minimized:

The E400 Series is based on a standard pulse-width modulated type circuit. Among the operating parameters of the E400 Series are an operating voltage up to 35 Vdc and an input or output current of up to 750 madc. Supporting circuitry in these units contains a minimal number of discrete components, which contributes to their small size and low cost.

Please consult the factory for new variations or custom applications for E400 converters.

E400 SERIES

E400 Series Part Numbering System:

E4XX—YYY A/B ZZ

- E4XX — Nom. Vdc Input
- YYY — Nom. Vdc Out (V × .10)
- A/B — Step Up/Step Down
- ZZ — I Out (madc × 10)

General Specifications:

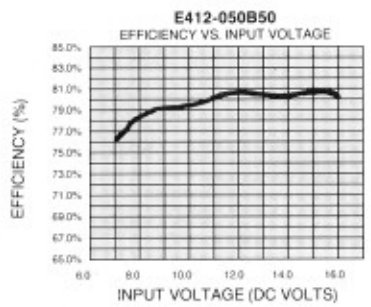
Power Rating:	To 2.5 W max.
Size:	1.00" × 1.38" × .70" high
Efficiency:	Typically 80%
Output Voltage Regulation:	Typically 1% line/load Typically 3% line/load/set point
Input Voltage Tolerance:	+/-28% on step-down units +/-20% on step-up units
Input or Output Voltage:	5 Vdc min., 35 Vdc max.
Input or Output Current:	Up to 750 madc, to 2.5 W max.
Operating Temperature Range:	0°C to +70°C

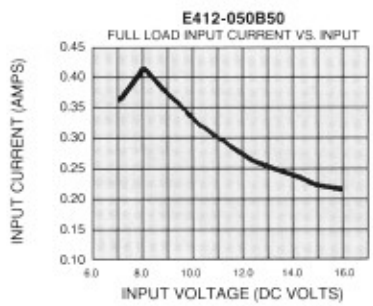
Both Input and Output Voltage are positive with respect to ground.
No Input/Output Isolation.

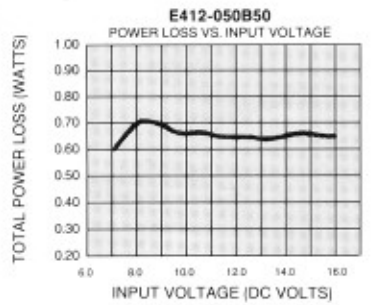
Existing Parts in this Series Include:

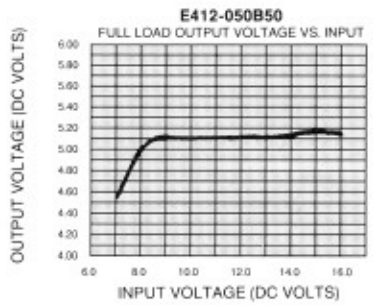
ERG Part No.	Nom. Vdc In	Vdc Out	Iout (madc max.)
E424-050B50 (formerly E337)	24	5	500
E412-050B50 (formerly E339)	12	5	500
E405-120A20 (formerly E399)	5	12	200

E400 Series Performance Curves







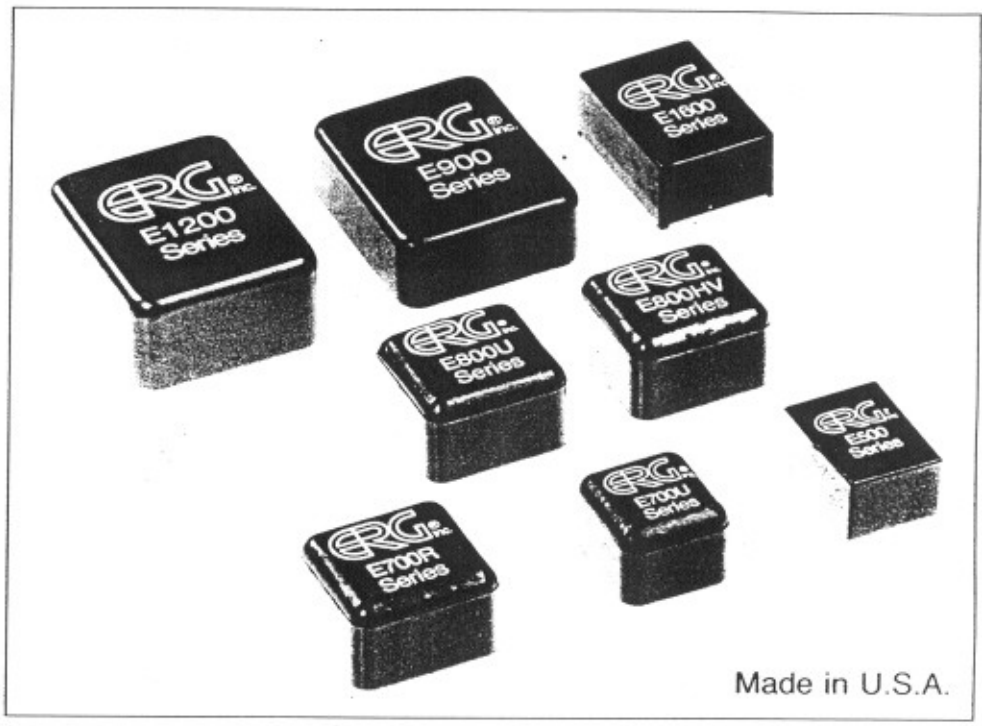


DC-DC

Converters to 25 Watts

DC Transformers: Ideal for Distributed Power & Other DC-DC Applications

ERG's lines of "dc transformers" are designed for operation from low level logic-type dc supply voltages. Originally used to produce the required 200 Vdc for segmented gas discharge displays, the lines have expanded to cover many other technologies and can be used in almost any dc-dc voltage-level change application requiring outputs of from 5 Vdc to 1500 Vdc at up to 25 watts.



Filtering

Because each customer's system and application is unique, no single system would satisfy all requirements. Therefore, very little is done on the input section to reduce reflected transients. Generally, these transients have little influence on the surrounding circuitry; but if there is some interaction, an input filter can be added externally which will reduce the amplitude — and therefor the effect — on the surrounding circuit.

Generally, just the addition of an input bypass capacitor will reduce this spiking to an acceptable level. The value of this capacitor should range between 10 uF and 250 uF with the value being inversely proportional to the input voltage (250 uF for a 5 Vdc input, 10uF for a 24 Vdc input). The type of capacitor is very important, the capacitor must exhibit low impedance at high frequencies (low internal inductance). The exact value and type should be determined experimentally. It may sometimes be necessary to bypass the larger capacitor with a small ceramic type capacitor to further reduce the overall impedance at high frequencies.

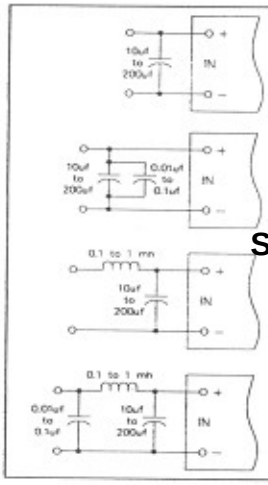
An "L" or "Pi" type filter may also be used on the input section to further reduce reflected transients. E900 and E1200 Series DC-DC converters both contain internal "L-C" input filters.

The larger capacitor should be the same range described above while the smaller capacitor should be 10 to 20 times smaller. The inductance ranges are from 20 uh to 1 mh. The capacitor ("L" filter) or the larger capacitor ("Pi" filter) should always be closest to the input of the DC-DC converter. The resistance of the inductance is important because it will have a direct effect on the overall regulation of the converter.

Other

There is no internal protection for either an output short circuit or input polarity reversal. However, these converters will absorb a momentary fault condition and it is recommended that the input be fused approximately 25% to 50% greater than the maximum full load input current

The presence of any net series inductance can cause the unit to operate unpredictably and should always be avoided.



Typical Input Filter Configurations

These filtering configurations will minimize the amount of switching ripple reflected on the DC input.

The specific component values required depend on the input current and the impedance of the input voltage source.

Figure (1) is adequate for most applications but is generally adequate in most switching systems.

Figure (2) provides a 50% reduction in higher frequency components of the input ripple.

Figure (3) provides adequate input filtering for analog systems.

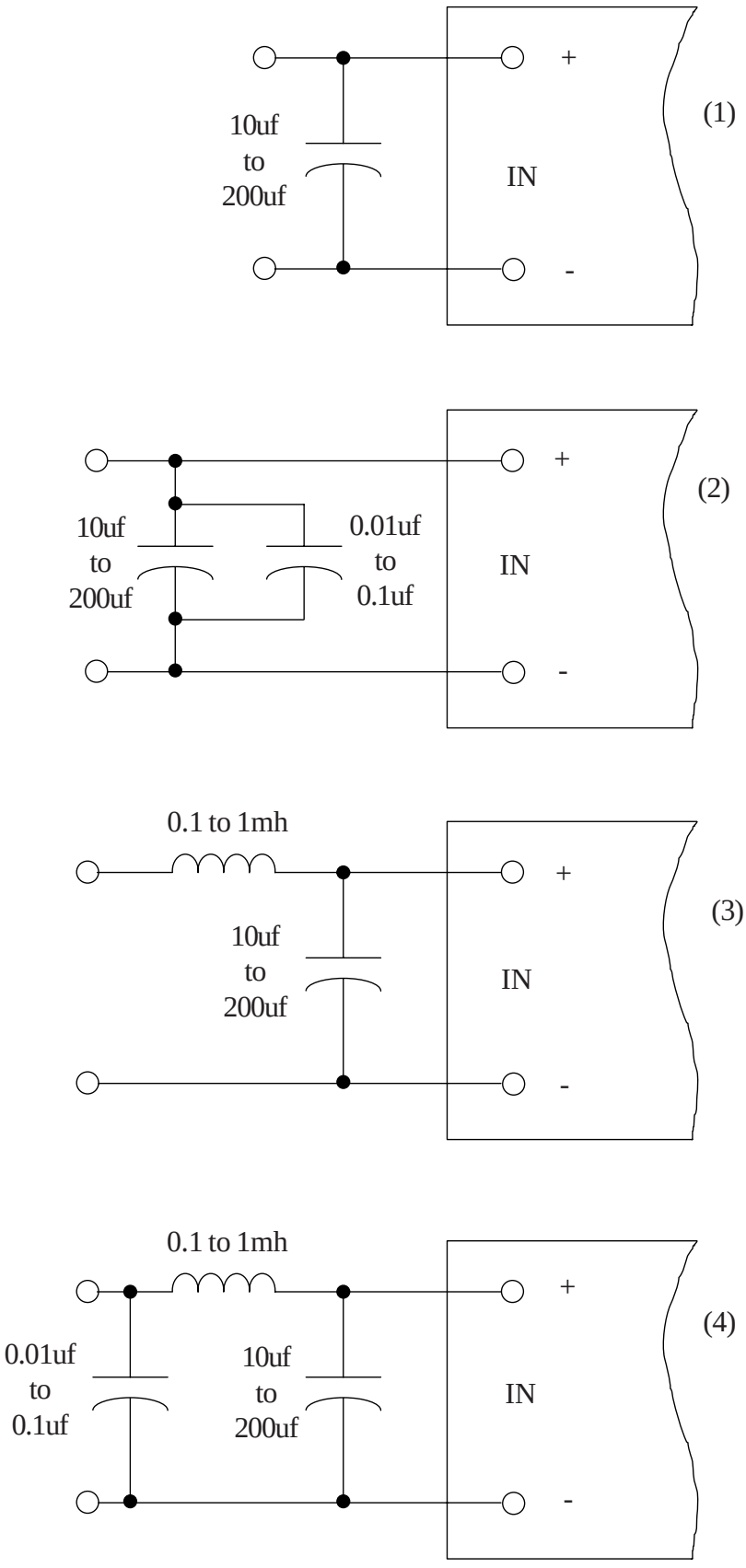
Figure (4) provides a 50% reduction in input ripple amplitude compared with figure (3).

SEE NEXT PAGE FOR DETAILS

DC-DC Converter Part Numbering System:

E - X X X - X X X - X

- E: Series
- X X X: 2 Digit Input Voltage Code
- X X X: Output Voltage in 100 Volts
- X: Output Current in ma.
- X: Output Suffix
  - (S) Single Output
  - (D) Dual Output
  - (U) Unregulated
  - (R) Regulated
  - (CT) Center Tapped



Typical Input Filter Configurations

These filtering configurations will minimize the amount of switching ripple reflected on the DC input.

The specific component values required depend on the input current and the impedance of the input voltage source.

These filtering configurations will minimize the amount of switching ripple reflected on the DC input.

Figure (1) is the least effective, but is generally adequate in most switching systems.

Figure (2) provides a 50% reduction in higher frequency components of the input ripple.

Figure (3) provides adequate input filtering for analog systems.

Figure (4) provides a 50% reduction in input ripple amplitude compared with figure (3).

E700 U DC-DC Converter, Unregulated, Center Tapped for a range of applications requiring up to 3W total output power . . . from High Voltage Displays to RS232 Loop Drivers . . .

The E700U Series is a basic 3 watt unregulated DC to DC Converter. Nominal output voltages of from 5 to 500 volts dc are available. Typical load regulation is 20% (5% from 20% of full load to full load). Overall efficiency is as high as 85%. The E700U offers a compact size (approx. 1.2 cubic inches), and four-pin board mounting with .040 diameter tin-plated brass terminals. This unit features a header with the input and output connections clearly marked.

E700 U SERIES

GENERAL SPECIFICATIONS
(Custom Units Available—Consult Factory)

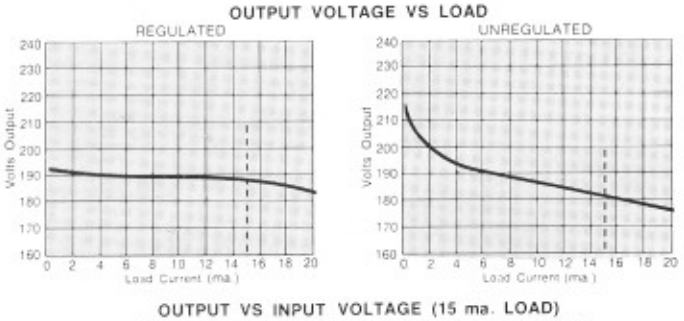
INPUT:	5 Vdc to 28 Vdc standard (your choice)	TEMP. RANGE OPERATING:	0°C to 70°C Standard Max. case temp. of 85°C (Other ranges available.)
OUTPUT:	5 Vdc to 500 Vdc standard (your choice), to 3 watts. Unregulated or Center Tapped	STORAGE:	-20°C to 80°C Standard (Other ranges available.)
		WEIGHT:	30 gms.
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute)	SIZE:	1.10" (27.94 mm) x 1.20" (30.48 mm) x .91" (23.11 mm) high
IDLING POWER:	< 1 watt	MOUNTING:	PC mounting standard
		CASE:	Plastic case standard
EFFICIENCY:	To 75% @ 5 Vdc in; to 85% @ 24 Vdc in	ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

*All specification subject to change without notice.

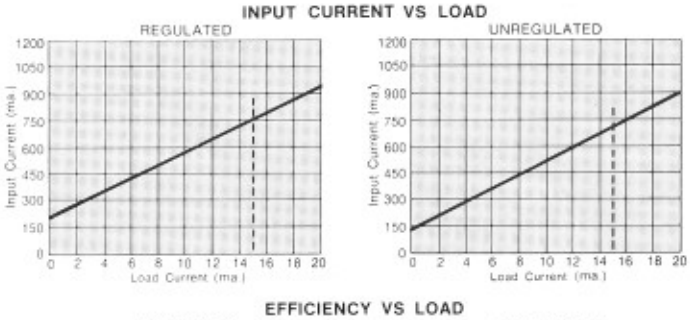
Typical Performance Specifications for E700U, E500U and E700R Converters

Curves reflect measurements taken from E705-215R and E705-215U Converters.
ERG converters with different input/output ratings deliver similar performance.

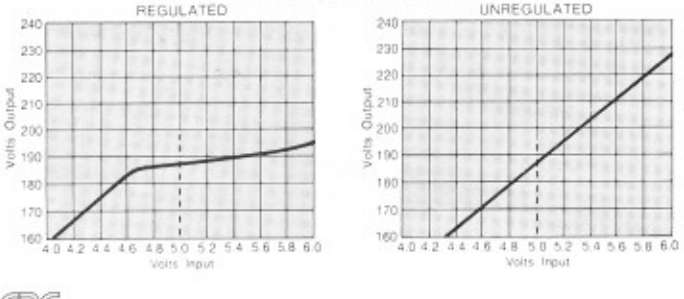
OUTPUT VOLTAGE VS LOAD



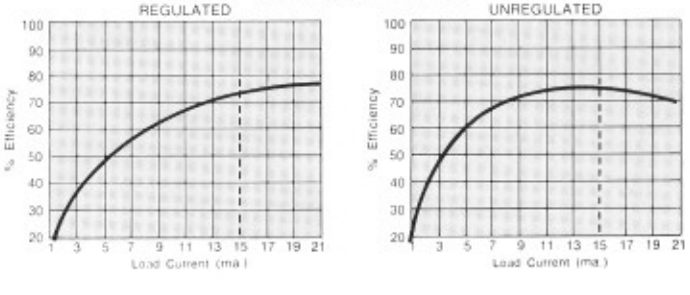
INPUT CURRENT VS LOAD



OUTPUT VS INPUT VOLTAGE (15 ma. LOAD)



EFFICIENCY VS LOAD



E500 U DC-DC Converters, Unregulated, Single and Center-Tapped Outputs for a range of applications requiring up to 3W total output power!

The E500 Series is basically a repackaged E700U. All the electrical parameters are the same. The E500 Series offers a lower profile, 20% smaller overall volume, and is designed to be used in high-volume applications. The E500 costs 20% less than the E700U because labor has been designed out. Input/Output termination is done using the internal resistor leads, and this unit is not recommended for applications where the system might be subjected to high levels of mechanical stress (shock and vibration) unless mechanically tied down. Like the E700 Series, there is input/output isolation on the single output version.

E500 U SERIES

GENERAL SPECIFICATIONS
(Custom Units Available—Consult Factory)

INPUT:	5 Vdc to 28 Vdc standard (your choice)	TEMP. RANGE OPERATING:	0°C to 70°C Max. case temp. of 85°C (Other ranges available.)
OUTPUT:	5 Vdc to 500 Vdc (your choice), to 3 watts. Unregulated Single or Center Tapped	STORAGE:	-20°C to 80°C Standard (Other ranges available.)
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute) in single output units only	WEIGHT:	20 gms.
IDLING POWER:	< 1 watt	SIZE:	1.00" (25.4 mm) x 1.38" (35.1 mm) x .70" (17.8 mm) high
EFFICIENCY:	To 75% @ 5 Vdc input; to 85% @ 24 Vdc input	MOUNTING:	PC mount
		CASE:	Plastic case standard
		ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

E700 R DC-DC Converter, Regulated for a range of applications requiring up to 3W total output power!

The E700R Series basically is the E700U in a larger case size to provide room for an internal zener reference series pass regulator. These units are designed to maintain regulation with ± 10% input variation (5% on 5 volt input units). The output regulation ± 5% (Line/Load). Available output voltages are from 5 Vdc to 250 Vdc. This unit is well suited for applications where the output voltage window is critical.

E700 R SERIES

GENERAL SPECIFICATIONS
(Custom Units Available—Consult Factory)

INPUT:	5 Vdc to 28 Vdc standard (your choice)	TEMP. RANGE OPERATING:	0°C to 70°C Standard Max. case temp. of 85°C (Other ranges available.)
OUTPUT:	5 Vdc to 250 Vdc standard (your choice), to 3 watts.	STORAGE:	-20°C to 80°C Standard (Other ranges available.)
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute)	WEIGHT:	40 gms.
		SIZE:	1.43" (36.32 mm) x 1.50" (38.10 mm) x 1.03" (26.16 mm) high
IDLING POWER:	< 1.25 watt	MOUNTING:	PC mounting standard
EFFICIENCY:	To 65% @ 5 Vdc in; to 75% @ 24 Vdc in	CASE:	Plastic case standard
		ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

*All specification subject to change without notice.

E1600 DC-DC Converters, Unregulated, Single and Center-Tapped Outputs for applications from High Voltage Displays to Optical Disk Drives requiring up to 6W total output power!

The E1600 Series is a basic 6 watt unregulated DC to DC Converter. The E1600 Series is available in single output and center-tapped versions. Nominal output voltages are available from 5 to 500 volts DC. Typical no load to full load regulation is 20%. Regulation from 20% of full load to full load is typically less than 5%. External input and output components can be added to enhance performance.

E1600 SERIES

GENERAL SPECIFICATIONS

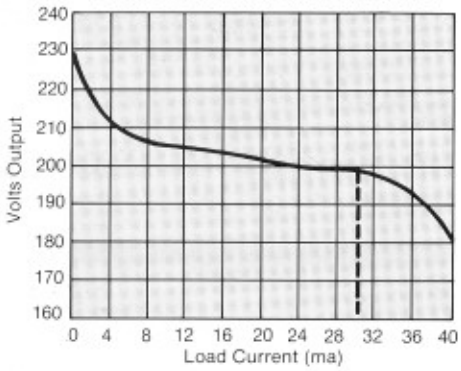
(Custom Units Available—Consult Factory)

INPUT:	5 Vdc to 28 Vdc (your choice)	TEMP. RANGE OPERATING:	0°C to 70°C Max. case temp. of 85°C (Other ranges available.)
OUTPUT:	5 Vdc to 500 Vdc (your choice), to 6 watts. Unregulated, Singe or Center Tapped	STORAGE:	-20°C to 85°C (Other ranges available.)
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute)	WEIGHT:	44 gms.
		SIZE:	1.30" (33.02 mm) x 1.88" (47.75 mm) x .82" (20.83 mm) high
IDLING POWER:	< 1.25 watt	MOUNTING:	PC mounting standard
EFFICIENCY:	To 75% @ 5 Vdc in; to 85% @ 24 Vdc in	CASE:	Plastic case standard
		ENCAPSULATED:	All units fully encapsulated with epoxy resin

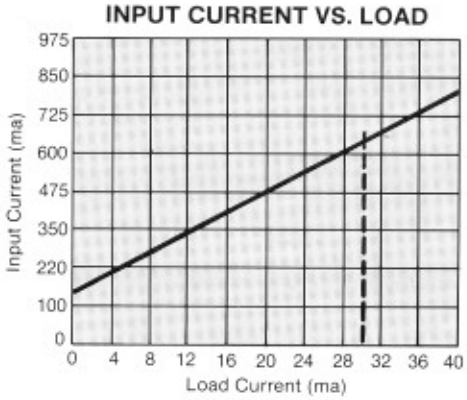
Typical Performance Specifications for E1600 Converters

Curves reflect measurements taken from E1605-2.0306 Converters.
ERG converters with different input/output ratings deliver similar performance.

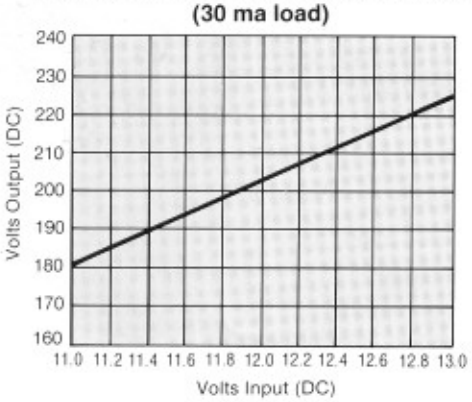
OUTPUT VOLTAGE VS. LOAD



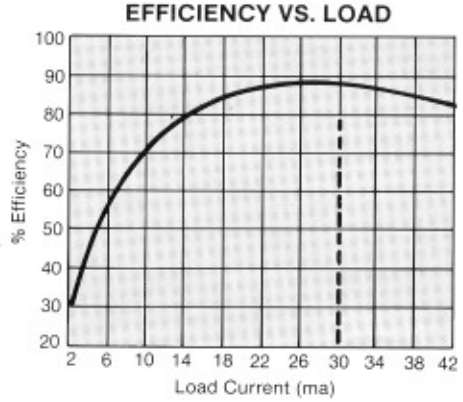
INPUT CURRENT VS. LOAD



OUTPUT VOLTAGE VS. INPUT VOLTAGE (30 ma load)



EFFICIENCY VS. LOAD



E800U
U—Unregulated

The E800U Series uses the larger E700R case size to provide room for additional copper required for higher voltage windings. The units are designed to provide from 500 to approximately 1000 Vdc outputs, at up to 6 watts. For a nominal non-recurring engineering fee, units can be tailored to your specific combination of input and output voltages.

Part numbers carry a "U" suffix.

E800 U SERIES

GENERAL SPECIFICATIONS
(Custom Units Available—Consult Factory)

INPUT:	12 Vdc to 24 Vdc standard (your choice)
OUTPUT:	500 Vdc to 1000 Vdc standard (your choice)
REGULATION:	Linear, proportional output
INPUT/OUTPUT ISOLATION:	To support high voltage output
TEMP. RANGE OPERATING:	0°C to 70°C Standard Max. case temp. of 80°C (Other ranges available.)
STORAGE:	-20°C to 80°C Standard (Other ranges available.)
WEIGHT:	Approx. 40 gms.
SIZE:	1.43" (36.32 mm) x 1.50" (38.10 mm) x 1.03" (26.16 mm) high
MOUNTING:	PC mounting standard
CASE:	Plastic case standard
ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

E800HV
HV—High Voltage (Unregulated)

The E800HV Series, also packaged in the E700R case, is designed to provide from 1000 to 1500 Vdc out for applications including to power mini-lasers, ionizing chambers and photomultiplier tubes. For a nominal non-recurring engineering fee, units can be designed with a variety of input/output voltage combinations to suit your applications. Please consult the factory.

Part numbers carry an "HV" suffix.

E800 HV SERIES

GENERAL SPECIFICATIONS
(Custom Units Available—Consult Factory)

INPUT:	12 Vdc to 24 Vdc standard (your choice)
OUTPUT:	1000 Vdc to 1500 Vdc standard (your choice)
REGULATION:	Linear, proportional output
INPUT/OUTPUT ISOLATION:	To support high voltage output
TEMP. RANGE OPERATING:	0°C to 70°C Standard Max. case temp. of 80°C (Other ranges available.)
STORAGE:	-20°C to 80°C Standard (Other ranges available.)
WEIGHT:	Approx. 40 gms.
SIZE:	1.43" (36.32 mm) x 1.50" (38.10 mm) x 1.03" (26.16 mm) high
MOUNTING:	PC mounting standard
CASE:	Plastic case standard
ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

E900 S/D DC-DC Converters, Unregulated, Single and Dual Outputs for applications from High Voltage Displays to Charging Capacitor Banks requiring up to 12W total output power!

The E900S is a single output DC-DC Converter with up to 12 watts of available output power (7.5 watts with a 5 Vdc input). When used with plasma displays that consume a constant current, regulating the high voltage units is not necessary. The E900 is typically within ±1% of the nominal output voltage at full load, which means an input tolerance of ±4% will allow the display to operate within the recommended ±5% voltage window. All E900's have a built-in input "L-C" filter to help minimize reflected input ripple that might appear on the input voltage supply, and a large internal output filter.

Generally there is no need for any external input or output filtering. The E900D is a dual output version of the E900S. The standard secondary output voltage is 16 Vdc @ approximately 100 madc. This isolated output voltage, with an external three terminal regulator, can be turned into the necessary 12 Vdc required by the drive electronics of many flat panel displays.

The second output of the E900D is completely separate and isolated from the first. This voltage can be almost any nominal value (10 Vdc to 250 Vdc).

E900 SERIES

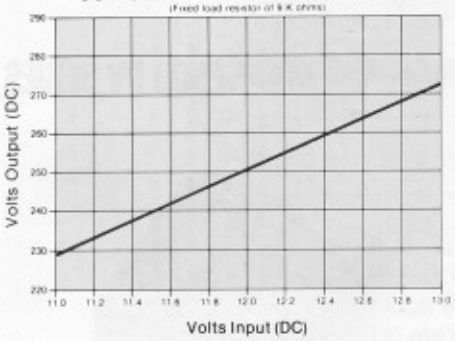
GENERAL SPECIFICATIONS (Custom Units Available—Consult Factory)

INPUT:	5, 12, 15 or 24 Vdc (your choice)	TEMP. RANGE OPERATING:	0°C to 70°C Max. case temp. 85°C (Other ranges available.)
OUTPUT:	Single or dual, up to 12 watts total. 5 to 500 Vdc	STORAGE:	-20°C to 80°C (Other ranges available.)
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute)	WEIGHT:	122 gms.
		SIZE:	2.00" (50.8 mm) x 2.50" (63.5 mm) x .98" (24.9 mm) high
IDLING POWER:	< 1.75 watt	MOUNTING:	PC mounting standard
EFFICIENCY:	To 75% @ 5 Vdc in; to 85% @ 24 Vdc in	CASE:	Aluminum
		ENCAPSULATED:	All standard units fully encapsulated with epoxy resin

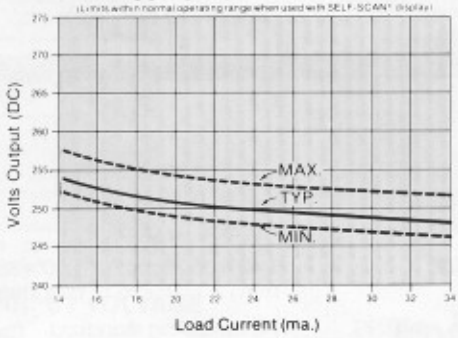
Typical Performance Specifications for E900 Converters

Curves reflect measurements taken from E912-2.5306 Converters.
ERG converters with different input/output ratings deliver similar performance.

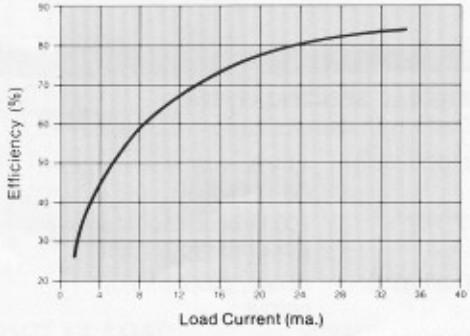
OUTPUT VOLTAGE VS. INPUT VOLTAGE
(Fixed load resistor of 8 K ohms)



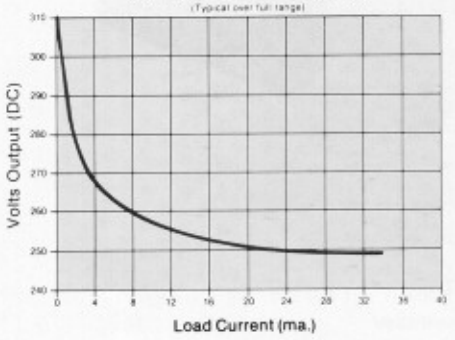
OUTPUT VOLTAGE VS. LOAD
(Limits within normal operating range when used with SELF-SCAN® display)



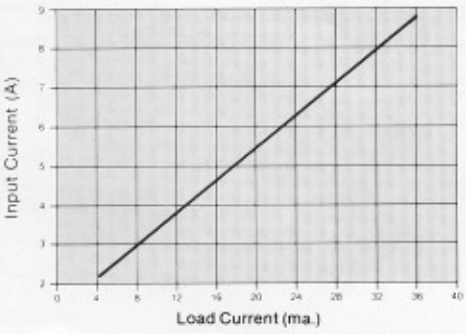
EFFICIENCY VS. LOAD



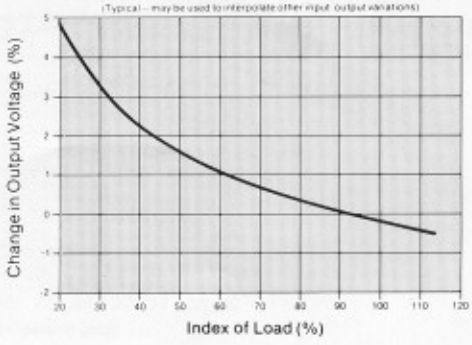
OUTPUT VOLTAGE VS. LOAD
(Typical over full range)



INPUT CURRENT VS. LOAD



CHANGE IN OUTPUT VOLTAGE VS. LOAD
(Typical — may be used to interpolate other input, output variations)



E1200 DC-DC Converters, Unregulated, Single Output only for High Voltage Displays, Charging Capacitor Banks and other applications requiring up to 25W total output power!

The E1200 is a single output DC-DC Converter with up to 25 watts of available output power. When used with plasma displays that consume a constant current, regulating the high voltage units is not necessary. The E1200 features the same footprint as the E900 series, and is available with various nominal output voltages. This unit is offered with nominal input voltages of from 12 Vdc to 48 Vdc.

All E1200's have a built-in input "L-C" filter to help minimize reflected input ripple that might appear on the input voltage supply, and a large internal output filter. Generally there is no need for any external input or output filtering.

The E1200 series comes in a metal shell that provides its own heatsinking, and allows a moderate temperature rise of 25°C. This unit requires no external heatsink, and has an operating temperature of 0 to 60°C. The maximum case temperature is 85°C.

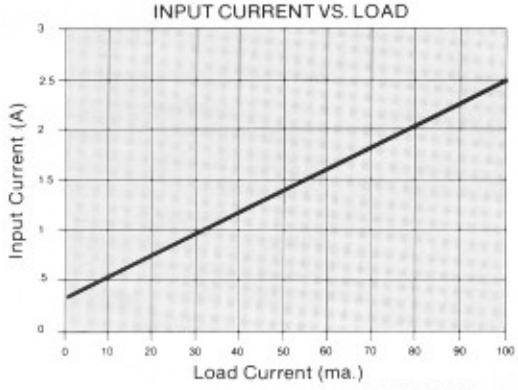
E1200 SERIES

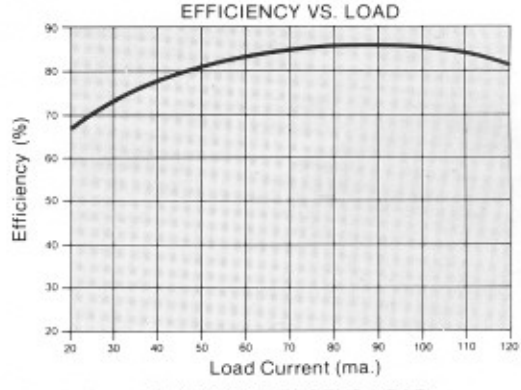
GENERAL SPECIFICATIONS (Custom Units Available—Consult Factory)

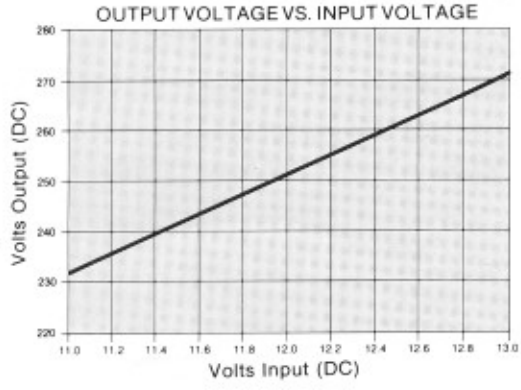
INPUT:	12, 15, 24 or 48 Vdc (your choice)	TEMP. RANGE OPERATING:	0°C to 60°C Max. case temp. of 85°C (Other ranges available.)
OUTPUT:	Single output up to 25 watts, 5 to 250 Vdc	STORAGE:	-20°C to 85°C (Other ranges available.)
INPUT/OUTPUT ISOLATION:	600 Vrms (60 Hz breakdown for one minute)	WEIGHT:	185 gms.
		SIZE:	2.00" (50.8 mm) × 2.50" (63.5 mm) × 1.19" (30.2 mm) high
IDLING POWER:	< 3.0 watts	MOUNTING:	PC mounting standard
EFFICIENCY:	To 82% @ 12 Vdc in; to 88% @ 24 Vdc in	CASE:	Aluminum
		ENCAPSULATED:	All units fully encapsulated with epoxy resin

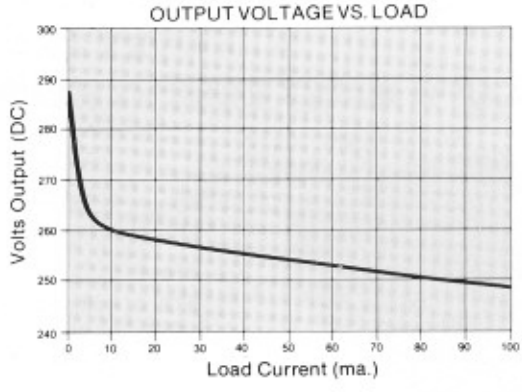
Typical Performance Specifications for E1200 Converters

Curves reflect measurements taken from E1212-2.5100 Converters.
ERG converters with different input/output ratings deliver similar performance.









VF SERIES

DC-DC/AC Converters for Vacuum Fluorescent Displays

ERG VF Converters Produce Both DC Anode and AC Filament Voltages for VF Displays Requiring up to 12 W Total Output Power!

General

VF Series modifications of ERG DC-DC Converters are engineered to power vacuum fluorescent displays requiring from less than one up to twelve watts total output power. These input-output isolated devices are available in three convenient packages designed to provide power outputs of up to 3, 6 or 12 watts.

VF Series converters typically provide two outputs: a dc voltage for the anode; and, a center-tapped ac output at oscillator frequency for the filament. Both the anode and filament voltages are tailored to match the selected display. Bias and grid voltages can be obtained by tapping off the filament and/or anode outputs.

Almost every vacuum fluorescent display variation requires a different combination of anode and filament voltages. Additionally, ERG VF Converters can be designed to operate from alternate dc input voltages, such as 5, 6, 9, 12, 15, 18, 24 or 28 Vdc. Thus, there are many different converters in this line.

If we have not made the input-output combination you require, we will be pleased to design and build prototypes at the standard unit price plus a nominal, nonrecurring engineering fee.

Custom Applications

Save Engineering Time!

In many cases, simply tell us what display you're using, what DC input voltages you have available, and we'll do the rest!

ERG's extensive library of information on various vacuum fluorescent display specifications helps ensure that your application will get immediate attention.

The handy Finder's Chart available from ERG provides a convenient cross-reference index of various vacuum fluorescent displays to the appropriate ERG VF Series Converters required to power them.

Save Development Costs!

Even if you're using a custom display, you no longer have to divert engineering time and talent to design the converter required for your application. Our sales and/or engineering staffs are ready to review your design to obtain the information we need to specify the proper ERG converter to satisfy your design objectives.

Save PC Board Space!

ERG Converters can save you board space and help reduce hardware costs. As long as your total power requirement is equal to—or less than—the power rating of the ERG Converter you're using, you can power two, three, even six displays from just one converter module.

VF Part Numbering System:

EX XX—.YY V Z.Z

- EX — Package
- XX — Input Voltage (Vdc)
- .YY — Anode Voltage (Vdc) × 100
- V — Vacuum Fluorescent Application
- Z.Z — Filament Voltage (Vrms)

Note:

For applications requiring from 7.5W to 12W output, contact factory for the appropriate E900VF part number.

General Specifications

(Custom Units Available—Consult Factory)

E700 VF SERIES

Max. Power Out:	3.0 watts
Standard Input:	5, 9, 12, 15, 24 Vdc
Input Vdc Range:	+/- 10%
Output:	DC Anode, AC Filament @ oscillator frequency (12-14 KHz)
Operating Temp.:	0° — 70°C
Max. Case Temp.:	80°C maximum
I/O Isolation:	300 Vrms, 60 Hz breakdown for 1 minute
Case:	Plastic
Size:	1.10" × 1.20" × .91" high (27.94mm × 30.48mm × 23.11mm high)
Weight:	30 gms.
Mounting:	PC Mount standard

E800 VF SERIES

Max. Power Out:	6.0 watts
Standard Input:	5, 9, 12, 15, 24 Vdc
Input Vdc Range:	+/- 10%
Output:	DC Anode, AC Filament @ oscillator frequency (12-14 KHz)
Operating Temp.:	0° — 70°C
Max. Case Temp.:	80°C maximum
I/O Isolation:	300 Vrms, 60 Hz breakdown for 1 minute
Case:	Plastic
Size:	1.43" × 1.50" × 1.03" high (36.32mm × 38.10mm × 26.16mm high)
Weight:	40 gms.
Mounting:	PC Mount standard

E900 VF SERIES

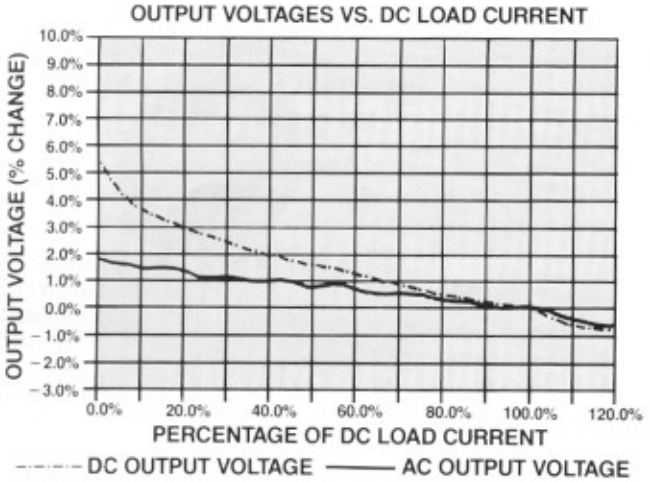
Max. Power Out:	12.0 watts
Standard Input:	5, 9 Vdc to 7.5W, 12, 15, 24 Vdc to 12 W
Input Vdc Range:	+/- 10%
Output:	DC Anode, AC Filament @ oscillator frequency (12-14 KHz)
Operating Temp.:	0° — 70°C
Max. Case Temp.:	80°C maximum
I/O Isolation:	600 Vrms, 60 Hz breakdown for 1 minute
Case:	Aluminum
Size:	2.00" × 2.50" × .98" high (50.8mm × 63.5mm × 24.9mm high)
Weight:	122 gms.
Mounting:	PC Mount standard

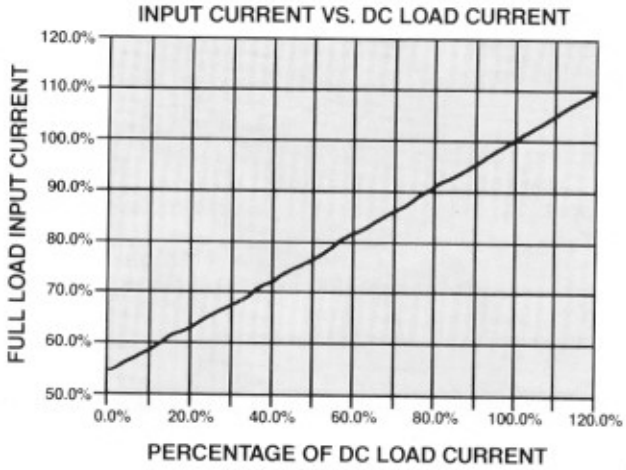
E900 VF² SERIES: CUSTOM APPLICATIONS ONLY

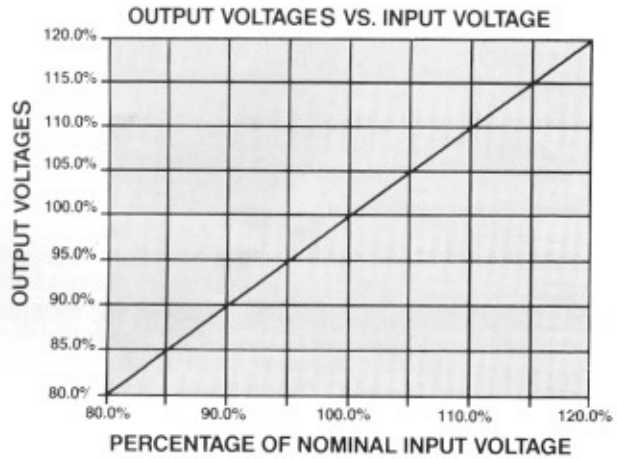
Max. Power Out:	12.0 watts
Standard Input:	5, 9 Vdc to 7.5W, 12, 15, 24 Vdc to 12 W
Input Vdc Range:	+/- 10%
Output:	2 DC Anode, 2 AC Filament
Operating Temp.:	0° — 70°C
Max. Case Temp.:	80°C maximum
I/O Isolation:	600 Vrms, 60 Hz breakdown for 1 minute
Case:	Aluminum
Size:	2.00" × 2.50" × .98" high (50.8mm × 63.5mm × 24.9mm high)
Weight:	122 gms.
Mounting:	PC Mount standard

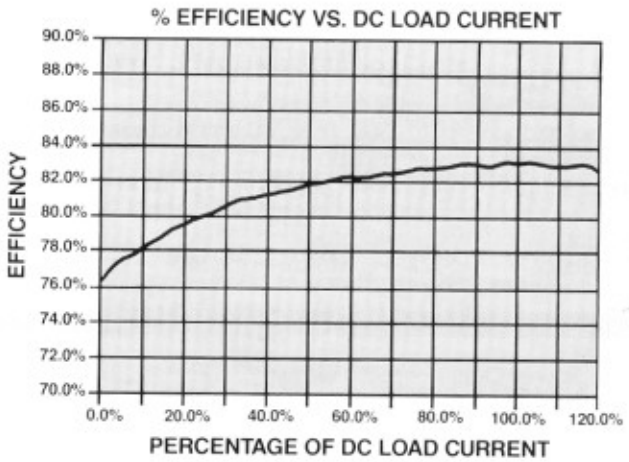
Typical Performance Specifications for VF Series Converters.

At room ambient, approximately 25°C. AC load is constant.









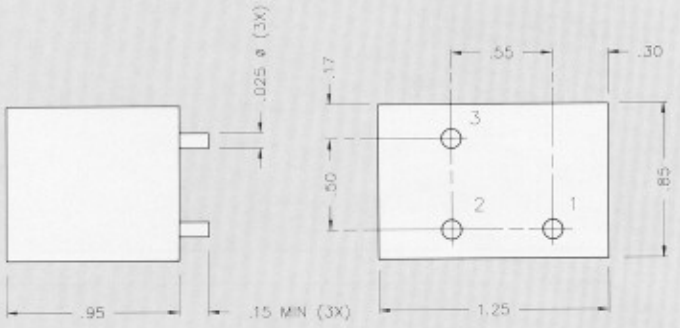
Notes:

1) 12–14Khz Typical. In some cases frequency can be adjusted to meet system requirements.
2) 0°C–70°C standard temperature range; other ranges available upon request.
3) 80°C max. case temp.: higher temperature available upon request.

Features:

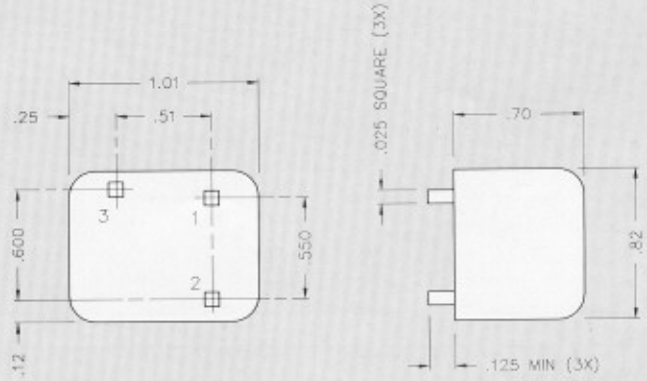
- Provide both dc anode and ac filament voltages for vacuum fluorescent displays requiring up to 12 watts total output power.
- Compatible with all major VF display makes, including Noritake (Itron), Futaba and NEC.
- Mount on your PC board as needed, where needed.
- High power density— Up to 2.5W/cu. in.
- High operating efficiency (to 85%).
- Rapid turnaround Ex Stock to six weeks.
- Modestly priced
- Epoxy Encapsulated for Superior environmental protection.

E600/LPS SERIES



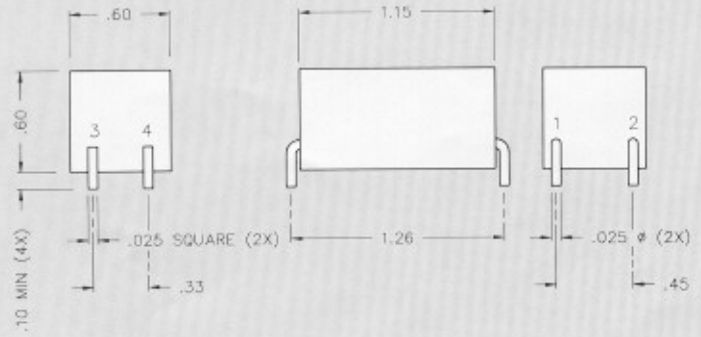
1. +Vin
2. COM
3. Vout

P PACKAGE



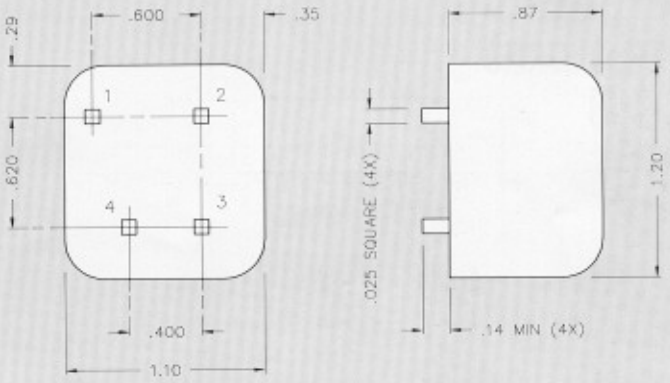
1. +Vin
2. COM
3. Vout

E300 SERIES



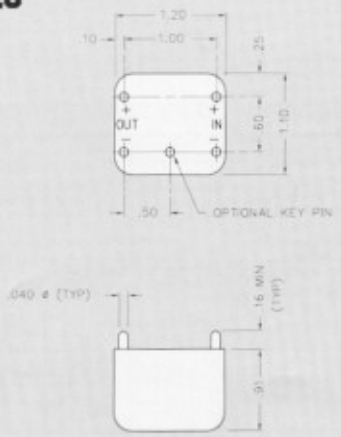
1. – Vin
2. + Vin
3. Vout (SQUARE PIN)
4. Vout (SQUARE PIN)

HPS SERIES

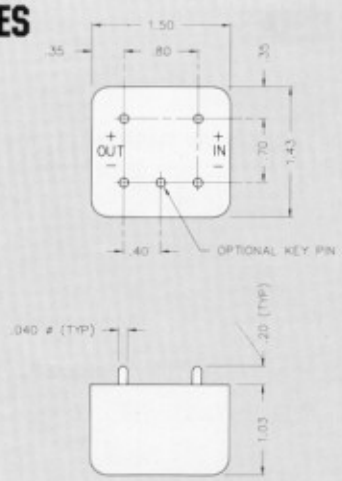


1. + Vin
2. – Vin
3. Vout
4. Vout

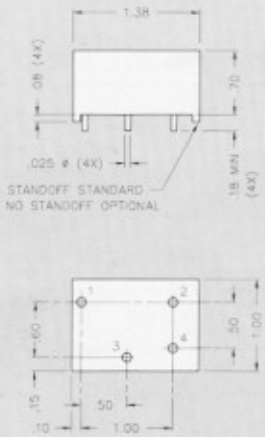
E700 SERIES (U/CT)



E700 R SERIES E800 U E800 HV

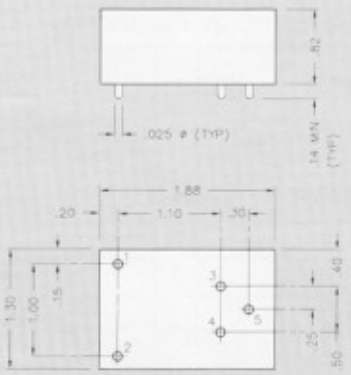


E500 SERIES (U/CT)



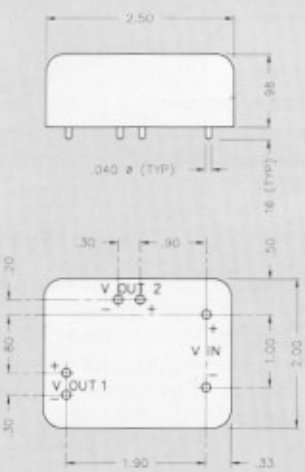
1. Vin (+)
2. Vout (+)
3. Vin (–)
4. Vout (–)

E1600 SERIES (S/CT)

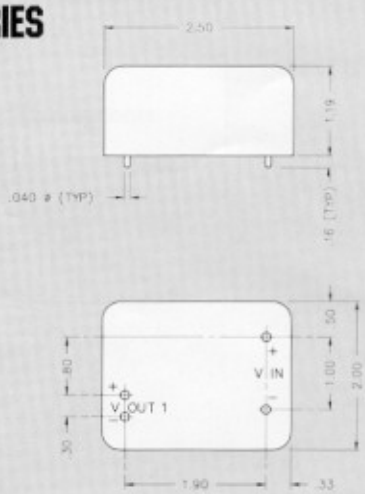


1. Vin (+)
2. Vin (–)
3. Vout (+)
4. Vout (–)
5. Vout (COM) CT ONLY

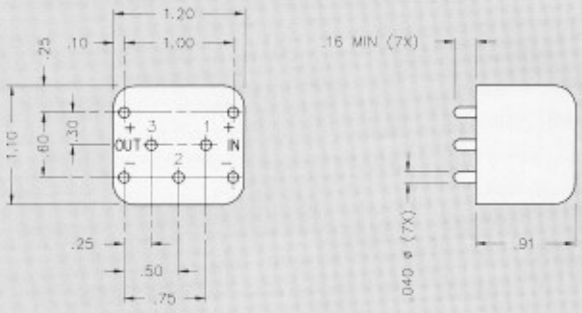
E900 SERIES (S/D)



E1200 SERIES

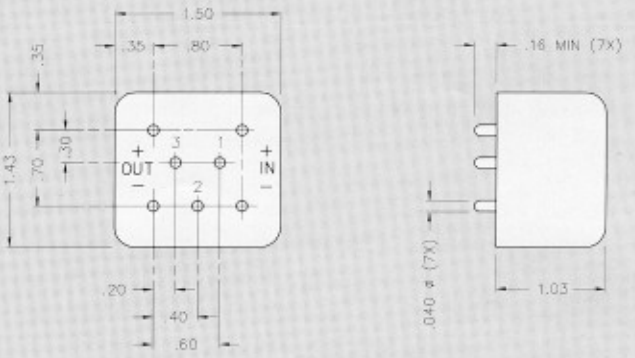


E700 VF SERIES



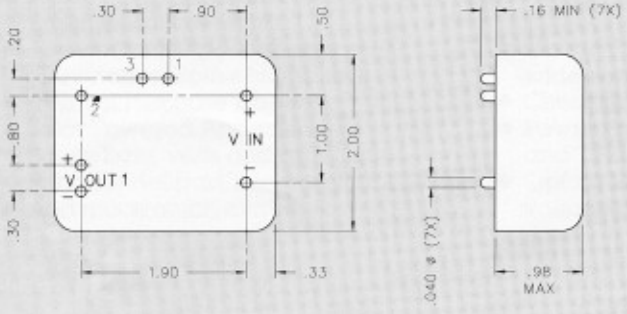
AC OUTPUT

E800 VF SERIES



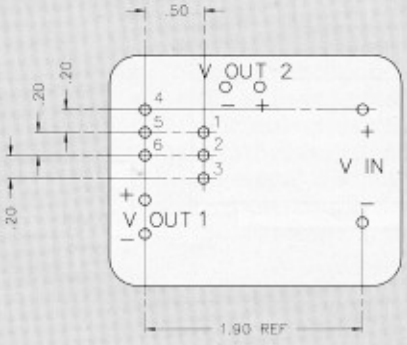
AC OUTPUT

E900 VF SERIES



AC OUTPUT

E900 VF² SERIES

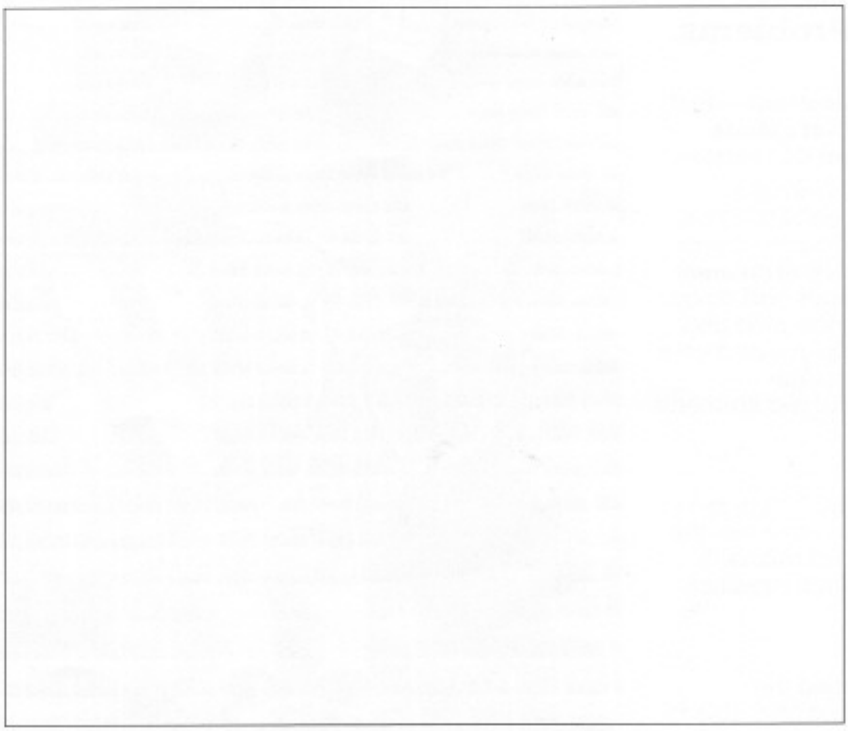


VOUT 3

VOUT 4

NOTES:

VOUT 1 = HIGHEST DC OUTPUT VOLTAGE
VOUT 2 = LOWEST DC OUTPUT VOLTAGE
VOUT 3 = LOWEST AC OUTPUT VOLTAGE
VOUT 4 = HIGHEST AC OUTPUT VOLTAGE



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